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Emergency medicine is a specialty which closely reflects societal challenges and consequences of public policy decisions. The emergency department specifically deals with social injustice, health and economic disparities, violence, substance abuse, and disaster preparedness and response. This journal focuses on how emergency care affects the health of the community and population, and conversely, how these societal challenges affect the composition of the patient population who seek care in the emergency department. The development of better systems to provide emergency care, including technology solutions, is critical to enhancing population health.

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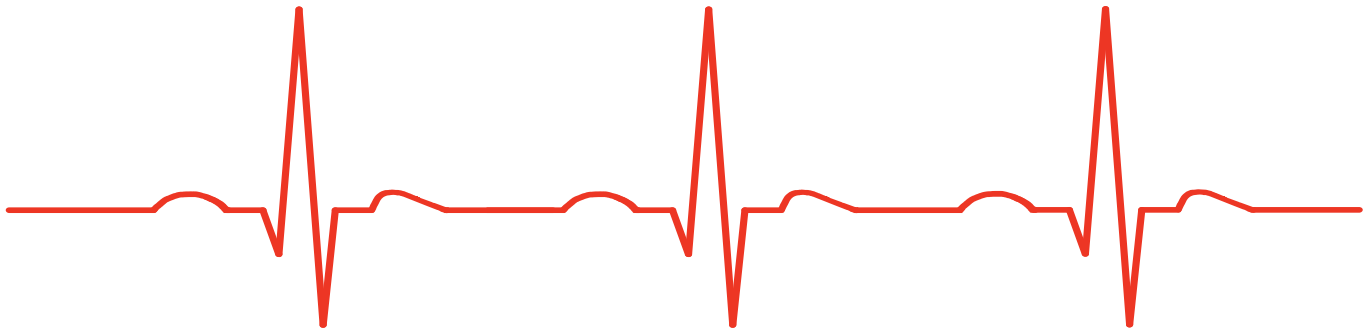
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Impact of Primary Spoken Language as a Social Determinant of Health on Cardiopulmonary Education and Use: Pilot Study

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Introduction: Over 350,000 out-of-hospital cardiac arrests occur annually in the United States, with neurologically intact survival below 10%. Recent literature demonstrates that survival is lower in communities of color and non-English speakers. Social determinants of health, such as healthcare access, language, and literacy, may serve as barriers to receiving cardiopulmonary resuscitation (CPR) education and using the skills learned. Current research is sparse on identifying barriers contributing to the lack of CPR education and use in non-English speaking communities. We hypothesized that barriers to CPR education and use differ between English- and Spanish-speaking learners. This study provides insights into how classes could be tailored to address disparities in CPR education and use.

Methods: In this cross-sectional study we used survey-based research to assess the knowledge, comfort, and perceived barriers to activating the 9-1-1 system and performing bystander CPR. Participants were recruited using convenience sampling at community-based events in Roanoke, Virginia. We directly compared responses between language groups using Fisher tests within R, adjusting for various demographic factors.

Results: We collected 367 surveys from the 550 participants (estimated 50 attendees each for 11 events) for a response rate of 66.7%. Of the surveys collected, 231 (63%) were in English and 136 (37%) in Spanish. Spanish-speakers were more concerned with immigration status (7% vs 1%), doing something wrong (14% vs 7%), and language barrier (31% vs 1%) compared to English-speakers when asked why they may not call 9-1-1. We found that 72% of English-speakers would have no problem calling 9-1-1, compared to only 16% of Spanish-speakers. Regardless of language, the most prevalent barrier to initiating CPR was the “fear of doing something wrong” with 49% of Spanish-speakers and 28% of English-speakers endorsing this as a barrier. Only 10% of Spanish speakers would have no concerns starting CPR, compared to 54% of English-speakers. Language was reported by 21% of Spanish-speakers vs 2% of English-speakers as a barrier to administering CPR.

Conclusion: Results of this pilot study highlight that Spanish-speaking respondents were less comfortable calling 9-1-1 and initiating CPR compared to English-speaking respondents. While there were some shared barriers between the groups, Spanish-speaking respondents were more likely to identify a barrier overall. These results suggest that marginalized communities would benefit from tailored educational models that address their unique challenges. Further research is necessary to better understand how social determinants of health serve as barriers to CPR education/use in specific communities. [West J Emerg Med. 2026;27(1)1–9.]

INTRODUCTION

In 2022, the American Heart Association (AHA) reported 356,461 out-of-hospital cardiac arrests (OHCA) in the United States with less than 9% surviving to hospital discharge.¹ A key piece to responding to OHCA is the “chain of survival” concept. The chain of survival is a sequence of time-sensitive events or “links”: early recognition of cardiac arrest and activation of the emergency-response system; immediate, high-quality cardiopulmonary resuscitation (CPR); rapid defibrillation; basic and advanced response of emergency medical services (EMS); and Advanced Life Support and post-arrest care.² Of these, CPR and early defibrillation using an automated external defibrillator (AED) are the most effective lay responder interventions.² Cardiopulmonary resuscitation is considered a bridge to defibrillation and largely functions to optimize the chances for neurologically intact recovery following return of spontaneous circulation. Permanent neurologic injury and chance for survival are estimated to decrease by 10% with every minute that passes between OHCA and initiation of CPR or use of an AED.^{1,3}

Despite this, lay responder delivery of CPR occurs in less than 40% of OHCA victims.⁴ This may be due in part to a misunderstanding or lack of knowledge of the capabilities of CPR, resuscitative measures, and other healthcare interventions.⁵ Early access and use of an AED in OHCA is considered the most likely avenue to increase OHCA survival; however, use of an AED prior to EMS arrival is only 3.7%.⁶ Research published in 2000 demonstrated the survival benefits from early use of AED in OHCA, using casinos as the study arena.⁷ Survival to discharge was 74% in arrests in ventricular fibrillation that had an AED used within three minutes.⁷

However, OHCA survival statistics can be misleading as there are discrepancies in lay rescuer CPR. Previous literature has found that globally, women are less likely to receive CPR from lay rescuers compared to men.⁸ Non-White individuals have repeatedly been reported to have lower rates of lay rescuer CPR when compared to White individuals. Disparities in Black and Hispanic populations receiving lay rescuer CPR are well documented.^{9–11} Being Black or Hispanic correlated to being 10–20% less likely to receive bystander CPR following a witnessed OHCA, regardless of the event occurring in public or at home.⁹ There is limited research on the link between language barriers and lay rescuer CPR, but there is evidence that underuse of 9-1-1, delays in care, and survival outcomes can be attributed to non-English speakers.^{12–14}

These disparities are in part due to social determinants of health (SDoH) or non-medical factors that influence health outcomes.¹⁵ The five domains of SDoH are commonly viewed as the following: economic stability; education access/quality; healthcare access/quality; neighborhood/built environment; and social/community context.¹⁶ Lack of equal access to CPR education is affected by each of these factors. In studies that have examined CPR education, there are lower rates of accessing education among individuals who

Population Health Research Capsule

What do we already know about this issue?

In communities of color, healthcare access, language, and literacy may serve as barriers to receiving CPR education and using those skills. Current research is sparse.

What was the research question?

We investigated barriers to serving as a lay rescuer and identified associations between socioeconomic factors (primarily language) and those barriers.

What was the major finding of the study?

The odds of Spanish-speaking respondents being comfortable calling 9-1-1 were 87% lower compared to English-speaking individuals (OR 0.13; 95% CI, 0.06–0.25; $P < .001$).

How does this improve population health?

Further research is needed to explore how social determinants of health and language barriers impact the out-of-hospital cardiac arrest chain of survival.

are women, non-White, older, and of a lower socioeconomic status.^{1,17, 18} Several factors have been identified that may represent barriers to CPR education/access, as well as activation of the chain of survival. Examples of these reported factors include language barrier, class cost, fear/distrust of law enforcement, fear over immigration status, liability concerns, and fear of causing harm to the victim.^{19–21}

These barriers may be seen in several groups who are limited in accessing CPR education and addressing these barriers is critical to increasing awareness and education. In this study we aimed to add to the identification of community-specific barriers. Our objectives were to 1) investigate barriers to successful activation of the chain of survival and serving as a lay rescuer, and 2) identify any associations between socioeconomic factors (primarily language) and barriers—specifically in Roanoke, Virginia. We hypothesized that barriers identified by participants who primarily spoke English would differ from those who primarily spoke Spanish.

METHODS

This study consisted of cross-sectional, survey-based research. A survey instrument (Appendix A) was designed to assess the knowledge, comfort, and perceived barriers to activating the 9-1-1 system and performing lay rescuer CPR.

Study Sample

Participants were recruited in person between June 2023–June 2024 using a convenience sampling strategy at community-based events in Roanoke, Virginia. These included free, non-certification, public CPR/AED classes taught in English and/or Spanish, as well as non-medical gatherings in association with community organizations. All persons ≥ 13 years of age were eligible to take the survey. Participants were asked to select from surveys in English or Spanish based on their primary spoken language. Community members who spoke a language other than Spanish or English were not administered surveys. Survey sites were selected based through convenience sampling and did not have specific selection criteria. They included English- and Spanish-speaking sites: churches; community CPR classes; local soccer games; community skills classes; and local restaurants. There were no other eligibility criteria. Surveys did not collect any private health information. Surveys were completed on paper and entered/stored via Research Electronic Data Capture (REDCap), housed at Virginia Tech Carilion School of Medicine.^{22,23}

Survey Design and Measures

Demographic information (ZIP code, age range, sex, race/ethnicity, education level, income) was collected via the survey instrument. Survey items related to perceived barriers to calling 9-1-1 or starting CPR, asked participants to consider the following barriers: law enforcement; immigration status; cost of CPR/AED training; fear of doing something wrong; language barrier; and concern for violence. In addition, participants had the option to mark “other” or no barrier to calling 9-1-1/starting CPR. The survey was created in English and then translated into Spanish by a fluent speaker and verified among multiple, bilingual, native Spanish-speakers to ensure retained accuracy and meaning. We excluded from the study any surveys that were collected outside the Roanoke area, as well as surveys indicating residence via ZIP code. A complete list of the included ZIP codes can be found in Appendix B. Any missing values were treated as “NA.”

Statistical Analysis

We conducted all analyses and data management using R 4.3.1 (R Foundation for Statistical Computing, Vienna, Austria).²⁴ Survey responses were directly compared between language groups (primary outcome) using Fisher tests. To analyze the association between language and perceived barriers, a model was built for each of the barriers that demonstrated statistical significance of $P < 0.001$ after the Fisher test. This choice was made to increase interpretability and to provide a baseline for more complex models in the future. As a result, each model was adjusted for age group, household income, and education level before being run against the outcome of survey language. For all models, the reference values were based upon previous literature to compare any relevant results to those of past studies. For age

group, the reference was 26–40 years of age. For household income, the reference was between \$10,000–\$30,000. For education level, the reference was two years of college.

We ran Fisher tests using the “testExact” argument within the “CreateTableOne” function from the package “tableone.”²⁵ Models were built using the “glm” function from the package “stats.”²⁴ Regression coefficient estimates were exponentiated, and we calculated 95% confidence intervals. Results of the regressions are presented as odds ratios (OR) with 95% CI and P -values.

RESULTS

Survey Response

In this study survey, response was voluntary and not incentivized; hence, the rate of participation at events varied. All events contained between 10–100 participants. Of the surveys distributed in Roanoke, VA, details were not kept on the number of event attendees and how many attendees completed surveys during the initial distribution of surveys. This information was only recorded at the last three events (of 11 participants each) where surveys were distributed. As a result, we were unable to calculate the complete survey response rate. With an approximation of 50 attendees per event and 11 events, there were approximately 550 total participants. Of those 550 participants, 367 surveys were collected for a response rate of 66.7%. Upon entering an event, participants were handed a survey and a writing tool. They were asked to complete it, if they were willing to, and to hand it back to a volunteer when finished. Once surveys were completed and returned, the CPR/AED education began. We believe the overall response rate was likely similar to this as there were no major changes in the structure of the training sessions or survey-collection methods between events.

Descriptive Statistics

A total of 367 surveys were collected: 231 in English and 136 in Spanish. Table 1 presents demographic information of survey participants.

Of English-speaking participants 72% indicated they would have no problem calling 9-1-1, compared to only 16% of Spanish-speaking participants who answered the same question (Table 2). In addition, Spanish speakers expressed higher rates of concern over the following barriers: immigration status (7%); fear of doing something wrong (14%); cost (14%); and language barrier (31%) when compared to English-speaking participants.

Regardless of language spoken, the most prevalent barrier to initiating CPR was the “fear of doing something wrong” with 49% of Spanish speaking] and 28% of English-speaking participants endorsing this as a barrier (Table 3). Only 10% of Spanish speakers stated they would have no concerns starting CPR, compared to 54% in the English-speaking group. Language barrier was indicated by 21% of Spanish speakers as a barrier to administering lay rescuer CPR, compared to 2% in the English-speaking group.

Table 1. Sociodemographic characteristics of respondents to a survey regarding their knowledge, comfort, and perceived barriers to performing bystander CPR.

	Overall (N = 367)	English (n = 231)	Spanish (n = 136)	P-value
Age				< .001*
13-25 years	62 (17.1%)	30 (13.2%)	32 (23.7%)	
26-40 years	75 (20.7%)	25 (11.0%)	50 (37.0%)	
41-55 years	82 (22.6%)	50 (21.9%)	32 (23.7%)	
56-70 years	96 (26.4%)	77 (33.8%)	19 (14.1%)	
71-85 years	41 (11.3%)	39 (17.1%)	2 (1.5%)	
>85 years of age	7 (1.9%)	7 (3.1%)	0 (0.0%)	
Sex				.11
Female	226 (62.1%)	147 (63.9%)	79 (59.0%)	
Male	133 (36.5%)	78 (33.9%)	55 (41.0%)	
Other	5 (1.4%)	5 (2.2%)	0 (0.0%)	
Education Level				< .001*
2 years of college	69 (19.4%)	59 (26.2%)	10 (7.6%)	
4 years of college	81 (22.8%)	48 (21.3%)	33 (25.2%)	
Graduate School	57 (16.0%)	50 (22.2%)	7 (5.3%)	
High School	137 (38.5%)	65 (28.9%)	72 (55.0%)	
Primary School	12 (3.4%)	3 (1.3%)	9 (6.9%)	
Race/Ethnicity				< .001*
Asian or Pacific Islander	2 (0.8%)	2 (1.0%)	0 (0.0%)	
Black	94 (35%)	94 (48%)	0 (0.0%)	
Hispanic or Latino	68 (26%)	1 (0.5%)	67 (94%)	
Multiracial or biracial	7 (2.6%)	6 (3.1%)	1 (1.4%)	
Native American or Alaskan Native	1 (0.4%)	1 (0.5%)	0 (0.0%)	
White	93 (35%)	90 (46%)	3 (4.2%)	
Household Income				< .001*
Under \$10,000	51 (15.4%)	19 (9.0%)	32 (26.2%)	
\$10,000-\$30,000	58 (17.5%)	25 (11.9%)	33 (27.0%)	
\$30,000-\$60,000	85 (25.6%)	49 (23.3%)	36 (29.5%)	
Over \$60,000	138 (41.6%)	117 (55.7%)	21 (17.2%)	
Under \$10,000	51 (15.4%)	19 (9.0%)	32 (26.2%)	
"Have you received CPR/AED training prior to today?"				< .001*
Yes, both	73 (28.0%)	65 (33.5%)	8 (11.9%)	
Yes, CPR only	65 (24.9%)	56 (28.9%)	9 (13.4%)	
Yes, AED only	4 (1.5%)	4 (2.1%)	0 (0.0%)	
No	119 (45.6%)	69 (35.6%)	50 (74.6%)	

*Statistically significant estimates at $P < .05$.

CPR, cardiopulmonary resuscitation; AED, automated external defibrillator.

Regressions*Barriers to Calling 9-1-1*

Primary language, age, and education level were significantly associated with willingness to call 9-1-1 (Table 5). The odds of Spanish-speaking respondents being willing to call 9-1-1 were 87% lower compared to

English-speaking individuals (OR 0.13; 95% CI, 0.06-0.25; $P < .001$). Primary language and age were significantly associated with barriers to calling 9-1-1. Spanish-speaking respondents were over 40 times more likely to indicate a language barrier to calling 9-1-1 when compared to English-speaking respondents (OR 40.08; 95% CI, 9.99-280.8; $P < .001$).

Table 2. Survey respondents' reported barriers to calling 9-1-1.

	Overall (N = 367)	English (n = 231)	Spanish (n = 136)	P-value
Willingness to call 9-1-1				< .001*
No	179 (48.8%)	65 (28.1%)	114 (83.8%)	
Yes	188 (51.2%)	166 (71.9%)	22 (16.2%)	
Law enforcement				.56
No	349 (95.1%)	218 (94.4%)	131 (96.3%)	
Yes	18 (4.9%)	13 (5.6%)	5 (3.7%)	
Immigration status				.01*
No	355 (96.7%)	228 (98.7%)	127 (93.4%)	
Yes	12 (3.3%)	3 (1.3%)	9 (6.6%)	
Cost				.03*
No	333 (90.7%)	216 (93.5%)	117 (86.0%)	
Yes	34 (9.3%)	15 (6.5%)	19 (14.0%)	
Fear of doing something wrong				.03*
No	333 (90.7%)	216 (93.5%)	117 (86.0%)	
Yes	34 (9.3%)	15 (6.5%)	19 (14.0%)	
Language barrier				< .001*
No	322 (87.7%)	228 (98.7%)	94 (69.1%)	
Yes	45 (12.3%)	3 (1.3%)	42 (30.9%)	
Concern for violence				.68
No	349 (95.1%)	221 (95.7%)	128 (94.1%)	
Yes	18 (4.9%)	10 (4.3%)	8 (5.9%)	
Other				.21
No	362 (98.6%)	226 (97.8%)	136 (100.0%)	
Yes	5 (1.4%)	5 (2.2%)	0 (0.0%)	

*Statistically significant estimates at $P < .05$.**Table 3.** Survey respondents' reported barriers to starting cardiopulmonary resuscitation.

	Overall (N = 367)	English (n = 231)	Spanish (n = 136)	P-value
Willingness to call 9-1-1				< .001*
No	229 (62.4%)	107 (46.3%)	122 (89.7%)	
Yes	138 (37.6)	124 (53.7%)	14 (10.3%)	
Law enforcement				1.00
No	353 (96.2%)	222 (96.1%)	131 (96.3%)	
Yes	14 (3.8%)	9 (3.9%)	5 (3.7%)	
Immigration status				1.00
No	360 (98.1%)	227 (98.3%)	133 (97.8%)	
Yes	7 (1.9%)	4 (1.7%)	3 (2.2%)	
Cost				1.00
No	359 (97.8%)	226 (97.8%)	133 (97.8%)	
Yes	8 (2.2%)	5 (2.2%)	3 (2.2%)	
Fear of doing something wrong				< .001*
No	235 (64.0%)	166 (71.9%)	69 (50.7%)	
Yes	132 (36.0%)	65 (28.1%)	67 (49.3%)	

*Statistically significant estimates at $P < .05$.

Table 3. Continued.

	Overall (N = 367)	English (n = 231)	Spanish (n = 136)	P-value
Language barrier				< .001*
No	335 (91.3%)	227 (98.3%)	108 (79.4%)	
Yes	32 (8.7%)	4 (1.7%)	28 (20.6%)	
Concern for violence				.73
No	359 (97.8%)	225 (97.4%)	134 (98.5%)	
Yes	8 (2.2%)	6 (2.6%)	2 (1.5%)	
Other				.56
No	358 (97.5%)	224 (97.0%)	134 (98.5%)	
Yes	9 (2.5%)	7 (3.0%)	2 (1.5%)	

*Statistically significant estimates at P < .05.

Table 5. Regression analysis between primary language and barriers to calling 9-1-1 among survey participants.

	Willingness to call 9-1-1		Immigration status		Cost		Fear of doing something wrong		Language Barrier	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Primary Language										
English	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Spanish	0.13*	0.06, 0.25	2.28	0.40, 19.44	1.45	0.59, 3.65	1.18	0.43, 3.25	40.08*	9.99, 280.8
Age										
13-25 years	0.43	0.16, 1.09	3.69	0.79, 21.6	2.02	0.74, 5.69	8.46*	2.78, 30.1	0.27*	0.07, 0.89
26-40 years	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
41-55 years	1.43	0.65, 3.19	0.73	0.09, 4.93	0.71	0.24, 2.00	0.62	0.15, 2.41	0.89	0.33, 2.34
56-70 years	4.89*	2.09, 11.9	**	**	0.17*	0.02, 0.73	0.19	0.01, 1.24	1.81	0.49, 6.86
71-85 years	3.07*	1.08, 9.37	**	**	**	**	**	**	4.1	0.39, 43.61
> 85 years of age	0.49	0.06, 3.50	4.71	0.14, 107.28	2.38	0.10, 23.94	4.85	0.19, 59.98	**	**
Education Level										
2 years of college	0.68	0.29, 1.59	**	**	2.03	0.59, 6.64	1.36	0.31, 5.24	0.72	0.16, 2.86
4 years of college	0.43*	0.19, 0.95	0.44	0.02, 3.41	1.88	0.62, 5.66	2.74	0.79, 9.88	0.8	0.27, 2.25
Graduate School	0.61	0.24, 1.54	1.71	0.07, 19.22	0.9	0.12, 4.22	0.45	0.02, 3.10	**	**
High School	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Primary School	0.66	0.09, 3.03	1.24	0.06, 9.45	0.47	0.02, 2.86	2.62	0.46, 12.87	1.59	0.33, 7.52
Household Income										
Under \$10,000	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
\$10,000-\$30,000	1.22	0.42, 3.59	3.57	0.73, 21.19	0.52	0.14, 1.78	1.34	0.34, 5.33	1.22	0.42, 3.59
\$30,000-\$60,000	2.37	0.91, 6.43	0.83	0.10, 5.85	0.47	0.14, 1.51	1	0.26, 3.78	2.37	0.91, 6.43
> \$60,000	1.81	0.68, 4.98	0.36	0.01, 3.93	0.52	0.15, 1.75	1.01	0.27, 3.85	1.81	0.68, 4.98

*Statistically significant estimates at P < .05.

**Estimate unable to be obtained due to small sample size.

OR, odds ratio; REF, reference.

.001). Respondents between 13-25 years of age were 73% less likely to indicate language as a barrier to calling 9-1-1 compared to respondents 26-40 years of age (OR 0.27; 95% CI, 0.07-0.89; $P = .04$).

Barriers to Starting Cardiopulmonary Resuscitation

Primary language and age were significantly associated with willingness to start CPR (Table 6). The odds of Spanish-speaking respondents being willing to start CPR were 89%

Table 6. Regression analysis between primary language and barriers to starting cardiopulmonary resuscitation among survey participants.

	Willingness to start CPR		Fear of doing something wrong		Language barrier	
	OR	95% CI	OR	95% CI	OR	95% CI
Primary Language						
English	REF	REF	REF	REF	REF	REF
Spanish	0.11*	0.05, 0.24*	1.91*	1.02, 3.61*	18.24*	4.63, 101.9*
Age						
13-25 years	0.55	0.19, 1.51	1.3	0.60, 2.80	0.31	0.06, 1.24
26-40 years	REF	REF	REF	REF	REF	REF
41-55 years	1.35	0.58, 3.19	0.49*	0.24, 0.98*	1.14	0.36, 3.57
56-70 years	4.79*	2.07, 11.51*	0.12*	0.04, 0.28*	3.5	0.82, 15.73
71-85 years	1.46	0.55, 3.95	0.39	0.14, 1.02	7.16	0.95, 60.23
>85 years	0.78	0.09, 5.76	0.37	0.02, 2.99	**	**
Education Level						
Primary School	1.48	0.20, 6.95	0.54	0.13, 1.96	1.4	0.25, 6.65
High School	REF	REF	REF	REF	REF	REF
2 years of college	1.09	0.49, 2.41	1.3	0.58, 2.93	0.49	0.08, 2.13
4 years of college	0.83	0.38, 1.82	1.49	0.73, 3.06	0.42	0.10, 1.48
Graduate School	0.8	0.33, 1.92	1.4	0.57, 3.40	0.36	0.01, 3.18
Household Income						
Under \$10,000	REF	REF	REF	REF	REF	REF
\$10,000-\$30,000	2.11	0.71, 6.65	0.67	0.27, 1.63	0.51	0.16, 1.55
\$30,000-\$60,000	2.23	0.81, 6.52	0.67	0.29, 1.56	0.42	0.14, 1.22
> \$60,000	1.09	0.39, 3.17	1.24	0.52, 2.99	0.07*	0.00, 0.51*

Spanish-speaking respondents were 18.24 times more likely to indicate language as a barrier to starting CPR, compared to English-speaking respondents (95% CI, 4.63-101.98; $P < .001$). Respondents who had an annual household income over \$60,000 were 93% less likely to indicate language as a barrier to starting CPR (OR 0.07; 95% CI, 0.00-0.51; $P = .03$).

*Statistically significant estimates at $P < .05$.

**Estimate unable to be obtained due to small sample size.

OR, odds ratio; REF, reference.

lower compared to English-speaking individuals (OR 0.11; 95% CI, 0.05-0.24; $P < .001$). Respondents 56-70 of age were 4.79 times more likely to indicate no problem starting CPR compared to those 13-25 (95% CI, 2.07-11.51; $P < .001$). Primary language and age were significantly associated with a fear of doing something wrong as barriers to starting CPR. Spanish-speaking respondents were 1.91 times more likely to indicate fear of doing something wrong as a barrier to starting CPR, compared to English-speaking respondents (95% CI, 1.02, 3.61; $P = .44$).

Primary language and income were significantly associated with barriers to starting CPR.

DISCUSSION

In this pilot study, we found language-specific barriers to successfully activating the chain of survival and serving as a lay rescuer. The chain of survival concept begins with the recognition of sudden cardiac arrest and initiation of the

emergency response system through calling 9-1-1, followed by the initiation of high-quality CPR. There is limited research investigating associations between language barriers and lay rescuer CPR, but there is evidence that underuse of 9-1-1 and delays in care can be attributed to non-English speakers.¹²⁻¹⁴ This study demonstrates that Spanish-speakers expressed higher rates of concern around certain barriers, compared to English-speakers. Additionally, several sociodemographic factors were associated with certain barriers.

Nearly three-quarters of our Spanish-speaking survey respondents reported they would have some problem with calling 9-1-1, including the language barrier. Other barriers to calling 9-1-1 that the Spanish-speaking respondents reported were the following: immigration status; “fear of doing something wrong”; and cost. Although there was no significant association between immigration status and demographic variables, it is important to recognize that we collected data prior to the current administration’s increase

in immigration enforcement. Regardless of language spoken, the most prevalent barrier to initiating CPR was the “fear of doing something wrong” with 49% of Spanish-speaking participants and 28% of English-speaking participants endorsing this as a barrier. Almost 90% of Spanish speakers stated they would have some problem starting CPR, compared to approximately 46% of the English speakers. Language was reported by 21% of Spanish speakers vs 2% of English speakers as a barrier to administering lay rescuer CPR. This is consistent with previous research on barriers to calling 9-1-1 and initiating CPR.^{18,26}

Second to language the most prevalent factor in barriers to calling 9-1-1 was age. Associations were seen between age and multiple barriers, including cost and fear of doing something wrong. Respondents between 56-70 years of age had higher odds of indicating they had no problem calling 9-1-1 and lower odds of reporting cost as a barrier compared to those 26-40 years of age. In the 13-25 cohort, the odds of reporting language as a barrier to calling 9-1-1 were lower and odds of reporting fear of doing something wrong was higher compared to those 26-40 years of age. Primary language was associated with a barrier to calling and willingness to call 9-1-1. Education level did demonstrate association with willingness to call 9-1-1.

Spanish-speaking respondents were 89% less likely to have no problem starting CPR compared to English-speaking respondents. In addition, Spanish-speaking respondents were 18.24 times more likely to indicate language as a barrier to starting CPR and 1.91 times more likely to indicate fear of doing something wrong as a barrier to starting CPR, compared to English-speaking respondents. Compared to those 26-40 years of age, respondents who were 41-70 years of age were less likely to report the fear of doing something wrong as a barrier to starting CPR.

These results build on previous findings that non-English speaking individuals face language barriers to calling 9-1-1 and starting CPR.¹¹⁻¹³ It also highlights the sociodemographic factors that have higher odds of being associated with certain barriers. This highlights the disparity in CPR education penetration equitably to all communities and the need for community-specific education.

LIMITATIONS

This was a pilot study focused on survey research in Southwest Virginia, specifically Roanoke, and should be viewed in light of several limitations. First, the majority of the Spanish-speaking individuals in the Roanoke area are from Honduras and Mexico.²⁶ Due to a variety of dialects within the Spanish language, the lack of formal testing for cultural or linguistic equivalence before translating the survey, and the lack of pretesting or cognitive interviewing to validate the survey, cross-group equivalence and generalizability may be limited. Interpretability may be limited due to race and ethnicity measurements that did not

follow federal standards by combining race and ethnicity into a single item. Efforts were made to reduce sampling bias by recruiting subjects from similar environments, but it is possible both groups are not fully represented by the sample data. Sample size was determined by feasibility and available participants. Given convenience sampling without a concretely calculable response rate, the possibility of selection and non-response bias is higher.

Third, regression models were built to account for some sociodemographic factors but not all. Age group, highest level of education, and household income were controlled for in models as they demonstrated statistical significance. Although race did demonstrate statistical significance, it was not included in the model. This was to avoid over-adjustment of the model along with other social determinants of health. Prior to the study start, a priori power analysis was not run. Sample size was determined by feasibility and available participants. As a result, the study may be underpowered to detect small-to-moderate differences across language groups and subgroups, increasing the risk of type II error and contributing to wide confidence intervals.

Given that English and Spanish were the only two languages studied, the barriers identified and their impact may vary among groups that speak other languages. Additionally, the role of religion or other cultural factors not investigated may play crucial roles in affecting willingness to perform CPR or call 9-1-1 and were not investigated in this study. Despite survey anonymity, the possibility of social desirability bias impacting results with self-reported data is a possible factor to consider. Other sociodemographic factors were not controlled for and could be potential confounders. Finally, in conducting this pilot study, our aim was to identify areas of future research and tangible goals for improved CPR education; this study lays the groundwork for such inquiry. Finally, we did not account for all barriers that may affect the various steps in the chain of survival for Spanish-speaking individuals.

CONCLUSION

Spanish-speaking survey respondents were significantly less likely to feel comfortable calling 9-1-1 and initiating CPR compared to those who spoke English. Further study investigating why this is the case, and what barriers are faced by other communities may yield greater ability to address the disparities in bystander CPR use and reception. This study demonstrates the need for further research exploring how social determinants of health impact the chain of survival in other non-English-speaking communities. Furthermore, this study underscores the need for community-tailored CPR education that includes information on the US emergency response system that is language-accessible and culturally appropriate.

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Seven Steps for Emergency Physicians to Dismantle Access Barriers and Build Equitable Care Systems

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As many as one fifth of the people who visit emergency departments (ED) annually report having no other source of healthcare, particularly in regions with primary care shortages. Since 2018, the Bridge Center at the Public Health Institute (Bridge) has led a national movement, shifting how EDs in hundreds of hospitals across more than 45 states address public health crises for populations historically underserved by the healthcare system. Change is hard; change in healthcare is particularly difficult. To address this gap, we developed a change-making framework that guides champions to disrupt the status quo and meaningfully improve the quality of care for patients who have few options beyond the ED. This versatile framework is based on implementation research and has been tested and shown to be successful at hundreds of hospitals where it has been applied to the treatment of substance use disorder, sexual and reproductive health needs, and harm reduction efforts including naloxone and emergency contraception distribution. Any champion can use this framework to decrease pre-existing bias, implement evidence-based practices for stigmatized health conditions, and create sustainable reform in US EDs and other acute care settings.

INTRODUCTION

Hospital operations in 2026 have grown increasingly complex and often lack clear direction and coordination. Healthcare leaders are struggling to balance budgets with cuts to Medicare/Medicaid, facing a historic staffing shortage,⁴ and responding to ever-changing threats to public health. Nearly half of Americans are uninsured, underinsured, or burdened by medical debt.⁵ It's getting worse, and disruption is needed. While bedside clinicians often have ideas for practical, patient-centered solutions, they often lack training to learn how to effectuate new ideas. This prevents clinical teams from making real-time changes. It can take up to 17 years for

medical practice to catch up to evidence,⁶ leaving hospitals, clinicians, and patients frustrated.

The Bridge Center at the Public Health Institute (Bridge) has spent over six years testing, refining, and implementing our healthcare change-maker framework that has transformed the healthcare status quo in one-third the traditional time. Together, we hold decades of experience across clinical and policy spaces, driving physician-led reform. Here we present our novel change-making framework for the first time. Importantly, our experience centers around practice reform in historically stigmatized care, such as addiction treatment and reproductive health, including abortion. Much existing implementation science assumes that practice will follow the evidence, but in our experience, when leading change that relates to marginalized patients, additional work is needed to normalize why and how to care for those who have fallen through the cracks in the safety net. Our framework was originally designed for acute care settings, but it has proven to be effective in a variety of healthcare settings. Our work extends diffusion theory⁷ by investigating how existing scientific evidence can inform care delivery in settings where change-makers face institutional inertia or political sensitivity.

Bridge Has Rapidly Transformed the Status Quo

Bridge was launched through its foundational CA Bridge program. California's Department of Health Care Services funded CA Bridge to provide grants to hospitals to build medication for addiction treatment (MAT) programs. MAT—specifically a drug called buprenorphine—is the gold standard treatment⁸ for opioid use disorder but was and still is dramatically under-prescribed due to factors including stigma and incomplete medical training.¹⁰ Over five years, Bridge administered grants and/or technical assistance to 291 of California's 330 hospitals to build MAT programs. This effort

tracked over half a million patient navigator encounters and over 125,000 buprenorphine initiations. Bridge has also supported MAT program initiation in hospitals across 40 states, changed national standards for prehospital addiction treatment,¹¹ and expanded access to sexually transmitted infection screening and reproductive healthcare.

Since its founding, Bridge has engaged hundreds of driven and compassionate clinical champions. Bridge clinical leaders and staff coach these champions to initiate practice changes by winning over hearts and minds, engaging multidisciplinary leadership teams, adding new medications to hospital formularies, embedding workflows in electronic health records, and training peers to use simple treatment protocols covering critical knowledge gaps historically missing from clinical training.

Getting Started: Bust Through Bureaucracy to Build the Case for Change

Complex, overlapping reporting structures are often a barrier to clinician-led change. Most hospitals are led by a CEO who reports to a board of directors and is supported by a “C-Suite” that oversees the hospital’s medical care and operations. While clinicians can either be employees or contractors, staffing privileges are typically handled by the Medical Staff Office. The Chief of Staff, medical department chairs, and other physician leaders’ roles are also critical to understand, as are the multidisciplinary hospital committees and work groups that manage hospital policies, medical staff bylaws, and pharmacy formularies. Considering this complex organizational chart, champions must consider: Who has a stake in the process you’re trying to improve? Is this change replacing a current process, or is it building guidance where none exists? Does it require executive support, a literature review of scientific evidence, or support from a specific stakeholder?

Champions should begin by meeting with leaders to understand the hospital’s existing structure for change. Accomplishing this task may not be straightforward. Tips to get started:

1. *Ensure your immediate supervisor is on board.* Blindsiding your direct supervisor tends to result in more harm than good. You do not need to have your boss’s full support, but it’s tough to succeed if they are in direct opposition to your idea.
2. *Meet people in person when possible.* Many hospital leaders are physically present in the hospital during weekday business hours. Introducing yourself in person can go a long way in moving the conversation forward.
3. *Get to know the person who sends meeting invites and sets the agenda.* Clinical leaders are often busy and inconsistent in responding to e-mails or calls. Most committees or department meetings are supported by staff with more predictable availability.
4. *Expect to be told no, and don’t accept the first no.* We

can’t tell you how many times the first three answers are “no” when advocating for practice change, particularly for stigmatized conditions such as opioid use disorder or pregnancy loss. Don’t let that deter you. “No” is far more common than “yes” when new ideas get pitched.

FOLLOW THE TRAFFIC LIGHT ANALOGY

As you meet and discuss your idea with others, they will sort themselves into three “traffic light” categories based on their level of interest in or resistance to your idea: green; yellow; and red lights.

First: Identify and Engage Green Lights.

“Green lights” are enthusiastic about your idea for change. They might have a connection to the care you’re advocating for, such as a loved one with a substance use disorder or personal experience with miscarriage. Engage green lights early. Let them draft policies, work with information technology to create charting templates, prepare staff training, create patient discharge instructions, etc. Keep an open mind: Green lights come in many forms—physicians, nurses, pharmacists, techs, navigators, security personnel, social workers, and more. All are welcome.

Next: Make it Easy for Yellow Lights to Participate.

We estimate that roughly 80% of people are “yellow lights.” These are busy people already overwhelmed by patient care, charting, keeping up with current practice guidelines, completing continuing medical education (CME) and other administrative tasks. For this group, creating change can mean more work, taking time to learn something new and disrupting an already tenuous work/life balance.

Yellow lights don’t have significant objections to your idea, but you must make it easy for them to participate. Work through as many “bumps” in the workflow as possible: Create automatic order sets; ensure clinical protocols are readily available at workstations; offer CME opportunities that provide relevant education; and share examples demonstrating improved patient care. Make the right thing the easy thing and regularly remind your peers of the change so it stays fresh.

Motivate Red Lights...Later.

Red lights are typically few but vocal in opposition. Their arguments may reflect gaps in current knowledge, reliance on outdated frameworks, or the influence of personal beliefs. Identify these people early. Meet with them to acknowledge their concerns but put them in a proverbial “parking lot” while you focus on green and yellow lights to get your change-making efforts off the ground. Keep group discussions focused and goal oriented. Later, you may need to use a senior-level leader or strategic peer pressure to bring them along. When thoughtfully engaged, red lights can flip to become some of the most productive green lights.

CASE STUDY: FROM FRAMEWORK TO ACTION

From Framework to Action	Co-author Dr. Alicia M. Gonzalez used this approach to implement medication for opioid use disorder (MOUD) with buprenorphine at a hospital on California's central coast.
Critical Points of Engagement for MOUD Implementation	- Hospital Community Board of Directors and CEO - Set strategic priorities for the hospital - Hospital CMO and Chief of Staff - Ensure standard of care is met by clinical teams - Emergency physician and nursing leadership - Care for emergency patients with OUD - Case management and social work leadership - Oversee staff typically consulted for patients with substance use disorder. - Pharmacy - Oversees hospital medication formulary and Pharmaceuticals and Therapeutics (P&T) committee
Traffic Light Approach to Engagement in Implementing MOUD	- Green lights: Advocated to P&T to include buprenorphine on formulary; worked with IT to ensure correct doses were orderable in the EHR; uploaded custom patient discharge instructions into the EHR; designed and hosted physician and nursing training on buprenorphine; created partnerships with community clinics to ensure "warm hand off" for patients being started on buprenorphine in the ED to have prompt access to ongoing outpatient care; presented to the hospital board and community partners to increase awareness of the opioid epidemic and the hospital's treatment program, established initial data-driven SMART goals and tracked progress. - Yellow lights: Completed recurrent training on MOUD clinical protocols; received feedback on positive outcomes for their patients started on buprenorphine; were solicited for feedback on making the program and related workflow smoother; were engaged to assist with red lights on shift as MOUD became the clear standard of care in the ED. - Red lights: Concerns were heard early on and addressed openly over time in group settings, eg via education to dispel myths or incorrect assumptions; were given time to see MOUD success cases from green and yellow lights. Six to nine months after implementation, clinicians still resistant to providing MOUD to patients were given one-on-one feedback and coaching by the medical director, with time to vocalize and address any remaining concerns but understanding practice variance was now considered outside the standard of care. Once each red light's concerns were addressed in a private setting with clear success of the program demonstrated, no red light required performance improvement planning.
MOUD Project Timeline	- Months 1-3: Green lights discovered; team of champions assembled; first meetings hosted with discussion of goals and timeline. - Months 3-6: Naloxone distribution program implemented. Given early resistance to MOUD based on lack of knowledge about its efficacy and evidence, in-hand naloxone distribution was a less controversial way to engage the entire ED in combatting the opioid epidemic and raised awareness of the issue. - Months 3-9: Green lights continued to work on infrastructure to ensure smooth workflows for clinical and support staff, eg, EHR orders, patient instructions, and preparing job-specific clinical training. Leaders of relevant departments (ED, Nursing, Case Management/Social Work, Pharmacy) were engaged in training timeline development. - Months 6-12: Initial clinician training completed, first patients treated with MOUD from the ED. Every initial patient was followed closely, and clinicians were given feedback on successful outcomes to demonstrate the effectiveness of the treatment. Green lights provided most buprenorphine. - Months 9-12: Yellow lights were given re-training, frequent reminders, and opportunities to ask questions in real time when caring for patients as well as at department meetings. Increasingly, starting buprenorphine became the standard of care for patients with OUD. - Months 12-18: Red lights who still carried significant concerns were addressed one-on-one by the ED medical director. - Months 12-24: Group and individual data shared with the team at specific intervals, along with reminders about clinical protocols to reinforce and expand/layer knowledge of MOUD. Education and training expanded outside the ED to medical, critical care, surgery, and labor and delivery teams throughout the hospital. Note: This work took place starting in January 2021, in part limited by significant hospital attention being focused on the volatile COVID-19 pandemic. And yet significant progress was made, and the program was able to succeed.

CEO, chief executive officer; CMO, chief medical officer; ED, emergency department; EHR, electronic health record; OUD, opioid use disorder; SMART, specific, measurable, achievable, relevant, and time-bound goals.

SEVEN STEPS TO SUSTAINABLE CHANGE

You've laid the groundwork, you understand your hospital's inner workings, and you know your key players. Next: Implement the Bridge Center's Seven Steps for Sustainable Change.

1. *Build your team.* Build a core team of green and yellow lights and assign tasks that use their strengths. Factor in legal, hospital policy, or religious considerations specific to your work, and engage experts in these areas. Be honest about your own capabilities and bolster your team with people whose expertise complements your own. Ideally, this team should include a champion from departments you want to impact, including nursing, patient navigation, and pharmacy. Set meetings with clear action-item driven agendas and stick to them.
2. *Research local examples.* Look to academic medical centers in your area, which are often ahead of community hospitals in adopting new approaches to patient care. Find nearby hospitals already implementing your proposed change. Competition in this context can be a driver for good and can help push past an initial "no." No leader wants their facility to be behind the times.
3. *Map action items and a realistic timeline.* Define the true north: What are you trying to see happen? Establish a project plan with a timeline and goals. This guidance might seem simple to someone with a background in project management, but that skillset is rarely taught to clinicians. Posters, brochures, and hospital marketing need to be updated. Staff need to be trained; an education plan must be created for all stakeholders, including less-considered teams such as security guards, custodial staff, hospital phone operators, and volunteers.
4. *Buckle up and facilitate.* There is no getting around it: Change-making is work and requires cross-disciplinary communication. Technology is your friend. Set reminders for yourself based on your project plan and schedule reminder emails to send in advance. If this is not your strength, engage a partner who is good at it. Someone else may have more experience with this skillset, and it can be a great opportunity to engage non-clinical champions such as patient advocates or hospital volunteers.
5. *Have a strategy for inclusion.* Engage others, focusing on what's in it for them. Green lights bring their own passion and inner "why." Yellow lights may respond to real examples of how this change made the workflow easier for a colleague or improved a specific patient's outcome. Others care more about decreasing repeat emergency department (ED) visits, shortening length of stay, or improving efficiency. Even red lights care about keeping up with the

standard of care and don't want to be outliers. Focus your message on your audience.

6. *Secure executive support.* It's important to have a senior-level leader on your team supporting this change. C-suite members, medical staff leaders, and department chairs all maintain influence in the hospital. Use your executive-level support to facilitate introductions early on and keep them engaged to help with red lights as another source of listening and acknowledgment, and affirm this change is the new expected standard.
7. *Measure and report back.* Share success back to everyone, loudly and often, in both quantitative and qualitative formats. Perhaps you have a simple graph showing an improvement in a measure of patient care alongside the story of a patient who achieved a better outcome because of this change. Show your team that this change matters and you are not wasting their time. The work is important enough to monitor, measure, and celebrate. Repeat this step again and again.

CONCLUSION

Change-making is an iterative process, but it does not have to take as long as the literature typically claims. Empowered clinical team members, motivated by making their workplace and patient care better, can do great things if given the tools to succeed. Those tools, however, are not taught to us as standard practice in medical training. Our goal in sharing these lessons learned at Bridge is to equip every clinical care team member with the basic knowledge necessary to make positive change. The best ideas to improve patient care come from frontline clinicians; our goal is to see them come to life.

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The One Big Beautiful Bill: A Looming Crisis for Health Equity and Emergency Medicine

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On July 4, 2025, the budget reconciliation bill—colloquially known as the One Big Beautiful Bill Act (OBBBA)—was signed into law, marking the first step in a slew of sweeping reforms across Medicaid, Medicare, and the Patient Protection and Affordable Care Act marketplaces.¹ While the legislation was promoted as a bold fiscal restructuring, its healthcare provisions carry profound implications for emergency medicine. For many Americans, the OBBBA is not an abstract budgetary exercise but a lived reality that will reshape how, when, and whether they can access care.

At the heart of the law are several major Medicaid changes: the introduction of nationwide work requirements, tighter and more frequent eligibility redeterminations, restrictions on immigrant eligibility, and new limits on state Medicaid financing flexibility.² According to the Congressional Budget Office, the law will reduce federal spending on healthcare by over \$1 trillion and lead to an increase of over 10 million uninsured individuals.¹ For those of us who work in the emergency department (ED), the consequences will be immediate and visible: more patients arriving uninsured, sicker, and later in the course of their illness.

Emergency physicians often highlight the 1986 Emergency Medical Treatment and Labor Act (EMTALA), one of the most comprehensive laws granting nondiscriminatory access to emergency medical care, as a defining aspect of our specialty. This law guarantees that no patient will ever be turned away, regardless of ability to pay, race, sex/gender, background, or creed.³ But EMTALA is an unfunded, safety-net mandate, not a substitute for comprehensive coverage, and its interplay and continued efficacy as health policy law continues to change.⁴ The law was designed to prevent patient dumping and was the nation's promise to patients of access to a doorway, but it does not

guarantee desperately needed access to longitudinal or preventative care that actually save lives.⁵

The OBBBA threatens to expose the fragility of relying on EMTALA alone as the medical care safety net of this nation. The Congressional Budget Office estimates that the work requirement provisions alone will reduce federal Medicaid spending by \$326 billion over 10 years and will lead to 5.3 million more uninsured patients by 2034.¹ This change will increase uncompensated care and widen health inequities. A major study from the National Bureau of Economic Research found that Medicaid expansion in certain states under the Affordable Care Act reduced the overall risk of death by 2.5%, and by as much as 20% among those newly eligible. Medicaid expansion saved approximately 27,400 lives between 2010 and 2022.⁶ Similarly, it was calculated that Medicaid expansion was associated with a net decrease of 31.8 deaths per 100,00 person-years following the COVID-19 pandemic. This trend was statistically significant for deaths related to chronic disease, and the protective effect of Medicaid was present regardless of age, sex, or race.⁷ Without Medicaid, we will be working against these positive trends.

Not only does the OBBBA target the recipients of Medicaid and their eligibility for the program, it significantly diminishes funding for the program via cap reductions in the Medicaid provider taxes from 6% to 3.5%. Rural hospitals disproportionately rely on Medicaid to keep the lights on, and the cap reductions caused so much alarm in states with higher Medicaid populations⁸ that the Rural Health Transformation Program (RHTP) was added to assuage policymakers with largely rural districts to sign the OBBBA. The RHTP is a \$50 billion fund administered through the Centers for Medicare & Medicaid over five years, advertised as a way to offset funding decreases from Medicaid. However, based on the way the RHTP is currently written, it is unlikely to make up for the

substantial Medicaid cuts, especially with no guarantees that the funding will reach rural hospitals and their patients.⁹

Rural hospitals are not the only hospitals at risk. Urban safety-net EDs, particularly those in academic medical centers, will shoulder worsening disproportionate strain. According to the Association of American Medical Colleges (AAMC), while its members comprise approximately 5% of hospitals in the United States, AAMC member centers deliver about 32% of all uncompensated care in the US.¹⁰

The financial stress created by the OBBBA on both rural and academic hospitals will accelerate closures and cause significant strain on their EDs. Without access to primary clinics for preventative care, patients will arrive at the door of the ED to access unscheduled and often uncompensated care, exacerbating EDs' crowding and boarding problems. More crowded EDs mean longer wait times, higher left-without-being-seen rates, increased boarding, and poorer patient outcomes. With the burnout rate already so high in emergency medicine, the potential worsening moral burden of emergency physicians—who must care for patients in increasingly inequitable and under-resourced circumstances—cannot be understated.¹¹

As a specialty, emergency medicine must remain vigilant. The passage of the OBBBA represents not just a fiscal shift but a public health turning point, much as the Affordable Care Act was several years ago. Regardless of one's political stance, the reality of this bill is clear: Millions will lose coverage, and the downstream effects will arrive at the doorsteps of EDs first. We must advocate for policies that preserve equitable access to care, anticipate the resource challenges ahead, and reject the illusion that EMTALA alone can sustain the nation's health.

This means continuing our own education, teaching residents the fundamentals of health policy (a recognized American Accreditation Council for Graduate Medical Education core competency), advocating through professional organizations, and working with local hospital leadership. The system for implementing the Medicaid work requirements will be state based; so there is still time for advocacy to key stakeholders and leaders to improve the ease of reporting requirements and reduce the inappropriate loss of insurance coverage. Rural and underserved hospitals with high numbers of uninsured and Medicaid populations are at greatest risk for lost funding and closure; urging state and federal policymakers to equitably apply and disperse the RHTP funds will be key to reducing these inequities.

These policy changes also present a unique opportunity for emergency physicians and departments to develop partnerships with community organizations to bridge the gaps in access and improve health equity. Many community and philanthropic organizations that have been filling the gaps and needs for many patients will face more barriers as need grows and funding options diminish. Strengthening partnerships and supporting them to continue their critical work will be

especially important. Additionally, the private sector holds significant potential to fund innovations in healthcare access, such as in frontiers of telehealth or artificial intelligence that may decrease healthcare inequalities and reduce emergency physician workload and burnout.^{12,13} If we truly want to save lives, we must lead the effort to build and sustain the infrastructure required to do so. Now is the time to advocate, speak up, and get ready.

Emergency medicine has always been proud to be the last line of defense for our safety net. Without broader systemic investment in access and equity, EMTALA risks becoming not a net but a thin thread—one that risks breaking under the weight of continued policy changes that limit access to healthcare.

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Racial Disparities in Door-to-Clinician Time for Cardiac Chest Pain in the Emergency Department

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Introduction: Timely evaluation in the emergency department (ED) is critical for patients with cardiac chest pain. Although racial disparities in ED wait times have been reported, few studies have focused specifically on cardiac-related presentations. In this study we assessed racial and ethnic disparities in ED door-to-clinician time for cardiac chest pain.

Methods: We conducted a retrospective analysis of adult ED visits for cardiac chest pain (2019–2025) at a tertiary-care academic hospital. Patients ≥ 18 years of age were included. Race/ethnicity was categorized as White, Hispanic/Latino, Black, Native American, Asian, or other/unknown. Multivariable generalized linear modeling assessed the association between race/ethnicity and door-to-clinician time, adjusting for demographics and clinical variables.

Results: The study included 3,925 patients. The overall median door-to-clinician time was 15.9 minutes (interquartile range 8.0–36.0). In unadjusted bivariate analyses, significant differences were observed across racial and ethnic groups ($P < .001$). Native American patients experienced the longest delays (23.8 minutes [13.9–49.8]), followed by Asian (18.6 minutes [8.4–36.5]) and Hispanic/Latino patients (17.1 minutes [9.3–43.7]). In contrast, White and Black patients had shorter median wait times of 14.9 minutes [7.1–33.9] and 15.0 minutes [8.8–38.7], respectively. After adjustment for age, sex, triage acuity, clinician type, and initial vital signs, Hispanic/Latino patients waited 18.2 minutes vs 14.9 minutes for White patients (absolute +3.3 minutes; 22% longer; relative risk 1.22, 95% CI, 1.09–1.36, $P < .001$). Adjusted times were also higher for Black (16.5 minutes), Native American (17.7 minutes), and Asian patients (15.1 minutes), but differences were not statistically significant.

Conclusion: Hispanic/Latino patients with cardiac chest pain experienced a 22% longer ED wait time than White patients. Our findings highlight the need for targeted interventions and multisite research to ensure equitable, timely care for all patients with acute cardiac conditions. [West J Emerg Med. 2026;27(1)18–24.]

INTRODUCTION

Acute chest pain is one of the most common presenting complaints in the emergency department (ED).^{1–3} It may indicate serious conditions such as acute coronary syndrome (ACS) or myocardial injury. Timely evaluation in the ED is

essential for the early diagnosis and management of ACS.^{2,4} However, not all patients presenting with chest pain receive equally timely care. Emerging evidence suggests that timeliness of evaluation and management may vary based on patient sex or race.^{3,5} Racial and ethnic differences in ED management have

been well documented. Multiple studies report that Black and Hispanic/Latino patients are more likely to be assigned lower Emergency Severity Index (ESI) levels and experience longer door-to-clinician times compared to White patients.^{6–12}

These delays may result in missed opportunities for early risk stratification, delayed diagnostics or treatment and, ultimately, worse clinical outcomes, thereby contributing to persistent health disparities. For example, data from the National Hospital Ambulatory Medical Care Survey found that Black patients with chest pain or dyspnea had significantly longer ED wait times than White patients. A recent analysis of over 310,000 ED visits showed that Hispanic/Latino and Black patients experienced longer median wait times than non-Hispanic White patients. Although some of these differences were attributed to factors such as mode of arrival and ESI, 12–27% of the disparities remained unexplained, potentially reflecting systemic bias or unmeasured confounders.¹³ Similarly, a retrospective analysis of 28,705 ED visits across 17 sites found that Black patients with chest pain experienced significantly longer wait times for evaluation by emergency clinicians compared to White patients.¹⁴ Banco et al (2022) also reported that Black patients received less timely and less aggressive evaluation for chest pain compared to their White counterparts.³ These patterns of unequal care may delay timely interventions, contributing to higher rates of missed or late diagnoses and worse cardiovascular outcomes.

Despite well-documented racial differences in ED wait times, gaps remain in understanding disparities among patients with confirmed cardiac chest pain. Prior studies often combined cardiac and non-cardiac presentations, risking misclassification bias. Additionally, most data come from East Coast urban safety-net hospitals, limiting generalizability. Our study addresses these gaps by focusing on confirmed cardiac chest pain in an understudied western US setting. The objective was to compare door-to-clinician times across racial and ethnic groups among adults presenting to a single, tertiary-care, urban, academic ED, to identify potential disparities in timely care delivery.

METHODS

Study Design and Settings

In this retrospective observational cohort study we analyzed electronic health record (EHR) data from adult patients presenting to the ED with cardiac-related chest pain between 2019–2025. The study was conducted at a tertiary-care, urban, academic ED in the western United States that serves a diverse patient population with approximately 62,000 annual visits. The ED provides comprehensive emergency care, including specialized cardiac services, and employs standardized triage protocols based on the ESI and chief complaint. For chest pain, triage pathways target a 12-lead electrocardiogram (ECG) within 10 minutes of arrival; additionally, standing nursing orders permit ECG and initial laboratory testing before clinician evaluation.

Population Health Research Capsule

What do we already know about this issue?
Emergency department wait-time disparities by race/ethnicity are documented, but cardiac chest-pain-specific delays and adjusted comparisons across groups remain understudied.

What was the research question?
Do door-to-clinician times for cardiac chest pain differ by race/ethnicity in a tertiary ED?

What was the major finding of the study?
Hispanic patients with cardiac chest pain waited 3.3 minutes longer (18.2 vs. 14.9 minutes, 22%) than White patients for ED clinician evaluation (RR 1.22, 95% CI 1.09–1.36, $p < 0.001$).

How does this improve population health?
Quantifying inequities in time-to-evaluation identifies targets for ED workflow and triage reforms, guiding interventions for equitable cardiac care.

Study Population

We included adult patients (≥ 18 years) who presented to the ED with cardiac symptoms, met the criteria for cardiac chest pain defined by elevated high-sensitivity cardiac troponin T (hs-cTnT) levels above sex-specific 99th percentile upper reference limits (≥ 14 nanograms per liter [ng/L] for females and ≥ 22 ng/L for males), consistent with institutional and guideline standards. An ACS diagnosis was confirmed using a combination of emergency physician documentation, ECG findings (eg, new ST-segment changes, T-wave inversions, and OMI equivalents such as new left bundle branch block, bifascicular block, or posterior myocardial infarction [MI] patterns), and *International Classification of Diseases, 10th Modification* codes (eg, I21.x for acute MI, I20.0 for unstable angina). This case definition reflects retrospective adjudication based on the ED workup, not triage impressions. Patients without ischemic ECG changes but with elevated troponin, including those with a significant delta rise on repeat testing, were also included to capture the full spectrum of myocardial injury.

We excluded cases with troponin elevation due to non-cardiac causes (eg, sepsis, renal failure, pulmonary embolism, myocarditis, pericarditis, tachyarrhythmia-related demand),

old or non-ischemic ECG changes, and ESI levels other than 2 or 3. We excluded five ESI level 4 cases due to their low representation, which would not meaningfully have impacted disparity estimates. We also excluded patients who eloped, left against medical advice (AMA), or had missing key data.

Data Source and Variables

We obtained data for this study from the Epic EHR system (Epic Corporation, Verona, WI). The data included de-identified records of patients who visited the ED. The database contains comprehensive information, including patient demographics and clinical variables. The primary outcome measure was door-to-clinician time, defined as the number of minutes from a patient's arrival at the ED to their initial evaluation by a clinician. The primary exposure variable was race/ethnicity as documented in the EHR. Categories included the following: White; Hispanic/Latino; Black; Native American (American Indian/Alaska Native); Asian American; and other (including "refused to say" or "unknown"). Other covariates included age (measured continuously in years), sex (categorized as male or female), and triage acuity. We also included patients' initial vital signs recorded at triage and clinician type, as well as whether the first evaluation was by an advanced care practitioner (ACP) or emergency physician.

This retrospective chart review followed key methodological standards recommended by Worster et al¹⁵ as follows: clearly defined inclusion and exclusion criteria; standardized and piloted data abstraction forms; use of trained and blinded abstractors; inter-rater reliability checks on a subset of charts; and routine monitoring of data quality throughout the abstraction process. This retrospective chart review was determined exempt by the University of Utah Institutional Review Board.

Data Analysis

We used descriptive statistics to summarize patient demographic and clinical characteristics, as well as door-to-clinician times across racial and ethnic groups. Continuous variables were reported as means with standard deviations for normally distributed data or medians with interquartile ranges for non-normally distributed data. Categorical variables were presented as counts and percentages. We performed comparisons of door-to-clinician times between racial and ethnic groups using ANOVA for normally distributed data and the Kruskal-Wallis test for non-normally distributed data. Chi-square tests were used for categorical variables.

To assess the association between race/ethnicity and door-to-clinician time, we used a generalized linear model with a gamma distribution and log link function to account for the heavily right-skewed outcome. This model estimates adjusted time ratios. These are expressed as rate ratios (RR), representing the proportional change in expected wait time. The model included an intercept term representing the baseline door-to-clinician time when all independent variables

were at their reference levels. Variables were selected a priori based on clinical relevance and conceptual considerations. The model included race/ethnicity, sex, ESI level, clinician type, and initial vital signs (systolic blood pressure, heart rate, and respiratory rate). Interaction terms between race/ethnicity and sex, as well as between race/ethnicity and triage level, were tested to explore potential effect modification. We conducted all analyses using SPSS v30 (IBM Corp., Armonk, NY).

RESULTS

Patient Selection and Exclusions

We initially identified 4,065 patients. Of those, 139 were excluded: five who had an ESI level of 4; 23 who eloped or left AMA; 42 with missing troponin results; and 69 with missing data on key variables. The final analytic sample included 3,925 patients (Figure).

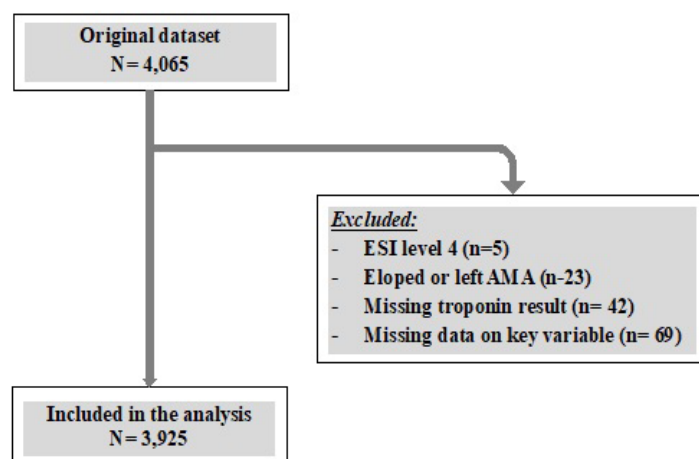


Figure. Flow diagram showing inclusion and exclusion criteria for a retrospective study examining door-to-clinician times for cardiac chest pain by race/ethnicity.

AMA, against medical advice; ESI, Emergency Severity Index.

Descriptive Stat and Unadjusted Analysis

A total of 3,925 patients were included in the analysis. The majority were White (n = 2,941; 74.9%), followed by Hispanic/Latino (n = 480; 12.2%), Black (n = 213; 5.4%), Native American (n = 135; 3.4%), Asian (n = 96; 2.4%), and unknown (n = 60; 1.5%). There were 1,826 females (46.5%) and 2,099 males (53.5%). Summary statistics stratified by race and ethnicity are presented in Table 1.

The mean age of the overall cohort was 57.9 ± 15.7 years. White patients were significantly older than other racial/ethnic groups (58.9 ± 15.5 years), with Native American patients being the youngest on average (52.5 ± 13.4 years). Sex distribution varied significantly across racial and ethnic groups ($P < .01$), with Hispanic/Latino patients having the highest proportion of females (53.1%) and Black patients the lowest (36.6%). In

terms of acuity, 1,554 patients (39.6%) were triaged as ESI level 2, and 2,371 (60.4%) were triaged as level 3. The distribution of triage levels varied significantly across racial/ethnic groups ($P = .02$). Asian patients had the highest proportion of level 3 triage (72.9%), while White patients had the highest proportion of level 2 (40.7%). Initial vital signs were comparable across all groups with no significant differences.

Regarding the outcome variable (door-to-clinician time/minute), the bivariate analysis showed significant differences across racial/ethnic groups ($P < .001$). The overall median door-to-clinician time for the cohort was 15.9 minutes [interquartile range 8.0-36.0]. Native American patients experienced the longest delays, with a median of 23.8 minutes [13.9-49.8], followed by Asian patients (18.6 minutes [8.4-36.5]) and those with unknown race/ethnicity (18.6 minutes [11.1-36.8]). Hispanic/Latino patients also had longer wait times than the overall median, at 17.1 minutes [9.3-43.7]. In contrast, White and Black patients had shorter median wait times of 14.9 minutes [7.1-33.9] and 15.0 minutes [8.8-38.7], respectively (Table 1).

Adjusted Analysis Results

In the adjusted analysis using a generalized linear model with a gamma distribution and log link, only the Hispanic/Latino group had a statistically significant association with longer door-to-clinician times. Compared with White patients (adjusted mean 14.9 minutes), Hispanic/Latino patients had an adjusted mean of 18.2 minutes (absolute difference +3.3 minutes; 22% longer wait; adjusted rate ratio 1.22, 95% CI, 1.09-1.36, $P < .001$). Adjusted mean times were also higher for Black (16.5 minutes), Native American (17.7 minutes), and Asian (15.1 minutes) patients relative to White patients, but these differences were not statistically significant. Both rate ratios and adjusted mean times are presented in Table 2.

Among covariates, increasing age was associated with slightly shorter door-to-clinician times ($\text{Exp}(B) = 0.99$, 95% CI, 0.99-0.99, $P < .001$). Triage level had the strongest effect: patients triaged as ESI level 3 waited nearly five times longer than those at level 2 ($\text{Exp}(B) = 4.90$, 95% CI, 1.86-12.94, $P < .01$). Respiratory rate was inversely associated with wait time ($\text{Exp}(B) = 0.97$, 95% CI, 0.96-0.98, $P < .001$), while heart rate

Table 1. Baseline demographic and clinical characteristics of patients with confirmed cardiac chest pain, stratified by race/ethnicity (N = 3,925), in a retrospective study of emergency department visits for cardiac chest pain.

Variable	Total (N = 3,925)	White (n = 2,941)	Hispanic/ Latino (n = 480)	Black (n = 213)	Native American (n = 135)	Asian (n = 96)	Unknown (n = 60)	P-value
Age (Mean $\pm$ SD)	57.9 $\pm$ 15.7	58.9 $\pm$ 15.5	54.6 $\pm$ 16.1	55.8 $\pm$ 14.1	52.5 $\pm$ 13.4	56.1 $\pm$ 16.5	57.9 $\pm$ 15.7	< .001
Sex								< .01
Female	1,826 (46.5%)	1,352 (46.0%)	255 (53.1%)	78 (36.6%)	69 (51.1%)	43 (44.8%)	29 (48.3%)	
Male	2,099 (53.5%)	1,589 (54.0%)	225 (46.9%)	135 (63.4%)	66 (48.9%)	53 (55.2%)	31 (51.7%)	
ESI level								.02
Level 2	1,554 (39.6%)	1,198 (40.7%)	173 (36.0%)	90 (42.3%)	45 (33.3%)	26 (27.1%)	22 (36.7%)	
Level 3	2,371 (60.4%)	1,743 (59.3%)	307 (64.0%)	123 (57.7%)	90 (66.7%)	70 (72.9%)	38 (63.3%)	
SBP Mean $\pm$ SD	141.8 $\pm$ 26.0	141.5 $\pm$ 25.9	142.0 $\pm$ 24.9	141.5 $\pm$ 28.0	145.7 $\pm$ 27.9	145.6 $\pm$ 30.3	141.5 $\pm$ 24.4	.38
HR Mean $\pm$ SD	87.4 $\pm$ 20.3	87.2 $\pm$ 20.2	88.7 $\pm$ 20.9	86.2 $\pm$ 19.9	90.2 $\pm$ 21.5	86.9 $\pm$ 20.0	86.7 $\pm$ 21.1	.34
RR Mean $\pm$ SD	19.0 $\pm$ 4.1	19.0 $\pm$ 4.0	19.3 $\pm$ 4.3	19.5 $\pm$ 6.0	19.7 $\pm$ 4.6	19.0 $\pm$ 3.9	18.5 $\pm$ 3.3	.10
Clinician type								.95
ACP	525 (13.4%)	398 (13.5%)	65 (13.5%)	26 (12.2%)	15 (11.1%)	12 (12.5%)	9 (15.0%)	
MD/DO	3,400 (86.6%)	2,543 (86.5%)	415 (86.5%)	187 (87.8%)	120 (88.9%)	84 (87.5%)	51 (85.0%)	
ED LOS/hour Median [IQR]	5.8 [4.3-7.6]	5.8 [4.3-7.6]	5.8 [4.5-8.1]	6.1 [4.7-8.0]	6.6 [4.9-8.4]	5.6 [4.4-7.2]	5.3 [3.9-6.7]	< .001
Door-to-clinician Median [IQR]	15.9 [8.0-36.0]	14.9 [7.1-33.9]	17.1 [9.3-43.7]	15.0 [8.8-38.7]	23.8 [13.9-49.8]	18.6 [8.4-36.5]	18.6 [11.1-36.8]	< .001

ACP, advanced care practitioner; ESI, Emergency Severity Index; HR, heart rate; IQR, interquartile range; LOS, length of stay; RR, respiratory rate; MD/DO, physician; SBP, systolic blood pressure.

showed a small positive association. Both effect sizes were modest, suggesting limited clinical impact. No significant associations were observed for sex, clinician type, or systolic blood pressure (Table 2).

DISCUSSION

This retrospective observational study examined the association between race/ethnicity and door-to-clinician time in the ED among patients presenting with confirmed acute cardiac chest pain. Using a generalized linear model with a gamma distribution and log link, we found that Hispanic/Latino patients experienced significantly longer wait times compared to White patients, with an estimated 22% (3.3 minutes) increase in door-to-clinician time after adjusting for key demographic and clinical covariates. Although other race/ethnicity groups also had longer average wait times compared to White patients, these differences were not statistically significant. Notably, the effect size for Native American patients approached significance, suggesting a potential disparity warranting further investigation in larger or more diverse cohorts.

While the observed adjusted difference in door-to-clinician time between Hispanic/Latino and White patients was approximately 3.3 minutes (18.2 vs 14.9 minutes), this gap was statistically significant and unlikely to be due to chance ($\text{Exp}(B) = 1.22$, 95% CI, 1.09-1.36, $P < .001$). The clinical relevance of this time difference warrants careful consideration. In isolation, a three-minute delay may appear modest; however, in the context of acute cardiac presentations, even small intervals can influence downstream care. Earlier clinician contact facilitates prompt diagnostic ordering, such as troponin testing, ECG interpretation, and risk stratification, all of which can impact time to intervention and overall outcomes. Moreover, disparities in door-to-clinician time may be part of broader care delays, compounded across sequential steps in ED management, that disproportionately affect historically marginalized groups. Thus, while the absolute time difference may be brief, its significance lies in what it represents: a measurable inequity in initial evaluation that could have cascading effects throughout the patient's care trajectory.

These findings contribute to the growing body of literature documenting disparities in cardiovascular emergency care by race and ethnicity.^{6,16-19} Furthermore, our results align with previous research showing that Hispanic/Latino patients experience longer wait times.^{10,13} Importantly, the longer wait times observed for Hispanic/Latino patients with confirmed cardiac chest pain likely reflect systemic barriers such as language differences, implicit bias, socioeconomic challenges, structural racism, stereotyping, or limited access to care.^{12,13,16,20-22} Although our study did not directly evaluate these underlying factors, the observed disparity underscores the need for targeted interventions to ensure equitable triage and timely clinician evaluation for all patient populations. Importantly, delays in initial evaluation may lead to postponed clinical decision-making, diagnostics, and interventions, particularly in

time-sensitive conditions such as ACS, where treatment delays have been associated with increased morbidity and mortality.²³

Furthermore, additional findings from this study merit attention. Patients triaged at ESI level 3 experienced significantly longer door-to-clinician times than those at level 2, consistent with the intended prioritization of more acute cases. These differences may also reflect local variation in how ESI is applied, as triage decisions can vary between clinicians even within standardized protocols. Initial vital signs were also associated with wait times: higher heart rate was associated with slightly longer wait times, whereas higher respiratory rate was associated with slightly shorter wait times. While these associations were statistically significant, their effect sizes were small, and their clinical relevance should be interpreted with caution.

Conversely, contrary to some prior research reporting longer wait times for Black patients,^{7,9,10,21,24} we did not observe significant differences for this group. Differences in local healthcare delivery, patient demographics, or operational factors unique to our setting may explain this discrepancy. Another key factor is our study's narrower inclusion criteria; we focused specifically on patients with confirmed cardiac chest pain, whereas many prior studies included all patients presenting with chest pain regardless of etiology. This broader inclusion may introduce greater heterogeneity, potentially amplifying observed differences. One strength of our study is the use of a well-defined, clinically homogeneous population, which minimizes misclassification bias and enhances internal validity. Moreover, our use of a generalized linear model with a gamma distribution and log link appropriately modeled the heavily skewed door-to-clinician time, enhancing the accuracy and validity of the results.²⁵

Timely evaluation of cardiac chest pain is critical to improving outcomes, and delays during the door-to-clinician interval may lead to missed diagnoses and delayed interventions. Our findings indicate that racial and ethnic disparities in this early phase of care persist even among patients with confirmed cardiac chest pain. This is the first study to explore such disparities in Salt Lake City, Utah, a predominantly White but increasingly diverse metropolitan area.²⁶ Our institution's ED patient population (~25% non-White) is broadly similar, although not identical, to the city's overall demographics, which should be considered when interpreting generalizability. These results illustrate how structural bias may manifest in less-studied regions and underscore the need for local and national quality improvement efforts to promote equitable ED triage and timely evaluation. Beyond documenting disparities, our findings point to the need for system-level interventions to reduce ED wait times for patients with cardiac chest pain. Practical strategies include the following: 1) implementing rapid assessment or clinician-in-triage models to shorten door-to-clinician times; 2) training triage staff in cultural competency and implicit bias mitigation to support equitable prioritization; and 3) leveraging artificial intelligence-based decision support to predict and monitor wait

Table 2. Association between race/ethnicity and door-to-clinician time in a retrospective study of adult patients presenting to the emergency department with cardiac chest pain. (Estimates are derived from a generalized linear model (gamma distribution with log link).

Variables	B	*Exp (B)	95% CI	P-value	Adjusted Mean (min)	Difference
Race/Ethnicity						
White (Ref)	—	—	—	—	14.9	—
Hispanic/Latino	0.20	1.22	1.09 – 1.36	< .001	18.2	+3.3
Black	0.10	1.11	0.94 – 1.30	.20	16.5	+1.6
Native American	0.17	1.19	0.97 – 1.43	.09	17.7	+2.8
Asian	0.01	1.01	0.79 – 1.27	.95	15.1	+0.2
Unknown	-0.09	0.91	0.69 – 1.22	.55	13.6	-1.3
Age (Year)	-0.01	0.99	0.99 – 0.99	< .001	—	—
Sex						
Female (Ref)	—	—	—	—	14.9	—
Male	-0.03	0.97	0.90 – 1.05	.49	14.5	-0.4
ESI						
ESI level 2 (Ref)	—	—	—	—	14.9	—
ESI level 3	1.59	4.90	1.86 – 12.94	< .01	73.0	+58.1
Clinician type						
ACP (Ref)	—	—	—	—	14.9	—
MD/DO	-0.01	0.99	0.90 – 1.11	.93	14.8	-0.1
SBP (mm Hg)	0.001	1.00	1.00 – 1.00	.55	—	—
HR (bpm)	0.002	1.00	1.00 – 1.00	.02	—	—
RR (b/min)	-0.03	0.97	0.96 – 0.98	<0.001	—	—

Adjusted means represent model-based expected times (estimated marginal means).

"Difference vs Ref" = adjusted mean – reference group adjusted mean.

Continuous covariates are reported as multiplicative effects per unit; adjusted means are not reported since values depend on selected reference points.

*Exp(B) represents the exponentiated coefficient from the gamma (log-link) model and is interpreted as an adjusted time ratio (rate ratio) for door-to-clinician time. Values >1 indicate a proportional increase (longer expected wait) and values <1 indicate a proportional decrease (shorter expected wait) relative to the reference group; for continuous covariates, the ratio is per 1-unit increase.

ACP, advanced care practitioner; bpm, beats per minute; b/min, breaths per minute; ESI, Emergency Severity Index; HR, heart rate; MD/DO, physician; mm Hg, millimeters of mercury; RR, respiratory rate; SBP, systolic blood pressure.

times across demographic groups.

LIMITATIONS

While these findings offer important insights, several limitations warrant consideration. Residual confounding is possible from unmeasured patient-level factors (eg, language, insurance type, socioeconomic status) and system-level factors. The study overlapped with COVID-19 surges and staffing changes, and we lacked validated crowding indices (National Emergency Department Overcrowding Scale and Emergency Department Working Index), real-time staffing data, arrival mode, and time-of-day/weekend measures. These operational factors may influence wait times and differ by race/ethnicity; thus, findings should be interpreted as associational rather than causal.

Results are based on a single healthcare system, which may limit generalizability, and the study population was relatively homogeneous, with non-White patients comprising ~25%. The

small size and under-representation of some racial and ethnic subgroups reduced statistical power, although the absence of disparities in groups such as Black patients may reflect genuinely equitable care at this institution. Finally, we did not capture compliance with triage protocols (eg, timely ECG or standing orders), which may have confounded door-to-clinician time estimates. Multisite studies with larger, more diverse populations and standardized operational measures are needed to confirm these findings and identify effective interventions.

CONCLUSION

This study demonstrates significant racial and ethnic disparities in door-to-clinician time among patients presenting with confirmed acute cardiac chest pain in the ED. Specifically, Hispanic/Latino patients experienced substantially longer wait times compared to White patients, highlighting ongoing inequities in timely emergency cardiovascular care. Although other groups

did not show statistically significant differences, trends among Native American patients suggest potential disparities that merit further investigation. These findings emphasize the critical need for targeted interventions to address systemic barriers and ensure equitable, prompt evaluation for all patients with time-sensitive cardiac conditions. Future research should focus on elucidating underlying causes and developing strategies to reduce these disparities across diverse healthcare settings.

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Mapping Five Years of #FOAMed: Trends, Engagement, and Shifting Topics on Twitter/X

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Introduction: Free Open Access Medical Education (FOAMed) has emerged as a prominent component of online medical communication, with X (formerly Twitter) serving as an active hub for professional exchange among clinicians. Despite its reach and influence, few longitudinal studies have examined how FOAMed content and engagement patterns evolve over time. In this study we aimed to analyze thematic shifts and user interaction trends in #FOAMed tweets over a five-year period.

Methods: We conducted a retrospective bibliometric and natural language processing (NLP) study of 6,000 high-engagement, English-language tweets tagged with #FOAMed, posted between January 1, 2020–December 31, 2024. Each month, the 100 tweets were selected from Twitter's "Top" tab and manually curated. We used latent Dirichlet allocation (LDA) to identify thematic clusters. Hashtag usage and engagement metrics were assessed using descriptive statistics and linear regression.

Results: We identified 10 distinct topics were identified through LDA modeling: point-of-care ultrasound (POCUS) education; neuro-radiology, cardiology-electrocardiogram (ECG); nephrology; and intensive care unit; ultrasound; prehospital/policy; webinars and learning; resuscitation scenarios; pediatric imaging; medical student education; and critical care and publications. Topic prevalence shifted over time: Early tweets focused on COVID-19 and critical care, while later years showed increasing attention to prehospital care, diagnostics, and POCUS. Mean tweet engagement peaked in 2023 (236.9 ± 914.6). Notably, hashtags such as #POCUS and #MedEd showed substantial increases in both usage and engagement, with #MedEd reaching a peak mean engagement of 287.7. In contrast, COVID-19 declined steadily, both in frequency (from 126 tweets in 2020 to just six in 2023) and in engagement (mean: 67.1 → 18.5). Spearman correlation analysis revealed that hashtag count had a weak but statistically significant correlation with engagement ($\rho = 0.047$, $P < .001$), suggesting that content quality, rather than volume, was the primary driver of visibility.

Conclusion: FOAMed discourse on Twitter/X remains dynamic, responsive to clinical priorities and shaped by peer interaction. Natural language processing and topic modeling are valuable tools to uncover longitudinal trends in digital medical education, reinforcing Twitter/X's role in informal, real-time learning communities. [West J Emerg Med. 2026;27(1)25–32.]

INTRODUCTION

Over the past decade, free open access medical education (FOAMed) has emerged as a global movement aimed at democratizing medical knowledge. By leveraging open-access

digital platforms, FOAMed empowers clinicians to bypass traditional academic gatekeeping and engage directly in the exchange of clinical insights, case-based discussions, and practical resources. Among these platforms, Twitter—recently

rebranded as X—has served as a real-time hub for FOAMed activity, connecting healthcare professionals across specialties and geographies through the unifying hashtag #FOAMed.¹ Despite the scale and visibility of FOAMed discourse, there remains a notable lack of longitudinal, data-driven studies examining how its content and engagement dynamics have evolved over time. Most existing research has focused on narrow slices of activity, such as the COVID-19 pandemic, or on specific user groups, leaving broader patterns unexplored.² Understanding the trajectory of FOAMed content is essential for identifying shifts in clinical emphasis and educational demand, thereby enabling educators and content developers to align resources with emerging areas of interest.^{3,4}

To address this gap, we conducted a five-year analysis of 6,000 high engagement tweets tagged with #FOAMed, applying natural language processing (NLP) and topic modeling techniques. Our goal was to identify dominant themes, chart engagement trends, and map the evolution of hashtag usage, highlighting how online medical discourse has shifted during a transformative period in global healthcare. Given the expanding influence of social media on informal medical education, tracking shifts in thematic content over time may provide meaningful insight into evolving clinical and educational priorities.

METHODS

Study Design

In this retrospective, descriptive bibliometric study we aimed to analyze the thematic and engagement characteristics of tweets tagged with #FOAMed between January 1, 2020–December 31, 2024. A total of 100 tweets per month were manually curated from the ‘Top’ tab in Twitter’s search results, resulting in a dataset of 6,000 tweets across the five-year study period. This sampling strategy was selected to ensure consistent temporal coverage and to reflect content highlighted by Twitter’s own ranking algorithm, in the absence of a publicly accessible full archive of FOAMed tweets.

Data Collection Process

We retrieved tweets using Twitter’s native search interface with the following structured query format: https://twitter.com/search?q=%23FOAMed%20since:YYYY-MM-DD%20until:YYYY-MM-DD&src=typed_query&f=top. The first 100 English-language tweets appearing in the “Top” tab each month were manually selected using Twitter’s public search interface. Although the specific criteria behind the “Top” tab rankings are not publicly disclosed, they are believed to incorporate signals such as recency, user relevance, and visible engagement metrics. We entered each selected tweet into a structured Excel spreadsheet (Microsoft Corporation, Redmond, WA) and reviewed them for eligibility. Although account-level data (e.g., usernames, follower counts) were available, we excluded them from analysis to avoid ethical concerns and to maintain our focus on content-level engagement.

Population Health Research Capsule

What do we already know about this issue?

Free Open Access Medical Education (FOAMed) provides online medical education, but long-term trends in engagement and thematic focus on Twitter/X are not well characterized.

What was the research question?

How have FOAMed tweet themes and engagement patterns evolved over five years (2020–2024)?

What was the major finding of the study?

Median engagement rose 34→57 (2020–23) and then declined to 42 (2024); #POCUS increased; #COVID19 declined.

How does this improve population health?

Tracking FOAMed trends highlights shifting educational priorities, enabling alignment of open-access resources with evolving clinical needs.

Inclusion Criteria

We included tweets if they 1) contained the hashtag #FOAMed, 2) were written in English, 3) were posted between January 1, 2020–December 31, 2024, 4) displayed visible engagement metrics (likes, retweets, replies), and (5) were not duplicated within the monthly datasets. Tweets that failed to meet any of these criteria were excluded. All tweets inherently met criterion (4) since the “Top” tab only displays posts with visible engagement.

Variables and Dataset Structure

For each tweet, we extracted the following variables: username; date of posting; tweet content; engagement metrics (number of likes, retweets, and replies); all hashtags used; and the total number of hashtags. All monthly datasets were merged into a single master dataset comprising 6,000 unique tweets, each represented as a structured row with corresponding variables. We did not apply bot-detection algorithms, and engagement metrics were recorded as displayed by Twitter, without adjustments.

Text Preprocessing and Topic Modeling

Natural language processing techniques were implemented in Python v3.11 (Python Software Foundation, Wilmington, DE). Preprocessing included lowercasing, removal of

punctuation and uniform resource locators (URL), and stopword elimination using an extended list based on the Natural Language Toolkit (NLTK) corpus, augmented with FOAM-specific terms (eg, foamed, foamcc, foamrad). We used the resulting cleaned and tokenized corpus as input for topic modeling.

We conducted topic modeling using latent Dirichlet allocation (LDA) implemented via the Gensim library. Models with 6-10 topics were tested using a bag-of-words representation. We selected the optimal model based on the highest *c_v* coherence score (0.4507), which yielded 10 topics. Each tweet was assigned a dominant topic based on its highest posterior probability. Human-readable topic labels were manually assigned by interpreting the top 10 keywords for each topic. We then used these topic assignments for temporal and statistical analysis.

Hashtag Analysis and Engagement Trends

Hashtags were extracted using regular expressions. We analyzed their frequency and distribution on a monthly and annual basis. Hashtag usage was also compared against engagement levels, defined as the sum of likes, retweets, and replies. We identified the top-performing tweets each year (based on likes, retweets, and replies), and their content was examined to explore potential drivers of high engagement.

Statistical Analysis

We calculated descriptive statistics, including mean, median, standard deviation, and interquartile range (IQR), for engagement metrics and hashtag counts. Relationships between content features (eg, hashtag count, tweet length) and engagement were evaluated using Spearman correlation coefficients. We applied non-parametric tests (Mann-Whitney *U* and Kruskal-Wallis) for group comparisons, given the non-normal distribution of engagement metrics—driven by a small number of highly viral tweets—as confirmed by the Shapiro–Wilk test ($P < .001$).

To assess trends over time, we calculated the number of tweets assigned to each LDA topic annually. Linear regression was used with year as the independent variable and topic frequency as the dependent variable. We reported slope (indicating average annual change) and R^2 values (goodness of fit) to determine whether each topic was increasing, decreasing, or stable over the study period. All analyses were conducted in Python v3.11 using the pandas, NumPy, SciPy, Seaborn, Scikit-learn, and Gensim libraries.

Ethical Considerations

All data used in this study were publicly available and collected in compliance with Twitter's terms of service. No identifiable private information was accessed, no human subjects were involved, and the analysis did not require interaction or intervention. Therefore, this study qualified as exempt from institutional board review under current guidelines.

RESULTS

Dataset Overview

We analyzed 6,000 English-language tweets tagged with #FOAMed, evenly distributed over five years (2020–2024) with 1,200 tweets sampled per year. After preprocessing, the median number of hashtags per tweet was four, while the median total engagement (likes + retweets + replies) was 42. However, the mean engagement was notably higher at 129.7 (SD 417.5), highlighting the impact of a small number of highly viral tweets on the overall distribution. The average number of hashtags per tweet was 5.18 (SD 4.07), with a maximum of 24. Interquartile range analysis revealed that 233 tweets exceeded the outlier threshold of 14.5 hashtags, contributing to a right-skewed distribution. Across the dataset, the median number of likes was 27 (Q1-Q3: 13-70), retweets had a median of 10 (Q1-Q3: 5-21), and replies had a median of 3 (Q1-Q3: 1-8). All annual comparisons showed statistically significant differences ($P < .001$) based on Kruskal-Wallis tests, as detailed in Table 1.

Correlation Between Tweet Features and Engagement

Spearman correlation analysis revealed strong positive associations between likes ($\rho = 0.991$) and retweets ($\rho = 0.911$) with total engagement ($P < .001$ for both). The number of replies showed a moderate correlation ($\rho = 0.465$, $P < .001$). In contrast, hashtag count exhibited very weak correlations with total engagement ($\rho = 0.047$, $P < .001$) and with likes specifically ($\rho = 0.033$, $P = .01$) (Figure 1).

Yearly Trends in Tweet Engagement

Mean engagement per tweet steadily increased from 58.2 in 2020 to a peak of 236.9 in 2023, before declining to 149.6 in 2024. In contrast, median engagement values remained comparatively stable, ranging from 33.0 to 57.0 across the five-year period. This disparity suggests that a small subset of highly viral tweets disproportionately influenced the overall engagement trend (Figure 2).

Most Common Hashtags (Excluding #FOAMed)

After removing the ubiquitous #FOAMed tag, analysis of the tweet corpus revealed several frequently used hashtags that reflect key thematic overlaps and clinical subdomains within the FOAMed community. The most prevalent was #meded, appearing in 2,009 tweets, followed by #medtwitter (1,667), #foamcc (1,295), #critcare (751), and #pocus (739). These hashtags covered a spectrum of topics, ranging from general medical education to specialty-specific content in critical care and point-of-care ultrasound. (POCUS). Line chart visualizations indicated a sharp increase in the use of #pocus and #critcare in 2023, while hashtags such as #covid19 and #foamcc peaked earlier, during 2020–2021.

Hashtag-specific engagement metrics revealed differing interaction patterns. Tweets containing #pocus demonstrated a marked rise in both usage and engagement, with mean

Table 1. Descriptive statistics for tweet engagement and content features across 6,000 #FOAMed tweets between 2020–2024.

Tweet Metrics (n)	2020 (1,200)	2021 (1,200)	2022 (1,200)	2023 (1,200)	2024 (1,200)	P-value
Likes (mean ± SD)	39.9 ± 76.5	53.1 ± 160.7	101.6 ± 269.4	185.7 ± 750.9	117.2 ± 301.0	N/A
Likes (median [Q1–Q3])	23 (13 – 43)	23 (13 – 51)	23 (11 – 77)	43 (19 – 124)	30 (15 – 89)	< .001
Retweets (mean ± SD)	16.3 ± 36.1	16.5 ± 36.4	27.8 ± 64.7	45.7 ± 151.6	29.0 ± 62.5	N/A
Retweets (median [Q1–Q3])	10 (5 – 19)	9 (5 – 18)	9 (4 – 21)	12 (5 – 31)	9 (4 – 24)	< .001
Replies (mean ± SD)	2.04 ± 4.47	2.23 ± 5.92	2.7 ± 7.45	5.51 ± 19.34	3.42 ± 14.12	N/A
Replies (median [Q1–Q3])	1 (0 – 2)	1 (0 – 2)	1 (0 – 2)	1 (0 – 4)	1 (0 – 2)	< .001
Engagement (mean ± SD)	58.2 ± 112.2	71.8 ± 200.8	132.1 ± 337.4	236.9 ± 914.6	149.6 ± 371.7	N/A
Engagement (median [Q1–Q3])	34 (20 – 64)	33 (18 – 72)	34 (17 – 104)	57 (26 – 161)	42 (20 – 117)	< .001
Hashtag Count (mean ± SD)	5.32 ± 4.28	5.32 ± 4.17	5.7 ± 4.12	4.95 ± 3.31	5.8 ± 4.28	N/A
Hashtag Count (median [Q1–Q3])	4 (2 – 7)	4 (2 – 8)	4 (3 – 8)	4 (3 – 6)	4 (3 – 8)	< .001

Note: Kruskal-Wallis *P*-values are reported only for medians; mean ± SD rows are marked as N/A.(non-parametric, Shapiro-Wilk test < .001) *FOAMed*, free open access medical education; N/A, not applicable.

engagement increasing from 51.7 in 2020 to 203.0 in 2023, before a slight decline in 2024 (175.3). In contrast, #criticare remained stable in frequency but fluctuated around a moderate engagement range (36.4–62.3), suggesting plateaued user interest; #foamcc reached peak engagement in 2023 (mean: 113.0), paralleling a minor drop in tweet count. Notably, #covid19 declined both in frequency (from 126 tweets in 2020 to six in 2023) and engagement (mean: 67.1 to 18.5), reflecting waning attention to pandemic-related content. Conversely, #meded demonstrated consistent popularity and broad applicability, peaking in engagement at 287.7 in 2023 (Figure 3).



Figure 1. Distribution of likes, retweets, and replies across #FOAMed tweets (2020–2024) demonstrating the correlation patterns between individual engagement metrics and overall interaction levels in a five-year study of high engagement *FOAMed tweets. *FOAMed, free open access medical education.

Topic Modeling and Interpretation

Topic modeling yielded 10 thematically coherent categories, based on the dominant posterior probabilities assigned to each tweet. Manual review of the top keywords allowed for labeling of the following themes: POCUS education; neuroradiology, cardiology–electrocardiogram (ECG); nephrology and intensive care unit ultrasound; prehospital/policy; webinars and learning; resuscitation scenarios; pediatric imaging; medical student education; and critical care and publications. These topic labels were derived by interpreting the top 10 keywords for each category. A complete list is provided in Supplementary Table 1 to enhance transparency and interpretability.

Yearly Distribution of Topics

Temporal visualization of topic prevalence (Figure 4) revealed substantial year-to-year variability, highlighting the

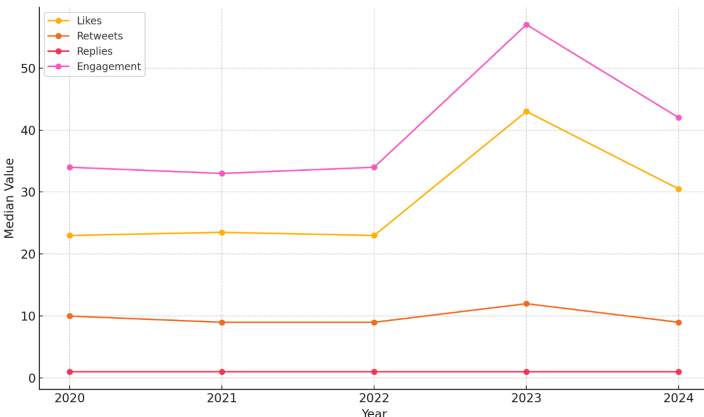


Figure 2. Yearly trends in mean and median engagement of #FOAMed tweets, illustrating the annual changes in average and median user engagement from 2020 to 2024, highlighting the disproportionate influence of highly viral tweets in 2023. *FOAMed*, free open access medical education.

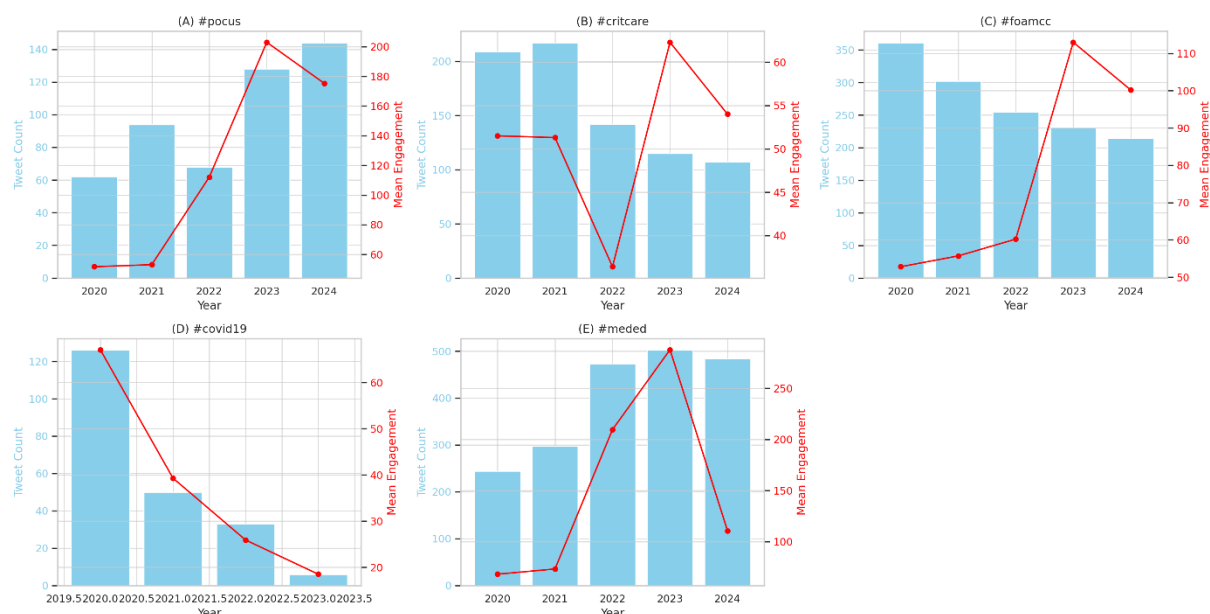


Figure 3. Yearly tweet frequency and mean engagement (composite) for five major hashtags. Notably, #pocus and #meded saw both usage and interaction peaks in 2023, while #covid19 steadily declined after 2020.

dynamic and evolving nature of FOAMed discourse. The prehospital/policy category exhibited the most pronounced increase, rising from near-zero mentions in 2020 to over 190 tweets in 2024. Similarly, both resuscitation scenarios and pediatric imaging showed steady upward trends over the five-year period, reflecting growing engagement with emergent care protocols and pediatric diagnostics. Cardiology–ECG topics also increased gradually.

In contrast, the frequency of tweets related to POCUS education and webinars and learning peaked during 2020–2021 and then declined. This decline may reflect a shift back to in-person clinical education as the acute phase of the COVID-19 pandemic subsided.

Statistical Trend Analysis

To explore how topic frequencies changed over time, we tracked yearly tweet counts for each category (Table 2). Four topics showed a clear upward trend over the five-year period, while one topic declined. Topics that showed little variation across years were described as stable.

DISCUSSION

The FOAMed movement on Twitter/X represents a dynamic and widely engaged medical education community, with contributors spanning multiple specialties and regions. Our five-year analysis revealed content spanning several distinct clinical and educational themes, echoing prior observations that FOAMed tweets convey varied resources, expert advice, and personal insights.¹ Through unsupervised topic modeling (LDA), we identified 10 distinct thematic domains, such as

POCUS, cardiology, and critical care, underscoring the breadth of subjects circulating under the #FOAMed umbrella.

Temporal trend analysis highlighted shifts in topic prevalence over time. Discussions surrounding critical care and COVID-19 peaked during 2020–2021, subsequently tapering off, while topics such as ultrasound (#POCUS) surged in later years. This suggests a reorientation toward core clinical education as the pandemic receded. Such findings align with broader analyses of Twitter discourse during COVID-19, where content prevalence was closely tied to real-world events and often characterized by short-lived spikes.⁵ For instance, nearly 40% of FOAMed tweets in early 2020 focused on COVID-19, demonstrating the community's rapid pivot to the crisis.¹ As that urgency waned, conversations recalibrated toward longstanding topics such as resuscitation and diagnostics, illustrating the dynamic and event-responsive nature of this community-driven curriculum.

Hashtag use patterns further reinforce FOAMed's adaptability. In tweets containing the #FOAMed tag, the most frequently co-occurring hashtags were #MedEd and #MedTwitter, indicating strong convergence between FOAMed and the broader medical education ecosystem. This overlap is unsurprising, given their shared ethos of open knowledge exchange. More specialized tags, such as #critcare and #POCUS, rose sharply in 2023, reflecting increased focus on critical care and ultrasound training. Conversely, #COVID19 and offshoot hashtags like #FOAMcc peaked early in the study period, consistent with an initial pandemic response followed by a return to non-COVID-19 content.

Engagement with FOAMed tweets remained robust

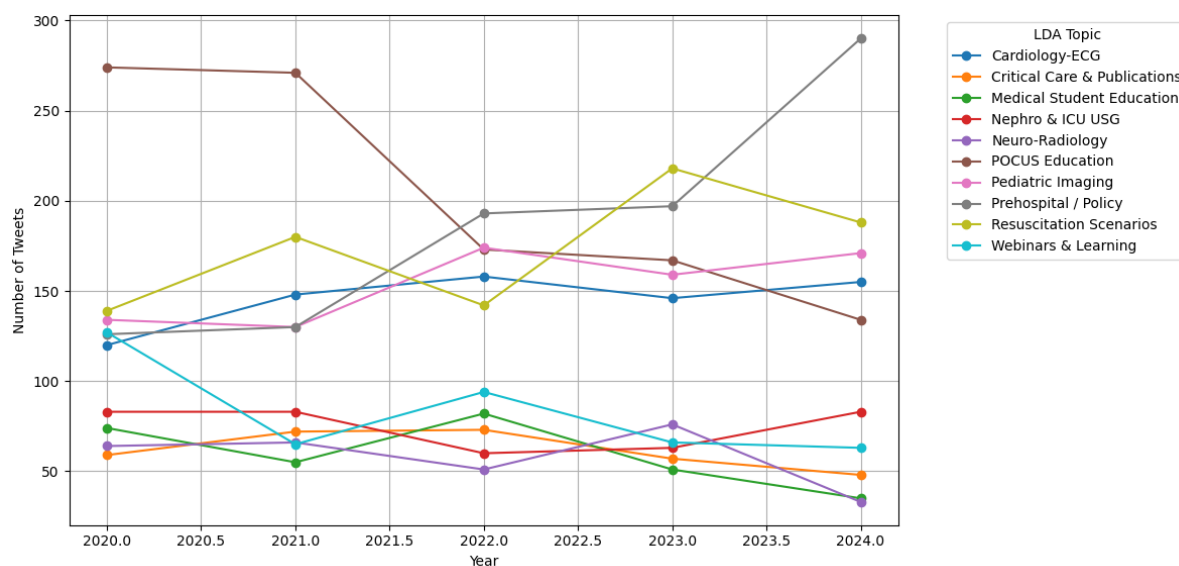


Figure 4. Topic distribution in FOAMed tweets over time. Latent Dirichlet allocation-derived topic frequencies from 2020–2024 reveal dynamic shifts in content focus. “Prehospital / policy” and “pediatric imaging” showed consistent upward trends, while early dominant themes like “POCUS education” declined.

ECG, electrocardiogram; FOAMed, free open access medical education; ICU, intensive care unit; LDA, latent Dirichlet allocation; USG, ultrasound sonography; POCUS, point-of-care ultrasound.

throughout 2020–2024, with a notable uptick in average interactions by 2023. This may reflect a reinforcing pattern observed in other social media-based educational settings, where frequently shared or interacted content tends to receive additional visibility, regardless of initial source or status.⁶ Previous research has shown that FOAMed thrives on interactivity. Riddell et al reported that 80% of tweets by influential emergency physicians elicited replies, retweets, or likes, underscoring strong community engagement.⁷ In our analysis, a small number of tweets with relatively high engagement appeared to drive the annual mean upward—typically those featuring novel clinical insights, concise infographics, or spirited debates. These characteristics align with prior findings that clarity and visual appeal significantly influence a tweet’s reach.⁸ In contrast, merely stacking hashtags or mentions was insufficient to guarantee engagement. Our data showed only a weak correlation between hashtag count and interaction, reinforcing that substance often outweighs superficial features.

The Twitter-based #FOAMed community is further sustained by a core network of influencers and content curators. Even without formal hierarchy, contributors worldwide collaborated to disseminate knowledge during the pandemic.¹ Earlier work identified emergency medicine “hub” users—those with high in-degree or centrality metrics—who helped bridge subcommunities and extend content reach.⁹ We deliberately excluded user-level metadata (eg, follower count, author status) to maintain a strict focus on content-level engagement patterns. While we did not analyze user networks, prior research has shown that influential voices can help amplify educational

content in online communities. Still, FOAMed is not a one-way broadcast by experts; it cultivates bidirectional discourse. A mixed-methods analysis of EM tweets found that physicians frequently replied, questioned, and even engaged in informal banter, thereby “building social rapport” within a professional context.⁷ This aligns with Wenger’s framework of a “community of practice” and may contribute to the sustained vitality of the platform. In related studies, user participation, whether active or passive, was linked to perceived value and satisfaction.¹⁰ Even “lurkers” gained from the communal pool of knowledge and ongoing dialogue.

Importantly, our study illustrates how modern data science can enhance the understanding of digital medical education. By leveraging NLP and topic modeling, we systematically analyzed thousands of tweets to extract dominant themes and patterns. This builds on earlier work that relied on manual coding or sentiment analysis to study Twitter-based FOAMed content.^{1,2} At scale, automated topic modeling methods such as LDA have been shown to detect latent, clinically relevant themes in large text datasets that human reviewers might overlook, for instance enabling clinically interpretable topic extraction from referral letters or social work notes—demonstrating capabilities beyond what manual review typically achieves.^{3,4} The thematic categories we identified closely mirror known areas of educational focus within emergency and critical care medicine, reinforcing the validity of the method. Furthermore, tracking the trajectory of these themes offered a novel form of “digital epidemiology,” allowing us to observe shifts in learning priorities in near real time.

This approach resonates with prior findings from

Table 2. Linear trend analysis of topic frequencies (2020–2024)

Topic	Slope (tweets/year)	R ²	Trend
Prehospital / policy	+39.5	0.881	Increasing
Resuscitation scenarios	+13.6	0.419	Increasing
Pediatric imaging	+10.3	0.628	Increasing
Cardiology-ECG	+6.8	0.512	Increasing
Nephro and ICU USG	−2.0	0.072	Decreasing

Linear regression analysis of yearly topic frequencies identified five themes with meaningful trends. “Prehospital / Policy” showed the strongest increase ($R^2 = 0.881$), while «Nephro and ICU USG” slightly declined.
ECG, electrocardiogram; ICU, intensive care unit; Nephro, nephrology; USG, ultrasound sonography.

conference-based Twitter analyses. Yiu et al showed that tweet volume during a national emergency medicine conference did not correlate with formal speaker evaluations yet accurately reflected which sessions resonated with the audience.¹¹ Similarly, our analysis suggests that Twitter/X can function as an informal but responsive barometer of educational relevance. In a post-pandemic landscape where medical journals and institutions increasingly recognize social media scholarship, from visual abstracts to tweetorials, FOAMed’s trajectory offers valuable insights for future digital learning strategies.

In summary, the FOAMed ecosystem remains dynamic and community-driven, with shifting content trends, engagement patterns, and evolving priorities. As new platforms and modalities emerge, the foundational principles of openness, collaboration, and responsiveness that underpin FOAMed should continue to inform innovations in medical education.

LIMITATIONS

This study has several limitations that warrant consideration. First, the dataset was constructed from the “Top” tab of Twitter/X’s search results, which are ranked by a proprietary and non-transparent algorithm. This introduces potential selection bias, as high-engagement or influencer-driven content may be over-represented. Second, only English-language tweets were included, which limits the global representativeness of FOAMed content and may exclude valuable contributions from non-English-speaking communities. Third, although LDA topic modeling offers a scalable method for identifying thematic trends, it lacks the contextual nuance of qualitative analysis. Assigning human-readable labels to topics, while informed by keyword distributions, remains a subjective process.

Finally, the use of engagement metrics (likes, retweets, replies) as indicators of influence should be interpreted cautiously. These metrics reflect attention and visibility, but not necessarily educational impact, knowledge retention, or learning outcomes. We also observed a relative drop in engagement in 2024 compared to 2023, which may reflect

broader platform trends, such as the rebranding of Twitter to X or reduced user activity. However, our study was not designed to evaluate such factors.

CONCLUSION

This five-year bibliometric- and natural language processing-based analysis provides a detailed view of how #FOAMed content on Twitter/X has evolved in response to clinical trends, global events, and shifting user interests. Our findings reveal that the Twitter-based #FOAMed community is thematically diverse, highly responsive, and sustained by a core network of engaged contributors. As content transitioned from pandemic-related topics to core clinical themes, we observed clear patterns in both topic distribution and engagement dynamics. By applying modern analytical tools, particularly topic modeling, this study contributes both methodologically and conceptually to the field of digital medical education scholarship. The results suggest that platforms like Twitter/X function not only as channels for information dissemination but also as real-time indicators of professional priorities and peer-driven learning.

Looking forward, future research should explore regional variations in FOAMed discourse, compare activity across platforms (eg, Mastodon, Bluesky), and integrate qualitative methods such as sentiment analysis or network mapping. Importantly, distinguishing educational value from mere virality will be essential in understanding how informal learning truly occurs in these digital spaces. Ultimately, FOAMed’s ethos of open access, collaboration, and agility positions it to remain a vital force in the evolving landscape of medical education.

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Resuscitation Leadership Education: A Needs Assessment of Emergency Medicine Residencies

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Introduction: Effective resuscitation leadership is a critical competency for emergency physicians, with evidence correlating strong leadership with improved team performance and patient outcomes during resuscitations. Despite its importance, the extent and nature of structured resuscitation leadership education in emergency medicine (EM) residency training remains unclear.

Methods: We conducted a voluntary, anonymous, needs assessment survey of United States (US) EM residency programs between August–October 2021. The survey assessed for the presence, content, and methods of formal resuscitation leadership curricula within these programs. We used descriptive statistics to analyze responses.

Results: Of the 261 US EM residency programs invited to participate, 80 responded (30.7%). Nineteen programs (23.8%) reported offering resuscitation leadership training through formal curricula, with considerable variation in both educational methods and content. Additionally, 68.4% of responding programs offered external generalized leadership development opportunities through partnerships with hospitals, universities, community organizations, and research entities.

Conclusion: A minority of surveyed US EM residency programs incorporate formal resuscitation leadership training into their curricula with significant variance in curricular content and educational methods. Given the critical role of resuscitation leadership in EM, our findings highlight the need for further research to evaluate the effectiveness of existing curricula and educational approaches. [West J Emerg Med. 2026;27(1)33–38.]

INTRODUCTION

Resuscitation leadership is a necessary skill for emergency physicians, with multiple studies demonstrating its significant impact on patient outcomes in high-pressure resuscitation scenarios.^{1–3} Strong leadership has been shown to enhance team performance during cardiopulmonary resuscitation.⁴ Similarly, key leadership competencies such as role delegation, task management, and effective communication have been found to influence both team performance and patient survival during resuscitation efforts.² Cooper and Wakelam highlighted a positive correlation between physician leadership and improved in-hospital resuscitation outcomes.⁵ Notably, Chan et al

demonstrated that the presence of actively engaged physician leaders during in-hospital resuscitations was significantly associated with improved patient survival.³ Additionally, a systematic review by Restivo et al demonstrated a positive link between leadership interventions and healthcare outcomes.⁶

Given the crucial role of resuscitation leadership in optimizing patient outcomes, it is essential that emergency medicine (EM) residents receive adequate training to develop into competent resuscitation leaders. The Accreditation Council for Graduate Medical Education (ACGME), in partnership with the American Board of Emergency Medicine, Association of American Medical Colleges, Council of Residency Directors in

Emergency Medicine, Emergency Medicine Residents' Association (EMRA), and the Review Committee for Emergency Medicine recognized the importance of leadership development when designing the EM Milestones. Consequently, leadership skills were embedded as essential competencies required for the successful completion of EM residency.⁷ These milestones encompass a wide range of skills, including emergency stabilization, multitasking, system navigation, professional behavior, and effective communication. However, it is unclear whether the implementation of these milestones has translated into effective leadership instruction for EM residents.⁸ Notably, in early 2025 the ACGME proposed additional requirements specifically mandating that EM residents demonstrate competence in leading a variety of resuscitations. This development reflects increasing national attention to resuscitation leadership as a core skill and underscores the need to better understand how current EM residency programs are training residents to meet this expectation.

Despite the clear need for leadership training, gaps in leadership development across GME persist. Over the past several decades, scholarly work has underscored the need for well-designed, competency-based leadership training for medical trainees.⁹ However, despite calls for action and the recognized impact of resuscitation leadership on patient outcomes, there remains a scarcity of well-researched and widely implemented leadership curricula.^{10–13} Additionally, EM residents have reported limited structured opportunities for leadership development during their training, with observation and non-specific feedback from faculty and peers serving as the most frequently cited leadership-learning strategies.¹⁴ Although EM residents participate in a high volume of clinical resuscitations, there is no current evidence evaluating whether EM graduates feel adequately prepared to lead resuscitations based solely on this experiential learning. No studies have assessed whether informal, experience-based instruction sufficiently develops the complex leadership competencies required in high-stakes resuscitative care.

Few EM resuscitation leadership resident educational approaches have been published.^{15,16} Additionally, the delivery of formal curricula focused on resuscitation leadership within EM residency programs remains unclear, as do the methods and content of existing programs.^{1,8,11,12} Limited research in medical education suggests that effective training may include explicit instruction on communication, team coordination, and environmental management; however, it is unclear whether and how these strategies are currently applied in EM residency training.⁸ In this study we aimed to assess the current state of resuscitation leadership training in EM residencies, examining the curriculum content and educational methods used in existing curricula.

METHODS

Study Design and Population

An anonymous, voluntary, needs assessment survey was

Population Health Research Capsule

What do we already know about this issue?
Resuscitation leadership improves patient outcomes; however, leadership training across graduate medical education is often limited.

What was the research question?
Do US emergency medicine residencies offer formal curricula for resuscitation leadership training?

What was the major finding of the study?
Of 80 (30.7%) responding EM residencies in the US, 19 (23.8%) reported offering a formal resuscitation leadership curriculum.

How does this improve population health?
Understanding current resuscitation leadership education can guide strategies to improve resuscitative care and outcomes across populations.

distributed to ACGME-accredited EM residency program directors across the US from August–October 2021. We obtained contact information for program directors from the Society of Academic Emergency Medicine and the EMRA program databases. For programs with outdated or missing contact information, additional details were sourced from publicly available information on individual program websites. The survey was electronically administered using REDCap electronic data capture tools, hosted at William Beaumont University Hospital.^{17,18} The survey received institutional review board exemption from William Beaumont University Hospital.

Survey Content

We designed the survey instrument to assess the presence and structure of formal resuscitation leadership curricula within EM residency programs in the US. Additionally, we aimed to explore the content and educational methods of these curricula and to determine whether programs relied on external resources for leadership training. The survey instrument was adapted from a previously published leadership needs assessment of US allopathic medical schools, developed by a group with extensive experience in medical education.¹⁹ For this study, we modified the instrument to shift the focus from medical school leadership education to EM residency resuscitation leadership education, with additional

items to capture EM residency-specific demographics. The 10-question survey (Figure 1S in the supplement) solicited demographic information about the residency programs, the presence and structure of formal resuscitation leadership curricula, and the use of external leadership training resources. Resuscitation leadership was defined in the survey as “[t]he act of coordinating and motivating a team during a medical resuscitation of acutely, critically ill and decompensating individuals.” Notably, the survey focused exclusively on medical resuscitation education and excluded trauma resuscitation training.

Statistical Analysis

We used descriptive analysis to summarize the findings from the needs assessment survey. After survey closure, we retrospectively conducted a post-survey wave analysis to detect potential non-response bias, a method previously used in health professions education research.^{20,21} We compared respondents to the first survey invitation with those responding after the final survey invitation using the Fisher exact test on the presence or absence of a formal resuscitation leadership curriculum. All statistical analyses were performed with SAS v9.4 (SAS Institute, Inc., Cary, NC).

RESULTS

Program Demographics

The needs assessment survey was distributed to 261 EM residency program directors in the US, with 80 responding (30.7%; AAPOR RR6).²¹ All US regions were represented among the respondents. Of the 80 programs, 63 (78.8%) were three-year and 17 (21.2%) were four-year residency programs. The majority of responding programs identified as academic (42 programs, 52.5%), while 30 programs (37.5%) were community-based, and eight programs (10.0%) identified as county-based.

Resuscitation Leadership Curricula Characteristics

Of 80 responding programs, 19 residency programs (23.8%) reported offering a formal resuscitation leadership curriculum as part of their training. For these 19 programs all US regions were represented, with 14 (73.7%) three-year residencies and five (26.3%) four-year residencies. Ten programs were academic (52.6%), six community (31.6%), and three county (15.8%). Participation in the curriculum was mandatory for residents in all programs that offered it. Of the 19 residency programs with formal resuscitation leadership curricula, 10 programs (52.6%) implemented a longitudinal approach spanning postgraduate years (PGY) 1-3. Several programs opted to initiate training at more advanced stages of residency: two programs (10.5%) conducted training during PGY2–PGY3, and one program each (5.3%) conducted training during PGY 3–PGY 4, PGY 2 only, or PGY 3 only. One program (5.3%) reported conducting training exclusively during the PGY-1 year. In our wave analysis to measure potential

non-response bias, there was no significant difference between early (N=35) and late (N=18) responders regarding the presence of a formal resuscitation leadership curriculum ($P = 1.00$).

Various educational methods were employed to deliver the curricula (Table 1), with simulation the most common approach (16 programs, 84.2%), followed by small-group discussions (12 programs, 63.2%), lectures (10 programs, 52.6%), and on-shift teaching (10 programs, 52.6%). Among the 19 programs with formal resuscitation leadership curricula, there were 17 unique combinations of educational methods employed (Table 1S). Notably, three programs (15.8%) used simulation as their sole educational method. The curriculum content also varied across programs (Table 2), with most focusing on clinical resuscitation leadership skills (18 programs, 94.7%); trauma resuscitation leadership skills (17 programs, 89.5%); communication and interpersonal skills (17 programs, 89.5%); and team building (13 programs, 68.4%). Programs reported 16 distinct combinations of curriculum content (Table 2S).

External Leadership Programming

Of the 80 responding programs, 54 (67.5%) provided leadership education opportunities through external partnerships. These included hospital-sponsored leadership programs (30 programs, 37.5%), university-sponsored programs (17 programs, 21.3%), community-sponsored programs (10 programs, 12.5%), and research-focused leadership programs (14 programs, 17.5%). Nine programs (11.3%) reported offering other leadership education opportunities, including resources from contract groups, advocacy training, chief resident forums, and supplementary didactic sessions. Of the 19 programs with a formal resuscitation leadership curriculum, 13 (68.4%) offered additional leadership education opportunities through external partnerships.

DISCUSSION

Prior studies have identified gaps in structured leadership training across graduate medical education. However, it remains unclear whether similar gaps exist within EM

Table 1. Resuscitation leadership curriculum content delivery methods for 19 residency programs.

Curriculum delivery	Frequency (n)	Percentage (%)
Lectures	10	52.63
Small-group discussions	12	63.16
Seminars/Workshops	1	5.26
Simulation	16	84.21
Case studies	5	26.32
Self-directed learning	2	10.53
On-shift teaching	10	52.63
Mentorship	7	36.84
Journal Club	1	5.26

Table 2. The focus of resuscitation leadership curriculum content in 19 residency programs.

Curriculum focus	Frequency (n)	Percentage (%)
Clinical resuscitation leadership skills	18	94.74
Trauma resuscitation leadership skills	17	89.47
Administrative leadership skills	1	5.26
Communication and interpersonal skills	17	89.47
Cultural sensitivity	3	15.79
Teaching/education	5	26.32
Health policy and managed care	0	0
Leadership theory	6	31.58
Team-building	13	68.42
Management skills	7	36.84
Conflict resolution	8	42.11

resuscitation leadership, an important consideration as the ACGME proposes additional resuscitation leadership requirements for EM residencies.^{10–13} To address this, we conducted a national needs assessment of EM residency programs to evaluate the presence of formal resuscitation leadership curricula.

Our assessment identified a gap in formal resuscitation leadership training among EM residency programs. We hypothesize that this deficiency is driven by several factors. A commonly cited challenge was the lack of time and resources within the crowded and complex medical education framework, where leadership and other “soft skills” are often deprioritized in favor of clinical and technical training.²² Learners also report barriers to leadership education, including difficulties in maintaining consistent leader-learner relationships, the lack of emphasis on leadership in feedback from superiors, and gender and racial dynamics that interfere with learning opportunities.²³

In practice, much of the resuscitation leadership instruction that EM residents receive occurs through informal or “hidden” curricula. While many physicians do grow into effective resuscitation leaders within their clinical environments, literature from medical education broadly suggests that reliance on informal, or hidden, curricula can introduce variability, bias, and gaps in training.^{1,24,25} Additionally, EM residency leadership may assume that existing educational practices adequately develop residents’ leadership skills in resuscitations, reducing the perceived need for formal curricula. However, no studies have rigorously evaluated whether current approaches consistently produce graduates with the necessary skills. Further research is needed

to determine whether existing training sufficiently prepares EM residents to competently lead emergent resuscitations.

An additional factor that contributes to the absence of high-quality resuscitation leadership curricula is the variability in resuscitation leadership training across medical education. Our assessment identified diversity in resuscitation leadership content and educational methods across programs. Simulation-based training was the most frequently used method, which aligns with its widespread adoption in EM residency education.²⁶ We hypothesize that its prominence in resuscitation leadership education reflects the unique strengths of simulation in replicating high-stakes resuscitations within a controlled learning environment. Additionally, simulation provides structured opportunities to practice and receive feedback on resuscitation leadership skills that are more difficult to convey through didactics or clinical shifts alone.^{27,28} Further analysis of best practices for resuscitation leadership educational methodology is needed to determine the best form of instruction for EM residents.

Commonly identified content themes included leadership performance, communication, and team-building. Notably, many programs reported incorporating both medical and trauma leadership skills into their curricula. We suspect this reflects an effort to build transferable leadership competencies across different resuscitation contexts. However, the degree to which trauma-focused leadership training complements or enhances medical resuscitation leadership skills remains unclear. Importantly, no program reported trauma leadership as the sole focus of its curriculum. Our findings also highlight substantial variability in curriculum content across programs, mirroring broader inconsistencies in leadership training across graduate and undergraduate medical education, as reported by Matsas et al and Rosenman et al.^{29,30} Both reviews highlighted the lack of standardized leadership frameworks as a key contributor to the slowed progress of leadership curriculum development and likely impacted the development of content specific to resuscitation leadership. Further research is needed to identify best practices and to evaluate how different curriculum content shapes EM residents’ resuscitation leadership skills.

Within EM, the Milestones Project offers the closest thing to a resuscitation leadership competency framework, but its lack of specificity hinders its application for developing resuscitation leadership curricula as indicated by Rosenman et al.⁸ Furthermore, the milestones do not cover key administrative, management, and conflict-resolution skills expected of practicing emergency physicians during resuscitations. Our study reflects previously reported gaps in opportunities for EM residents to develop these broader resuscitation leadership competencies.¹⁴ The development of consensus, competency-based frameworks for resuscitation leadership within EM warrants further investigation.

There is a wealth of validated leadership models in fields such as business, the military, and aviation that could serve as valuable resources for EM trainees.¹⁵ Many responding EM

residency programs provide voluntary leadership training through external partnerships, including hospital, university, and community-based programs, which may draw on these external leadership models. Programs like Crew Resource Management, US Army officer leadership programs, and executive leadership courses have shown success in improving leadership skills.^{10,15} Similarly, government-sponsored healthcare leadership programs such as TeamSTEPPS and STARTT have demonstrated promise in enhancing leadership capabilities.^{31,32} Non-EM specialty resuscitation leadership curricula have also been explored and show significant improvements in patient outcomes in pediatric, traumatic and intensive care unit resuscitations.^{33–37} Additionally, research programs focused on resuscitation leadership may contribute relevant leadership skills.

Emergency medicine residents are also expected to complete standardized, guideline-based training including Advanced Trauma Life Support (ATLS), Advanced Cardiovascular Life Support (ACLS), and Pediatric Advanced Life Support, which include elements relevant to both trauma and medical resuscitations. However, it remains unclear how effectively these external models can be adapted to the unique demands of medical resuscitation leadership in EM.³³ For example, while ATLS may incorporate some leadership principles, the degree to which it or similar courses develop the real-time leadership skills required for leading diverse emergency teams is uncertain. Notably, prior research has shown that ACLS training alone is insufficient to prepare physicians for resuscitation leadership roles.⁵ Further, the variability in content and delivery across these programs raises questions about which approaches are best suited for EM residency training. Future research should focus on exploring how these external leadership frameworks could be tailored to EM resuscitation leadership education. Moreover, addressing the barriers that prevent the implementation of resuscitation leadership training in EM residencies will be key to developing and integrating effective programs in the future.

LIMITATIONS

Our study has limitations that should be acknowledged. The overall response rate was relatively low, which increases the risk of non-response bias as non-respondents may have had different needs in resuscitation leadership than respondents. Additionally, our study was underpowered to detect resuscitation leadership curriculum differences in three- vs four-year EM residency programs. However, our wave analysis demonstrated no significant difference between early and late responders, suggesting that non-respondent data would be unlikely to substantially alter the results.²¹ Moreover, the proportion of three- vs four-year programs among respondents closely paralleled national distributions at the time of the survey.³⁸ Geographic representation was also broadly similar, with modest over-representation of Great Lakes programs and under-representation of Great Plains programs.

Our survey instrument did not undergo formal validity testing or piloting, which may have led to variable interpretation of survey items. In particular, “on-shift teaching” was listed as one of several educational methods by programs that reported having a formal curriculum; however, we recognize that the structure and consistency of this approach may vary across institutions. Lastly, survey responses were taken from program leadership perspective and lack resident insights on the impact of resuscitation leadership training. However, EM resident lack of leadership training has been well documented previously, and we assumed that such a gap likely extends to resuscitation leadership.

CONCLUSION

Most of the US EM residency programs that participated in this study reported lack of a formalized resuscitation leadership curriculum, with existing programs showing considerable variability in educational methods and curriculum content. This inconsistency mirrors broader challenges in leadership education across medical training. Additional research is essential to determine whether traditional leadership training improves resuscitation performance and patient outcomes, and to inform the potential development of targeted educational strategies. While there is potential to adapt established leadership programs from other fields to emergency medicine, further research is necessary to validate their effectiveness in enhancing resuscitation leadership skills.

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Simulation Curriculum Improves Emergency Medicine Resident Preparedness for the New American Board of Emergency Medicine Certifying Exam

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Introduction: In 2024, the American Board of Emergency Medicine (ABEM) announced the launch of a new certifying exam that emergency medicine (EM) residency graduates must pass to achieve specialty certification. To date, there are no comprehensive curricula published in the available literature to aid residents in exam preparation.

Methods: In this pre-post pilot study, 44% (24/55) of postgraduate year 1 (PGY-1) through PGY-4 EM residents at a single site participated in a four-hour simulated certifying exam curriculum. Learners were asked to complete a four-point Likert scale survey rating self-reported preparedness (very unlikely – very likely) to take the ABEM Certifying Exam, as well as comfort with the ABEM tested competencies, preceding and following the simulation session.

Results: Survey respondents (n = 21; 87.5%) reported an improvement in overall preparedness to take the ABEM Certifying Exam, yielding a pre-post mean difference score of +1.2 (1.9 [unlikely] pre to 3.1 [likely] post, P < .001). Additionally, there was an improvement in all ABEM-tested competencies; pre-post mean difference score ranged from +0.5 (3.0 pre to 3.5 post) for patient-centered communication to +1.1 (2.2 pre to 3.3 post) for clinical decision-making (P < .001 for all competencies).

Conclusion: Given the critical need, and self-reported improvement in preparedness, EM training programs nationwide could consider incorporating a similar simulation curriculum into their didactic experience to help better prepare their learners for the new ABEM Certifying Exam. [West J Emerg Med. 2026;27(1)39–43.]

INTRODUCTION

Every year, over 2,500 physicians achieve American Board of Emergency Medicine (ABEM) certification, indicating that they have demonstrated sufficient knowledge and clinical skills to provide competent patient care.¹ Obtaining ABEM certification entails the completion of a

two-step process comprised of a written (qualifying) exam followed by a practical exam. This practical exam, known as the “oral exam,” was instituted over 45 years ago and consisted of seven scenario-based interviews meant to measure skills otherwise challenging to assess in a multiple-choice format. In February 2024, ABEM announced the

release of a new practical exam, the ABEM Certifying Exam, which will replace the oral exam in 2026. The new certifying exam focuses on the following competencies: difficult conversations; managing conflict; patient-centered communication; reassessment/troubleshooting; procedures; ultrasound; clinical decision-making; and prioritization.²

Pre-existing published resources to guide exam preparation are limited. Therefore, there is a critical need to create curricula that prepare emergency medicine (EM) residents for the new ABEM Certifying Exam. One tool that has been used successfully in other domains is medical simulation. A systematic review of simulation-based medical education found that simulation, when paired with traditional didactic education, has a superior impact on confidence, knowledge retention, and clinical performance compared to didactic education alone.³ Furthermore, prior studies revealed that medical simulation leads to improved Objective Structured Clinical Examination (OSCE) performance among medical students and residents.⁴⁻⁶ Medical simulation has also been found to have a favorable effect on assessment of interpersonal communication competence.⁶ A four-day immersive simulation curriculum yielded comparable OSCE performance to a six-week clinical rotation in cardiology and respiratory medicine.⁷ Simulation has also had a favorable impact on skill acquisition, such as ultrasound and medical procedures.^{4,8} Lastly, medical simulation resulted in improved confidence and decreased anxiety preceding summative exams.⁹

While prior studies suggest that simulation may be helpful in preparing residents for future examinations, there is currently no published data evaluating the impact of simulation curricula on preparing EM residents for the new ABEM Certifying Exam. In this pilot study, we assessed the effect of a novel simulation curriculum on resident self-reported preparedness for the ABEM Certifying Exam. The included cases can be easily replicated by other EM residency programs to aid their residents in exam preparation.

METHODS

In this pre-post pilot study, we invited all EM residents at a single, urban EM training program to participate in a simulated ABEM Certifying Exam curriculum. Our primary outcome was change in resident self-reported preparedness for the exam before and after the simulated curriculum, as measured by surveys distributed to learners preceding and following the four-hour curriculum.

Survey Development

We developed pre- and post-simulation surveys using an iterative process with the intention to create easy-to-understand questions stems, omitting double-barreled questions, implicit negatives, and leading questions. Survey questions were meant to assess level 1 (reaction) and level 2 (learning) of the Kirkpatrick model.^[10] We conducted pilot testing on attending physicians not included within the studied population. The pre-simulation survey included nine questions, which were

intended to evaluate trainees' overall perceived level of preparedness to take the exam, as well as their comfort with individual competencies: difficult conversations; managing conflict; patient-centered communication; reassessment/troubleshooting; procedures; ultrasound; clinical decision-making; and prioritization (Appendix 1). Each question was graded on a four-point Likert scale (1=very unlikely, 2=unlikely, 3=likely, 4=very likely) on the trainees' confidence in passing the ABEM Certifying exam right now. We chose a four-point Likert scale to force a non-neutral response. A similar survey was delivered at the close of the simulation session (Appendix 1), which was identical to the pre-simulation survey aside from the inclusion of two additional questions evaluating the effectiveness of the curriculum and overall suggestions for improvement.

Curriculum Description

This curriculum was designed using Kern's six-step model for curriculum development.¹¹ There is a general need among EM training programs to help prepare learners for the new ABEM Certifying Exam, but there are limited resources available for preparation. Within our program, we identified a targeted need among our senior residents who will be among the initial cohort across the country taking this exam. The overarching goal in developing this curriculum was to prepare our residents for the overall format and the individual competencies tested for the ABEM Certifying Exam.

Educational strategies used simulation to replicate the structure of the Certifying Exam. Several learning theories support the use of simulation as an appropriate modality to help prepare learners for this new ABEM requirement, including behaviorally oriented experiential learning, which posits that knowledge gained from confronting a problem in a simulated environment can be applied to real-world situations, and reflection on action, which suggests feedback obtained during the simulation debriefing will trigger self-reflection on performance and guide further efforts for exam preparation.¹² Implementation required obtaining buy-in from program leadership, faculty, and trainees. Finally, program evaluation is ongoing and includes a post-simulation survey of participants.

In total, this curriculum took place over the course of four hours. Residents first attended a lecture including a description of, and grading criteria for, the four case types assessing interpersonal communication. Participants then rotated through a series of four stations where one resident acted as the examinee for each while the others observed. They then received immediate feedback on their performance from the facilitator and their colleagues. Participants then received a second lecture on technical skills and clinical reasoning case types, followed by practice sessions with each case type in a similar format to the interpersonal communication stations. The session concluded with a post-simulation survey.

Simulation cases were written to mimic those on the ABEM Certifying Exam based on publicly available resources on the

ABEM website. These included four cases assessing interpersonal communication (difficult conversations, managing conflict, patient-centered communication, and reassessment/troubleshooting), two cases evaluating technical skills (ultrasound and procedures), and two cases assessing clinical reasoning (clinical decision-making and prioritization). Interpersonal communication and ultrasound cases were led by two faculty members, one playing the role of a mock patient and the other acting as a facilitator. The remaining cases required only one faculty member to act as a facilitator. Case materials varied by case type and are included as [supplementary material](#).

Data Collection

We collected survey data anonymously, although each participant created a unique, non-identifiable code to pair the pre- and post-simulation results. There were no surveys with incomplete or missing data, although pre-simulation surveys without corresponding post-simulation data were excluded from analysis. To determine differences in the nine survey questions pre/post-simulation, we performed paired *t*-tests. To adjust for multiple comparisons, *P*-values < .01 were considered statistically significant. Differences pre/post are reported as means with 95% confidence intervals. All analyses were performed using SAS statistical software v9.4 (SAS Institute, Inc, Cary, NC). Figures were created using GraphPad Prism v10.4.1 (GraphPad Software, San Diego, CA). The University of Pennsylvania Institutional Review Board reviewed our study and deemed it exempt.

RESULTS

Of the 55 PGY-1 to PGY-4 EM residents invited to attend, 24 (43.6%) elected to participate. This included four PGY-1, eight PGY-2, four PGY-3, and eight PGY-4 residents. Of the 24 in attendance, 21 (87.5%) completed both the pre- and post-

surveys. All group comparisons reached statistical significance. Overall confidence pre-simulation was low, with five (24%) residents reporting that they were likely to very likely to pass the ABEM Certifying Exam (Table 1). Post simulation, 17 (81%) respondents reported that they were likely to very likely to pass, yielding a 57% improvement (Table 1). Overall confidence to pass the ABEM Certifying Exam increased by 1.2 points from an average of 1.9 to 3.1 (unlikely to likely) on a four-point Likert scale (95% CI, 0.92-1.46, *P* < .001, Figure).

Similarly, across all competencies, we observed increases in self-reported learner preparedness. Mean improvements in pre/post scores ranged from +0.47 (patient-centered communication) to +1.1 (clinical decision-making, Figure) and percentage increases in confidence ranging from 9.5-47% (Table). Individual group comparisons are as follows:

Clinical reasoning stations: clinical decision-making scores increased by 1.1 points from an average of 2.2 to 3.3. Prioritization scores increased by 0.7 points from an average of 2.4 to 3.1

Technical skills stations: Ultrasound scores increased by 0.8 points from an average of 2.6 to 3.4. Procedures scores increased by 0.5 points from an average of 2.8 to 3.3.

Interpersonal communication stations: Difficult conversations scores increased by 0.7 points from an average of 2.8 to 3.5. Managing conflict scores increased by 0.8 points from an average of 2.6 to 3.4. Patient-centered communication scores increased by 0.5 points from an average of 3.0 to 3.5. Lastly, reassessment and troubleshooting scores increased by 0.7 points from an average of 2.6 to 3.3.

Overall satisfaction with this curriculum was favorable with 95% of respondents (20/21) agreeing (n=6) or strongly agreeing (n=14) that they felt more prepared to take the ABEM Certifying Exam following this curriculum. The one participant who strongly disagreed with this statement

Table. In a study measuring perceived exam preparedness among emergency medicine residents following a simulated ABEM Certifying Exam, comparison of the percentage of participants responding “likely” or “very likely” to pass on pre- vs post-simulation surveys.

	Absolute % likely or very likely		Difference: Post- pre
	Pre	Post	
Overall confidence	23.8%	81.0%	57.2%
Clinical decision-making	42.9%	90.5%	47.6%
Managing conflict	61.9%	95.2%	33.3%
Ultrasound	52.4%	100.0%	47.6%
Prioritization	47.6%	81.0%	33.4%
Reassessment and troubleshooting	61.9%	90.5%	28.6%
Difficult conversation	76.2%	95.2%	19.0%
Procedures	71.4%	100.0%	28.6%
Patient-centered communication	90.5%	100.0%	9.5%

ABEM, American Board of Emergency Medicine.

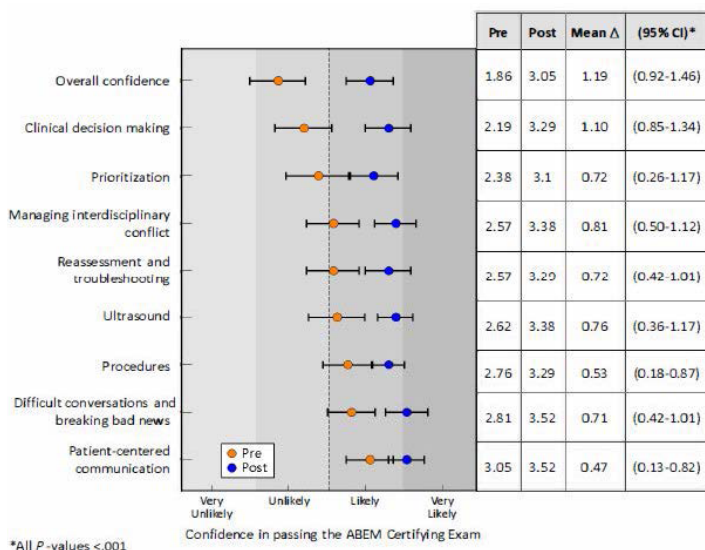


Figure. In a study measuring perceived exam preparedness among emergency medicine residents following a simulated ABEM Certifying Exam, comparison of mean differences in self-reported learner preparedness scores on pre- vs post-simulation surveys. ABEM, American Board of Emergency Medicine.

commented, “super-helpful, thank you for setting this up,” raising the possibility of an erroneous entry. Respondents requested that a list of possible procedures and ultrasound exams that could be tested in the ABEM Certifying Exam be highlighted in the introductory presentation.

DISCUSSION

To our knowledge, this is the first study to report on a simulation curriculum that prepares residents to take the 2026 ABEM Certifying Examination and helps fill a critical gap in exam-preparatory resources. We observed a positive correlation between completion of a simulated exam and self-rated preparedness to take the certifying exam both overall and within each of the eight tested competencies. Furthermore, most residents rated that they felt more prepared to take the certifying exam as a direct result of this curriculum.

The practice of EM has changed since the inception of the oral board exam in 1980. As a paternalistic approach to medicine has fallen out of favor, the importance of interpersonal communication has grown. In the age of shared decision-making and patient advocacy, patient-centered communication, managing conflict, and the companionate delivery of sensitive information have become increasingly important skills. Likewise, given increasing emergency department boarding times, effective reassessment and troubleshooting have become critical facets of daily practice. Lastly, given the widespread uptake of point-of-care ultrasound among emergency clinicians, demonstrating proficiency with this modality is essential. Therefore, the replacement of the traditional oral board exam with the new certifying exam is reflective of the contemporary

practice of emergency medicine.

In addition, with the rapid expansion and use of artificial intelligence (AI) in medical education, learners have access to medical knowledge with far more ease than in prior decades. This raises the question of what competencies might be integral to the effective practice of EM in the future. One could argue that the competencies chosen by ABEM, such as procedures and difficult conversations, should be taught and assessed in a more comprehensive manner in EM training. For example, in the clinical learning environment, one could imagine that when a learner is questioned about a specific disease process to assess knowledge, they could use AI to rapidly provide an answer. Or while a resident is providing bedside care, AI could help generate differential diagnoses and management plans. Teaching and assessing these other skills highlighted by the ABEM Certifying Exam, such as managing interdisciplinary conflict and patient-centered communication, could help residents expand their skills to those that would be complementary to AI and critical to the effective practice of EM in the future. Our study identifies an increase in confidence in these types of competencies among participants. Further efforts could be directed into expansion of this curriculum to meet these anticipated future needs.

While the content of the exam mirrors contemporary residency training and may be informative to the future practice of EM, there is a lack of resources to aid in preparation. The existing oral board exam has a 96% pass rate, which is largely attributable to an abundance of existing courses, residency didactic curricula, and resources for independent practice.¹ Given that no such resources are available for the new certifying exam, there is reasonable concern among EM residents over the possibility of declining board pass rates. While it remains to be seen whether an effect on pass rates will come to fruition, simulation curricula intended to mimic summative exams increase confidence and decrease test-taking apprehension, which in turn has shown a positive impact on resident wellbeing.⁹ Our study highlights the overall improved confidence learners have in passing the ABEM Certifying Exam following this curriculum. Our study team will follow this cohort to obtain longer term data, including preparedness at the time of graduation. We also plan to compare ABEM Certifying Exam pass rate among those who participated compared to those who did not participate in this simulated curriculum.

LIMITATIONS

While learners noted that they felt more prepared to take the ABEM Certifying Exam, longer term studies are needed to measure board pass rate following the implementation of a certifying-exam simulation curriculum. This is especially critical as our current cohort of residents has no prior experience with the new exam and, therefore, perceived preparedness may not translate into improved board pass rates. Additionally, given that participation in this curriculum was voluntary, with a subset of residents choosing to participate,

there is the potential for selection bias. This also led to a modest sample size, which increases the risk of sampling bias and thus reduces power. Future iterations of this curriculum will include additional members of our residency program.

Moreover, the single-site design of this pilot study may limit generalizability; however, the provided curriculum could be easily adopted or adapted at other training programs interested in preparing their learners for this new exam. Additionally, we were unable to analyze the effect by PGY level. Future studies could explore whether a curriculum like this would be better suited for a more junior vs senior learner. Finally, while we used parametric statistics to analyze ordinal data, results were similar using non-parametric statistics, and prior studies support the statistical equivalence of using parametric and non-parametric testing when analyzing Likert scales.¹³

CONCLUSION

Our simulated certifying exam curriculum, the first of its kind to be described in the literature, can help meet a critical need for exam preparation resources among EM residents. With the cases created for this study, other training programs can design a simulated ABEM Certifying Exam experience for their trainees with minimal resources to better prepare their residents for this requirement. Future studies should explore alternative tools and curricula to better teach and assess EM residents for the new competencies critical for the ABEM Certifying Exam, as well as the practice of emergency medicine now and in the future.

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Comparison of Acute Stroke Outcomes Between Code Trauma vs Code Stroke Activations

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Introduction: Patients with acute stroke may occasionally present as trauma activations, particularly after being found down or sustaining falls. This atypical presentation can delay diagnosis and treatment. Our objective in this study was to compare time to brain imaging, use of reperfusion therapies, and clinical outcomes, including discharge disposition and mortality, between patients with acute stroke presenting as code trauma activations and those presenting as code stroke activations.

Methods: We conducted a retrospective review of all trauma activations at our Level I trauma center from January 2018-December 2024. Patients diagnosed with acute stroke on initial trauma imaging after trauma evaluation formed the code trauma activation (CTA) group. These patients were compared to all patients diagnosed with acute stroke after a code stroke activation (CSA) in 2024. The primary outcome was door-to-imaging time; secondary outcomes included door-to-intervention time, discharge disposition, and mortality.

Results: There were 208 CSA patients and 198 CTA patients. The CTA patients were older (75.3 vs 70.3 years of age, $P < .001$) and had a higher percentage of hemorrhagic stroke (43.9% vs 14.4%, $P < .001$). The CTA patients had a higher National Institutes of Health Stroke Scale score (14.44 vs 9.67, $P < .001$). Despite minimal injuries (mean Injury Severity Score 3.3), CTA patients experienced longer times to initial brain imaging (47.4 vs 24.8 minutes, $P < .001$). Mean door-to-thrombolysis (50.3 vs 43.7 minutes, $P = .19$) and door-to-puncture time (98 vs 82 minutes, $P = .18$) did not differ significantly. The CTA patients had lower rates of discharge home (23.2% vs 42.8%, $P < .001$) and higher mortality (24.2% vs 12%, $P < .001$). On multivariate analysis, trauma activation itself was not independently associated with mortality (OR 1.57, CI, 0.53-4.27, $P = .42$). Age, stroke severity scores, hemorrhagic stroke, and early imaging were independently associated with mortality after acute stroke.

Conclusion: Acute stroke patients presenting as trauma activations face significant delays in imaging and lower rates of thrombolytic treatment, despite low injury burden. While trauma activation designation was not independently associated with mortality, delays in imaging and higher hemorrhage prevalence were strongly linked to worse outcomes. These findings highlight modifiable workflow opportunities, particularly streamlined imaging and early stroke recognition in low-impact trauma presentations, to improve delivery of care. [West J Emerg Med. 2026;27(1)44–50.]

INTRODUCTION

Stroke remains a major public health burden in the United States with approximately 795,000 cases reported annually.¹ In 2021, the stroke-related death rate was 41.1 per 100,000 population, reflecting an 8.4% increase from 2011.¹ Of all strokes, 87% are ischemic, 10% are intracerebral hemorrhages (ICH), and 3% are subarachnoid hemorrhage.¹ The clinical presentation of stroke varies significantly depending on the affected vascular territory. Middle cerebral artery strokes, which account for roughly 50% of ischemic strokes, typically present with hemiparesis, neglect, and visual field deficits.² Anterior cerebral artery strokes often cause contralateral lower extremity weakness, while posterior cerebral artery or vertebrobasilar system strokes may present with ataxia or vertigo.³⁻⁵ Given the sudden onset and disabling nature of these symptoms, it is not difficult to imagine how a stroke could precipitate a traumatic event, such as a fall while walking, a motor vehicle collision, or an accident while operating machinery. When these patients are found down, especially if there are signs of head trauma, they may be brought to the emergency department (ED) as a trauma activation.

Time is critical in acute stroke care. Large vessel occlusions are estimated to result in the loss of 1.9 million neurons per minute, translating to 3.1 weeks of neurologic aging for every minute of treatment delay.⁶ Current American Stroke Association guidelines emphasize expedited imaging and intervention, targeting brain imaging (door to imaging) within 20 minutes of arrival and thrombolytic administration (door to needle) within 60 minutes. Fibrinolysis remains effective up to 4.5 hours after last known well time, while mechanical thrombectomy may be performed up to 24 hours from last known well time.⁷

In contrast, trauma activations necessitate a more comprehensive initial evaluation based on Advanced Trauma Life Support (ATLS) principles. Primary and secondary surveys, extended focused assessment with sonography for trauma, chest radiograph, pelvis radiograph, and stabilization interventions are typically completed prior to computed tomography (CT).⁸ For patients with relatively minor traumatic injuries but significant neurologic deficits, subtle signs of acute stroke may be underappreciated, leading to critical delays in diagnosis and treatment.

At the health system level, door-to-imaging and door-to-needle time are proven, actionable system performance metrics. Studies have shown that standardized bundles including prehospital notification, direct to CT, and parallel workflows can reliably shorten treatment times across hospitals.^{9,10} Earlier reperfusion translates to better functional outcomes, with some studies estimating weeks to months of disability-free life gained for minutes saved in treatment.¹¹

Strokes masquerading as trauma pose a unique diagnostic and operational challenge. Although trauma pathways prioritize rapid imaging, the inherent workflow delays

Population Health Research Capsule

What do we already know about this issue?

Stroke patients mis-triaged as trauma activations may face imaging delays, missed thrombolysis windows, and worse outcomes, but data are limited.

What was the research question?

Do stroke patients presenting as a trauma activation differ in time to brain imaging, treatment, and outcomes compared to code stroke patients?

What was the major finding of the study?

Code trauma vs code stroke patients: time to brain imaging 47 vs 25 minutes, thrombolytic use 4% vs 26%, mortality 24% vs 12% ($P < .001$).

How does this improve population health?

Findings highlight workflow changes to speed imaging in atypical stroke presentations, improving access to timely treatment and outcomes.

compared to stroke activations may impact timely reperfusion therapy. At our institution, parallel activation systems exist for trauma (code trauma) and stroke (code stroke). Our objective in this study was to compare time to brain imaging, use of reperfusion therapies, and clinical outcomes, including discharge disposition and mortality, between patients with acute stroke presenting as code trauma activations and those presenting as code stroke activations. We hypothesized that patients with stroke initially evaluated under the trauma pathway experience delays in brain imaging leading to delayed treatment and higher mortality compared to those triaged through the dedicated stroke pathway.

METHODS

After institutional review board approval was obtained, we retrospectively reviewed all adult trauma patients ≥ 18 years of age at our Level I trauma center who were evaluated between January 2018–December 2024. We included all patients who were diagnosed with a cerebrovascular accident on CT during their initial workup. These patients comprised our first group, the code trauma activation (CTA) group. We excluded patients who were evaluated as a trauma consult. We then queried the code stroke hospital database for all patients evaluated as a code stroke and confirmed to have an acute stroke without evidence of traumatic intracranial hemorrhage

on CT during 2024. These patients comprised our second group, the code stroke activation (CSA) group. We excluded patients seen as a stroke consult.

To be included in either group patients were diagnosed with acute stroke on initial ED imaging (non-contrast head CT and/or CT angiogram of the head/neck). Hemorrhagic stroke was defined by acute blood on non-contrast CT and determined by radiology to have a non-traumatic pattern. Acute ischemic stroke was defined by radiology-reported acute ischemic changes on non-contrast CT and/or CT angiogram evidence of large-vessel occlusion consistent with the clinical syndrome. We excluded cases with normal initial CT/CT angiogram that were diagnosed on later or alternative imaging. The primary outcome was time to initial brain imaging. Time to brain imaging was defined as time from arrival in the ED to the first time stamp on the non-contrast head CT acquisition, which even in the case of CT angiogram head, a non-contrast run was performed first. Imaging protocols for acute stroke and trauma evaluations remained standardized across the study period. Scanner location and availability did not vary substantially during the study period; a dedicated CT scanner adjacent to the ED was consistently available for both trauma and stroke activations. The secondary outcomes were door-to-intervention time, discharge disposition, and mortality. Trauma activations were conducted in accordance with departmental (ATLS-based) policy, including primary and secondary surveys with typical adjuncts including ultrasounds, chest radiographs, and pelvis radiographs prior to CT when indicated. A formal audit of each chart for strict compliance was not performed at part of the retrospective review.

Demographic data points collected included age and sex. Characteristics including stroke type (hemorrhagic vs ischemic), National Institutes of Health Stroke Scale (NIHSS) score, and mode of hospital arrival were recorded for each group. For the CTA group, injury data collected included mechanism of injury, level of trauma activation (1, 2 or 3), type of injury (fracture type, solid organ injury, or facial soft tissue injury including face or scalp laceration, hematoma, or abrasion), Injury Severity Score (ISS), and total Glasgow Coma Scale (GCS) score on arrival. For each group we recorded and compared time to initial brain imaging, as well as time to interventions such as thrombolytic therapy and thrombectomy. Additional outcomes measured included discharge disposition and length of stay (LOS).

We performed all bivariate analyses with SPSS Statistics for Windows v29 (IBM Corp., Armonk, NY). A Mann-Whitney *U* test was used to compare continuous variables and a chi-square was used to compare categorical variables in the bivariate analysis. We presented categorical data as percentages and continuous data as a mean with standard deviation. We then performed a multivariable logistic regression analysis to determine the risk of mortality for patients with acute stroke arriving as a code stroke activation

vs code trauma activation. We adjusted for potential confounders, which were selected based on discussion among coauthors, review of the literature, and identification of univariate, statistically significant differences between proposed confounding variables. These included age, presence of ≥ 2 comorbidities (including hypertension, diabetes mellitus, chronic obstructive pulmonary disease, congestive heart failure, chronic kidney disease, end-stage renal disease, and atrial fibrillation), early imaging (time to CT < 20 minutes), and type of stroke (ischemic vs hemorrhagic). *P*-values were defined as statistically significant if $< .05$.

This study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines and followed key methodological principles outlined by Worster et al for medical record review studies in emergency medicine, including the use of clearly defined inclusion and exclusion criteria, and predefined data definitions to minimize bias.¹²

RESULTS

A total of 208 patients were activated as a code stroke, which was confirmed on CT imaging, while 198 patients were activated as a code trauma but were diagnosed with an acute stroke on imaging. The CTA patients were older (75.3 vs 70.3 years of age, $P < .001$). There was no difference in sex between the two groups (52.5% male vs 59.6% male, $P = .63$). The CTA patients had a higher incidence of hemorrhagic stroke (43.9% vs 14.4%, $P < .001$). The CTA patients were more likely to arrive by ambulance (93.4% vs 79.3%) while CSA patients had a higher percentage arrive by private vehicle (4.0% vs 17.3%, $P < .001$). The CTA patients had a higher average NIHSS score (14.44 vs 9.67, $P < .001$) (Table 1).

We recorded injury patterns for the 198 patients in the CTA group, with the primary mechanism being falls (97%),

Table 1. Characteristics of patients treated for cerebrovascular accident after code stroke activation vs code trauma activation.

Characteristic	Code stroke (n = 208)	Code trauma (n = 198)	<i>P</i> -value
Age, years, mean	70.3	75.3	$< .001$
Male %	59.6%	52.5%	.63
Stroke type			$< .001$
Ischemic	178 (85.6%)	111 (56.1%)	
Hemorrhagic	30 (14.4%)	87 (43.9%)	
Mode of Arrival			$< .001$
Ambulance	165 (79.3%)	185 (93.4%)	
Private Vehicle	36 (17.3%)	8 (4.0%)	
Transfer	7 (3.4%)	5 (2.5%)	
NIHSS, mean	9.67	14.44	$< .001$

NIHSS, National Institutes of Health Stroke Scale.

followed by motor vehicle collision (3%). Of the CTA patients, 40.9% were activated as a level 1 trauma, 41.9% were activated as a level 2, and 17.2% as a level 3 trauma. Recorded injuries were predominantly facial abrasions/hematomas (33.3%), followed by extremity fractures (2.5%), and spinal fractures (2.5%). Two patients had low-grade splenic lacerations (1.0%). The average ISS for CTA patients was 3.3, and the average initial total GCS was 11.7. Of patients arriving as a CTA, 42.4% underwent non-contrast CT head for trauma and stroke protocol imaging during the initial imaging session (Table 2).

The mean time to brain imaging was significantly higher in the CTA group (47.4 vs 24.8 minutes, $P < .001$). More patients in the CSA group underwent thrombolytic therapy (3.6% vs 25.8%, $P < .001$). Of the 107 ischemic stroke patients in the CTA who did not receive thrombolytics, only 24 (22.5%) had a documented contraindication to thrombolytics therapy. Mean door-to-thrombolytics time tended to be higher in the CTA group, but this did not reach statistical significance (50.3 vs 43.7 minutes, $P = .19$). There was no difference in the percentage of patients who underwent thrombectomy in each group (11.1% vs 16.8%, $P = .13$). Mean door-to-puncture time tended to be higher in the CTA group without statistical significance (98 vs 82 minutes, $P = .18$). Disposition from the hospital showed fewer patients in the

CTA group going home (23.2%), more going to a skilled nursing facility (39.4%), more going to hospice (6.6%), and fewer leaving against medical advice (2.0%) compared to CSA patients (home, 42.8%; skilled nursing facility, 35.1%; hospice, 1.4%; and against medical advice, 5.3%, $P < .001$). Mortality was higher in the CTA group (24.2% vs 12.0%, $P < .001$) (Table 3). A posthoc power analysis demonstrated our sample size provided $> 80\%$ power to detect a > 15 -minute difference in mean door-to-imaging time between two groups at an α of 0.05.

After adjusting for potential confounders, there was no difference in mortality if initially managed as a code trauma activation (OR 1.57, CI, 0.53-4.27, $P = .42$). Independent predictors of mortality included age (OR 1.03, CI, 1.01-1.05, $P = .01$), NIHSS (OR 1.10, CI, 1.04-1.15, $P < .001$), early imaging < 20 minutes (OR 0.44, CI, 0.22-0.90, $P = .02$), and hemorrhagic stroke type (OR 2.87, CI 1.42-5.80, $P = .003$) (Table 4).

DISCUSSION

Our study highlights that patients with acute stroke who are initially evaluated under trauma activation protocols experience significantly longer times to brain imaging and worse outcomes compared to those triaged through dedicated stroke pathways. While patients arriving as CTA had minimal injuries, they had nearly double the time to imaging compared to those arriving as CSA. Multivariate analysis confirmed that delayed imaging and hemorrhagic stroke were independently associated with mortality, rather than the trauma activation pathway itself. This suggests that operational delays rather than injury burden may be contributing to poor outcomes; however, causality cannot be inferred from this retrospective study.

Our most notable finding was the difference in time to brain imaging, with a mean of 47.5 minutes in the CTA group vs 24.8 minutes in the CSA group. While there are limited studies comparing stroke outcomes based on team activation, Madhok et al found no difference in time to CT for patients seen as a trauma activation compared to those evaluated in other pathways.¹³ However, one institution recognized the potential for delay in management of patients evaluated in a trauma pathway and created a novel pathway called "STRAUMA," which evaluates patients as a dual code trauma and code stroke and put a heavy emphasis on early neurology evaluation and brain imaging. Lee et al evaluated 580 patients at a Level I trauma center, 469 stroke alerts and 111 STRAUMA alerts. They still found increased time to brain imaging even with their novel STRAUMA alert pathway (23.1 minutes in the STRAUMA group vs 16.9 minutes in the stroke group, $P < .001$). Similar to our results, they also found decreased use of thrombolytics (13.5% in STRAUMA vs 27.9% in stroke group, $P < .001$) and higher mortality in the STRAUMA group compared to the code stroke group (14.4% vs 6.0%, $P = .003$).¹⁴

Table 2. Injury pattern of patients treated for cerebrovascular accident after code trauma activation.

Characteristic	Code trauma (N = 198)
Mechanism, n (%)	
Fall	174 (87.9%)
Found down	18 (9.1%)
MVC	6 (3.0%)
Activation level	
Level 1	81 (40.9%)
Level 2	83 (41.9%)
Level 3	34 (17.2%)
Injuries	
Extremity fractures	5 (2.5%)
Spinal fractures	5 (2.5%)
Pelvic fractures	0
Splenic laceration	2 (1.0%)
Facial abrasions/hematomas	66 (33.3%)
ISS, mean (IQR)	3.3 (3.0)
GCS total, mean	11.7
Initial dual imaging*	84 (42.4%)

*Patients underwent non-contrast trauma scans and stroke-protocol scans during initial imaging session
GCS, Glasgow Coma Scale; ISS, Injury Severity Score; IQR, interquartile range; MVC, motor vehicle collision.

Table 3. Outcomes of patients treated for cerebrovascular accident after code stroke activation vs code trauma activation.

Outcome	Code stroke (n = 208)	Code trauma (n = 198)	P-value
Time to brain Imaging, mean, minutes	24.8	47.4	< .001
Thrombolytics, n (%*)	46 (25.8%)	4 (3.6%)	< .001
Door-to-thrombolytics time, mean in minutes	43.7	50.3	.19
Thrombectomies, n (%*)	35 (19.7%)	22 (19.8%)	.13
Door-to-puncture time, mean	82	98	.18
LOS, mean, days	9.0	9.55	.29
Discharge disposition, n (%)			< .001
Home	89 (42.8%)	46 (23.2%)	
SNF	73 (35.1%)	78 (39.4%)	
Hospice	3 (1.4%)	13 (6.6%)	
AMA	11 (5.3%)	4 (2.0%)	
Mortality, n (%)	25 (12.0%)	48 (24.2%)	<.001

*Percentages are for patients with ischemic stroke in each category (178 for code stroke activation, and 111 for code trauma activation). AMA, against medical advice; LOS, length of stay; SNF, skilled nursing facility.

Importantly, Lee et al compared STRAUMA only with code stroke alerts. To assess operational value, future evaluations should also benchmark STRAUMA against standard CTAs as the dual alert could still provide benefit for patients with atypical symptoms brought in as a traditional trauma alert. Just as ED crowding has been shown to adversely affect door-to-imaging times and, therefore, overall outcomes for stroke patients, it is likely that aspects of the trauma evaluation at many institutions contribute to slowing of critical imaging in stroke patients.¹⁵ While some patients may require initial stabilization and airway management, it is unlikely this played a large role in our patient population given the minimal traumatic injuries noted in the CTA group.

In hemodynamically stable patients with minimal external injury yet focal neurologic deficits, several routine steps in the trauma bay can add clinically significant time to CT, such as positioning for chest and pelvis radiographs, possibly adjusting the plate for adequate radiographs, extremity plain films, and bedside ultrasound. These can affect transport time to the CT scanner and even change the patient's priority for the CT scanner if higher acuity patients arrive in that time interval. Many of these tasks are deferrable until after head CT without compromising trauma evaluation as long as the primary survey is complete and the patient remains hemodynamically stable. Operational pathways that prioritize direct to CT after primary survey, with parallel neurology notification, may shorten door-to-imaging time while preserving patient safety.

It seems that in nearly half of CTA patients, the trauma team recognized the possibility of an underlying neurologic event, as 42% underwent both typical non-contrast trauma CT and CT angiography of the head and neck during their initial imaging session. This dual-imaging approach suggests that the

team had early suspicion for stroke, even while proceeding through a trauma activation pathway. Incorporating CT angiography in such cases may help identify large vessel occlusions and expedite reperfusion therapies. Future protocols could consider establishing a low threshold for adding CT angiography of the head and neck in trauma patients with unexplained neurologic deficits or minimal external injuries, as this strategy may reduce delays in diagnosis without significantly altering trauma workflows.

When intervention was performed, we found no statistically significant difference in time to interventions in the CTA compared to the CSA group. However, we did find a large disparity in the use of thrombolytics in patients with ischemic stroke: only 3% of CTA patients with ischemic stroke received thrombolytics compared to 25% in the CSA group. Despite the proven benefits of thrombolytic therapy in acute ischemic stroke both in acute and long-term outcomes, patients arriving as a CTA are receiving this treatment less frequently.¹⁶ Documented contraindications to thrombolytics, such as unknown last known well time, factor Xa use, or

Table 4. Multivariable logistic regression analysis for risk of mortality for patients with acute stroke.

Risk factor	OR	CI	P-value
Age (Years)	1.03	1.01-1.05	.01
<2 Comorbidities	0.88	0.33-2.36	.81
NIHSS	1.10	1.04-1.15	< .001
Early imaging (<20 minutes)	0.44	0.22-0.90	.02
Hemorrhagic stroke (vs ischemic)	2.87	1.42-5.80	.003
Arrival as Code Trauma	1.57	0.53-4.72	.42

NIHSS, National Institutes of Health Stroke Scale; OR, odds ratio.

NIHSS < 6 accounted for 22.4% of ischemic stroke patients in the CTA group who did not receive thrombolytics. However, this does not fully explain the treatment gap compared to CSA patients, suggesting that delays in imaging or reluctance to administer thrombolytics in the setting of trauma may also contribute to missed therapeutic windows. These findings underscore two modifiable targets for trauma-activated stroke patients: expediting imaging, and actively identifying last known well time early in the trauma evaluation. Both may improve access to time-sensitive reperfusion therapies.

Our CTA patients had worse outcomes overall, including higher mortality and less frequent discharge home compared to skilled nursing facility or hospice. However, on multivariate analysis, evaluation as a code trauma was not independently associated with mortality. Age, NIHSS score, stroke type, and early imaging were independently associated with mortality. These have been well-studied in the literature, with studies confirming worse outcomes in older age, hemorrhagic stroke, higher NIHSS score, and delayed imaging.¹⁷⁻²⁰ Our CTA cohort contained a higher proportion of hemorrhagic stroke. We hypothesize this reflects non-focal presentations typical of hemorrhagic stroke (such as syncope, severe headache, or vomiting) which, especially in the presence of minor external injuries, may more likely prompt a trauma activation than the classic unilateral deficits of ischemic stroke.

While we cannot intervene on the type of stroke a patient has, their age, or the severity of the NIHSS score, we did observe system-level opportunities for improvement. For patients with minor external injury yet focal neurologic deficits, establishing a stroke-in-trauma order set (including CTA head/neck along with non-contrast CT head), early capture of last known well time, a parallel notification of neurology (such as in the STRAUMA study), or even a direct to CT after primary survey could reduce door-to-imaging times and potentially improve access to reperfusion therapy. Even modest reductions in treatment delays can expect to lower long-term disability, thereby reducing disability-adjusted life years (DALYs).²¹ Future prospective work should track patients' functional outcomes to enable DALY estimation. Additionally the resource implications of a dual-activation system should be evaluated against other costs such as CT use, ED length of stay, re-imaging rates and intensive care unit and hospital length of stay.

Lastly, prehospital stroke screening likely plays a major role in how patients are triaged and ultimately evaluated. Emergency medical services (EMS) impression can direct otherwise similar patients toward trauma vs stroke pathways, especially when the patient is found down or has minor signs of trauma such as facial abrasions or lacerations. Tools such as the Cincinnati Prehospital Stroke Scale have been validated and shown to be useful in the prehospital setting²²; however, use and documentation of these tools and EMS prenotification were not captured in our dataset. Regional protocols may also favor trauma activation in borderline cases. These unmeasured

prehospital factors could contribute to pathway selection and the observed time metrics. Future work should prospectively capture EMS screening results, pre-notification, and destination criteria, and evaluate whether standardized screening plus criteria-based dual activations can shorten imaging delays while preserving patient safety.

LIMITATIONS

Our study has several limitations. Our single-center design places limits on the generalizability of the findings. Further, the retrospective design introduced potential selection bias and limits causal inference. As with all registry-based reviews, there was the possibility of coding inaccuracies, which may have influenced the results. Additionally our registry did not include prehospital variables, such as the accuracy of field stroke- screening tools, EMS clinical impressions or prehospital decision-making, all of which could contribute to whether patients were brought in as a code trauma vs code stroke. Additionally, operational factors such as trauma team composition or strict adherence to our trauma algorithms may influence time to brain imaging, but these data were unavailable.

The CSA patients were restricted to 2024 due to data availability, whereas CTA patients spanned 2018-2024; although there were no major institutional changes to stroke pathways during that time, this difference may have introduced temporal bias. Last known well time is not well-documented in many of the CTA patients, which likely represents a confounder. Although we adjusted for several confounders in our multivariate analysis, unmeasured variables such as prehospital decision-making and EMS triage protocols could have influenced activation type. Lastly, we did not assess time to final radiology interpretation, which may have further clarified intervention delays.

CONCLUSION

In patients with acute stroke, initial triage as a trauma activation was associated with significant delays in brain imaging and markedly lower rates of thrombolytic administration, despite a low burden of traumatic injury. Although trauma activation alone was not independently associated with mortality, delays in imaging and a higher incidence of hemorrhagic stroke in this group were strongly associated with mortality. These findings highlight an important association between activation pathway and time-sensitive care, while acknowledging that stroke and trauma activations represent inherently different patient populations. Future work should focus on defining safe, evidence-based strategies to streamline imaging for suspected neurologic emergencies in trauma patients, while preserving the essential elements of trauma evaluation. Additional multicenter studies are needed to determine whether modifications to activation algorithms or dual-alert models can reduce delays without introducing unintended harm.

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Evaluation of Dizziness in the Emergency Department: Prevalence and Diagnostic Utility of Clinical Scales for Functional Vertigo

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Introduction: Functional vertigo is commonly missed in the emergency department (ED) and often misdiagnosed as other peripheral vestibular disorders. It is strongly associated with anxiety and depression, yet standardized diagnostic criteria are lacking in the ED setting, leading to unnecessary tests and misdiagnosis. We aimed to assess the diagnostic accuracy of the Vertigo Symptom Scale - Short Form - Autonomic (VSS-SF-A) and the Hospital Anxiety and Depression Scale – Anxiety (HADS-A) and – Depression (HADS-D) for distinguishing functional vertigo from other peripheral vertigos in the ED and to determine its prevalence.

Methods: This was a prospective, cross-sectional, observational study of adult patients of a tertiary-care ED with dizziness. We included patients who received an initial peripheral vertigo diagnosis from attending emergency physicians. Blinded otolaryngologists (ENT) verified all final diagnoses through standardized evaluation methods performed on the same day as the ED visit. We excluded patients with central, metabolic, cardiovascular conditions. Study participants received thorough vestibular evaluations while a separate physician, also blinded to diagnostic outcomes, administered the VSS and HADS tests, which typically require 15-20 minutes to complete. The final ENT evaluation served as the criterion reference for the diagnosis of functional vertigo. We evaluated the diagnostic accuracy of the scales through receiver operating characteristic (ROC) analysis.

Results: During the study period, 694 patients presented to the ED with dizziness-related complaints, of whom 69 (9.9%) met the inclusion criteria and were enrolled in the study. Of 69 patients initially diagnosed with peripheral vertigo in the ED, ENT specialists confirmed functional vertigo in 25 (36.2%) and peripheral vertigo in 44 (63.8%). Functional vertigo patients were significantly younger (43.4 ± 16.9 vs 60.1 ± 14.9 years of age, $P < .001$). In patients with functional vertigo, the mean VSS-SF-A, HADS-A, and HADS-D scores were 9.04, 9.28, and 7.52, respectively, compared to 3.80, 4.18, and 2.91 in peripheral vertigo cases. Conversely, the VSS-SF subscale—Vestibular-Balance (VSS-SF-V)—scores were higher in peripheral vertigo patients (13.05 vs 6.56), all $P < .001$. The ROC analysis showed that VSS-SF-A (cutoff ≥ 8 , area under the curve [AUC] 0.85, 95% CI, 0.76-0.94) had the highest accuracy for diagnosing functional vertigo, with a sensitivity of 72% and specificity of 84.1%, followed by the HADS-A (cutoff ≥ 8 , AUC = 0.81, 95% CI, 0.70-0.91), which had a sensitivity of 68% and specificity of 88.6%, while HADS-D (cutoff ≥ 4 , AUC = 0.80 95% CI, 0.60-0.90) showed 76% sensitivity and 75% specificity.

Conclusion: Functional vertigo is an underdiagnosed condition that produces dizziness in patients. The Vertigo Symptom Scale and Hospital Anxiety and Depression Scale show promise for enhancing early diagnosis while reducing unnecessary imaging and improving patient care. Future research is needed to confirm these findings through larger multicenter cohorts. [West J Emerg Med. 2026;27(1)51–60.]

INTRODUCTION

Tertiary-referral dizziness units diagnose functional vertigo in approximately 19.5% of adult patients presenting with dizziness, which is the second most common diagnosis after benign paroxysmal positional vertigo.¹ Functional vertigo, also known as psychogenic-somatoform vertigo or functional dizziness, describes dizziness that stems from psychological origins rather than structural problems. This condition produces head-turning and body-rocking sensations, which distinguish it from the typical spinning sensation found in somatic vertigo.^{2,3} Many patients present to the emergency department (ED) with vertigo and dizziness as their main symptoms. According to population-based studies these conditions affect 17-30% of the population and account for 3.5-11% of total ED admissions. The number of patients visiting the ED for dizziness has risen by approximately 50% during recent years.⁴⁻⁶

Previous studies have reported that functional vertigo may represent 30-50% of all dizziness cases, thus making it one of the leading causes of dizziness in outpatient and hospital environments.^{7,8} Despite the high prevalence of vertigo cases in ED settings, distinguishing peripheral vestibular disorders from functional vertigo is still challenging. Peripheral vestibular disorders such as benign paroxysmal positional vertigo, vestibular neuritis, and Ménière's disease have well-defined clinical and diagnostic criteria. But there are no standardized approaches for diagnosing functional vertigo in the ED.⁹ Often, the diagnosis is made by ruling out all other possible causes and relies on the physician's clinical judgment.¹⁰ In this study we aimed to fill this knowledge gap through an evaluation of the Vertigo Symptom Scale (VSS) and the Hospital Anxiety and Depression Scale (HADS) for diagnosis of functional vertigo in ED patients.

Misdiagnosis of vertigo subtypes, particularly failure to identify central causes, can lead to unnecessary imaging, delays in appropriate treatment, and increased healthcare costs.^{11,12} The close relationship between functional vertigo and anxiety, depression, and psychosomatic disorders indicates a multifaceted relationship between vestibular and psychological factors.¹³ Jang et al discovered a substantial link between depression and dizziness, which indicates that mood disorders frequently produce dizziness symptoms because they affect both the vestibular system and related brain areas.¹⁴ Anxiety stands as a primary symptom that patients with functional vertigo commonly experience.^{1,15} The HADS is a validated psychometric tool used to assess anxiety and depression in hospital settings. It has two subscales: HADS-Anxiety (HADS-A) and HADS-Depression (HADS-D), each with seven items scored on a 0-3 scale, with total scores ranging from 0 to 21. Higher scores on the HADS-A indicate increased anxiety symptoms, while higher scores on HADS-D suggest clinically significant depressive symptoms. This scale is widely used in both clinical and research settings

Population Health Research Capsule

What do we already know about this issue?

Functional vertigo is often misdiagnosed in the emergency department (ED), leading to unnecessary tests and delayed management.

What was the research question?

Can the Vertigo Symptom Scale (VSS) and Hospital Anxiety and Depression Scale differentiate functional from peripheral vertigo in ED patients?

What was the major finding of the study?

A score ≥ 8 on the VSS-Short Form-Autonomic-Anxiety diagnosed functional vertigo with 72% sensitivity and 84% specificity (AUC = 0.85, $P < .001$).

How does this improve population health?

Early detection of functional vertigo may reduce imaging, lower healthcare costs, and improve patient outcomes in ED care.

for screening and assessing the severity of psychiatric comorbidities in various medical conditions.¹⁶

The VSS represents a validated assessment instrument that evaluates dizziness and vertigo symptom intensity. The VSS-Short Form Vestibular (VSS-SF-V) and VSS-Short Form Autonomic (VSS-SF-A) subscales contain eight vestibular- and balance-related items and seven autonomic- and anxiety-related items. The scoring system uses a 0-4 scale for each item to determine overall symptom severity. The VSS-SF-V subscale assesses vestibular symptoms including vertigo and imbalance and motion-induced dizziness to help identify peripheral vestibular disorders. The VSS-SF-A subscale evaluates autonomic symptoms including sweating, nausea and palpitations, which commonly occur in functional vertigo.¹⁷

We hypothesized that implementing psychometric scales during standard ED assessments would boost the accuracy of functional vertigo detection, while decreasing the number of incorrect diagnoses and unneeded medical procedures. The current medical literature lacks an objective method to diagnose functional vertigo. We sought to evaluate the VSS and HADS along with their subscales as potential diagnostic tools for ED patients with dizziness. The implementation of psychometric assessments in clinical practice will lead to better diagnostic precision and more efficient patient care and improved treatment results. Our secondary aim was to establish the real prevalence of functional vertigo among patients presenting to

the ED who were initially diagnosed with peripheral vertigo.

METHODS

Study Objective

We aimed to assess the utility of the HADS and the VSS in diagnosing functional vertigo in patients presenting with dizziness to the ED after ruling out all central causes. The original scales used were validated and found to be reliable and trustworthy in the Turkish language.^{13,18} Our secondary objective was to establish the true prevalence of functional vertigo among patients who were initially thought to have peripheral vertigo when they arrived at the ED.

Study Design

We conducted this prospective, cross-sectional, observational study between January 2023–January 2024 in the Department of Emergency Medicine at Koç University Hospital, a tertiary-care center in Istanbul, Türkiye, treating approximately 43,000 patients annually in its ED. We evaluated the occurrence of functional vertigo among dizziness patients while assessing the VSS and HADS scales as diagnostic tools. A separate physician, blinded to the diagnostic outcomes, administered the VSS and HADS tests. These self-reported questionnaires are brief and straightforward, with a total completion time of approximately 15–20 minutes, depending on the patient's condition and reading speed. Patients underwent otolaryngological (ENT) consultations and comprehensive vestibular assessments performed on the same day as their ED visit. The final clinical opinion of the ENT specialist served as the criterion reference for the diagnosis of functional vertigo.

The Koç University Ethics Board approved the study (approval number: 2023.276, IRB1.090), while all participants gave their written consent to participate. The study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and Standards for Reporting Diagnostic Accuracy Studies (STARD) guidelines for reporting findings.^{19,20} There were no missing data for primary variables.

Study Population and Patient Selection

Between January 2023–January 2024, a total of 694 patients presented to the Koç University Hospital ED with dizziness-related complaints.

Inclusion Criteria

Patients were eligible for inclusion if they were ≥ 18 years of age, presented to the ED with acute or subacute dizziness, and were initially presumed to have peripheral vertigo by the attending emergency physician. Additionally, patients were required to have undergone an ENT consultation for vestibular assessment and received a definitive diagnosis based on ENT evaluation and vestibular testing.

Exclusion Criteria

Patients were excluded if their dizziness was attributed to a

confirmed central pathology such as stroke, vestibular migraine, or multiple sclerosis. Other exclusion criteria included dizziness due to metabolic or cardiovascular causes, pregnancy, and lack of ENT consultation—typically due to the unavailability of ENT physicians during night shifts or weekends.

The study included 69 patients who received a complete ENT evaluation. Forty-four patients were diagnosed with peripheral vertigo conditions such as benign paroxysmal positional vertigo, vestibular neuritis, and Ménière's disease while 25 patients received a final diagnosis of functional vertigo because they showed no structural vestibular abnormalities despite ongoing dizziness symptoms (see Figure 1).

Emergency Department and ENT Specialist Evaluation

The ED evaluation started by eliminating central causes of vertigo through neurological examination, review of cranial imaging (when available), and clinical evaluation using the

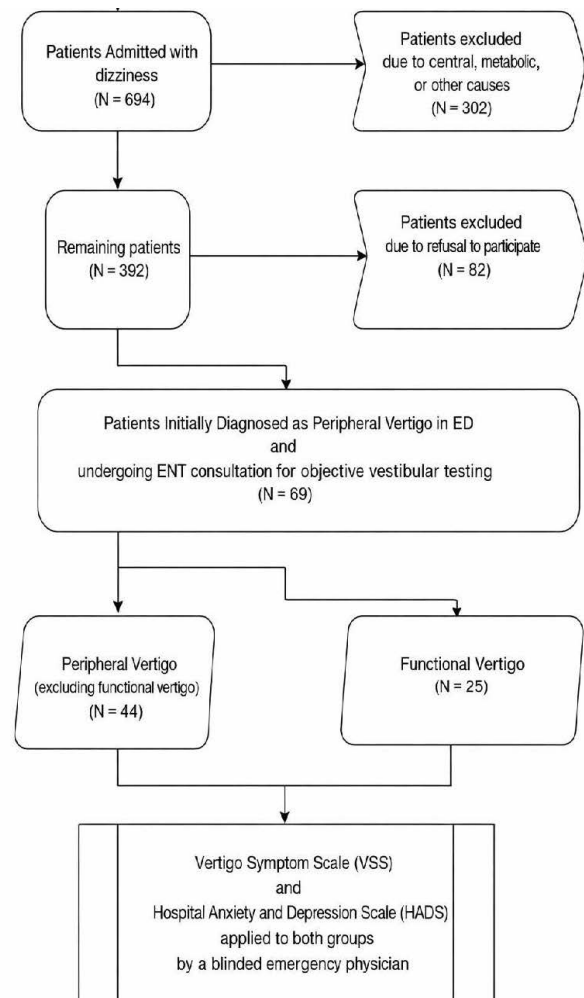


Figure 1. Patient flowchart in a study of dizziness-related emergency department visits.

ED, emergency department; ENT, Ear-nose-throat; VSS, Vertigo Symptom Scale; HADS, Hospital Anxiety and Depression Scale.

timing and triggers approach as outlined in recent emergency medicine guidelines during the first.¹² The Head-Impulse, Nystagmus, Test of Skew assessment was performed only in patients with continuous vertigo and no obvious auditory symptoms, following the timing-and-triggers approach to differentiate central from peripheral causes. The assessment included orthostatic blood pressure tests to detect autonomic dysfunction.

The evaluation process for patients with suspected peripheral vertigo involved a complete vestibular examination by ENT specialists if the ENT clinic was available. The ENT specialists were blinded to the patient's condition. This assessment included the following:

- Dix-Hallpike maneuver to identify benign paroxysmal positional vertigo
- Audiometric testing to assess co-existing cochlear involvement
- Videonystagmography to evaluate spontaneous and positional nystagmus
- Caloric testing (bithermal irrigation) to assess unilateral vestibular hypofunction
- Posturography with the Romberg test to evaluate postural stability.

The diagnosis of functional vertigo was made for patients who had no structural vestibular deficits but continued to experience dizziness symptoms that did not match their test results. The final classification for peripheral vertigo was made according to a definitive objective diagnosis, whereas the classification of functional vertigo was made by clinical judgment, the exclusion of all other vestibular disorders, negative findings on previously mentioned examinations, and symptom patterns suggestive of functional dizziness.

Assessment of Anxiety and Depression

The VSS and the HADS were used to evaluate the potential psychological factors in functional dizziness for all participants. We used the VSS to evaluate vestibular and autonomic symptoms and the HADS to evaluate clinically significant anxiety and depressive symptoms. The assessments were administered by an emergency physician who was not aware of the patient's final diagnosis to minimize bias.

Data Collection and Statistical Analysis

The research design for this study involved a prospective, cross-sectional, observational approach to examine adult patients who visited a tertiary-care ED with dizziness symptoms. The analysis used patient data obtained from electronic health records that contained demographic information together with clinical characteristics and vestibular test results. Patients who provided consent and had a final diagnosis confirmed by ENT and objective tests, completed the questionnaires. To minimize bias, a blinded emergency physician who was not involved in the initial

assessment independently analyzed the VSS and HADS scores without knowledge of the patients' final diagnoses. All statistical analyses were performed using SPSS Statistics v20.0 (IBM Corporation, Armonk, NY) and Jamovi v2.4.11 (The Jamovi Project, Sydney, Australia). The normality of data distribution was assessed using the Shapiro-Wilk and Kolmogorov-Smirnov tests. We presented data as mean $\pm$ standard deviation for continuous variables and percentages for categorical variables. We used the Student *t*-test together with the chi-square test and Pearson correlation analysis for between-group comparisons, and we used receiver operating characteristic (ROC) curve analysis to assess the diagnostic precision of VSS and HADS scores for distinguishing functional from peripheral vertigo. A *P*-value $< .05$ determined as statistical significance.

Power Analysis

We conducted a G Power analysis to determine the statistical power of the study. The lowest expected Pearson correlation ($R^2 = .37$) was applied using bivariate normal modeling, with an alpha error of $P < .001$ and a total sample size of 69; the study demonstrated a statistical power of 99%, indicating a strong likelihood of detecting true associations between anxiety, depression, and functional dizziness.

Ethical Consideration

The research followed the principles of the Declaration of Helsinki together with the ethical rules of the institution. The Koç University Ethics Board granted ethical approval (2023.276 (IRB1.090)). The participants gave their consent through written statements before data collection started, and researchers maintained the patients' confidentiality throughout the entire study. The research data received protection through anonymization, and only authorized personnel had access to the data.

RESULTS

The study included 69 patients after evaluations and ENT specialist consultations; 25 patients had functional vertigo, and 44 patients had peripheral vertigo (Figure 1). The study revealed that in our patient population the prevalence of functional vertigo occurred in 36% of cases, which may not be generalizable to other settings due to our single-center design.

The mean age of patients with functional vertigo was significantly younger (43.44 ± 16.85 years of age) compared to those with peripheral vertigo (60.14 ± 14.93 , $P < .001$). The sex distribution was not significantly different between the two groups, with 60% females in the functional vertigo group and 54.5% females in the peripheral vertigo group ($P = .66$) (Table 1).

The VSS-Short Form-Total (VSS-SF-T) scores were comparable between both groups, suggesting no difference in the overall severity of vertigo symptoms ($P = .66$). However, scores on the VSS-Short Form-Autonomic (VSS-

SF-A), HADS-Anxiety (HADS-A), and HADS-Depression (HADS-D) were significantly higher in the FV group ($P < .001$), whereas scores on the VSS-Short Form-Vestibular (VSS-SF-V) subscale were significantly higher in the peripheral vertigo group ($P < .001$) (Table 1).

The Pearson correlation analyses are summarized in Table 2. The VSS-SF-A scores demonstrated strong correlations with both HADS-A ($r = 0.695$, $P < .001$) and HADS-D ($r = 0.609$, $P < .001$) scores, which showed higher scores on these assessments in patients diagnosed with functional vertigo.

The VSS-SF-V scores showed an inverse relationship with VSS-SF-A, HADS-D and HADS-A scores. The pattern of high VSS-SF-V scores with low scores on other assessments was characteristic of peripheral vertigo. The patient distribution and inter-scale correlation matrix is shown in Figure 2, which shows that elevated VSS-SF-A, HADS-A, and HADS-D scores are more pronounced in functional vertigo (Figure 2).

ROC curve analysis (Figure 3) for diagnostic accuracy showed the following:

- A HADS-A score threshold of ≥ 8 provided the highest diagnostic accuracy for functional vertigo, with a sensitivity of 68%, specificity of 88.64%, and an area under the curve (AUC) of 0.807.
- A HADS-D score threshold of ≥ 4 demonstrated optimal diagnostic values with a sensitivity of 74%, specificity of 75%, and an AUC of 0.804.
- A VSS-SF-A score threshold of ≥ 8 demonstrated optimal diagnostic accuracy, with a sensitivity of 72%, specificity of 84.09%, and an AUC of 0.847.
- For diagnosing other types of peripheral vertigo, a VSS-SF-V score threshold of ≥ 9 yielded a sensitivity of 81.82%, specificity of 72%, and an AUC of 0.795.

The results for positive and negative predictive values are summarized in Table 3. A ROC analysis showed that VSS-SF-A (cutoff ≥ 8 , AUC = 0.85, 95% CI, 0.76-0.94) had

Table 1. Descriptive and baseline characteristics of patients diagnosed with functional vs peripheral vertigo in a study of dizziness-related emergency department visits.

Variable	Functional Vertigo (n = 25) Mean (SD), 95% CI	Peripheral Vertigo (n = 44) Mean (SD), 95% CI	P-value
Age (years)	43.44 (16.85), 36.49–50.39	60.14 (14.93), 55.60–64.68	<.001*
VSS-SF-V Score	6.56 (5.66), 4.22–8.90	13.05 (6.02), 11.22–14.87	<.001*
VSS-SF-A Score	9.04 (3.94), 7.41–10.67	3.80 (3.66), 2.68–4.91	<.001*
VSS-SF-T Score	15.60 (8.94), 11.91–19.29	16.84 (7.39), 14.60–19.09	.54
HADS-A Score	9.28 (5.03), 7.20–11.36	4.18 (3.03), 3.26–5.10	<.001*
HADS-D Score	7.52 (4.50), 5.66–9.38	2.91 (2.59), 2.12–3.70	<.001*
Sex, n (%)	n (%)	n (%)	.66
Female	15 (60.0)	24 (54.5)	—
Male	10 (40.0)	20 (45.5)	—

Student t-test was used for all continuous variables. Distribution by sex was analyzed via chi-square (χ^2) test. $P < .05$ is considered statistically significant. * $P < .05$ is considered statistically significant.

VSS-SF-V, Vertigo-balance subscale score; VSS-SF-A, Autonomic-anxiety subscale score; VSS-SF-T, Total vertigo symptom score; HADS-A, anxiety subscale of the Hospital Anxiety and Depression Scale; HADS-D, depression subscale of the Hospital Anxiety and Depression Scale.

Table 2. Correlation matrix among the scales used in a study of functional vertigo diagnosis in emergency settings.

Scale	VSS-SF-V r (P)	VSS-SF-A r (P)	VSS-SF-T r (P)	HADS-A r (P)	HADS-D r (P)
VSS-SF-V	1	-0.023 (.853)	0.823 (<.001) *	-0.084 (.494)	-0.158 (.194)
VSS-SF-A	-0.023 (.853)	1	0.549 (<.001) *	0.695 (<.001) *	0.609 (<.001) *
VSS-SF-T	0.823 (<.001) *	0.549 (<.001) *	1	0.325 (.006) *	0.214 (.078)
HADS-A	-0.084 (.494)	0.695 (<.001) *	0.325 (.006) *	1	0.726 (<.001) *
HADS-D	-0.158 (.194)	0.609 (<.001) *	0.214 (.078)	0.726 (<.001) *	1

Pearson correlation coefficients (r) are shown with P-values in parentheses. Correlations with $P < .05$ are marked with * to indicate statistical significance. Cases in which $P < .001$ are shown as <.001 for clarity.

VSS-SF-V, Vertigo-balance subscale score; VSS-SF-A, Autonomic-anxiety subscale score; VSS-SF-T, Total Vertigo Symptom Score; HADS-A, Anxiety subscale of the Hospital Anxiety and Depression Scale; HADS-D, Depression subscale of the Hospital Anxiety and Depression Scale.

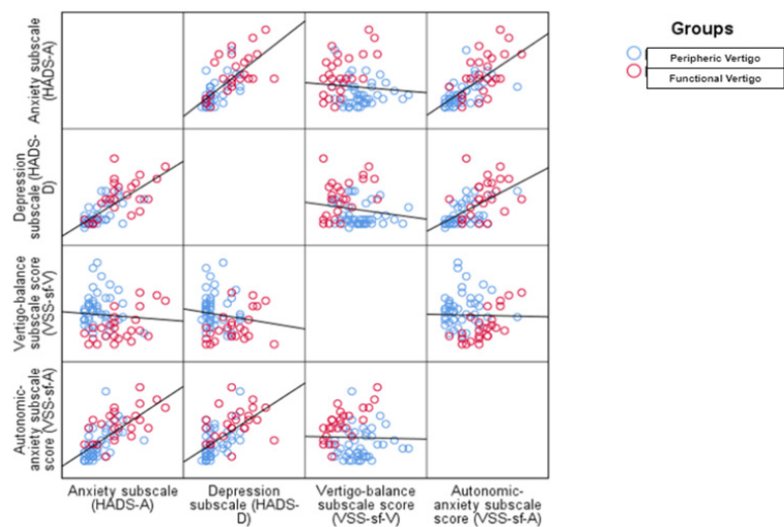


Figure 2. Matrix graph of patient distributions and correlations in a study of vertigo subtypes among emergency department patients. This figure provides a visual representation of the distribution of patients and the correlations among scores on the following scales: VSS-SF-A (Autonomic-Anxiety Subscale), VSS-SF-V (Vertigo-Balance Subscale), HADS-A (Anxiety Subscale), and HADS-D (Depression Subscale). Patient data are stratified by their final clinical classification as either functional vertigo (red) or peripheral vertigo (blue). The diagonal panels display individual variable distributions while the lower left panels show pairwise correlation plots between scales. This visual summary highlights how anxiety-related and autonomic symptoms are inter-related in different vertigo subtypes. VSS-SF-V, Vertigo-balance subscale score; VSS-SF-A, Autonomic-anxiety subscale score; HADS-A, Anxiety subscale of the Hospital Anxiety and Depression Scale; HADS-D, Depression subscale of the Hospital Anxiety and Depression Scale.

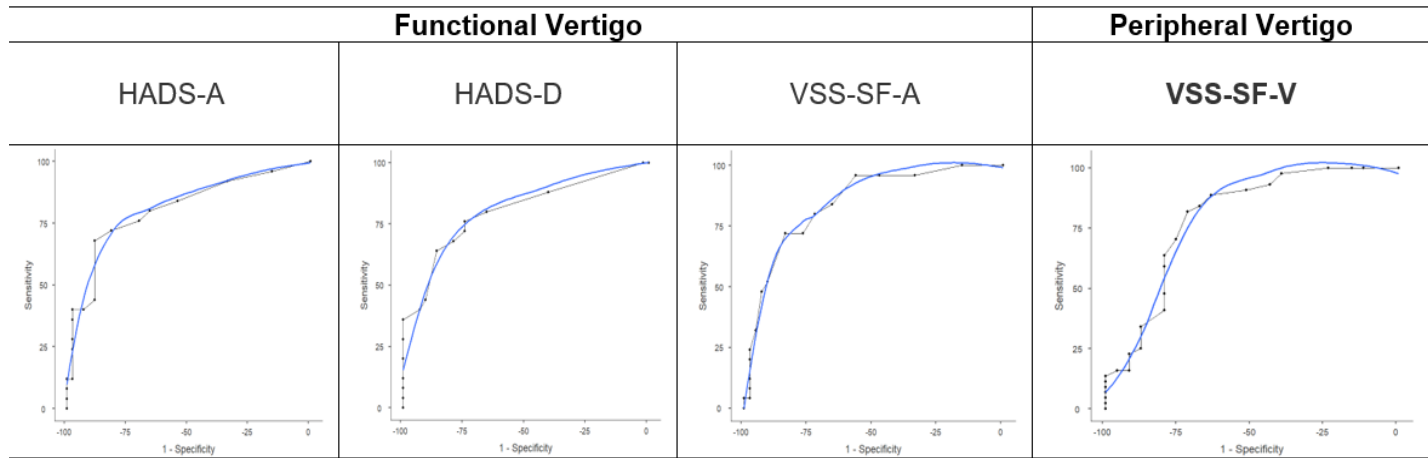


Figure 3. Diagnostic capabilities of each test according to ROC curve analysis identifying functional vertigo in a study of emergency department patients. This figure shows ROC curves for each diagnostic measure in differentiating functional vertigo from peripheral vertigo. The AUC values, optimal cut points, and associated sensitivity/specificity values are indicated for each measure. Such metrics guide clinicians in identifying the most predictive thresholds for each scale. VSS-SF-V, Vertigo-balance subscale score; VSS-SF-A, Autonomic-anxiety subscale score; HADS-A, Anxiety subscale of the Hospital Anxiety and Depression Scale; HADS-D, Depression subscale of the Hospital Anxiety and Depression Scale; ROC, receiver operating characteristic; AUC, area under the curve.

the highest accuracy for diagnosing functional vertigo, with a sensitivity of 72% and specificity of 84.1%, followed by HADS-A (cutoff ≥ 8 , AUC = 0.81, 95% CI, 0.70-0.91) had a sensitivity of 68% and specificity of 88.6%, while HADS-D (cutoff ≥ 4 , AUC = 0.80, 95% CI, 0.60-0.90) showed 76% sensitivity and 75% specificity. The ROC curves in Figure

3 demonstrate that VSS-SF-A and HADS-A and HADS-D successfully differentiated functional from peripheral vertigo and VSS-SF-V successfully identified peripheral vertigo.

DISCUSSION
Prevalence and Overlooked Nature of Functional Vertigo

In the ED setting functional vertigo is often missed because this condition receives inadequate recognition and incorrect diagnoses. Our research showed that 36% of patients who received an initial peripheral vertigo diagnosis in the ED actually had functional vertigo without any detectable organic disease, which supports prior research results that non-organic dizziness cases represent 30-50% of all dizziness cases in clinical settings.^{5,21} Schmid et al (2011) reported that dizziness in many patients could not be fully explained by identifiable medical conditions, with most diagnostic tests failing to reveal pathological results.²² We found that functional vertigo remains a common condition that clinicians frequently mistake for peripheral vestibular dysfunction, underscoring the need for improved diagnostic methods in the ED.

Diagnostic Accuracy of Psychometric Tools

Our research revealed that psychometric assessments are significantly associated with the differentiation of functional vertigo from peripheral vestibular disorders and may aid in diagnostic decision-making. The VSS-SF-A produced the best diagnostic results among the tested measures with an AUC of 0.847 when using a cutoff score of 8. The HADS-A and HADS-D tests showed diagnostic accuracy with AUC values of 0.807 and 0.804, respectively, when using cutoff scores of 8 and 4. The VSS-SF-V subscale scores demonstrated high diagnostic accuracy (cutoff ≥ 9 , AUC = 0.795) in the peripheral vertigo group, which suggested that vestibular causes were the main issue for these patients—a finding supported by prior studies.²³

Researchers have assessed the VSS for its ability to differentiate organic from functional vertigo. The “vertigo-related symptoms” subscale according to Tschan et al (2008) proved useful for distinguishing organic vertigo patients from healthy participants but the “somatic anxiety and autonomic arousal” subscale demonstrated only moderate success in differentiating functional vertigo. The results of that study match our findings; however, they used the full version of the

scales in their research.²⁴ In a study by Talaat et al in 2020 that was designed to validate the language of the Arabic version of the VSS, one of their secondary findings was that the Arabic version of the VSS-SF successfully distinguished patients with vestibular disorders from those with anxiety-related vertigo.²⁵

Dyukova et al (2021) proposed that the VSS-SF could be used to predict the risk of developing functional vertigo in patients with high anxiety levels.²⁶ The research conducted by Limburg et al with 72 participants demonstrated that functional vertigo patients exhibited elevated Beck Anxiety scores.²⁷ Our research included patients with peripheral vertigo (benign paroxysmal positional vertigo included); the functional vertigo patients who received VSS and HADS assessments confirmed the need to evaluate for anxiety. Several studies have also explored the utility of HADS in patients experiencing dizziness. Chronic dizziness and vertigo are often associated with anxiety and depression.²⁸ Piker et al (2015) examined the application of HADS for psychiatric symptom assessment in patients with dizziness. The authors determined that HADS successfully measured general psychological distress, but they found it inadequate for distinguishing between various vertigo subtypes. This was in contrast to the results of our study, which showed that HADS-A and HADS-D scores demonstrated better ability to distinguish functional vertigo from organic vertigo compared to their findings.²⁹

A study by Tschan et al (2008) indicated that HADS could help in distinguishing between functional vertigo and organic vertigo, although with moderate effectiveness. They found that patients with functional vertigo had significantly higher scores on the anxiety (HADS-A) and depression (HADS-D) subscales, while patients with organic vertigo had lower scores. This finding is consistent with our results, which showed that HADS-A and HADS-D had higher discriminatory power.²⁴ Zhu et al (2020) investigated HADS scores in patients with vestibular migraine (and benign paroxysmal positional

Table 3. Diagnostic accuracy metrics for clinical scales used to differentiate functional and peripheral vertigo in a study of emergency department patients with dizziness.

A. Best diagnostic values for functional vertigo.

Scale	Cut Point	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Youden's Index	AUC	Metric Score
HADS-A	8	68.0	88.6	77.3	83.0	0.566	0.807*	1.57
HADS-D	4	76.0	75.0	63.3	84.6	0.510	0.804*	1.51
VSS-sf-A	8	72.0	84.1	72.0	84.1	0.561	0.847*	1.56

B. Best diagnostic value for peripheral vertigo.

Scale	Cut Point	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Youden's Index	AUC	Metric Score
VSS-sf-V	9	81.8	72.0	83.7	69.2	0.538	0.795*	1.54

Receiver operating characteristic (ROC) curve analyses were used to determine optimal cut points for diagnosing vertigo subtypes.

AUC values marked with * denote statistical significance ($P < .05$)

AUC, area under the curve; VSS-SF-V, Vertigo-balance subscale score; VSS-SF-A, Autonomic-anxiety subscale score; HADS-A, Anxiety subscale of the Hospital Anxiety and Depression Scale; HADS-D, Depression subscale of the Hospital Anxiety and Depression Scale; PPV, positive predictive value; NPV, negative predictive value.

vertigo and found that patients with vestibular migraine had significantly higher HADS scores, while benign paroxysmal positional vertigo patients had lower scores. They proposed that HADS could help differentiate functional vertigo from organic causes, which is in line with our findings.³⁰

The research by Russia et al (2023) focused on functional vertigo risk assessment for patients with benign paroxysmal positional vertigo. The study revealed that patients who experienced moderate anxiety and depression symptoms without showing any clinically important psychiatric conditions had risk of developing functional vertigo. The study established a link between anxiety and functional dizziness development, which supports our findings.³¹ Hashimoto et al (2021) found a positive correlation between HADS anxiety levels and functional vertigo episode frequency, with higher HADS-A scores associated with more frequent vertigo attacks. This further supports the link between anxiety and functional vertigo.³²

Clinical and Demographic Correlations

We found that functional vertigo patients were younger compared to peripheral vertigo patients (43.44 vs 60.14 years of age, $P < .001$). This finding suggests that functional vertigo should be considered as a differential diagnosis, especially in younger patients with dizziness. This age-related distinction is important, as it suggests that functional vertigo may often be overlooked in this demographic (as reported in prior research), which potentially could lead to misdiagnosis and inappropriate management.¹⁴ Prior research has also shown that a significant portion of patients with dizziness may have underlying mood or anxiety disorders. Studies by Nagaratnam et al and Ferrari et al reported similar findings, highlighting the need to consider psychosomatic factors when evaluating dizziness in younger patients, which is consistent with our findings.^{33,34} The study by Ventura et al showed that 52 of 189 patients with vertigo/dizziness complaints had medically unexplained symptoms. They found that non-organic vertigo patients exhibited psychogenic patterns more frequent than those with organic vertigo, which supports the argument that a significant portion of dizziness cases may arise from psychosomatic or functional factors.³⁵

Interplay with Anxiety and Depression

Our research demonstrates that anxiety and depression have complex relationships with vertigo. The identical VSS-SF-T scores between functional and peripheral vertigo groups indicate that symptom severity does not serve as a distinguishing characteristic. This raises an important question: Is anxiety and depression a reaction to vertigo symptoms, or a manifestation itself of underlying anxiety disorders? Although the VSS-SF-T scores were similar between the groups, a deeper analysis of the subscales revealed that VSS-SF-A scores were significantly higher in patients with functional vertigo, whereas VSS-SF-V scores

were elevated in cases of peripheral vertigo. This suggests that mood disorders, such as anxiety and depression, may be associated with vertigo symptoms with similar severity even in the absence of organic vestibular pathology. These results support the hypothesis that functional vertigo originates from psychological factors rather than structural vestibular dysfunction, reinforcing the need for a multidimensional approach to the diagnosis and management of this often overlooked condition.

A review by Staab et al found that primary anxiety disorders can cause dizziness and that a thorough assessment is required to determine causality.³⁶ Our findings support a strong association between psychological factors and functional dizziness, consistent with their hypothesis. Differentiating between symptom-induced anxiety and anxiety-induced vertigo is crucial for accurate diagnosis and proper treatment.

The observed strong correlations between HADS-A and VSS-SF-A ($r = 0.695$, $P < .001$) and HADS-D and VSS-SF-A ($r = 0.609$, $P < .001$) suggest an association between anxiety and depression and that they influence the severity of autonomic symptoms in functional vertigo patients. The results align with previous studies, which have shown that patients with functional vertigo commonly display increased autonomic dysfunction indicators associated with anxiety and depression.^{1,37} Our findings support previous studies by Staab and Lahmann et al (2015), which showed that functional vertigo produces greater autonomic dysfunction and anxiety symptoms than organic vestibular disorders. Lahmann discovered that patients with unexplained dizziness had higher psychiatric disorder rates, which supports the requirement for comprehensive diagnostic methods in patients without organic disease.^{21,36} Our research supports the expanding scientific evidence that shows functional vertigo results from impaired sensory integration and heightened autonomic reactions rather than actual vestibular system problems. The results demonstrate the necessity of combining psychological support with vestibular assessment in clinical practice.³⁶

Management Implications

The high correlation between HADS and VSS-SF-A scores indicates that anxiety and depression are associated with greater severity of vertigo symptoms in patients with functional dizziness, which supports the idea that functional vertigo patients should receive psychiatric treatment at an early stage.²⁸ Research conducted by Limburg et al demonstrated that multimodal psychosomatic treatments effectively decreased dizziness severity in these patients, thus supporting the need for psychological support in functional vertigo management.²⁷ Cognitive-behavioral therapy and pharmacological treatments, such as selective serotonin reuptake inhibitors, have been found to be useful in reducing both vertigo symptoms and associated psychological distress.³⁸ The distinction between functional vertigo and peripheral

vertigo is crucial, as misdiagnosis may lead to delays in appropriate psychological treatment and increased healthcare costs.²² Diagnosis of functional vertigo at an early stage is important to begin appropriate psychological treatments. Our study supports the use of psychometric tools in the ED to enhance diagnostic accuracy and early treatment planning for functional vertigo.

LIMITATIONS

Our study has some limitations. The small sample size and single-center design limit generalizability, requiring validation with larger, multicenter studies. Our reliance on ENT assessments without formal psychiatric evaluation may limit the accuracy of functional vertigo diagnoses. Future studies should include psychiatric consultations to enhance diagnostic accuracy. Lack of follow-up data is another limitation; future research should assess long-term outcomes with repeated VSS and HADS scoring after treatment of the underlying physiological disorder.

A larger sample, multidisciplinary evaluation, and follow-up studies will enhance the reliability of scores to address functional vertigo diagnosis with the use of anxiety and depression scales in emergency settings. Another limitation lies in the performance of the clinical scales themselves. With sensitivities and specificities ranging from 68-88%, these tools are not diagnostic gold standards and are best used in conjunction with clinical judgement and other diagnostic criteria. The implementation of brief psychometric scales including VSS and HADS within ED and ENT settings could speed up the detection of functional vertigo. Early identification enables immediate psychological assessment and reduces the need for unnecessary diagnostic imaging and improves patient management. Future research should focus on creating standardized algorithms for functional vertigo triage and treatment to improve both patient care outcomes and efficiency.

Furthermore, the role of emergency physicians in diagnosing functional vertigo may be debated. While the primary responsibility in the ED is to rule out emergent conditions such as central vertigo, differentiating between peripheral and functional causes may exceed the typical scope of emergency care and require interdisciplinary collaboration. Future multicenter studies with larger, more diverse populations and inclusion of structured psychiatric evaluations are needed to enhance generalizability and reduce potential sources of bias. Research should investigate how early psychiatric interventions affect patient outcomes and healthcare costs

CONCLUSION

Our research indicates that using the Vertigo Symptom Scale and Hospital Anxiety and Depression Scale in standard ED and ENT assessments show promise as supportive tools for identifying functional vertigo in emergency settings and may assist clinicians in the early recognition and management

of this condition. These assessment tools have the potential to decrease the number of diagnostic procedures and reduce the time required for proper psychological treatment. Our study suggests that psychometric tools may aid in identifying functional vertigo in the ED setting, supporting the potential role of emergency clinicians in early diagnostic consideration and treatment planning.

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Improving Standardization and Access to Care via Seizure Pathways in the Emergency Department

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Introduction: Seizures are one of the most common neurological presentations to an emergency department (ED), often as a first seizure of life or a breakthrough seizure. There is practice variation regarding the diagnostic workup and management for these patient populations. A standardized pathway for emergent evaluation of first seizure of life or breakthrough seizure currently does not exist, resulting in variability in evaluation and timing of outpatient care.

Methods: We created standardized pathways for evaluation and management of patients presenting to the ED with a first seizure of life or breakthrough seizure. These pathways, implemented at a large, quaternary-care hospital system, were utilized on 130 patients presenting with a seizure and compared with all patients with seizure on whom the pathway was not used, between May 2022–October 2023. Outcomes of interest included ED length of stay (LOS), proportion of patients admitted, time to outpatient follow-up, and difference in resource utilization. We compared categorical variables using chi-square test and continuous variables using the Wilcoxon rank-sum test. Equality of variance between the two cohorts was tested using the Levene test.

Results: There was no statistically significant difference between the percentage of male and female patients evaluated via standard-of-care model (45.6% and 49.5%) and those on the pathway (56.9% and 43.1%). The average age of patients was similar between standard-of-care and pathway groups (41 and 39 years, respectively). Median ED LOS was 5.0 (Interquartile range [IQR] 2.9–9.4) hours for standard of care and 4.8 (IQR 3.1–7.0) hours for pathway ($P = .34$), with a significant difference in variability in time for pathway group ($P < .001$). Fewer patients were admitted or observed with pathway use ($P < .02$). Median time to outpatient follow-up was 41.0 days (IQR 17.0–93.0) with standard of care and 23.5 days (IQR 8.0–57.0) with pathway use ($P < .001$). More urinalyses ($P < .001$), drug screens ($P < .001$), alcohol levels ($P < .001$) and computed tomography for first seizures ($P < .001$) were ordered for the pathway group. Fewer magnetic resonance imaging studies were ordered for patients in the breakthrough seizures group using the pathway ($P < .001$).

Conclusion: Standardized pathways to approach seizure presentation in the ED can reduce variability in care, improve time to outpatient neurologic care, and standardize seizure-safety counseling. [West J Emerg Med. 2026;27(1)61–66.]

INTRODUCTION

Approximately 11% of the United States population will experience a seizure in their lifetime.¹ Seizure account for about 1 in 100 emergency department (ED) visits, totalling nearly one million visits between 1993–2003.^{1,2} Up to 30% of patients with epilepsy present to the ED with breakthrough seizures, often undergoing repetitive and costly testing, such as neuroimaging, with limited benefits.^{3–5} Patients with an established outpatient practitioner have fewer ED visits and admissions, but delays in follow-up contribute to readmissions and fragmented care.^{6,7} Standardized pathways can expedite outpatient referral, reduce ED recidivism and improve resource use.⁸ Such pathways have already been shown to improve outcomes in conditions such as stroke, hip fracture, myocardial infarction, and (in Ireland) seizures, by reducing length of stay (LOS) and readmissions, and improving time to follow-up and adherence to guidelines.^{9,10}

Currently, the American Academy of Neurology (AAN) provides evidence-based guidelines for a first unprovoked seizure in adults, focusing on counseling about antiseizure medication. Such guidelines do not exist for emergent evaluation or management of breakthrough seizures in patients with known prior seizures; however, comprehensive reviews of the evaluation and treatment of patients presenting with seizures have been well published.^{11,12} The American College of Emergency Physicians lacks comprehensive guidelines for first or breakthrough seizures.¹³ This gap in standardized ED care, combined with prolonged delays to outpatient neurology follow-up, prompted us to develop seizure evaluation pathways. Our quality improvement (QI) initiative was designed to reduce time to outpatient follow-up with a neurologist, shorten ED LOS, and standardize care, demonstrating that seizure pathways can be successfully implemented in a large, academic center to optimize patient outcomes.

METHODS

A multidisciplinary team of epileptologists, neurohospitalists, and emergency physicians at a large, urban, multi-hospital academic center (Level 4 epilepsy center), where lab testing, imaging, and electroencephalogram (EEG) was available 24/7, developed ED clinical pathways for first seizure of life and breakthrough seizures using the Medical Research Council framework.¹⁴ Pathways were based on AAN best practice guidelines and expert consensus when guidelines were lacking.^{11–13} The pathways outlined suggested immediate workup (labs and imaging), “red flag” findings prompting urgent neurologic consultation, indications for expedited EEG/magnetic resonance imaging (MRI), and a structured process for scheduling outpatient neurology follow-up (Figures 1–2). The pathways were designed as guidance for emergency physicians rather than mandatory orders. The pathways were reviewed by senior epileptologists and emergency physicians. The study was granted institutional review board exemption.

Using published literature and expert opinion, the

Population Health Research Capsule

What do we already know about this issue?
Diagnostic and management approaches to first and breakthrough seizures vary substantially, reflecting the lack of a standardized clinical evaluation pathway.

What was the research question?
We implemented emergency department (ED) pathways for first and breakthrough seizures to reduce length of stay (LOS) and improve neurology follow-up.

What was the major finding of the study?
Pathway use led to decreased median time to outpatient follow-up (17.0 vs. 41.0 days, $P < .001$) and variability in LOS ($P < .001$).

How does this improve population health?
Standardized ED seizure pathways can reduce variability in care, improve time to outpatient neurologic care, and standardize safety counseling.

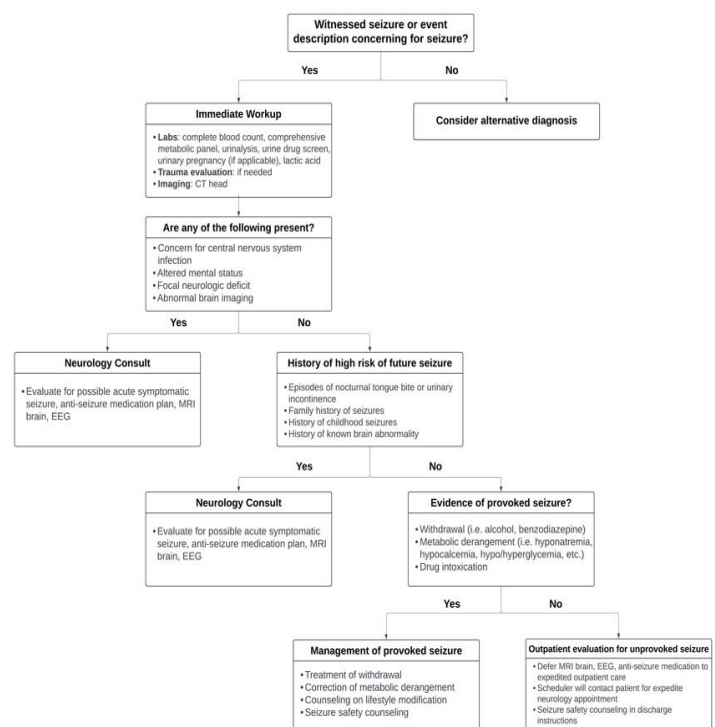


Figure 1. Pathway template for first seizure of life, demonstrating suggested workflow for patients presenting to the emergency department with a first seizure of life. EEG, electroencephalogram; MRI, magnetic resonance imaging.

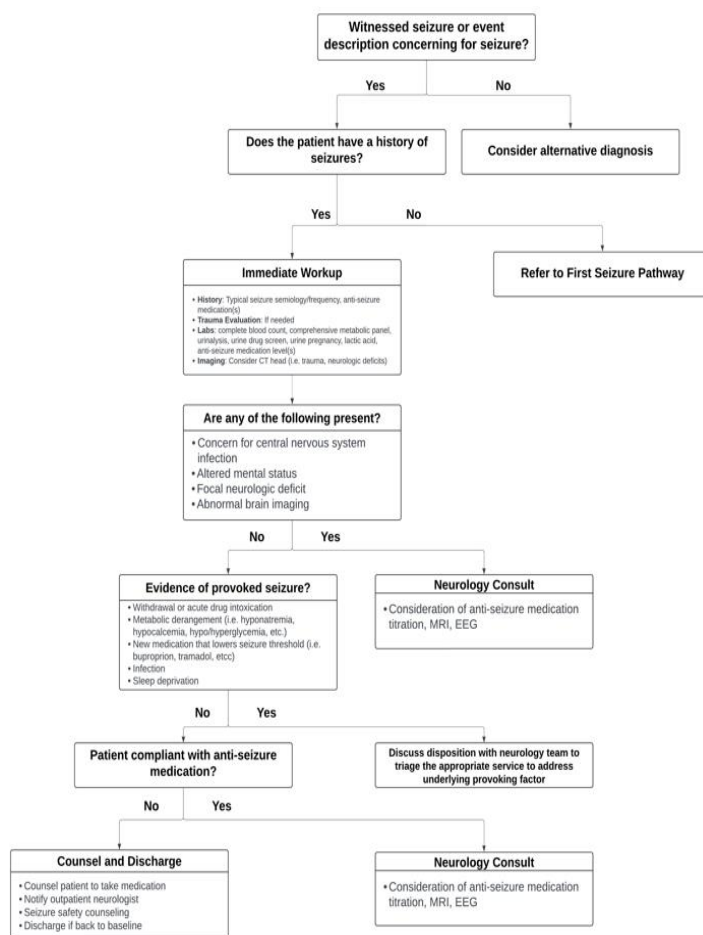


Figure 2. Pathway template for breakthrough seizure, demonstrating suggested workflow for patients presenting to the emergency department with a breakthrough seizure. EEG, electroencephalogram; MRI, magnetic resonance imaging.

workgroup also developed standardized discharge materials on seizure safety, provoking factors, and first aid for use in the ED (Supplement).¹⁵ Pathways and discharge literature were published on the health system intranet, and an electronic health record-based (EHR) order set was developed to facilitate recommended testing and expedited follow-up. Patients with existing neurology providers were referred back to them, while others were scheduled with the next available epilepsy advanced practice provider, general neurologist, or epileptologist. Studies that would not result during the ED stay were forwarded to the patient's existing neurologist or primary care physician. Emergency department faculty across the health system were educated on the existence and use of the pathways. Implementation began in May 2022. We reviewed pathway utilization in October 2022, followed by re-education of staff, which increased use fourfold.

One year after implementation (June 2023), we queried the EHR for all ED seizure presentations (*International Classification of Diseases, 10th Rev [ICD-10]* codes including

the words "Seizure," "Epilepsy," "Convulsion," "Post-ictal state," "First time Seizure," "Breakthrough seizure") and divided them into standard-of-care and pathway groups. The pathway group was further subdivided into breakthrough seizure and first seizure of life; the non-pathway group could not be subclassified due to limitations with *ICD-10* sampling (ie, limited use of specific codes). Pathway use was clinician-dependent to maintain natural workflow, influenced by frequency of ED presentation, patient complexity, and clinician familiarity with the pathway. Outcomes included ED LOS, admission rates, time to outpatient follow-up, and resource utilization. We compared categorical variables using chi square tests, continuous variables with Wilcoxon rank-sum test, and variance with the Levene test. Analyses were performed using Stata SE 13.1 for Windows (StataCorp, LLC, College Station, TX).

RESULTS

Across three hospitals, 2,664 patient encounters were identified. The pathways were used in 130 encounters (67 breakthrough seizure, 63 first seizure). Patient demographics are outlined in Table 1. Median LOS was similar between groups: 5.0 hours (Interquartile range [IQR] 2.9-9.4) for standard care vs 4.8 hours (IQR 3.1-7.0) for pathways ($P = .34$). Variability in LOS was lower for pathway use (90th percentile: 11.7 hours for pathway vs 24.4 hours for standard of care, $P < .001$).

No pathway patients were admitted, compared to 120 in the standard-of-care group ($P < .001$). Overnight stays (admission plus observation) occurred in 6.2% of pathway patients vs 12.3% of standard-of-care patients ($P = .02$). Median time to outpatient neurology/epilepsy follow-up was shorter with pathways: 23.5 days (IQR 8-57) vs 41.0 days (IQR 17.0-93.0) ($P = .001$). Subgroup analysis showed 24.0 days (IQR 9.0-62.0) for first seizure of life ($P = .047$) and 16.0 days (IQR 7.0-57.0) ($P = .008$) for breakthrough seizures.

Resource use and testing patterns differed by pathway use. Basic labs were ordered equally, but pathways prompted more extensive testing for common seizure-provoking factors, including urinalysis, alcohol level, and urine drug screen ($P < .001$). First seizure-pathway patients had significantly more head computed tomography (CT) than no-pathway patients (98.4 vs 52.8%, $P < .001$). Breakthrough seizure pathway patients had fewer MRI studies compared to standard-of-care patients (1.5 vs 9.1%, $P < .001$). Use of EEGs did not differ (6.0 vs. 5.9%, $P = .68$).

DISCUSSION

With this QI initiative we aimed to generate and implement standardized ED pathways for first seizure of life and breakthrough seizure. Pathway use led to faster outpatient access, reduced variability in ED LOS and diagnostic testing, and fewer hospital admissions. We hope these pathways provide a framework for other centers to optimize seizure care delivery in the ED.

Table 1. Patient demographics of the pathway and standard-of-care groups in a study of the development and implementation of seizure care pathways in the emergency department.

	Standard of care	Pathway			
		Breakthrough seizure	First seizure of life	Pathway total	
Sex (n, %)					$P = .14$
Male	1,215 (45.6%)	38 (56.7%)	36 (57.2%)	74 (56.9%)	
Female	1,319 (49.5%)	29 (43.3%)	27 (42.8%)	56 (43.1%)	
Age (median, IQR)	41 (30,57)	41 (25,534)	37 (29,49)	39 (29,51)	$P = .09$
Race (n, %)					$P = .08$
White	695 (26.1%)	8 (11.9%)	24 (38.0%)	31 (23.8)	
Black	1,614 (60.8%)	55 (82.1%)	33 (52.3%)	88 (67.7%)	
Asian	39 (1.4%)	0	4 (6.3%)	4 (3.1%)	
Other	226 (8.8%)	4 (6.0%)	2 (3.2%)	6 (4.6%)	

There was no significant difference between the demographics of the pathway group or the standard-of-care group.

Access to Outpatient Care

Neurology access in the US is limited, with average wait times of up to 60 days, and up to six months for specialist care, which can result in delayed treatment, testing, and counseling.^{16,17–19,20,21} In our initiative, pathway patients, with or without an established primary care physician, saw neurologists significantly sooner. Institutions adopting seizure pathways should consider linking ED discharge to central scheduling to trigger expedited outpatient follow-up. Additionally, establishment of an associated outpatient clinic for first seizure evaluation can provide a direct outlet for expedited patient care and ensure the pathway is sustainable.⁷ While delays between ED discharge and outpatient visits persist, providing standardized seizure-safety literature can improve knowledge and confidence and bridge this gap.²² We did not directly assess these outcomes, which is a possible direction for future study.

Decreased Length of Stay

Although median ED LOS was similar between groups, pathway use markedly reduced extreme ED LOS values (some over 24 hours), improving ED throughput and patient flow, which can improve patient satisfaction. Pathway usage resulted in significantly fewer hospital admissions. If repeated in larger cohorts, this finding could suggest meaningful reductions in healthcare costs and improve bed availability for other patients requiring urgent care.^{23–25}

Standardization of Care

Pathways promoted a more uniform evaluation of provoked vs unprovoked seizures, standardizing testing for common provoking factors (ie, urinalysis, urine drug screen, and alcohol level). They reduced MRI use in breakthrough seizures while ensuring that CT was completed for patients with first seizure of life, consistent with best practice guidelines. It is critical not to miss a structural lesion in this patient population as it is associated

with a significantly higher risk of subsequent seizures, warranting more timely treatment with an anti-seizure medication. Use of EEG remained low and comparable between groups, aligning with evidence suggesting the low yield of a routine EEG in the ED, which thus could be deferred to an outpatient setting.²⁶

LIMITATIONS

This initiative had several limitations. The pathways were implemented in a single, large, academic health system, and further evaluation is needed to determine whether results are reproducible. Pathways were only used in a small proportion of seizure encounters. We found that a major barrier was EHR design, which prioritizes frequently used orders over order sets, requiring additional clicks, thereby reducing pathway use.²⁷ Stronger behavioral nudges could improve adoption but were not feasible in this initiative. Additionally, while there was support from ED leadership and faculty, house staff, who often place the orders in the ED, were not directly targeted for education, highlighting a key area for improvement in future implementation efforts.

Pathway use was not randomized but at the discretion of the emergency physician. While this increases the fidelity of use in the natural environment, it can result in selection bias. Patient identification based on *ICD-10* codes are restrictive and do not distinguish between provoked, unprovoked, first, or breakthrough seizures. Additionally, we excluded patients with an *ICD-10* code of status epilepticus, which limited the patient population. Some of the granularity of a first seizure or breakthrough seizure, particularly in the non-pathway group, could have been lost due to incomplete *ICD-10* coding.

Future studies should evaluate pathways in larger, randomized cohorts and explore additional outcomes such as anti-seizure medication prescribing, adherence, seizure frequency, yield of ED neuroimaging, and cause of breakthrough seizures, as well as ease of use.

Table 2. Comparison of resource use between the standard of care, first seizure of life pathway, and breakthrough seizure pathway in a study of the development and implementation of seizure care pathways in the emergency department.

Ordered (n, %)	Standard of care	Breakthrough seizure	First seizure of life	Significance testing
MRI	232 (9.1%)	1 (1.5%) ^a	4 (6.4%)	$P < .001$
CT	1,340 (52.8%)	40 (59.7%)	62 (98.4%) ^a	$P < .001$
EEG	151 (6.0%)	4 (6.0%)	3 (4.8%)	$P = .68$
Urinalysis	638 (25.1%)	40 (59.7%) ^a	36 (57.1%) ^a	$P < .001$
Urine drug screen	760 (29.9%)	45 (67.2%) ^a	51 (81.0%) ^a	$P < .001$
Ethanol level	525 (20.7%)	53 (79.1%) ^a	58 (92.1%) ^a	$P < .001$
CBC	2,145 (84.7%)	63 (84.7%)	63 (100%)	$P < .001$
BMP and/or CMP	2,158 (85.2%)	56 (107.9%)*	68 (100.1%)*	$P < .001$
Outcomes				
Length of stay	5.0 hours	4.6 hours	5.0 hours	$P = .34$
Admissions	120 (4.5%)	0 (0%) ^a	0 (0%) ^a	$P < .001$
Observation	96 (3.6%)	3 (2.3%)	5 (3.8%)	$P = .55$
Median readmissions (30 days)	1	1	1	$P = .31$
Median time to outpatient follow-up	41 days	24 days ^a	16 days ^a	$P = .001$

*Percentage is over 100% as both a BMP and CMP may have been ordered

^a Denotes significant change from standard-of-care group.

BMP, basic metabolic panel; CBC, complete blood count; CMP, comprehensive metabolic panel, CT, computed tomography; EEG, electroencephalogram; MRI, magnetic resonance imaging.

CONCLUSION

Overall, seizure pathways improved efficiency, reduced unnecessary variation, and enhanced access to timely outpatient care, supporting their role as a scalable model for ED seizure management.

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Women with Suicidal Ideation, Substance Use Disorder, or Intimate Partner Violence in the Emergency Department: Retrospective Analysis of Contraceptive Documentation

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Introduction: Prior research demonstrates that emergency department (ED) patients with suicidal ideation (SI), substance use (SUD), and/or intimate partner violence (IPV) have disproportionate adverse outcomes for both women and infants. The 2013 Hague Protocol suggested that children with caregivers with the above characteristics are also more likely to suffer from child maltreatment. Of all pregnancies in this group, as many as 90% are unintended. We hypothesized that women with SI/SUD/IPV have gaps in care access, high levels of unscheduled care use, and reduced ED contraceptive inquiry, which if addressed could potentially improve outcomes.

Methods: We conducted a chart review of 62,284 ED visits from 2018–2021 from a suburban four-hospital system in the Southern United States. We compared women of reproductive age (15–44) with SI/SUD/IPV (4,776) against controls (57,508). The exposures were defined as women with SI, SUD, and/or IPV. We analyzed results using the chi-square test (χ^2) with Bonferroni adjustment to test for independence and logistic regression.

Results: Women suffering from SI/SUD/IPV who present to the ED have contraceptive status less frequently documented compared to controls without these factors (39.5 vs 51.7%, RR 0.77, CI, 0.74–0.79, $P < .001$). They also have reduced access to care, with higher rates of uninsurance (32.7 vs 26.1%, $P < .001$), more care in the acute care environment, longer ED length of stay (LOS) (mean was 10.38 vs 3.87 hours, $P < .001$), higher hospitalization rates (61.0 vs 8.7%, $P < .001$), and higher 30-day ED revisits (11.8 vs 8.8%, $P < .001$), even after adjusting for the Social Vulnerability Index, acuity, age, and obesity (adjusted odds ratio 1.52 95% CI 1.36–1.70 $P < .001$).

Conclusion: Despite significant morbidity coupled with reduced access to ambulatory care and disproportionately increased ED use, little ED contraceptive documentation exists. This practice contributes to inequity, given the increased number of unintended pregnancies and greater need of contraceptives in women with suicidal ideation/substance use disorder/intimate partner violence. [West J Emerg Med. 2026;27(1)67–77.]

INTRODUCTION

Females suffering from suicidal ideation (SI), substance use disorder (SUD), and/or intimate partner violence (IPV) have disproportionately high mortality rates.¹⁻³ In 2022, the National Safety Council reported 28,134 deaths in females from drug overdoses and, according to the US Centers for Disease Control and Prevention (CDC), in 2020–2021 there were 58,701 deaths of females attributable to alcohol use.^{4, 5} For women who survive a suicidal attempt at 20 years of age, life expectancy is shortened by 11 years.⁶ Over half of homicides in women are the result of by IPV, and about 75% of female IPV survivors experience some form of injury related to IPV.⁷ These conditions present at pre-conception can be predictive of the occurrence during pregnancy.⁸⁻¹⁰ Furthermore, as per the CDC, women with behavioral emergencies constitute the leading cause of pregnancy-related deaths in the US.^{11, 12}

The consequences of IPV during pregnancy include an increased risk of pre-term birth, low birth weight, fetal injury, poor maternal mental health, and death.¹³ In SUD, increased rates of pre-term birth, stillbirth, fetal anomalies, and neurodevelopmental effects, as well as neonatal abstinence syndrome and fetal alcohol spectrum disorder can occur.¹⁴⁻¹⁶ Children of women with SI/SUD/IPV also experience higher rates of maltreatment and are at risk for adverse childhood experiences, which have been linked to chronic health problems.^{17, 16, 18} The 2013 Hague Protocol—based on a before-and-after study analyzing over one million caregiver visits to the ED—identified child maltreatment with 91% positive predictive value in children of adult ED patients who were found to have a serious psychiatric condition such as SI, SUD, or IPV during their ED course. (Figure 1).

Despite the deleterious outcomes for both mothers and infants, women with SI/SUD/IPV have rates of unintended pregnancies as high as 90%.^{19, 20-22} An unintended pregnancy is one that is unwanted or untimed.²³ Unintended pregnancies are independently associated with increased adverse maternal and infant outcomes, including reduced antenatal care, child nutrition, child vaccination status, increased incidence of abortion, infant mortality, and poor maternal mental health conditions.²⁴ In sum, maternal and infant mortality is high in SI/SUD/IPV, and pregnancies are more likely to be unintended in these behavioral patients. Most unintended pregnancies result from not using contraception or from not using it consistently or correctly.²³ The American College of Obstetrics and Gynecology supports comprehensive and unhindered access to contraceptives, but there are currently no guidelines for the provision of comprehensive preventive family planning services in the ED.²⁴⁻²⁶

While it is unknown whether EDs may constitute an appropriate setting to offer preconception contraceptive services to populations with SI/SUD/IPV, mounting evidence supports the benefit of ED family planning interventions in targeted groups, such as pediatrics, or for those patients who lack access to family planning services.²⁷⁻²⁹ What is unique

Population Health Research Capsule

What do we already know about this issue?

Women with suicidal ideation (SI), substance use disorder (SUD), or intimate partner violence (IPV) face high maternal/infant mortality and poor access to reproductive care.

What was the research question?

Do women with SI/SUD/IPV in the emergency department (ED) have lower rates of contraceptive documentation than other women?

What was the major finding of the study?

Only 39.5% of SI/SUD/IPV women had contraception documented vs 51.7% controls (RR 0.77, CI, 0.74-0.79, P < .001).

How does this improve population health?

Awareness of gaps in ED contraceptive care can aid emergency clinicians to better support interventions to reduce unintended pregnancy and improve outcomes for at-risk women.

about SI/SUD/IPV patients is that they may have additional barriers to accessing traditional healthcare services and use the ED instead.³⁰ For example in IPV, an abuser can isolate a woman and deprive her of money, transportation, and access to healthcare, or can sabotage efforts at contraception, refuse to practice safe sex, control the outcome of a pregnancy (by forcing a woman to continue the pregnancy, have an abortion, or to injure her in a way to cause a miscarriage), forbid sterilization, or control access to other reproductive health services.^{31,32} Ultimately, the ED remains a primary, discrete point of care for many at-risk patient groups.³³

Additionally, access to primary care is significantly reduced among those with behavioral health emergencies.^{34, 35, 36, 37} In an effort to identify inequalities in care, our primary aim in this study was to evaluate differences in contraceptive documentation during ED visits between SI/SUD/IPV and non-SI/SUD/IPV groups. The secondary purpose was to evaluate the odds of women with SI/SUD/IPV having reduced odds of access to an established primary care physician (PCP) and increased use of unscheduled care as defined by ED length of stay (LOS), hospitalization rates, and ED re-visits.

METHODS

This was an observational, retrospective chart review to

Intimate Partner Violence	Serious Substance Abuse	Suicide Attempt
• Clear-cut cases where the ED professional had strong suspicion • If sustained injuries occurred, all parties were included irrespective of the severity of illness or depth of the wounds	• Patients seen after intoxication with hard drugs. "Hard drugs" were restricted to psychoactive drugs that are addictive and perceived as especially damaging (eg, ecstasy, heroin, cocaine, amphetamine) • Patients who abused alcohol or "soft drugs" (eg, tranquilizers, cannabis products) were only included if in addition, the following situations were met: • No adequate care for the children • Collateral information indicated substance abuse adversely affected the domestic situation • Hospital records indicated the patient had previously been admitted several times following abuse of the substances	• Seen after a suicide attempt or auto mutilation, regardless of the lethality of depth of wound as in the case of auto mutilation

Figure 1. The Hague characteristics identify women suffering from suicidal ideation, substance use disorder, and/or intimate partner violence.
ED, emergency department.

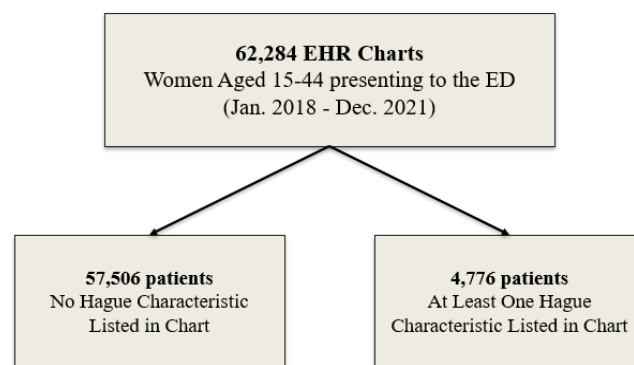


Figure 2. Women identified with the Hague characteristics of suicidal ideation, substance disorder and/or intimate partner violence compared to women presenting without Hague characteristics.
ED, emergency department; EHR, electronic health record.

assess contraceptive use by patients suffering from SI/SUD/IPV who visited a large, not-for-profit hospital system between 2018–2021. The system is comprised of four campuses in a suburban community setting in the Southern United States. Care settings included a non-university affiliated academic center and community centers that saw a combined annual patient population of approximately 200,000 patients in their EDs. The system's main site has a Level I trauma center, a ST Elevation Myocardial Infarction (STEMI) center and a Comprehensive Stroke Center, and is accredited for pain and addiction care in the ED.

Institutional Review Board Approval

The study received expedited approval from the institutional review board.

Sampling Methods

In this study we examined the charts from 62,284 women 15–44 years of age who initially presented to the ED between January 2018–December 2021. These encounters were sorted based on whether the patient had been in the ED with IPV, SI, and/or SUD. To test associations and differences between the groups on key characteristics and outcomes under investigation we compared women with no SI/SUD/IPV (56,708) to women without these characteristics (4,776) (Figure 2).

Based on previous literature, women with Hague characteristics were those who had SI/SUD/IPV. Missing data were retained, and we employed listwise deletion in the analysis. Chart data was de-identified using the safe harbor methodology and securely managed within a research data platform compliant with the Health Insurance Portability and Accountability Act. The historical data required to respond to research questions was fully de-identified before the investigation team received the final dataset fully anonymized.

Case Selection Criteria

We included in the study women of reproductive age 15–44) with a lifetime ED visit with SI/SUD and/or IPV. Inclusion characteristics were defined by the *International Classification of Diseases, 10th Revision (ICD-10)* (Figure 3) based on the Hague protocol.¹⁷ We specifically chose inclusion criteria based on the ED-specific Hague Protocol study,¹⁷ which enlisted caregiver risk factors that increased the vulnerability of their dependent children. Of note, marijuana use was not included in the *ICD-10* case selection criteria as the focus was to include conditions in the Hague protocol that were also associated with high mortality. As per the CDC, alcohol-attributable deaths in 2020–2021 were 178,307, and according to the National Safety Council, preventable drug overdoses in 2022 accounted for 99,592 deaths.⁴ Given the above, inclusion of cannabis would have artificially reduced the impact that substance use of hard drugs and alcohol has on outcomes and was, therefore, excluded.

Variables Definitions

Each case was examined for SI/SUD/IPV (Figure 2) to determine group inclusion. Then, we compiled the following: the financial payor group; Social Vulnerability Index (SVI) score, social determinants of health (SDoH), discharge disposition; length of time from arrival to ED to disposition from ED, ED re-visits rates (30 days); and presence of completed obstetrics/gynecology screening questions.

Uninsurance status was defined as lacking any type of insurance (Medicaid, Medicare, commercial, automobile, agency, veteran's, or worker's compensation), and these patients were self-pay. Having PCP care was defined as having an established PCP on record (typically, a family medicine or internal medicine practitioner, pediatrician, or gynecologist). Hospitalization included both psychiatric and transfers as well as medical admissions. Observation in the ED was excluded.

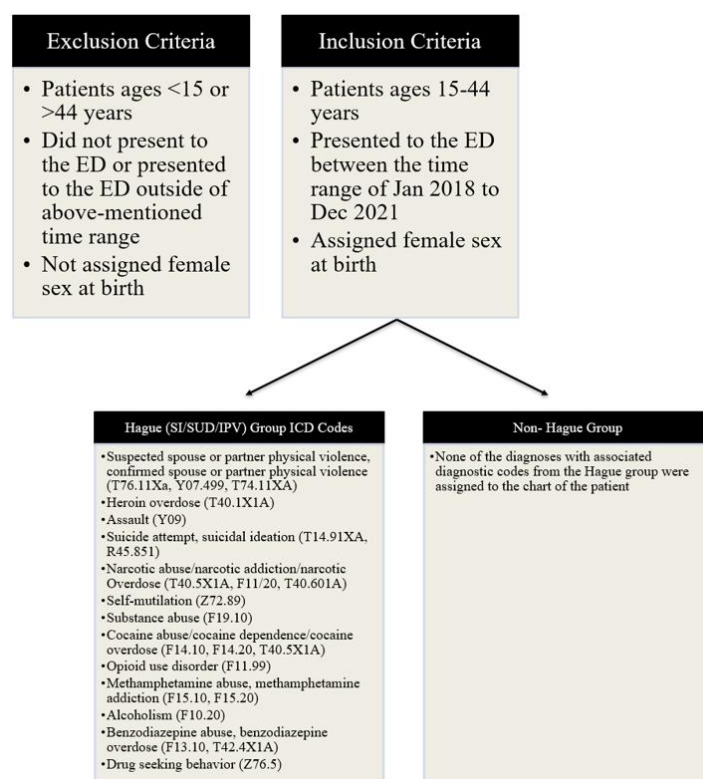


Figure 3. Inclusion and exclusion criteria for case groups comprised of women with and without suicidal ideation, substance use disorder and/or intimate partner violence who presented to the emergency department with specific diagnoses and respective *ICD-10 diagnostic codes included for the Hague group. ICD-10, International Classification of Diseases, 10th Revision; SI, suicidal ideation; SUD, substance use disorder; IPV, intimate partner violence.

In addition to the variables of interest, we included SDoH, obesity, and age in the analysis, given their known negative impact on healthcare outcomes.³⁸⁻⁴⁰ The SDoH, in particular, are considered to be key factors affecting outcomes under investigation.⁴¹ Social vulnerabilities, including poverty, lack of access to transportation, and crowded housing, are directly related to SDoH.⁴² To account for the effect of social vulnerability, consistent with the CDC recommendations, we used the SVI, a measure of socioeconomic factors that affect how resilient communities are when facing disaster. In healthcare-related research, social vulnerability is used to determine its effects on health outcomes. The SVI comprises four key factors: socioeconomic status; household composition/disability; minority status/language; and housing/transportation factor (measured by housing structure, crowding, and vehicle access variables).^{43, 44}

The SVI includes the following social factors: poverty (below 150% poverty estimate, 2018–2022 American Community Survey [ACS]; unemployment; having a minority status (Hispanic or Latino, Black, Asian, American Indian or

Alaska Native, Native Hawaiian or Pacific Islander)⁴⁵; housing cost burden (annual income < \$75,000, which is 30%+ of income spent on housing costs, estimate of 2018-2022 ACS); non-high school diploma, uninsured, household total, > 65 years of age, < 17 years of age; disability; single-parent household; limited English proficiency; living in a multiunit house, mobile home, crowded living space or group quarters; and not having a vehicle. Each census tract received a flag if it was in the 90% for the metric.

We defined obesity as a body mass index ≥ 30 . A 30-day repeat ED visit was defined as repeat ED encounters in a span of 30 days. Acuity was defined by Emergency Severity Index (ESI) level, with ESI 1 being highest and ESI 5 lowest. We defined contraceptive status as a method of contraception, including no method documented, abstinence, condom, chemo/radiation, ablation, postmenopausal, perimenopausal, pregnant or recently pregnant, oophorectomy, injection, intrauterine device, implant, oral contraceptive, hysterectomy, or tubal ligation. No formal requirement for contraceptive documentation is currently part of the ED nursing triage system; thus, any contraceptive documentation that did occur was likely either previously documented (from other visits), documented during the ED visit on a case-by-case basis, or documented during the follow-up period at the moment in which the data was collected. We defined ED LOS as the time from ED intake to ED discharge from the facility or to the next point of care.

Medical Record Identified

Project data from the hospital's clinical research data platform Epic (Epic Systems Corporation, Verona, WI) was collected by the blinded data administrator of graduate medical education, in compliance with both institutional and federal requirements.

Abstractor Training

The primary abstractors were trained and/or certified in the use of the data analytics platform Qlik Sense (QlikTechnologies Inc., King of Prussia, PA) and had data architect and business analyst certifications or training.

Abstractor Forms

Data abstractor forms were used to define the variables and inclusion/exclusion criteria.

Abstractor Blinding

The abstractors were part of this or additional research studies for this team and, therefore, had previously been introduced to the hypothesis and study objectives. However, the data were de-identified after being collected from the database based on 45CFR 46 guidelines of the US Department of Health & Human Services.⁴⁶

Performance Monitoring and Interobserver Reliability

Approximately 10% of the data for patients in the SI/

SUD/IPV group were reviewed manually by the data developer and first author to confirm accurate data inclusion and exclusion (age, sex, and an ED visit with IPV and/or a severe behavioral health concern). A qualitative measure determined interobserver reliability. It was based on an agreement between both abstractors.⁴⁷

Missing Data Management Plan

Statistics for each category were based on all the cases with valid data in the specified ranges for all variables in the categories. Of the 62,284 sample size, 800 charts (1.3%) did not have a Hague characteristic documented and were excluded from analysis using the listwise deletion approach, which is standard practice when dealing with missing data below a 5% threshold.⁴⁸ If no contraceptive was documented, it was coded as “contraceptive not documented,” which resulted in 49.3% of all included women (30,294) not having contraception status documented. If Epic had multiple forms of contraception documented, the notes and data entry points were reviewed for accuracy, and all forms of contraception were included in the analysis and coded as “contraception documented.”

As the study was retrospective in nature, no causal relation can be established. We attempted to establish the odds of certain outcomes. In doing so, our goal was that the model would predict the odds of deleterious outcomes occurring based on the variables studied.

Research questions and the level of measurement suggested the appropriate statistical test. We analyzed data using SPSS 28 (IBM Corporation, Armonk, NY). To determine whether a statistical association existed between women with Hague characteristics vs non-Hague characteristics in terms of odds of contraceptive documentation, and due to the nominal nature of the variables, we conducted a chi-square test of independence with Bonferroni adjustment for a post hoc test. To test for differences in the LOS between women with and without SI/SUD/IPV characteristics, we used an independent sample *t*-test. Finally, to determine the odds of contraceptive documentation, 30-day revisits, and hospitalization, we used a logistic regression. Missing cases were treated using listwise deletion.

As described in this section, we followed established guidelines for reporting observational studies.³⁸ To summarize what has been described in this section, the following optimal retrospective chart review methods, as defined by Worster et al,³⁹ were followed to the extent that was possible and were outlined for compliance purposes as subtitles above.

RESULTS

Table 1 represents the differences in demographics and insurance types between women with and without SI/SUD/IPV characteristics, as well as the number of women in each sub-category (SI/SUD/IPV). Women with suicidal ideation were the highest subset of the case sample, followed by SUD and IPV. Women with multiple characteristics comprised the

smallest, although still substantial, subsample (see Table 1).

A 2x2 chi-square cross-tabulation test suggests that the contraceptive status of women with SI/SUD/IPV was less frequently documented (39.5 vs 51.7%, $P < .001$) with lower relative risk (RR) for contraceptive status reporting in SI/SUD/IPV women (RR .765, 95% CI, .74 - .79). This remained true (aOR .54, 95% CI, .50 - .58, $P < .001$) even after adjusting for SVI status, acuity, and ED LOS in logistic regression analysis. Further, based on the logistic regression analysis that adjusted for the presence of SVI, acuity, and the LOS, the odds of contraceptive documentation varied based on acuity and LOS in the non-Hague group only. Indeed, low emergency severity indices (ESIs) of 4 and 5 have an aOR of contraceptive documentation of 0.72 (CI 0.53 - 0.97, $P < .05$) and 0.60 (CI, 0.42 - 0.85, $P < .01$), respectively. Emergency department LOS had an aOR of 1.02 (CI, 1.01-1.02, $P < .001$) for contraceptive documentation. However, none of these factors affected the documentation odds of women with Hague characteristics. In these women, no statistically significant trend was associated with acuity or LOS (see Table 2).

Table 2 demonstrates that women with Hague characteristics had contraceptive status less frequently documented (39.5 vs 51.7%, $P < .001$) with lower RR for contraceptive status reporting in SI/SUD/IPV women (RR .765, 95% CI, .74 - .79). This remained true (aOR .54, 95% CI, .50-.58, $P < .001$) even after adjusting for SVI status, acuity, and ED LOS in logistic regression analysis. Further, based on the logistic regression analysis that adjusted for the presence of SVI, acuity, and the LOS, the odds of contraceptive documentation varied based on acuity and LOS in the non-Hague group only. Low ESIs of 4 and 5 had an aOR of contraceptive documentation of 0.72 (CI, 0.53 - 0.97, $P < .05$) and 0.60 (CI, 0.42 - 0.85, $P < .01$), respectively. Emergency department LOS had an aOR of 1.02 (CI, 1.01-1.02, $P < .001$) for contraceptive documentation. However, none of these factors affected SI/SUD/IPV women's documentation odds. In women with Hague characteristics, no statistically significant trend was associated with acuity or LOS.

Women with SI/SUD/IPV who presented to the ED experienced lower rates of PCP care (50 vs 46.1%, $P < .001$) and higher rates of uninsurance (32.7 vs 26.1%, $P < .001$). Relative risk for being uninsured was higher for these women (RR 1.25, 95% CI, 1.20-1.31), as was the RR of not having a PCP (RR 1.19, 95% CI, 1.15-1.22). Women in the Hague category also had longer ED LOS (a mean of 10.38 hours vs 3.87 hours, mean difference 6.5, 95% CI, -6.8, -6.2, $P < .001$). Results from a logistic regression and chi-square test of independence with Bonferroni adjustment for post hoc analysis indicate that women with SI/SUD/IPV had higher rates of hospitalization (61 vs 8.7%, $P < .001$) and significantly higher odds of being hospitalized (aOR 17.02, CI, 15.87-18.25, $P < .001$) even after adjusting for SVI, age, and obesity (see Table 3).

Table 3 demonstrates that women presenting with Hague

Table 1. Demographics and insurance type of women with and without characteristics of suicidal ideation, substance use disorder, and/or intimate partner violence who presented to the emergency department.

		Non-SI/IPV/SUD	SUD	Suicidal	IPV	Multi	Total
Insurance	Commercial	2,4672	359	906	119	91	26,147
		48.1%	19.7%	45.9%	26.7%	27.4%	46.8%
	Medicaid	11,898	557	635	147	99	13,336
		23.2%	30.6%	32.2%	33.0%	29.8%	23.9%
	Medicare	1,315	76	61	11	16	1,479
		2.6%	4.2%	3.1%	2.5%	4.8%	2.6%
Patient ethnicity	Self-pay	13,378	831	370	169	126	14,874
		26.1%	45.6%	18.8%	37.9%	38.0%	26.6%
	Total	51,263	1,823	1,972	446	332	55,836
	Not Hispanic	45,532	1,781	1,752	391	328	49,784
		81.4%	95.3%	86.1%	83.0%	94.8%	82.0%
Patient race	Hispanic	10,436	87	284	80	18	10,905
		18.6%	4.7%	13.9%	17.0%	5.2%	18.0%
	Total	55,968	1,868	2,036	471	346	60,689
	Unknown	577	15	27	1	4	624
		1.0%	0.8%	1.3%	0.2%	1.1%	1.0%
Patient race	White	37,861	1,653	1,541	315	302	41,672
		66.8%	87.4%	74.7%	66.5%	86.5%	67.8%
	Black	8,132	143	224	80	27	8,606
		14.3%	7.6%	10.9%	16.9%	7.7%	14.0%
	Asian	724	3	27	3	0	757
		1.3%	0.2%	1.3%	0.6%	0.0%	1.2%
Patient race	Other	9,414	77	243	75	16	9,825
		16.6%	4.1%	11.8%	15.8%	4.6%	16.0%

SI, suicidal ideation; SUD, substance use disorder; IPV, intimate partner violence.

characteristics had higher rates of hospitalization (61 vs 8.7%, $P < .001$) and had significantly higher odds of being hospitalized (aOR 17.02, CI, 15.87-18.25, $P < .001$) even after adjusting for SVI, age, and obesity. Further, women with Hague characteristics had higher rates of 30-day ED-repeat visits (11.9 vs 8.8%, aOR 1.52, 95% CI, 1.36-1.70, $P < .001$) even after adjusting for SVI, acuity, age, and obesity (see Table 4).

Table 4 demonstrates that women with Hague characteristics had higher rates of 30-day ED-repeat visits (11.9 vs 8.8%, aOR, 1.52, 95% CI, 1.36-1.70, $P < .001$) even after adjusting for SVI, acuity, age, and obesity.

DISCUSSION

A high prevalence of SI/SUD/IPV characteristics, which are considered by the CDC as representing vulnerability, require attention to ensure that the population of women with these characteristics are adequately served in ED.⁴⁹ However, results from this large, multicenter, retrospective cohort study highlight that women with SI/SUD/IPV emergencies had reduced

contraceptive documentation, regardless of a woman's acuity or ED LOS, which suggests that this particular population of women is underserved. These women were additionally associated with reduced access to care, high ED use rates, and increased hospitalizations. This is the first study to evaluate non-emergency contraceptive inequalities in the ED among patients with behavioral characteristics of SI/SUD/IPV. Less documentation may reflect reduced access to family planning services due to clinicians' fear of being perceived as judgmental, or as a result of stigmatization of these women or increased incidence of physician burnout associated with their complex social and behavioral needs.⁵⁰ Emergency department literature is limited, as prior studies have excluded behavioral patients and patients with emotional distress who might still desire (and benefit) from family planning services.^{51,28} In one such study (which excluded behavioral patients), emergency clinicians only asked about contraceptive use 23% of the time, over 90% "never" provided condoms, injections, implants, or IUDs, and 60% reported "never" providing prescriptions for non-emergency contraceptive pills, patches, or rings.⁵² Our

Table 2. Contraceptive documentation in the emergency department for women with suicidal ideation, substance use disorder, and/or intimate partner violence.

	All Women				Non-Hague status				Hague characteristics (SI/SUD/IPV)			
	Sig. P-value	aOR	95% CI for aOR		Sig. P-value	aOR	95% CI for aOR		Sig. P-value	aOR	95% CI for aOR	
SVI Total	>.05	1.01	1.00	1.01	>.05	1.01	1.00	1.02	>.05	0.99	0.96	1.02
ED LOS (hours)	<.001	1.01	1.01	1.01	<.001	1.02	1.01	1.02	>.05	1.00	1.00	1.01
ESI 1 (immediate)	<.001	Reference			<.001	reference			<.05	reference		
ESI 2 (emergent)	>.05	1.12	0.86	1.47	>.05	1.20	0.88	1.64	>.05	1.01	0.57	1.77
ESI 3 (urgent)	<.05	1.33	1.02	1.74	<.05	1.38	1.02	1.86	>.05	1.29	0.73	2.28
ESI 4 (less urgent)	<.01	0.69	0.52	0.90	<.05	0.72	0.53	0.97	>.05	1.09	0.57	2.07
ESI 5 (non-urgent)	<.001	0.57	0.41	0.78	<.01	0.60	0.42	0.85	>.05	0.00	0.00	
SI/SUD/IPV Status ¹	<.001	0.54	0.51	0.59	NA				NA			
Obesity ¹	>.05	1.15	0.62	2.16	>.05	1.26	0.63	2.49	p>.05	0.41	0.05	3.64

Contraceptive status documentation as an outcome, with multiple variables (SVI, ED LOS, ESI, Hague status, and obesity) that may contribute to such.

¹defined as the presence of the noted variable.

aOR, adjusted odds ratio; ED, emergency department; ESI, Emergency Severity Index. LOS, length of stay; NA, not applicable; SI, suicidal ideation; SUD, substance use disorder; IPV, intimate partner violence; SVI, Social Vulnerability Index.

study highlights that the odds were likely even lower in behavioral patients. Additionally, the reduced access to care and reduced contraceptive documentation demonstrated in this study is in line with prior research demonstrating a link between improved access to family planning with insurance expansion.⁵³

Consistent with prior literature, this study's results support the notion that women suffering from SI/SUD/IPV are known to be more likely to be frequent ED users.^{54,55} This study demonstrated frequent ED use, ED LOS, hospitalization, and ED re-visits. Given that these women interface with acute care clinicians at high rates and have significant unmet care needs, EDs could bridge a care gap and provide targeted interventions to improve access to contraceptive counseling and initiation in those patients who desire such services.^{29,56-58} Current non-emergency screening and preventative services routinely carried out in some EDs include targeted basic pharmacologic coverage (such as non-emergent medications like antihypertensives), vaccination programs, and hepatitis C and HIV screenings.^{51,59-62}

Reducing barriers to contraception initiation (to include initiating at the time when a woman requests) has been recognized as an important initiative to reduce unintended pregnancies.⁶³ Integrating care in populations with SI/SUD/IPV is increasingly supported.⁶⁴⁻⁶⁶ This study highlights that women with SI/SUD/IPV have an opportunity to receive family planning services due to the increased time they spend in the acute care setting. We suspect that lack of contraceptive documentation reflects both the reduced access to outpatient family planning services that behavioral patients face and the lack of non-emergent contraceptive counseling that occurs in the ED. Indeed, there has been little emphasis in emergency

medicine training and practice on preventive contraceptive counseling and initiation from the ED, and placement of an etonogestrel implants, for example, requires additional training and certification.^{67,68}

Given the limited follow-up care in these populations, effective programs that can both address the underlying risk factors while bridging the family planning gaps may be developed. For example, in an ED patient with opioid use disorder who is at risk of an unwanted pregnancy, treatment of the underlying SUD could be initiated along with contraceptive initiation. In the state of Georgia where this study was conducted, trained registered nurses may place a contraceptive injectable or an implant.⁶⁹ In this way, a patient could receive care for her underlying SUD and address modifiable SDOH, as well as bridge the contraceptive gap, if desired, while she embarks on the road to recovery. By initiating a long-acting contraception, less urgent follow-up would be required, and the ED could orchestrate links to accessible community programs that match the patient's needs.

The results of this study highlight an opportunity for further research to address an ED intervention to reduce the adverse outcomes of unintended pregnancies, increased rates of unintended pregnancies in populations with mental health issues, and the long-lasting increased rates of adverse childhood experiences in the offspring of women suffering from SI/SUD/IPV. With this gap, a potential opportunity to improve the outcomes of both women and their children by addressing non-emergency contraceptive care in the ED may be on the horizon. This study provides evidence that highlights the inequity in family planning services in ED patients with SI/SUD/IPV and, therefore, an unmet need and

Table 3. Rates of hospitalization in women with suicidal ideation, substance disorder, and/or intimate partner violence who presented to the emergency department.

	Wald	Sig. P-value	aOR	95% CI for aOR	
				Lower	Upper
SI/SUD/IPV status ¹	6306.9	<.001	17.02	15.87	18.25
Obesity ¹	21.7	<.001	4.83	2.49	9.36
SVI total	0.0	>.05	1.00	0.99	1.01
Age	145.3	<.001	1.02	1.02	1.02

¹presence of the noted variable.

aOR, adjusted odds ratio; SI, suicidal ideation; SUD, substance use disorder; IPV, intimate partner violence; SVI, Social Vulnerability Index.

opportunity. The American College of Obstetrics and Gynecology supports funding for research that identifies effective strategies to reduce health inequities in unintended pregnancy and access to contraception.⁷⁰ Future studies should evaluate and include women with behavioral risk factors and clinicians' perspective and barriers to contraceptive initiation in the ED, patients' preferred method(s), and patient-centered, non-coercive successful models that demonstrate how to operationalize these services in the post-COVID-19 era of boarding and ED crowding.

LIMITATIONS

Despite numerous strengths of this research that focuses on the understudied and potentially underserved population of women, this cohort study had several limitations. First, it was conducted in a single hospital system with a patient demographic and access to services that may not represent the rest of the country. Second, while equal sub-populations in a study such as this should not be expected, it needs to be mentioned that the proportion of patients with SI/SUD/IPV was not equally distributed. Further, patients with IPV are often under-reported, which could have resulted in lower incidence of IPV reported or the quantity of multiple inclusion characteristics reported. The ICD-10 codes used to screen for Hague populations may have missed inclusion characteristics that were not identified by those codes. Additionally, the control group was significantly larger than the case group, although this did not per se affect the outcome in the analysis conducted.

It is possible that contraceptive discussions were performed, but not documented, due to multiple factors including lack of reimbursement associated with reproductive counseling in the ED or the lack of perceived relevance by ED staff. It is also possible that the documentation present was from those established with the system (and PCP) and not because contraceptive care was discussed in the ED, as the system in which this study was performed does not currently have protocolized contraceptive care in the ED. Additionally,

Table 4. 30- day emergency department re-visits for women with suicidal ideation, substance disorder, and/or intimate partner violence.

	Wald	Sig. P-value	aOR	95% CI for aOR	
				Lower	Upper
SVI total	24.99	<.001	1.04	1.02	1.05
ESI 1 (immediate)	11.83	<.05	reference		
ESI 2 (emergent)	0.00	>.05	0.99	0.62	1.57
ESI 3 (urgent)	0.27	>.05	1.13	0.71	1.80
ESI 4 (less urgent)	0.06	>.05	1.06	0.67	1.69
ESI 5 (Non Urgent)	1.41	>.05	1.38	0.81	2.37
SI/SUD/IPV status ¹	52.83	<.001	1.52	1.36	1.70
Obesity ¹	0.00	>.05	1.02	0.36	2.85
Age	25.445	<.001	1.01	1.01	1.01

¹presence of the noted variable.

aOR, adjusted odds ratio; ESI, Emergency Severity Index; SVI, Social Vulnerability Index.

data in the study overlap with data collected at the beginning of the COVID-19 pandemic, which may have affected how patients used the ED. Another study suggested that mental health ED visits increased during the COVID-19 pandemic,⁷¹ which could have disproportionately worsened the use of the acute care setting by behavioral patients, thus skewing the results of this study. Nevertheless, a possible disproportionate increase in the susceptibility of deleterious outcomes in behavioral populations would heighten the importance of addressing the disparities present in the care of these women.

Despite the limitations of this study, its contribution to the literature is of value given the scarcity of research focusing on family planning in the ED and the significant inequity in the reproductive outcomes of behavioral women. Therefore, we believe the data from this study can provide a background framework that can highlight opportunities to improve care in these populations.

CONCLUSION

Women of reproductive age who struggle with suicidal ideation, substance use disorder, and or intimate partner violence suffer from significant reproductive service inequality, which contributes to inequity for both the mothers and their children. This research highlights that women who suffer from SI/SUD/IPV have less contraceptive status documentation, fewer established primary care physicians, and higher rates of uninsurance, which likely limit their access to preventive contraception despite their increased need. Despite deleterious maternal outcomes, childhood-related adverse outcomes, elevated rates of unintended pregnancies in these populations, and reduced access to ambulatory care, these women are not receiving care in the ED that could bridge their care gaps.

While the ED can be fast paced and perceived to have insufficient time to address family planning, this study highlights that women with SI/SUD/IPV characteristics had lower prevalence and odds of having their contraceptive status documented. At the same time, this study documents that these patients have longer ED LOS, higher rates of hospitalization, and higher rates of 30-day ED-revisits. This increased contact time with the acute care setting may allow emergency clinicians to identify care gaps in reproductive healthcare and potentially improve the outcomes of marginalized women and their children with interventions. Further research to understand these patients and gauge clinicians' interest in ED contraceptive counseling and initiation in the ED, in addition to contraceptive service preferences, barriers, and patient-centered processes that are inclusive should be prioritized.

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Sexual Assault and Forensic Exam Offers in the Emergency Department: A Retrospective Study

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Introduction: Patients who report sexual assault in the emergency department (ED) have a legal right to a forensic exam. Emergency departments that do not provide such exams must offer transfer to a forensic site. Little is known about the factors influencing whether patients are offered a forensic exam and complete the transfer. In this study we aimed to identify patient characteristics associated with being offered a forensic exam in an ED that does not perform them on site.

Methods: We conducted a retrospective chart review of adult patients presenting to a single, urban, academic ED between January 2017–December 2019. The ED receives over 75,000 visits annually and refers patients to an external site for forensic exams. Using keywords “sexual assault” or “rape” we identified charts that included whether the visit involved an initial report of sexual assault. Charts were abstracted for demographics, insurance status, psychiatric history, clinician concern for acute mental illness or substance use, and mode of arrival. The primary outcome was whether a forensic exam was offered. Statistical analyses included chi-square tests and penalized logistic regression.

Results: Of 167 charts reviewed, 108 met inclusion criteria. Of these, 94 patients (87.0%) were offered a forensic exam and 14 (64.8%) accepted transfer. Patients who were offered exams were younger (mean age 29.9 vs 36.8 years, $P = .05$), more likely to arrive ambulatory (69.1 vs 42.9%, $P = .02$), and less likely to have a psychiatric history (31.9 vs 71.4%, $P = .01$). Clinician concern for acute psychiatric illness or substance use was significantly associated with not offering a forensic exam (64.3 vs 16.0%, $P < .001$). In regression analysis, this concern was the only independent association of not being offered a forensic exam (adjusted odds ratio 0.16, 95% CI, 0.03–0.76, $P = .02$). Additionally, 23.1% of patients were uninsured, significantly higher than the local rate of 2.7%.

Conclusion: Patients in the ED who report sexual assault are less likely to be offered a forensic exam if they present with signs of acute mental illness or substance use disorder. These findings highlight the need for standardized protocols and advocacy to ensure equitable access to forensic exams, especially for patients with behavioral health needs or without insurance.

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INTRODUCTION

Sexual violence is a public health crisis in the United States. Contact sexual violence, defined as rape, sexual coercion, forced penetration, and/or unwanted sexual contact,

affects 54.3% of adult women and 30.7% of adult men in the US.¹ These acts of sexual violence have significant acute and chronic repercussions for the victims. In the acute period after sexual assault, 1 in 7 female victims reported sexually

transmitted infections, 1 in 3 were injured, 1 in 7 became pregnant, and 2 in 3 were fearful and/or concerned for safety.¹ Victims of sexual violence also have higher long-term rates of chronic medical conditions and activity limitations.¹

It is estimated that 21% of victims of sexual violence will seek acute medical care, which results in greater than 55,000 emergency department (ED) visits related to sexual assault in the US each year.^{2,3} The ED, therefore, has a unique opportunity to make a significant impact on the acute and long-term care of victims of sexual violence. Federal, state, and local laws regulate ED care for victims of sexual assault. The Survivor's Bill of Rights Act of 2016 established and updated statutory rights nationwide that include the right to...not be prevented from receiving a forensic medical examination and not be charged for an examination; (2) have a sexual assault evidence collection kit (ie, a rape kit) preserved for 20 years or the maximum applicable statute of limitations, whichever is shorter; (3) receive written notification prior to destruction or disposal of a rape kit; and (4) be informed of these rights and policies.⁴

Therefore, every ED is required to offer or facilitate a free sexual assault forensic exam that includes evidence collection, known commonly as a Physical Evidence Recovery Kit (PERK), to every patient who reports sexual assault.

In addition to the forensic exam and PERK, ED care should provide comprehensive services for key medical and behavioral interventions. The standard of care includes sexually transmitted disease prevention, emergency contraception, injury identification and treatment, and trauma-informed care practices to reduce the acute and long-term psychological impact of sexual violence.⁵ Many EDs also employ a patient advocate who may provide acute crisis intervention at the initial ED visit and/or subsequent long-term advocacy and connection to community resources for the victim.

Previous studies have consistently demonstrated that Sexual Assault Nurse Examiners (SANE) and patient advocates together provide higher rates of comprehensive medical services and proper completion of forensic exams compared to ED care without these resources. The SANEs also have been shown to establish a compassionate attitude, provide clear explanations, and empower individual agency for victims of sexual assault.⁶ In contrast, ED staff in departments that do not have SANEs have been observed to convey skepticism of the victims in 53.2% of visits and to blame them for the circumstances of assault in 28.4% of visits.⁶

Recent surveys have found that only 55.3% of EDs in the US often or always have SANE services.⁶ To compensate for the lack of on-site SANE care, EDs have developed different models of providing the federally mandated forensic services. Some EDs will transfer patients to SANE centers based on the evidence that SANEs provide higher quality comprehensive services.^{6,7} Other EDs have adopted telemedicine programs using remote SANE consultation in real time.^{8,9} Finally, some EDs will provide the forensic exams and PERK collection

Population Health Research Capsule

What do we already know about this issue?

Patients reporting sexual assault have a legal right to forensic exams, but access in emergency departments (ED) without on-site exams is inconsistent.

What was the research question?

What factors influence whether ED patients reporting sexual assault are offered a forensic exam?

What was the major finding of the study?

Clinician concern for acute mental illness or substance use reduced exam offers (odds ratio .16, 95% CI, 0.03-0.76, P = .02).

How does this improve population health?

Identifying disparities in forensic exam offers supports standardized ED protocols to ensure equitable care for sexual assault survivors.

without a SANE.¹⁰ Little is known about the factors that impact sexual assault victim care in the 44.7% of EDs that transfer patients to forensic sites. Previous studies have examined ED staff comfort and knowledge in caring for victims of sexual assault¹¹; however, much less is known about the quality of patient care in systems that transfer patients. We aimed to answer the following question: In an ED that does not provide forensic exam services, what factors affect whether patients reporting sexual assault are offered a forensic exam and are ultimately transferred to a location with a SANE.

METHODS

Study Setting

We conducted a retrospective, cohort study from January 1, 2018–December 31, 2022 in a single, urban, academic ED in the US with 75,000 annual visits that does not provide sexual assault forensic exams. The study was deemed exempt by the institutional review board (IRB#NCR224704). No funding was received for this study. During the study period, the ED policies related to patients who reported sexual assault were to offer the patient transfer to a local ED that does provide forensic exams. The acute window for the forensic exam is 120 hours or less from assault, as defined by the local SANE program. Patients that decline transfer are offered a patient advocate on the phone, the opportunity to make a police report, and comprehensive sexually transmitted infection prevention and emergency contraception. Patients may choose any combination or none

of these services. We performed a retrospective chart review to evaluate factors that impact whether patients reporting sexual assault in the acute window are offered transfer for a forensic exam. Our study design and the following methodology adheres to the following elements of optimal retrospective chart review: abstractors trained before data collection; definition of inclusion and exclusion criteria for case selection; definition of variables; use of data abstraction forms; measurement and discussion of inter-observer reliability; description of the medical record database; description of the sampling method; description of statistical management of missing data; and IRB approval.¹³

Patient Selection

Patient charts were selected through a keyword search for “sexual assault” or “rape” mentioned anywhere in the chart. Physician and nursing notes were included in the initial query. We included all ED charts over the three-year period in the initial search. Next, two reviewers read each chart to determine whether the patient encounter met inclusion criteria. Each chart was read by both reviewers. Reviewer discrepancies were resolved through consensus discussions. Reviewers were trained to abstract variables using the study protocol. Charts were abstracted for inclusion criteria, predefined variables, and the study outcomes. For inclusion, the patient had to be ≥ 18 years of age, and the ED encounter must have included the initial report of sexual assault. The variables included the following: age; race; sex; mode of arrival; insurance; location of assault; a history of psychiatric illness; and whether there was clinician concern for psychiatric illness or substance use at the initial encounter for sexual assault in the ED. The primary outcome was whether the emergency clinician offered the patient a sexual assault forensic exam if they presented within the acute window.

Quantitative Variables

We grouped detailed insurance information into Medicaid, Medicare, private insurance, or uninsured/discount. City- and county-level data, when available, was gathered for the variable “Jurisdiction of Assault”, which were grouped as follows: District of Columbia (DC); Maryland (MD); Virginia (VA); unknown, or other. The remaining variables were not grouped and are largely binary, aside from age, which was kept as a continuous variable. For the purposes of regression, to avoid issues with collinearity, some additional groupings were made. For “mode of arrival,” we combined “brought in by ambulance” and “Advanced Life Support (ALS) ambulance,” as well as “law enforcement” and “other.” For “location of assault,” we grouped locations by DC, MD and VA to account for the perfect separation in outcomes. For the same reason, we decided to code the lone “male to female” participant as female for the purposes of this study. The variable “clinician concern for psychiatric illness or substance use at the initial encounter for sexual assault in the ED” was determined based on two-reviewer agreement on chart review. The variable was defined

by whether the patient chart documented clinician concern or description of acute psychosis, delusions, hallucinations, or erratic behavior. We defined this variable as acute mental illness or substance use, as the emergency clinicians of record on chart review were often unable to determine the etiology of behavior during the initial patient encounter. The variable “history of psychiatric illness” was also determined based on two-reviewer agreement on chart review. We included any historical diagnosis of psychiatric illness of any severity. If any variable was not listed in the chart, or missing, it was categorized as “unknown.”

Statistical Methods

We compared patient characteristics between those who were offered a sexual assault forensic exam ($n = 94$) and those who were not offered a forensic exam ($n = 14$), using appropriate statistical tests. Continuous variables (eg, age) were compared using Student *t*-tests, while we compared categorical variables (eg, race, sex, mode of arrival, insurance status, location of assault, psychiatric history, concern for psychosis/substance use at visit) using chi-square tests. A significance level of .05 was used for all statistical tests.

To identify factors independently associated with forensic exam offering while accounting for the small sample size ($n = 108$) and outcome imbalance, we performed a penalized logistic regression with L1 regularization using the generalized linear model function in the statsmodels Python package (Python Software Foundation, Wilmington, DE). This approach helps prevent overfitting and manages separation issues common in datasets with rare outcomes. The model included the following potential associations: age; race; sex; mode of arrival; insurance status; location of assault; psychiatric history; and concern for psychosis/substance use at visit. Results are presented as adjusted odds ratios with 95% confidence intervals.

RESULTS

Exploratory Data Analysis

We identified 167 patient charts in the initial keyword search. A total of 108 patients were included in the analysis. Inter-rater agreement was near perfect, Cohen kappa 0.95. We excluded 59 charts because sexual assault was not reported by the patient, or the ED visit was not the initial encounter for sexual assault. Of the included patients, 94 (87.0%) were offered transfer for sexual assault forensic exam and 14 (13.0%) were not offered the exam, or there was no record of the exam being offered. Table 1 presents the demographic and clinical characteristics of the study population.

Patients who were offered forensic exams were significantly younger than those not offered an exam (mean age 29.9 ± 9.7 vs. 36.8 ± 11.3 years of age, $P = .05$). Mode of arrival differed significantly between groups ($P = .02$), with a higher proportion of patients arriving ambulatory in the sexual assault exam-offered group (69.1 vs 42.9%). Insurance status also showed significant differences ($P = .02$), with patients having private insurance (40.4 vs 21.4%) or being uninsured (25.5 vs 7.1%) more likely to be

Table 1. Demographic and clinical characteristics of patients reporting sexual assault in the emergency department with data stratified by whether patients were offered a forensic exam.

	Overall	Forensic exam not offered	Forensic exam offered	P-value
Number	108	14	94	
Age, mean (SD)	30.8 (10.2)	36.8 (11.3)	29.9 (9.7)	.05
Race, n (%)				
Black	54 (50.0)	10 (71.4)	44 (46.8)	.22
Other/Unknown	17 (15.7)	1 (7.1)	16 (17.0)	
White	37 (34.3)	3 (21.4)	34 (36.2)	
Sex, n (%)				
Female	92 (85.2)	11 (78.6)	81 (86.2)	.64
Male	15 (13.9)	3 (21.4)	12 (12.8)	
Male to female	1 (0.9)	0 (0.0)	1 (1.1)	
Mode of arrival, n (%)				
ALS ambulance	1 (0.9)	0 (0.0)	1 (1.1)	.02
Ambulatory	71 (65.7)	6 (42.9)	65 (69.1)	
BLS ambulance	33 (30.6)	6 (42.9)	27 (28.7)	
Law enforcement	2 (1.9)	1 (7.1)	1 (1.1)	
Other	1 (0.9)	1 (7.1)	0 (0.0)	
Insurance, n (%)				
Medicaid	35 (32.4)	7 (50.0)	28 (29.8)	.02
Medicare	7 (6.5)	3 (21.4)	4 (4.3)	
Private	41 (38.0)	3 (21.4)	38 (40.4)	
Uninsured/discount	25 (23.1)	1 (7.1)	24 (25.5)	
Jurisdiction of assault, n (%)				
District of Columbia	27 (25.0)	0 (0.0)	27 (28.7)	.11
Maryland	9 (8.3)	2 (14.3)	7 (7.4)	
Other	4 (3.7)	1 (7.1)	3 (3.2)	
Unknown	61 (56.5)	11 (78.6)	50 (53.2)	
Virginia	7 (6.5)	0 (0.0)	7 (7.4)	
History of psychiatric illness, n (%)				
No	68 (63.0)	4 (28.6)	64 (68.1)	.01
Yes	40 (37.0)	10 (71.4)	30 (31.9)	
Clinician concern for acute psychiatric illness or substance use at initial encounter, n (%)				
No	84 (77.8)	5 (35.7)	79 (84.0)	< .001
Yes	24 (22.2)	9 (64.3)	15 (16.0)	
Accepted transfer for forensic exam, n (%)				
No	34 (31.5)	11 (78.6)	23 (24.5)	< .001
Yes	70 (64.8)	0 (0.0)	70 (74.5)	
Eloped	4 (3.7)	3 (21.4)	1 (1.1)	

offered the forensic exam compared to those with Medicaid (29.8 vs 50.0%) or Medicare (4.3 vs 21.4%).

Notably, patients without a psychiatric history were more

likely to be offered the forensic exam (68.1 vs 28.6%, $P = .01$). Similarly, patients without concerns for psychosis at the time of visit were more frequently offered the forensic

exam (84.0 vs 35.7%, $P < .001$). Among patients offered a transfer for the forensic exam, 74.5% accepted it, while none of the patients in the non-offered group had the opportunity to accept. No significant differences were observed between groups regarding race, sex, or jurisdiction of assault.

Regression Results

In the penalized logistic regression model adjusting for potential confounders, concern for psychiatric illness or substance use at the time of visit emerged as the only significant independent association of forensic exam being offered (adjusted odds ratio [AOR] 0.16, 95% CI, 0.03-0.76, $P = .02$). Patients with emergency clinician concern for acute mental illness or substance use had 84% lower odds of being offered the forensic exam compared to those without such concerns, after controlling for age, psychiatric history, race, sex, mode of arrival, insurance status, and jurisdiction of assault.

Age showed a trend toward lower odds of forensic exam being offered with increasing age (AOR 0.96, 95% CI, 0.89-1.03, $P = .27$), although this did not reach statistical significance. Similarly, while psychiatric history was associated with lower odds of a forensic exam being offered in unadjusted analysis, this association was attenuated after adjustment for other factors (AOR 0.81, 95% CI, 0.15-4.46, $P = .80$). Other factors, including race, sex, mode of arrival, insurance status, and assault location, did not show significant independent associations with the likelihood of being offered the forensic exam in the adjusted model. Regression results detailed in Table 2.

DISCUSSION

In this retrospective, cohort study of adult patients reporting sexual assault in the ED, we found that patients were less likely to be offered a SANE forensic exam if the clinician observed behavior consistent with acute mental illness or acute substance use at the initial ED encounter. There were also non-statistically significant but observed trends of lower rates of forensic exam being offered for patients who were older or who had a history of psychiatric illness. In addition, the observed percentage of patients reporting sexual assault who were uninsured (23.1%) was much higher than the general percentage uninsured in the local population (2.7%).¹³

Acute Mental Illness and Substance Use

Our study found that 40% of patients had a history of psychiatric illness, which is consistent with previous studies demonstrating that 26-47% of patients evaluated for forensic exam by a SANE had a history of psychiatric illness and were more likely to be victims of sexual assault in their lifetime.¹⁴⁻¹⁸ There are numerous case reports of patients with acute mental illness reporting sexual assault being denied a forensic exam; however, there is a lack of research demonstrating acute mental illness as a risk factor.¹⁹ In our study, 22% of patients reporting sexual assault demonstrated behavior consistent with

acute mental illness or acute substance use. Substance use by victims and perpetrators prior to sexual assault is common. Seifert found that 51% of sexual assault victims reported substance use prior to their assault.²⁰ Acute psychosis not attributed to psychiatric illness or substance use during an ED visit for sexual assault is also common; sexual assault itself may lead to trauma-induced psychosis.²¹

There are numerous reasons a clinician may not offer a forensic exam to a patient with acute signs of mental illness or substance use. The emergency clinician may be motivated by beneficence and non-maleficence and have concern for the patient's ability to consent to the exam, concern that the invasive forensic exam will exacerbate acute psychosis or retraumatize the patient, or the clinician may prioritize treating the acute mental illness over the forensic exam. The clinician may also be impacted by personal bias, lack of trust or belief of assault, belief that the report of sexual assault is motivated by secondary gain, or personal experience.²²

The complex decision to offer a forensic exam to a person demonstrating acute mental illness was explored in depth by Miles et al. In their paper, the authors based their guidance on the American Disabilities Act that prohibits discrimination based on disability defined as, "a physical or mental impairment that substantially limits one or more major life activities or a record of having such an impairment or being perceived by others as having such an impairment."²³ Therefore the authors found that, "if a patient with [mental illness] requests treatment for sexual assault, there must be a high bar for denial of that request."²² Patients who request a sexual assault forensic exam, are cooperative, and demonstrate capacity should always be offered SANE services regardless of behavior consistent with acute mental illness or substance use.²²

In our study there was no documentation of capacity evaluations for patients presenting with behaviors consistent with acute mental illness or substance use. Furthermore, there was no documentation that the decision not to offer a SANE examination was attributed to clinician concern regarding a lack of capacity. In the absence of clearly documented capacity assessments and serial evaluations for changes in mental status during the ED encounter, it remains imperative that all cooperative patients who demonstrate capacity are offered a SANE examination, irrespective of co-occurring mental illness or substance use.

Our study demonstrates that there is a continued need to advocate for patients with acute mental illness to receive equitable access to sexual assault forensic exams and comprehensive sexual assault services. Through research, education, and advocacy, emergency clinicians can improve sexual assault care for this vulnerable patient population. In addition, further work should establish clear and standardized guidelines for emergency clinicians on when to offer the SANE forensic exam for patients with acute mental illness. Standardized guidelines could limit clinician bias and reduce the ethical dilemma of when to offer forensic exams.

Table 2. Logistic regression analysis of factors independently associated with patient being offered a sexual assault forensic exam in a study of 108 visits for sexual assault to the emergency department.

Variable	Odds Ratio	95% Confidence Interval	P-value
Age	0.96	0.89 – 1.03	.24
Clinician concern for acute psychiatric illness or substance use at initial encounter	0.16	0.03 – 0.76	.02
Race			
Other/Unknown vs. Black	1.82	0.16 – 21.02	.63
White vs. Black	1.72	0.22 – 13.16	.60
Sex (Male vs Female)	0.70	0.11 – 4.49	.71
Mode of Arrival			
Ambulance vs. ambulatory	2.29	0.26 – 20.06	.46
Other/ law enforcement vs. ambulatory	0.43	0.01 – 14.64	.64
Insurance			
Medicaid vs. private	0.71	0.10 – 5.31	.74
Medicare vs. private	0.61	0.05 – 6.92	.69
Uninsured discount vs. private	2.72	0.21 – 35.86	.45
Jurisdiction of assault (District of Columbia/Virginia/Maryland vs. other/unknown)	2.656	0.41 – 17.17	.31
History of psychiatric illness	0.81	0.15 - 4.46	.80

Health Insurance

In our study, a higher proportion of patients reporting sexual assault were uninsured (23.1%) or enrolled in Medicaid (32.4%) compared to the local population (2.7% and 24%, respectively).^{13,24} These findings are consistent with previous studies, which have reported that up to 29.5% of patients reporting sexual assault were covered by Medicaid and 27.7% were uninsured or self-pay.² However, limited research has compared rates of uninsurance among patients reporting sexual assault to those in the general population. Further investigation is needed to understand the underlying factors contributing to higher rates of uninsurance in this population. This is particularly important because, although forensic services are provided free of charge under the Victims of Crime Act through the Crime Victims Fund, patients may still perceive these services as costly—potentially deterring them from seeking care.²⁵ A better understanding of the relationship between sexual assault and lack of insurance could help clinicians more effectively support and advocate for patients, including assisting them with health insurance enrollment.

LIMITATIONS

The study was limited by the number of patients included in the sample size. The relatively small sample size reduces the statistical power of the results, creates wider confidence intervals due to the greater impact of outliers, and limits the generalizability of the results. In addition, charts may

have been missed for inclusion if the patient reported sexual assault, but the documentation included alternate descriptors other than the keywords “sexual assault” or “rape.” The likelihood of missing data is possible due to the broad range of terms used to describe sexual assault. The study was also limited by the inherent nature of retrospective chart review: The variables collected were not standardized at the time of chart documentation. Therefore, there may be missing data, categorized as “unknown,” if clinicians did not elect to document specific variables.

The external validity is limited as the study was conducted at a single, academic, urban ED that does not perform sexual assault forensic exams. The EDs that include SANE services on site may have less variance in forensic exam offering as there are fewer barriers to completing the exam. Further research that is multicenter with a larger sample size is needed to expand the generalizability of the results.

CONCLUSION

Patients presenting to the ED reporting sexual assault are less likely to be offered a forensic exam if the clinician has concerns for acute mental illness or acute substance use. In addition, patients reporting sexual assault are uninsured at a higher percentage compared to the local population. These results suggest that emergency clinicians have the opportunity to provide equitable access to sexual assault forensic exams and to assist victims of sexual assault with health insurance enrollment.

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Preliminary Post-Dobbs Trends in Emergency Department Use for Early Pregnancy Complications

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Introduction: Following the 2022 Dobbs Supreme Court decision, emergency department (ED) use for early pregnancy complications (EPC), such as miscarriage and ectopic pregnancy, may increase in states that enacted severely restrictive abortion policies. Patients may increasingly seek EPC-related care in the ED due to delays in treatment resulting in greater symptom severity or reduced access to usual settings of obstetric and family planning care. Our objective in this study was to examine the association between severely restrictive abortion policies and post-Dobbs EPC-related ED visits.

Methods: This retrospective, cross-sectional study used data from the 2016-2022 National Hospital Ambulatory Medical Care Survey. Our primary outcome measure was ED visits among female patients 15-49 years of age for EPC-related care, defined using encounter diagnosis code or chief complaint. We used multivariable logistic regression to examine the association between US region and post-Dobbs, EPC-related visits, as the number of states with severely restrictive abortion policies (bans from conception to six weeks) varied by region, from zero (Northeast) to 10 of 17 states in the South.

Results: We identified 7,872,445 weighted EPC-related visits (unweighted $n = 1,008$) among 266,222,232 weighted (unweighted $n = 32,841$) encounters for female patients 15-49 years of age (3.0%). The median age was 28 (IQR 23-32). The proportion of pre- vs post-Dobbs EPC-related visits was 3.1% vs 2.5% in the Northeast ($P = .72$); 3.2% vs 3.5% in the West ($P = .80$); 2.4% vs 3.1% in the Midwest ($P = .36$); and 2.9% vs 3.7% in the South ($P = .50$). Compared to the Northeast, the adjusted odds of post-Dobbs EPC-related visits were 1.4 in the West (95% CI, 0.4-5.2), 1.4 in the Midwest (95% CI, 0.4-4.6), and 1.3 in the South (95% CI, 0.4-4.7).

Conclusion: This preliminary study did not find a statistically significant association between US region and post-Dobbs ED visits for early pregnancy complications. However, given the increasing restrictions surrounding reproductive healthcare access, the ED represents an important setting for the delivery of this care. Further investigations using more robust data sources are needed to understand the effect of prohibitive abortion laws on the ED use and the management of early obstetric complications. [West J Emerg Med. 2026;27(1)85–90.]

INTRODUCTION

The 2022 US Supreme Court decision in *Dobbs v Jackson Women's Health Organization* allowed individual states to regulate abortion access.¹ Following this decision, many

states immediately enacted severely restrictive abortion policies. These states were disproportionately in the South and Midwest.² Prohibitive abortion policies can impact treatment for early pregnancy complications (EPC), such as

ectopic pregnancy or miscarriage. Clinicians may fear legal consequences for providing treatment involving pregnancy termination, potentially leading to undertreatment or treatment delays.³⁻⁵ Further, eliminating family planning care settings can decrease access to prenatal and gynecological services.^{3,6}

As a result of these changes, individuals in abortion prohibitive states many increasingly seek EPC-related care in the emergency department (ED).⁷ Patients not offered treatment for miscarriage or ectopic pregnancy may develop worsening symptoms necessitating emergent evaluation.⁷ Definitive treatment may be delayed until patients meet state exceptions for abortion, increasing the risk of complications requiring ED management.⁵ Decreased access to usual settings of obstetric care may lead patients to seek ED care for early pregnancy concerns.⁷⁻⁹ Self-managed abortion has increased post-Dobbs, and ED visits for complications, although rare, may increase.¹⁰

The impact of severely restrictive abortion policies on ED utilization for EPC-related care is currently unknown. In this study we aimed to examine the association between severe abortion restrictions and post-Dobbs EPC-related ED encounters.

METHODS

Study Design and Data Source

This was a retrospective, cross-sectional study of patient encounters at US hospital-based EDs from 2016–2022. We used data from the National Hospital Ambulatory Medical Care Survey (NHAMCS), a nationally representative sample of ED visits collected annually by the National Center for Health Statistics at the Centers for Disease Control and Prevention. The NHAMCS uses a four-stage probability sampling design, and sampling weights are provided to produce population-based estimates. Non-federal, general, and acute care hospitals located in the 50 US states and the District of Columbia are eligible for sampling. We chose 2016 as the start of the study period given the transition to the *International Classification of Diseases, 10th Revision (ICD-10)*, in 2016. The final year of NHAMCS collection was 2022. This study adheres to STROBE guidelines for observational studies (Appendix 1).¹¹ In this study we used the publicly available, de-identified NHAMCS; our study was exempt from review by the University of California, San Francisco Institutional Review Board.

Study Population

We identified all ED visits in NHAMCS during the study period of 2016–2022. We then restricted the study population to patients coded as female and those of reproductive age, defined as 15–49 years of age. Because of the limitations of NHAMCS, we could not capture ED encounters among pregnant patients coded as other than female.

Outcome Measures

The primary outcome was the proportion of ED visits

Population Health Research Capsule

What do we already know about this issue?

Following the enactment of restrictive abortion policies, predominantly in the South, delays in management for early pregnancy loss and ectopic pregnancy were reported.

What was the research question?

Are severely restrictive abortion policies associated with an increase in emergency department (ED) encounters for early obstetric complications?

What was the major finding of the study?

Post-Dobbs, there was a non-significant rise in ED visits for early obstetric complications in the South (2.9% before vs 3.7% after; $P = .50$).

How does this improve population health?

This preliminary study provides initial evidence on how severe abortion restrictions may lead to changes in ED use for early pregnancy complications; further studies are needed.

for EPC-related care among all visits for female patients of reproductive age. We identified EPC-related visits using relevant *ICD-10* and reason for visit codes (Appendix 2).^{8,12} These codes encompass encounters for bleeding in pregnancy, the spectrum of miscarriage and abortion, ectopic and molar pregnancy, and other abnormal products of conception. We described patient demographics characteristics for these visits. These include patient age, race, ethnicity, and insurance payer. Age was categorized as ≥ 35 years vs <35 years, as advanced maternal age (≥ 35 years) is a risk factor for miscarriage and ectopic pregnancy. We describe EPC-related encounter characteristics, including hospitalization, repeat ED visit within 72 hours, and Metropolitan Statistical Area status.

Exposure

We categorized the study period as before (January 2016–June 2021) or after (July–December 2022) the Dobbs decision. The public NHAMCS does not include state-level data. We thus used US region as a proxy for exposure to severely restrictive abortion policies, defined as bans from conception to six weeks, as varying numbers of states in each region enacted such policies immediately following the Dobbs decision (Appendix 3). This included zero of nine Northeastern states, one of 13 (8%) Western states, three of 12

(25%) Midwestern states, and 10 of 17 (59%) Southern states (Appendix 3).

Analysis

We performed a descriptive analysis of EPC-related ED visits, including the proportion of these visits among all visits for females ages 15-49 years of age, patient demographics, and encounter characteristics. Next, we performed a bivariate analysis comparing the proportion of EPC-related visits before (July-December 2016–2021) and after (July-December 2022) the Dobbs decision, overall and by US region. We restricted the pre-Dobbs period to July-December to account for seasonality in ED visits. We used survey-weighted Pearson chi-squared statistics, and we report associated *P*-values. Statistical significance was set at $P < .05$. The NHAMCS multistage probability-based sample weights were applied to obtain unbiased population-level estimates. Weighted results are reported unless otherwise specified.

We then used multivariable logistic regression to examine the association between US region and post-Dobbs, EPC-related visits. Our model included an interaction term between time-period (pre- [January 2016–June 2022] vs post- [July-December 2022] Dobbs) and region; Northeast is the reference as no states enacted a total or six-week abortion ban. We examined unadjusted associations, and then estimated multivariable logistic regression models adjusting for age, race, ethnicity, insurance payor, and season.¹² We conducted a sensitivity analysis excluding 2020–2021 given ED use variability during the Covid-19 pandemic. Total case analysis was performed. We report odds ratios (OR) and 95% confidence intervals. Analyses were performed using Stata 18.5 (StataCorp, College Station, TX).

RESULTS

During the study period, there were 7,872,445 weighted EPC-related visits (unweighted $n = 1,008$) among 266,222,232 weighted visits (unweighted $n = 32,841$) for female patients 15-49 years of age (3.0%). By region, EPC-related visits accounted for 1,268,956 weighted encounters in the Northeast (3.1%), 1,749,370 encounters in the West (3.0%), 1,517,557 encounters in the Midwest (2.6%), and 3,336,563 encounters in the South (3.1%). Patient and encounter characteristics, overall and by US region, are displayed in Table 1.

The overall proportion of EPC-related visits in the pre-Dobbs period (restricted to July-December) was 2.9% (3,271,128 weighted visits) and 3.4% (752,526 visits) in the post-Dobbs period ($P = .44$). By US region, the proportion of pre- vs post-Dobbs EPC-related encounters was 3.1% (559,291 visits) vs 2.5% (58,667 visits) in the Northeast ($P = .72$); 3.2% (757,876 visits) vs 3.5% (130,945 visits) in the West ($P = .80$); 2.4% (555,856 visits) vs 3.1% (153,327 visits) in the Midwest ($P = .36$); and 2.9% (1,398,105 visits) vs 3.7% (409,587 visits) in the South ($P = .50$) (Appendix 4).

In the fully adjusted logistic regression model,

compared to the Northeast region, the odds of post-Dobbs EPC-related visits were 1.37 times greater in the West (95% CI, 0.36-5.20), 1.39 times greater in the Midwest (95% CI, 0.42-4.62), and 1.34 times greater in the South (95% CI, 0.39-4.65) (Table 2). A sensitivity analysis excluding 2020–2021 did not lead to significantly different point estimates.

DISCUSSION

This is the first study to examine national trends in ED utilization following the Dobbs decision. In this preliminary analysis, we did not find clear evidence for increased EPC-related ED visits by US region in the six months following the Dobbs decision. Estimates from our multivariable regression analysis demonstrate an increased odds of EPC-related visits in regions with a greater number of states with total or six-week abortion bans. However, the 95% CIs for these estimates are too wide to rule out the possibility of no effect.

The proportion of EPC-related encounters increased in the post-Dobbs period in all regions except the Northeast, although these differences did not reach statistical significance. The greatest increases were in the South (2.9% to 3.7%; $P = .50$) and Midwest (2.4% to 3.1%; $P = .36$). Emergency department visits related to EPC continue to represent approximately 3% of all visits among females of reproductive age. This finding is in line with previous estimates, representing over one million annual visits.^{12,13}

While literature on this topic is nascent, a recent national survey of emergency physicians found that 20% of participants in abortion-permissive states reported increased pregnancy-related visits among patients from abortion-restrictive states.¹⁴ Among participants in abortion-restrictive states, 24% reported delays in their management of suspected or known ectopic pregnancy.¹⁴ Such delays could result in repeat ED utilization for ongoing symptoms. After Texas enacted a total abortion ban in 2022, miscarriage-related ED visits rose by 25%, and blood transfusions during such visits increased by 54%, further supporting the occurrence of delays in care in abortion-restrictive settings leading to ED visits for life-threatening complications.¹⁵

LIMITATIONS

This study has several limitations. First, we used survey-based data from NHAMCS, which has several known limitations.¹⁶ Next, this analysis lacked long-term post-Dobbs data, as 2022 was the final year NHAMCS was collected. As there were only 53 unweighted post-Dobbs EPC-related visits, this analysis was underpowered to detect a significant change in our primary outcome, resulting in wide confidence intervals in our regression analysis. Finally, the public-use NHAMCS does not include state-level data. Region was instead used as the exposure, as severely restrictive policies were disproportionately enacted in the South and Midwest. Data sources with further post-Dobbs data and state-level estimates may yield a more definitive comparison.

Table 1. Characteristics of emergency department encounters for early pregnancy complications among female patients 15–49 years of age, by US region (2016–2022), weighted.

	All N = 7,872,445	Northeast n = 1,268,956 (15.2%)	West n = 1,749,370 (21.9%)	Midwest n = 1,517,557 (21.9%)	South n = 3,336,563 (41.0%)
Age (median [IQR])	28 (23–32)	29 (24–37)	29 (25–33)	23 (27–31)	27 (22–31)
Age (years)					
Age < 35	6,407,229 (81.39)	887,155 (69.91)	1,371,291 (78.39)	1,309,173 (86.27)	2,839,610 (85.11)
Age ≥ 35	1,465,216 (18.61)	381,801 (30.09)	378,079 (21.61)	208,384 (13.73)	496,952 (14.89)
Race and Ethnicity					
Non-Hispanic White	3,471,488 (44.10)	476,895 (37.58)	742,967 (42.47)	476,895 (49.72)	1,497,133 (44.87)
Non-Hispanic Black	2,147,249 (27.28)	399,688 (31.50)	71,808 (4.10)	399,688 (31.66)	1,195,307 (35.82)
Hispanic	1,916,896 (24.35)	350,483 (27.62)	816,358 (46.67)	350,483 (14.73)	526,581 (15.78)
Other	336,811 (4.28)	41,890 (3.30)	118,237 (6.76)	41,890 (3.90)	117,542 (3.52)
Insurance payor					
Self-pay	786,121 (10.92)	68,289 (6.07)	109,015 (6.71)	120,887 (9.33)	487,931 (15.46)
Private insurance	2,168,211 (30.11)	440,739 (39.20)	512,119 (31.52)	427,884 (33.03)	787,470 (24.94)
Medicaid or Medicare	4,030,909 (55.98)	587,409 (52.24)	949,123 (58.43)	738,831 (57.04)	1,755,546 (55.61)
Other/ unknown	215,914 (3.00)	27,954 (2.49)	54,250 (3.34)	7,676 (0.59)	126,035 (3.99)
MSA status					
MSA	7,144,726 (90.76)	1,234,303 (97.27)	1,710,765 (97.79)	1,310,087 (86.33)	2,889,571 (86.60)
Non-MSA	727,719 (9.24)	34,653 (2.73)	38,605 (2.21)	207,470 (13.67)	446,991 (13.40)
Hospital admittance					
Yes	407,748 (5.18)	78,474 (6.18)	112,432 (6.43)	73,555 (4.85)	143,287 (4.29)
No	7,464,696 (94.82)	1,190,482 (93.82)	1,636,938 (93.57)	1,444,002 (95.15)	3,193,275 (95.71)
72-hour revisit					
Yes	435,049 (5.53)	69,050 (5.44)	122,538 (7.00)	38,128 (2.51)	205,334 (6.15)
No	6,768,088 (85.97)	1,136,568 (89.57)	1,423,230 (81.36)	1,436,239 (94.64)	2,772,051 (83.08)
Unknown/blank	669,308 (8.50)	63,338 (4.99)	203,602 (11.64)	43,190 (2.85)	359,178 (10.76)

Note: Numbers may not sum to 100% due to rounding error.

MSA, Metropolitan Statistical Area.

CONCLUSION

This preliminary study did not find evidence for changes in early pregnancy-related ED utilization by region immediately following the Dobbs decision, although the study is limited in several ways. Nevertheless, the ED represents an increasingly important setting for the delivery of reproductive health care. Further studies using robust data sources are needed to investigate trends in pregnancy-related visits in abortion restrictive states, including the management and outcomes for these conditions.

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Table 2. Unadjusted and multivariable logistic regression results: association between United States region and post-Dobbs period on EPC-related ED visits related to early pregnancy complications among female patients 15-49 years of age (2016–2022).

	OR	95% CI	aOR ^a	95% CI	aOR ^b	95% CI
Region*/Time Period						
Northeast	REF	-	REF	-	REF	-
West	1.53	(0.39, 0.93)	1.49	(0.38, 5.79)	1.37	(0.36, 5.20)
Midwest	1.52	(0.44, 5.21)	1.50	(0.44, 5.10)	1.39	(0.42, 4.62)
South	1.57	(0.44, 5.63)	1.53	(0.44, 5.34)	1.34	(0.39, 4.65)
Time Period						
Pre-Dobbs	REF	-	REF	-	REF	-
Post-Dobbs	0.79	(0.28, 2.25)	0.80	(0.28, 2.30)	0.84	(0.30, 2.35)
Region						
Northeast	REF	-	REF	-	REF	-
West	0.93	(0.68, 1.28)	0.94	(0.68, 1.28)	0.84	(0.61, 1.15)
Midwest	0.80	(0.60, 1.07)	0.81	(0.61, 1.07)	0.82	(0.61, 1.11)
South	0.94	(0.71, 1.25)	0.94	(0.71, 1.25)	0.98	(0.74, 1.30)

^aAdjusted for season (Summer: June, July, August; Fall: September, October, November; Winter: November, December, January; Spring: March, April, May).

^bAdjusted for season, age, race and ethnicity, and payment.

EPC, early pregnancy complications; OR, odds ratio; REF, reference.

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Emergency Physician and Emergency Nurse Communication in the Emergency Department: A Mixed-methods Study

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Introduction: The emergency department (ED) is a setting where communication occurs often and with potential consequences for patient care. In this study we sought to determine nurse and physician perspectives on the nature and implications of effective and ineffective communication in the ED.

Methods: We used a mixed-methods design, including an online survey followed by in-person focus groups with emergency nurses (EN) and emergency physicians (EP). Participants were recruited through email listserves to emergency staff at four hospitals. We integrated quantitative survey results with focus-group themes.

Results: A total of 115 eligible ENs and EPs completed the initial questionnaire (50% response rate from ENs, 65% response rate from EPs). Responses from nurses and physicians were similar; both noted that poor communication is frequent, adversely affects patient care and ED function, affects trust, particularly between individuals, and that non-verbal communication behaviors affect team communication. In the focus groups (consisting of 18 EPs and 17 ENs), six themes emerged: 1) Situations, built physical environment, and medium of communications all impact quality of communication; 2) core elements of desired professional communication include respect and attention, often conveyed through non-verbal behaviors; 3) poor communication begets poor communication and influences interpersonal relationships; 4) effective communication is seen as fundamental to patient care but also has impacts beyond patient care; 5) clinician gender and gender dyads influence communication dynamics; and 6) participants were able to identify learning activities and techniques for effective communication.

Conclusion: Emergency nurses and physicians across four EDs described failures of communication as both frequent and significant to patient care. This study identified characteristics of effective communication, complex factors influencing communication, and emphasized the whole-team impact of communication quality. [West J Emerg Med. 2026;27(1)91–98.]

INTRODUCTION

Interpersonal communication is a fundamental skill in emergency care.¹ Optimal care in high-acuity, high-volume

settings requires consistent, active communication within the team. Communication is subject to bias and error; thus, optimizing it plays a cross-cutting role in patient safety and

quality of care.^{2,3} Lapses in communication can negatively affect the medical team's functionality, strain individual clinicians resulting in burnout, and are detrimental to patient care.^{4,5} While teamwork and collaboration are emphasized in the emergency department (ED),^{6,7} particularly in resuscitation, routine communications between emergency physicians (EP) and emergency nurses (EN) in non-critical situations is teamwork that has not been studied in depth yet potentially affects all interactions.

The literature has examined challenges with nurse-physician communication, finding that multidisciplinary teams' communication can affect patient care positively or negatively.⁸ In a 2012 review of ED communication, when communication was centered on patient care, individuals were prepared, prompt, and minimized interruptions. The review identified challenges to effective communication, including nurses and physicians misunderstanding each other's roles, hierarchical environments, communication style (descriptive vs succinct), interruptions, and stressful working environments.⁸ Additional literature identified factors associated with effective nurses-physician communication, including mutual understanding, trust, respect, and collaborative attitudes, and factors inhibiting effective communication, including lack of communication, indirect modes of communication (eg, via the electronic health record [EHR] system), insufficient information, selective communication, language, and cultural factors.^{9,10}

While there is literature addressing general physician/nurse communication,¹¹ little is known about direct interactions specific to the ED. Studies related to ED communication focused on areas tangential to effective communication among EN/EP team members, for example, physician-patient interactions,¹² physician-consultant exchanges,^{13,14} or handoffs.^{15,16} A better understanding of EN/EP communication—including ineffective communication—could facilitate intervention development to systematically identify and ameliorate such interactions, potentially decreasing errors, harm, costs, and stress on healthcare staff. Our objective in this study was to explore effective and ineffective communication, the influence of individual and system factors on communication, and the perceived impact of communication practices on quality and efficiency of care.

METHODS

Study Design

This was a mixed-methods study of EPs and ENs with an explanatory sequential design, using focus-group data to provide context and deeper insights into survey responses.¹⁷ Participants completed an online survey to identify general types and frequency of communication challenges and facilitators and then attended focus groups further exploring and characterizing the quantitative findings.

Study Participants and Setting

We defined ENs as registered nurses primarily employed in ED. EPs were defined as physicians who were in their third year

Population Health Research Capsule

What do we already know about this issue?

Team communication in emergency medicine is critical to quality care. Breakdowns in communication lead to errors, breakdowns in team dynamics, and patient harm.

What was the research question?

How often do communication breakdowns occur and how can we counteract them?

What was the major finding of the study?

90% of emergency clinicians feel poor communication occurs during every shift, and 95% believe it adversely affects patient care.

How does this improve population health?

This study identified characteristics of effective communication, complex factors influencing communication, and emphasized the whole-department impact of communication quality.

of training or had completed training in emergency medicine (EM). We included ENs/EPs practicing at least half of their employment time in one of four EDs: an urban, academic Level I trauma center (40,000 visits/year) that is the primary teaching site for a three-year residency program; an urban community ED 10 miles away (35,000 visits/year); a suburban community ED approximately 20 miles away (9,000 visits/year); and a rural ED 98 miles away (14,000 visits/year). Exclusion criteria were less than two years of experience in emergency medicine and working exclusively in a pediatric ED. These exclusion criteria were chosen to ensure sufficient experience in EM. Clinicians working solely in the pediatric ED were excluded because the environment—a small, stable group of physicians and nurses, low-volume practice, and small physical footprint—is sufficiently distinct that we felt issues raised might not be generalizable to other EDs.

Data Collection Tool

We developed a novel questionnaire to examine the types, frequency, and impact of potential communication gaps between healthcare clinicians caring for ED patients. The initial email questionnaire was based on a literature review of existing health communication literature and observed experiences of study team members. Review details are in Appendix A. Questions were guided by the Input-Mediator-Output framework, conceptualizing how information flows through systems.¹⁸ It has been applied to healthcare teamwork

and aligns with hospital communication processes, considering clinical information and decision-making (inputs), staff and communication systems (mediator), and team impacts and patient outcomes (output). The questionnaire also included basic information about participants, including role/degree, practice experience, and demographic data.

The collaborative team reviewed and revised the questionnaire through an iterative process of face validity testing with structured feedback responses by individuals who met inclusion criteria but were excluded from the final survey population. The trial group responded to the questionnaire twice, one week apart, to assess reliability, and responses were identical 94% of the time. The final questionnaire (Appendix B) had six items assessing frequency of poor or ineffective communication, impact of communication on trust among colleagues, ED clinical team functioning, patient care, and the effect of non-verbal behaviors. Questions were single-answer multiple choice questions.

An initial focus-group discussion guide was created using the same framework and literature review, designed to align with and provide depth and context to survey data. The guide was reviewed by team members and evaluated for face validity as described above for survey development. The final interview guide (Appendix C) had six topics, with suggested prompts and probes, exploring the importance of EN/EP communication, needed and desired information to be exchanged, good communication techniques, poor communication techniques, identification of communication gaps, and behaviors that contribute to communication.

Data Collection

ENs/EPs in four different EDs were invited to participate in the questionnaire via internal email listservs distributed by ED nurse managers and medical directors. Invitees received up to four requests to complete the survey through their work emails. Respondents meeting inclusion criteria were invited to take part in the full questionnaire. Those who completed the questionnaire were invited to participate in focus groups with EPs and ENs to characterize communication gaps further. Questionnaire responses were stored anonymously to mask responses from focus-group leaders. Questionnaire responses led to discipline-based focus groups. Two trained interviewers moderated focus groups, one a non-clinical co moderator (in all groups), for consistency, and one a co-moderator from the aligned discipline (nursing or medicine [DJ, NM, LH]), to ensure clinical context, language, and nuance were conveyed and captured. Moderators used prompts and probes to elicit and clarify information. Focus groups lasted 60-90 minutes. Patient safety was defined as accurate clinical assessments, correct treatment interventions, and disposition plans that minimize harm, but specific incidents were left to participant opinion.

Focus groups were recorded on digital audio recording software, transcribed verbatim using a human transcription

service (TranscriptionPuppy, Miami, FL), and entered into qualitative data management software (MaxQDA 2018). Transcripts were anonymized by replacing names with numerical identifiers to maintain theme continuity from individuals while protecting their identities.

Data Analysis

For demographic information and survey results, we calculated summary statistics, stratified by role (EP/EN).

We used thematic analysis for focus group results entailing identifying recurring patterns, themes, and categories within the data relating to the nature and impact of different communication behaviors in the ED. Preliminary codes were created from major topic headings in the interview guide and refined by iterative, repeated transcript analysis by the research team, resulting in creation of an initial codebook with definitions. Research team members reviewed and edited the document together to ensure there was a shared understanding of codes and to identify any needed revisions. Research team members included both EPs and nurses, as well as a medical student and a non-physician team member without experience in ED research or practice. During study planning, data collection, and analysis, we included individual reflection and team discussion of the positionality of the ED team members with respect to the data and power dynamics within the team. An integrated codebook, consisting of mutually agreed-upon codes, was entered into the MaxQDA database with the final version of each transcript. Two independent coders (JP and AG) applied the coding scheme to each transcript. Notes taken during interviews were reviewed to understand conversation context, tone, and interactions among participants. Coding discrepancies or ambiguities were resolved through discussion during full team meetings.

We summarized major themes and subthemes into an initial thematic framework based on commonalities, shared meanings, and applicability to the research aims, including alignment with broad survey topics. The study team collaboratively finalized themes and selected illustrative quotes representing the range of responses relevant to each theme. Data interpretation differences were addressed through discussion and re-review of transcripts and coded materials, ensuring that quotes were understood fully and in context.

Ethical Approval and Competing Interests

The Oregon Health & Science University (OHSU) Review Board exempted this study. The authors have no competing interests. This study received institutional funding from the OHSU Department of Emergency Medicine.

RESULTS

There were 146 survey respondents, with 115 eligible participants, including 81 ENs (of 164 possible EN participants, 50% response rate) and 34 EPs (of 52 possible EPs, 65% response rate), who completed the entire survey.

Table 1 lists EP/EN demographics. Each discipline was asked the same six questions, with the results in Table 2. Although the surveys were sent to four hospitals, several EPs/ ENs worked at multiple sites. Therefore, participants represented nine hospitals across seven healthcare systems.

A total of 18 EPs and 17 ENs agreed to participate in focus groups separated by professional discipline. Seven focus groups (three EP and four EN groups) were conducted. Some focus group participants and facilitators/authors knew each other from working together.

Table 1. Demographics of clinicians responding to a survey regarding communication practices between emergency physicians and emergency nurses.

Category	Emergency physicians N=34	Emergency nurses N=81
Sex		
Male	14 (41.2%)	14 (17.3%)
Female	20 (58.5%)	65 (80.3%)
Prefer not to answer	0 (0%)	2 (2.5%)
Age		
<35	13 (38.2%)	31 (38.3%)
35-<45	15 (44.1%)	25 (30.9%)
45-<55	2 (5.9%)	13 (16.1%)
55+	4 (11.8%)	12 (14.8%)
Experience		
2-<5 years	13 (38.2%)	30 (37.1%)
5-<10 years	12 (35.3%)	16 (19.8%)
10-<15	3 (8.8%)	10 (12.4%)
15-<20	1 (2.9%)	12 (14.8%)
>20 years	5 (14.7%)	13 (16.1%)
Race		
White	27 (79.4%)	73 (90.1%)
Asian	4 (11.8%)	0 (0%)
Prefer not to identify	3 (8.8%)	8 (9.9%)
Ethnicity		
Hispanic or Latino	1 (2.9%)	3 (3.7%)
Non-Hispanic or Latino	27 (79.4%)	72 (88.9%)
Prefer not to identify	6 (17.7%)	6 (7.4%)
Primary practice type		
Urban academic	23 (67.7%)	42 (51.9%)
Urban/ suburban	8 (23.6%)	26 (32.1%)
Rural community	3 (8.7%)	13 (16.0%)

Survey Results

Table 2 summarizes survey results. Overall, ENs/EPs felt poor or ineffective communication occurs commonly, most agreeing that such communication occurs 1-4 times per shift. Further, both disciplines agreed that these communication challenges adversely affected patient care at least sometimes

Table 2. Questionnaire responses by clinicians responding to a survey regarding communication practices between emergency physicians and nurses.

	Emergency physicians (N=34)	Emergency nurses (N=81)
How often on shift do you experience poor or ineffective emergency physician-nurse (EP/EN)?		
Never	1 (3.0%)	5 (6.49%)
1-4 times per shift	26 (78.8%)	60 (77.9%)
5-10 times per shift	6 (18.2%)	11 (14.9%)
>10 times per shift	0 (0.0%)	1 (1.3%)
How often does poor or ineffective EP/EN communication adversely affect patient care?		
Never	0 (0.0%)	6 (7.8%)
Sometimes	27 (81.8%)	53 (68.8%)
Often	5 (15.2%)	17 (22.1%)
Always	1 (3.0%)	1 (1.3%)
How often does poor or ineffective EP/EN communication prevent the ED clinical team from functioning?		
Never	0 (0.0%)	4 (5.2%)
Sometimes	14 (42.2%)	39 (50.7%)
Often	16 (48.5%)	31 (40.3%)
Always	3 (9.0%)	3 (3.9%)
How often does poor or ineffective EP/EN communication affect the trust you place in the individual?		
Never	2 (6.0%)	9 (11.7%)
Sometimes	19 (57.6%)	37 (48.1%)
Often	11 (33.3%)	29 (37.7%)
Always	1 (3.0%)	2 (2.6%)
How often does poor or ineffective EP/EN communication affect the trust you place in most EPs/ENs?		
Never	15 (45.5%)	32 (41.60%)
Sometimes	17 (51.5%)	37 (48.1%)
Often	1 (3.0%)	7 (9.1%)
Always	0 (0.0%)	1 (1.3%)
How much are non-verbal behaviors a factor in effective team communication in the ED?		
Never	0 (0.0%)	0 (0.0%)
Sometimes	7 (21.2%)	43 (55.8%)
Often	23 (69.7%)	27 (35.1%)
Always	3 (9.0%)	7 (9.1%)

EN, emergency nurse; EP, emergency physician; ED, emergency department.

and prevented the medical team from functioning well. Poor EN/EP communication was felt to affect both the trust afforded the individual dyad and “sometimes” the trust afforded the entire discipline. Non-verbal behaviors were felt to impact communication interactions.

Focus Group Results

Qualitative analysis identified six major themes, summarized along with representative quotes in Table 3.

Theme 1: Situations, built physical environment, and medium of communications all impact quality of communication.

Participants observed that certain clinical situations tend to be associated with more effective communication, for example, acute resuscitations where all parties are physically and temporally close, while other situations tend to have poorer communication, notably patients boarding for prolonged periods in the ED with transitions between multiple care teams. Further, situational elements influence consistent communication. For example, if a group of ENs is talking, the EP may be less likely to interrupt and communicate with the specific EN about a specific patient. Both disciplines identified preferences with regard to means of communication. Face-to-face communication was most appreciated. Common work areas facilitated communication through proximity and presence. Telephone communication was felt to be the second-best option, although concerns about inopportune timing of calls and task interruption from calls were raised by both disciplines. Electronic communications (chart communications, nursing orders, or “sticky notes”) through the EHR had ease-of-use advantages and potential for positive communication; however, it could also cause conflict. Electronic communications were felt to have the greatest risk of misinterpretation, as well as the highest risk of being ignored or missed by the receiving party. However, it was felt to be a non-intrusive way to communicate simple messages (for example, “labs are back,” or “pain medicine ordered”). Other technologies (video chat, voicemail) were not thought to be practical in the ED.

Theme 2: Core elements of desired professional communication include respect, closed-loop communication, and attention, often conveyed through non-verbal behaviors.

Participants identified communication components important for effective information transfer and the EN/EP relationship, including specific verbal and non-verbal actions. Conveying respect for colleagues, recognizing the training and experience of the other person, explicitly acknowledging receipt of communication, and physically demonstrating listening were mentioned by both disciplines as necessary components communication. Nonverbal behaviors were noted to impact the quality of communication. Making eye contact, turning toward a speaker, and nodding at appropriate moments to acknowledge active listening were positive behaviors

that conveyed respect and strengthened the relationship. Conversely, behaviors such as arm crossing, continuing typing while someone is talking, and not making eye contact or eye-rolling were noted to have negative impacts on the EP/EN relationship. Traditional medical hierarchy has physicians at the top and nurses in subordinate roles.¹⁴ Participants agreed that although this traditional dynamic is changing, persisting manifestations such as lack of respect toward nurses from physicians can make effective communication difficult for nurses.¹⁴ Participants agreed both parties share communication responsibility and that both disciplines have challenges initiating and sustaining good communication with one another.

Theme 3: Poor communication begets poor communication in later interactions.

Participants reflected that the absence of Theme 2 critical elements may beget communication hesitance, resulting in poor communication and team disconnect. Participants shared that ENs with information may hesitate to relay the information to an EP if there has been a prior negative interaction with that EP, or with physicians in general. Additionally, EPs may not share information they have with ENs if they do not believe that there is an immediate need for the EN to know that detail, losing the opportunity to exchange further information.

Theme 4: Effective communication is seen as fundamental to patient care but also has impacts beyond patient care.

Both disciplines agreed communication is critically important for team dynamics that translate into the quality of care that patients receive. Participants described key roles of effective communication, including creating a shared understanding of the patient’s clinical status and care plan, guiding their clinical actions, and affecting their ability to communicate with patients and families. Participants expressed that poor communication leads to decrements in care, not just for the immediate patient, but potentially for all patients cared for by the EN/EP dyad. Participants also noted that perceived positive or negative communication had spillover effects, impacting care beyond any single case, as it affects the “feeling” of the entire department.

Theme 5: Clinician gender and gender dyads influence communication dynamics.

Age was downplayed as a positive or negative impact factor with experienced EPs/ENs having good and bad communication habits in equal portions. Experience working together did tend to lead toward positive communication. Sex seemed to play a role in communication dynamics. The greatest communication conflict (noted by both disciplines) involved communication in female/female physician/nurse dyads. Male/male communication dyads had the least perceived conflict, with males often finding commonalities to

Table 3. Summary of themes with illustrative quotes from focus groups examining communication between emergency physicians and emergency nurses.

Theme	Illustrative quote(s)
1: Situations, built physical environment, and medium of communications all impact quality of communication.	Physician 5 – “It is a challenge where the departments are set up [with] nurses and the doctors [seated] in separate areas ... doctors’ room on the side and then like the nurses’ on the back hallway ... it’s hard to communicate with the nurses [because] I can’t just look up and see them.”
2: Core elements of desired professional communication include respect, closed-loop communication, and attention, often conveyed through non-verbal behaviors.	Physician 3 – “making eye contact and facing the person that you’re talking with is a great concept” Nurse 4 – “stopping and turning away from the computer for a second if you need to be heard is a clear sign of respect.” Physician 4 – “If someone is talking to you, give them the respect of looking at them, [and] turning around.”
3: Poor communication begets poor communication in later interactions	Nurse 2 - “It was told to me that I was completely off base... I should go away. Maybe it would [be] safer and better for the patient if me and this doctor stopped talking to each other.” Nurse 2 - “There’s people whose ego is there and if they have a nurse telling them what to do, then they absolutely will not do what is being said to the point of where safety is completely compromised. I need to stop talking to this person, they need to figure it out on their own, because talking to them now is actually making them dig in more.”
4: Effective communication is seen as fundamental to patient care but also has impacts beyond patient care	Nurse 1 - “Communication... is... the most important [thing] in regard to patient care. More so than actual knowledge... simply because if you work with someone who isn’t a great communicator then it’s really hard to fully understand what’s expected next of you and [to] communicate what we’re seeing to a physician or a team that isn’t otherwise at bedside.” Nurse 5 - “Her [physician] coming up to me and explaining why she wants to go this way -- or that way -- feels inviting for me to contribute, and to have open communication with the patient.” Physician 1 - “Team communication is critical to our job and it’s implicit in what we do every day. Without it, there are significant roadblocks and things are less efficient, but only if you have clear communication amongst the whole team. Plans are more quickly seen through. Patient outcomes, I think, are better and it gives a feeling of the department working as a whole and not just individuals providing care.”
5: Clinician gender and gender dyads influence communication dynamics, age and experience dyads did not.	Physician 5 - “I think the more communication errors I perceived are just the small ones that don’t affect the patient care directly but they affect relationships in the department. And again, it gets back to the trust and respect thing.” Physician 2: “I think that males can be assertive without being perceived as bitchy. I think that female-to-female interaction between a ... female team leader physician and ... female nurse, I think that that dynamic actually can sometimes be more tense.” Nurse 3: “There’s so much more ... casual sports conversations that go on between the male nurses and the male docs. And you see ... so much more communication happen between them, even about ... patients ... I’ve definitely had feelings of ... like I can’t even talk to you right now, or I’m not part of this group right now”

Table 3. Continued.

Theme	Illustrative quote(s)
6: Techniques for effective communication can be implemented.	Physician 3: “There are courses like TeamSTEPPS that can help with communication, I don’t know that they are specific to emergency medicine, though.”

discuss or bond over that are outside patient care and medical work. Male/female EN/EP or EP/EN combinations were not perceived to have excessive communication challenges.

Theme 6: Techniques for effective communication can be implemented.

Participants identified structured learning activities and techniques that might contribute to more effective communication behaviors in the ED. Activities mentioned include programs like TeamSTEPPS or American Heart Association life support classes. Specific techniques mentioned include closed-loop communication, creating a shared mental model, and asking clarifying questions. However, as identified under Theme 1, such learning activities are focused on high-acuity situations (eg, resuscitations) and not routine care of more stable and long-term patients.

DISCUSSION

Our multisite, exploratory mixed-methods study of EPs/ ENs communication demonstrated that both disciplines consider communication vital to high-quality care, yet it is often inadequate. ENs/EPs share views on the occurrence of communication failures and impact on patient care, shared perspectives on characteristics of effective communication and responsibility for communicating well, effect of communication on the team’s “feel” at work, and the need for better communication outside episodic resuscitation care (where existing communication training tends to focus). Most participants felt communication gaps had a significant impact on patients and team dynamics and that non-verbal communication affects the quality and perception of communication. The persistence of hierarchies and lack of respect and recognition of knowledge and experience were felt more heavily among ENs.

Current literature recognizes communication as vital to patient care, and poor or lacking communication can have detrimental effects on patient outcomes.^{19,20} Our study corroborated previous findings in other settings. We identified times when communication was highly effective, with positive returns in care, including in-person episodes of acute team-based care. In-person communication continued to be the most common and preferred means of communicating, despite advances in technologies.²¹

Respondents observed that sex and nurse/physician sex dyads do affect inter-disciplinary communication, consistent with prior literature. In a study of nurse and resident

physicians, Manchada et al found that female/female EN/EP interactions can be strained,² more than male/male (EN/EP) or female/male EN/EP (or EP/EN) relationships. They found that ENs and resident EPs often had differences in communication perception, with nurses feeling more comfortable asking for clarification from female resident EPs, while female resident EPs perceived questioning their care in a way male emergency resident physicians did not experience. While we did not purposefully over-sample or have built-in probes about sex dynamics, we note that our sample was disproportionately women, potentially creating an environment where such issues might be more comfortably verbalized.

In the questionnaire, both disciplines indicated poor communication affects the trust of the individual and sometimes their discipline as a whole; within focus groups, participants elaborated how poor communication initiates a cascade of effects on patient safety, team function, and interpersonal relationships. On a positive note, respondents identified existing trainings and learnable communication behaviors, suggesting teams can improve identified communication issues. Further study is needed to evaluate how to advance behaviors enhancing EN/EP communication and relationships, how the physical space and technology can be optimized to facilitate effective communication, and optimal training to establish and sustain effective communication.

LIMITATIONS

There are limitations to our study. Due to the anonymized nature of the survey, we were unable to confirm there were no repeat responders. Among those who self-identified for the focus groups, there were no repeat responders. Response rates were modest, potentially limiting generalizability. Surveying within the study team’s own group may have biased the sample in either direction (eg, encouraging or discouraging participation due to familiarity); anonymity guarded against concerns of privacy and confidentiality. However, the sample was robust compared to other studies of its kind, and the heterogeneity of responses suggests capture of a wide range of experience and perspectives. While our sample had heterogeneity in terms of setting, the data represents a single state, and findings could be limited to this region. Given the universality of many aspects of emergency care in the US, we suspect few observations were uniquely local. Our sample was not racial or ethnically diverse; while it is representative of the workforce demographics in this study, it limits the

generalizability and identification of intersectional elements of communication in the ED setting. The communication impact of sex dynamics was an unexpected finding; however, only traditional male and female roles were explored, and non-binary gender identities were not discussed.

CONCLUSION

Emergency nurses and emergency physicians across four EDs described communication failures as common and significant to patient care. This study identified characteristics and modalities of effective communication, complex factors influencing communication, including clinician sex dynamics and type of care, and emphasized the impact on the whole department impact of communication quality.

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Factors Associated with Patients Leaving Without Being Seen in a Canadian Emergency Department

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Introduction: Patients leaving without being seen is a critical quality metric for emergency department (ED) performance and is associated with negative patient outcomes and operational inefficiencies. In this study we aimed to systematically assess patient- and system-level factors influencing leaving-without-being-seen behavior.

Methods: We conducted a retrospective cohort study at The Ottawa Hospital, a tertiary-care ED with 85,000 annual ED visits in Ottawa, Canada. We analyzed all patient encounters for two years from May 2022–April 2024. Variables included demographics characteristics (age, sex), visit specifics (arrival day and time, Canadian Triage and Acuity Scale [CTAS] scores, presenting complaints), and operational metrics (ED occupancy metrics). Multivariate logistic regression analyses evaluated the influence of these factors on rates of leaving without being seen.

Results: Of 170,536 ED visits, 15,473 (9.1%) patients left without being seen, and 2,716 (1.6%) left before triage. Each additional 10 years of age reduced the adjusted odds of leaving without being seen by 20.2% (older patients left less frequently). Male patients had 9.4% higher adjusted odds of leaving without being seen compared to females. For every five patients waiting to be seen, the adjusted odds of leaving increased by 16.9% for a newly arriving patient. For every five patients already seen but awaiting disposition, the adjusted odds of leaving increased by 9.6% for a newly arriving patient. Compared to CTAS 2 patients (high acuity), CTAS 3 patients had 67.1% higher adjusted odds of leaving, CTAS 4 patients had 134% higher adjusted odds, and CTAS 5 patients (lowest acuity) had 176% higher adjusted odds of leaving.

Conclusion: Younger age, male sex, lower acuity, and ED crowding independently and significantly increase rates of leaving without being seen. Importantly, both crowding and volume of patients waiting impact left-without-being-seen behaviour. Optimizing patient flow through strategic movement within the ED may enhance the perception of progress, encouraging patients to remain for care. [West J Emerg Med. 2026;27(1)99–103.]

INTRODUCTION

Patients leaving without being seen is a key indicator of emergency department (ED) quality. High rates of leaving without being seen (LWBS) are associated with poor outcomes.¹ Understanding the factors influencing LWBS

behaviour can inform targeted interventions to improve patient care. The decision to leave without being seen can involve patient- and system-level factors. Studies show that age, sex, and acuity affect patients' urgency perceptions and willingness to wait.^{2,3} Operational factors, like time of day and crowding,

also influence the likelihood of leaving without being seen.⁴⁻⁶ Additionally, characteristics such as higher volume EDs, and being a trauma hospital or teaching center, are associated with higher LWBS rates.^{7,8} Understanding the relative influence of these factor can identify at-risk populations and guide strategies to reduce these rates.

In this study our goal was to assess the factors affecting patients who leave without being seen by a physician and to quantify their relative impact. We aimed to provide a comprehensive overview that can support targeted quality improvement efforts to reduce LWBS rates and improve patient safety.

METHODS

Study Design and Time Period

This single-center, retrospective cohort study included all ED visits from May 1, 2022–April 30, 2024. No patients were excluded. This study was granted a quality improvement exemption by the The Ottawa Hospital Research Ethics Board.

Study Setting and Population

We conducted this study at the The Ottawa Hospital General Campus in Ottawa, Canada. It is a regional, tertiary-care and cancer center with approximately 85,000 annual ED visits. The department has 73 beds, with five beds for ambulatory fast-track patients and 24 for the remaining ambulatory patients. The ambulatory section has a secondary internal waiting room for patients after assessment to await results. The hospital uses the electronic health records system Epic (Epic Systems Corporation, Verona, WI).

Outcome Measures

Our primary outcome measure was the proportion of patients who leave without being seen by a physician.

Data Collection

We collected data for all ED visits over a two-year period. A centralized database compiled information on the following: 1) demographic characteristics (age and sex); 2) visit characteristics (day and hour of arrival, Canadian Triage and Acuity Scale [CTAS] score, presenting complaint using the Canadian Emergency Department Information Systems chief complaint list, and disposition); and 3) operational characteristics (number of patients waiting to be seen and the number of patients who have been seen already but await a disposition at the time of a patient's arrival).

Data Analysis

We used multivariate logistic regression to assess the impact of these variables on LWBS rates. Independent variables included age, sex, day/hour of arrival, CTAS score, presenting complaint (shortlisted to the top 10 individual complaints or "other," including all other presentations), the number of patients waiting to be seen, and those already seen

Population Health Research Capsule

What do we already know about this issue?
Patients leaving without being seen reflects ED quality and is linked to worse health outcomes.

What was the research question?
This study quantified how patient- and system-level factors affected the likelihood of patients leaving without being seen.

What was the major finding of the study?
ED crowding, younger age, male sex, and lower acuity increased these rates. An increase in the number of patients waiting raised the odds of leaving by 16.9% (OR 1.168, 95% CI, 1.161-1.177; $P < .001$).

How does this improve population health?
Reorganization of the ED could enhance the perception of progress to make waiting more tolerable.

but awaiting disposition at the time of patient arrival. Analyses were conducted using R v4.4 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Of 170,536 encounters, 2,716 patients (1.6%) left prior to triage, 15,473 (9.2%) left without being seen, and 152,347 (90.8%) were seen by a physician. Among those assessed, 27,954 (18.3%) were admitted. The mean patient age was 50 years (SD 21), and 45.7% were male. The most common presenting complaints were abdominal pain (9.5%), shortness of breath (5.0%), chest pain (4.1%), generalized weakness (4.0%), and lower extremity injury (3.2%). Of those who left without being seen, the mean age was 41 years (SD 18). Despite making up 45.7% of patients, males made up 46.8% of those who left without being seen. For all patients, the most common presenting complaints amongst those leaving without being seen included abdominal pain (8.6%), chest pain (4.3%), headache (3.7%), shortness of breath (3.7%), and substance misuse/intoxication (3.7%).

The adjusted odds ratio of leaving without being seen for the top 10 most common presenting complaints are shown in the Table compared to the most common presenting complaint of abdominal pain. Age was negatively associated with leaving; each additional 10 years had a 20.2% decrease in odds (OR, 0.798, 95% CI, 0.790-0.805; $P < .001$). Males were 9.4% more

Table. Adjusted odds of leaving without being seen by categorical factors among emergency department patients in a large, urban Canadian retrospective cohort study.

Factor	Percentage of all visits	Percentage of LWBS	Probability of LWBS	Adjusted odds ratio [95% CI]
Presenting complaint				
Headache	2.3%	3.7%	14.2%	1.80 [1.61-2.01]
Vomiting and/or nausea	2.4%	3.1%	11.4%	1.31 [1.16-1.47]
Other	59.9%	63.9%	9.6%	1.13 [1.06-1.21]
Chest Pain (cardiac features)	4.1%	4.3%	9.1%	1.83 [1.64-2.04]
Lower extremity pain	3.1%	3.0%	8.5%	1.05 [0.94-1.18]
Back pain	3.0%	2.9%	8.4%	1.19 [1.06-1.34]
Abdominal pain	9.5%	8.6%	8.0%	1.00
Upper extremity injury	2.6%	2.1%	7.1%	0.65 [0.57-0.75]
Lower extremity injury	3.2%	2.5%	7.0%	0.65 [0.58-0.74]
Shortness of breath	5.0%	3.7%	6.5%	1.00 [0.90-1.12]
Weakness – generalized	4.0%	2.2%	4.8%	0.83 [0.72-0.94]
Time of arrival				
Day (7 AM – 5 PM)	58.3%	34.7%	5.4%	1.00
Evening (5 PM - 12 AM)	29.2%	45.9%	14.4%	2.94 [2.82-3.05]
Night (12 AM – 7 AM)	12.5%	19.3%	13.9%	4.95 [4.69-5.23]
CTAS				
CTAS 1 (highest acuity)	0.7%	0.1%	1.5%	0.19 [0.11-0.32]
CTAS 2	23.0%	18.1%	7.0%	1.00
CTAS 3	55.7%	54.5%	8.7%	1.67 [1.59-1.76]
CTAS 4	13.2%	18.0%	12.2%	2.34 [2.20-2.50]
CTAS 5 (lowest acuity)	5.2%	7.8%	13.5%	2.76 [2.55-2.99]
Sex				
Female	54.1%	53.0%	8.8%	1.00
Male	45.8%	46.7%	9.2%	1.09 [1.06-1.13]

CTAS, Canadian Triage and Acuity Scale; LWBS, leaving without being seen.

likely to leave compared to females (OR, 1.094, 95% CI, 1.057-1.13; $P < .001$). Patients arriving on Mondays and Tuesdays were less likely to leave without being seen compared to other days. Those arriving in the evening and night were more likely to leave without being seen compared to those arriving during the day. An increase of five patients in the number waiting to be seen raised the odds of leaving by 16.9% (OR, 1.169, 95% CI, 1.161-1.177; $P < .001$). An increase of five patients in the number of patients already seen but awaiting disposition raised the odds of leaving by 9.6% (OR, 1.096, 95% CI, 1.087-1.104; $P < .001$). Compared to CTAS 2 patients, CTAS 3 patients had 67.4% higher odds of leaving (OR 1.674, 95% CI, 1.590-1.763; $P < .001$), CTAS 4 patients had 134.6% higher odds (OR, 2.346, 95% CI, 2.201-2.500; $P < .001$), and CTAS 5 patients had 176.6% higher odds of leaving (OR, 2.766, 95% CI, 2.551-2.999; $P < .001$).

For those who left before triage, age was negatively associated with leaving; each additional 10 years had a 21% decrease in odds of leaving (OR, 0.79, 95% CI, 0.78–0.81, $P < .001$).

Males were 9% more likely to leave compared to females (OR, 1.09, 95% CI, 1.06-1.13, $P < .001$). Patients arriving on Mondays and Wednesdays were less likely to leave before triage compared to other days. Patients arriving in the evening (5 PM–12 AM) had 57% higher odds of leaving before triage compared to daytime arrivals (7 AM–5 PM) (OR, 1.57; 95% CI, 1.45–1.71, $P < .001$). Those arriving overnight (12 AM–7 AM) posed an even greater risk, with 121% higher odds of leaving before triage (OR 2.21, 95% CI, 1.95-2.50, $P < .001$). An increase of five patients in the number waiting to be seen raised the odds of leaving before triage by 14% (OR 1.14, 95% CI, 1.13-1.16, $P < .001$). An increase of five patients in the number of patients already seen but awaiting disposition raised the odds of leaving before triage by 10% (OR 1.10, 95% CI, 1.08-1.22, $P < .001$).

DISCUSSION

Interpretation of Findings

Younger adults and patients with lower acuity

presentations were more likely to leave without being seen. Men had a 9% higher adjusted odds ratio of leaving; however, they were only 0.4% more likely to leave, which is of questionable clinical significance. Arrivals on Mondays and Tuesdays had the lowest odds of leaving without being seen. Both the number of patients waiting and the number that had been seen awaiting disposition significantly increased LWBS rates. It is likely that patients perceive crowding by the number of people physically in the waiting room and by their witnessing of access block into the ED with less movement of new patients from the waiting room into the ED for assessment. Patients may be more tolerant of waits if they observe movement and less tolerant in a static waiting room.

Comparison to Previous Studies

Our findings align with prior studies showing that men, younger adults, and low-acuity patients are more likely to leave without being seen.^{3,8,9} Lower acuity remains one of the most consistent predictors of LWBS.⁹ Our data also support a well-established link between ED crowding and higher LWBS rates.⁶ Consistent with established literature, we found a clear association between longer wait times and increased LWBS rates, emphasizing the effect of operational pressures and broader institutional issues.¹⁰

Health Systems Implications

Recognizing that patients tolerate waiting better when they perceive movement,¹¹ EDs should promote patient-flow strategies to possibly reduce the rate of patients leaving without being seen. Strategies like transitioning patients through different zones can create an impression of forward momentum, reducing LWBS rates without changing actual wait times.¹¹ Patients who remain stationary early in their visit feel more anxious and disengaged, as they perceive they are “not in the system yet.”¹² Designated intake or transition zones could reinforce engagement, and integrating such design and operational strategies may improve patient experience, enhance throughput, and reduce leaving without being seen rates.

Further, since acuity level remains such a strong predictor of patients leaving without being seen, having dedicated areas of the ED for low-acuity presentations may improve throughput and decrease this population’s rate of leaving. Patients arriving during overnight and early morning hours had the highest probabilities of leaving without being seen. These off-peak hours are typically associated with lower levels of physician staffing, suggesting that aligning staffing models more closely with arrival pattern data may mitigate leaving-without-being-seen behaviour by reducing wait times during high-risk periods.

Research Implications

Further research should explore psychosocial factors influencing patients’ decisions to leave without being seen,

such as perceived urgency, past healthcare experiences, access to timely primary care, and individual tolerance for waiting. Future trials testing interventions addressing these factors may offer solutions to decrease LWBS rates. The correlation between crowding and LWBS rates observed in our study emphasizes the need for further research to assess both ED-specific inefficiencies and system-wide challenges to mitigate rates of leaving without being seen and improve overall patient care. While most efforts target actual wait-time reduction, insights from queuing theory and social science suggest improving the perception of waiting may be equally valuable.¹¹ Operational strategies should be investigated to improve the perception of progress of patients waiting to lower the rates of leaving without being seen.

LIMITATIONS

This study’s comprehensive dataset from a busy, tertiary-care hospital strengthens its findings. However, as a single-center study, findings may not generalize to other settings. Local triage practices could influence presenting complaint categorization. We did not study or present any patient outcomes of the patients who left without full ED evaluation. Some factors that may influence leaving without being seen were not studied, such as arrival method. While our ED does not use an internal waiting room, EDs with such a layout may experience different patterns of LWBS behaviour than those shown in this study.

While the number of boarders may influence ED flow, our dataset only captured boarder counts at a fixed daily time point rather than dynamically at the time of each new patient’s arrival. In a univariate analysis, boarder count was moderately correlated with the number of patients already seen but awaiting disposition at the time of the new patient’s arrival (r 0.56). Due to this limitation and the potential for collinearity, we excluded boarder count from the final model.

CONCLUSION

This study quantifies the impact of various factors on the behaviour of patients who leave without being seen. Patients of younger age, male sex, with lower triage acuity, and who arrived during the evening and night had higher odds of leaving without being seen. Importantly, both the volume of patients waiting and crowding in the ED, impact LWBS behaviour negatively. Optimizing patient flow through strategic movement within the ED may enhance the perception of progress, encouraging patients to remain for care.

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Impact of Alcohol Intoxication on Mortality and Emergency Department Resource Use in Suicidal Patients

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Introduction: In North America, suicide ranks among the top causes of death in individuals 15-60 years of age. In this study we aimed to determine whether an emergency department (ED) presentation for suicidal behaviors accompanied by acute alcohol intoxication was associated with increased six-month suicide or all-cause mortality compared to non-intoxicated presentations of suicidal behaviors.

Methods: We performed a retrospective cohort study of adults (≥ 18 years) presenting to 16 EDs in Alberta, Canada, between April 2011–March 2021. Suicidal attempt or self-harm was identified via International Classification of Diseases codes, 10th Rev, Canadian Enhancement (ICD-10-CA). Patients were classified as acutely intoxicated if they had relevant ICD-10-CA codes or a blood alcohol concentration ≥ 2 millimoles per liter (9.2 milligrams per deciliter). We excluded patients who died on arrival, were transferred, or were non-residents. The primary outcome was suicide-specific mortality at six months; secondary outcomes included all-cause mortality, use of involuntary holds, psychiatric consultations, admissions, and ED return visits. Median differences with 95% confidence intervals and unadjusted odds ratio (OR) with 95% CI were reported for continuous and categorical variables, respectively.

Results: Among 58,051 suicidal or self-harm patients, 17,488 (30%) were classified as intoxicated. Six-month suicide mortality was similar between intoxicated and non-intoxicated groups (0.3% each; adjusted sub-distribution hazard ratio = 0.98 [95% CI, 0.73-1.38]), indicating no significant association between alcohol intoxication and suicide-specific death. Intoxicated patients were more often male (58% vs 52%; OR 1.26 [1.22-1.31]), arrived by ambulance (70% vs 50%; OR 2.32 [2.23-2.41]), and were more frequently placed on involuntary holds (26% vs 16%; OR 1.92 [1.83-2.00]). They had fewer hospital admissions (10.8% vs 15.4%; OR 0.63 [0.60-0.67]), longer ED stays (411 vs 277 minutes; median difference = 134 minutes [127.7-140.3]), and higher ED return rates at 30 days (19.8% vs 18.3%; OR 1.10 [1.05-1.15]) and six months (45.8% vs 42.1%; OR 1.16 [1.12-1.20]).

Conclusion: Acute alcohol intoxication among ED patients presenting with suicidal behaviors was not independently associated with higher six-month suicide mortality. Patients with acute alcohol intoxication had increased use of involuntary holds, longer lengths of stay, and more frequent ED return visits. Future work should explore other psychosocial and clinical factors, including substance use and psychiatric comorbidities, that may influence outcomes beyond the acute setting. [West J Emerg Med. 2026;27(1)104–113.]

INTRODUCTION

Death by suicide is an international public health concern, especially among younger adults in their prime years of life. In North America, it ranks among the top causes of death in individuals 15-60 years of age, posing substantial societal and economic costs.^{1,2} Alcohol use disorder (AUD) is widely recognized as a risk factor for suicidal ideation, attempts, and completion.³⁻⁶ A population-based study in the United Kingdom found that alcohol-related hospital admissions conferred a markedly higher risk of suicide (hazard ratio [HR] 26.8) over six years.⁶ While a recent systematic review confirmed this association, the authors also noted a lack of research focusing on emergency department (ED) settings.⁷

Accurately identifying individuals at highest risk of suicide can be challenging, particularly when distinguishing acute risk factors, such as intoxication, from chronic comorbidities such as established AUD or depressive disorders.^{8,9} Although a study from Finland suggested that patients presenting to an ED with suicidal behavior and acute intoxication have lower six-month suicide mortality,¹⁰ other work indicates that acute alcohol use increases the likelihood of a suicide attempt, but does not clarify whether it affects subsequent deaths by suicide.^{11,12} Postmortem analyses have similarly yielded mixed findings on the prevalence of alcohol use among suicide decedents, further complicating the question of causation.¹³

To address the gap between well-documented chronic AUD risk and less-studied acute intoxication, we aimed to determine whether acute intoxication at the time of ED presentation for suicidal behavior increased six-month mortality (both suicide-specific and all-cause) and to describe ED transitions in care, including admissions, involuntary holds, and return visits. By leveraging a large, population-based database from an entire Canadian province of 4.3 million people, we sought to provide a more nuanced perspective on the role of acute alcohol intoxication in short-term outcomes among ED patients presenting with suicidality.

METHODS

Study Design and Setting

We performed a retrospective, cohort study using linked administrative databases from 16 EDs across two major catchment zones in Alberta, Canada. Each ED contributes standardized data on patient presentations to provincial databases. The University of Alberta Health Research Ethics Board approved this project (Pro00095789). The need for individual patient consent was waived due to the retrospective nature of the study.

Selection of Participants

All adult patients (≥ 18 years of age) presenting to one of the participating EDs with suicidal attempt or self-harming behavior between April 1, 2011–March 31, 2021 were eligible. We identified cases using *International Classification*

Population Health Research Capsule

What do we already know about this issue?

Chronic alcohol use disorder increases suicide risk, but mortality of patients presenting both intoxicated and suicidal to the emergency department (ED) is unknown.

What was the research question?

Does acute alcohol intoxication increase 6-month suicide mortality in suicidal ED patients?

What was the major finding of the study?

Six-month suicide mortality was 0.3% in both intoxicated and sober groups (adjusted hazard ratio 0.98, 95% CI, 0.73-1.38; $P = .94$).

How does this improve population health?

These findings clarify that acute intoxication alone does not increase short-term suicide risk, but this patient group requires more ED resources.

of Diseases, 10th Revision, Canadian Enhancement (ICD-10-CA) codes for suicidal attempt or self-harm (X60-X84, Y10-Y34, and X40-X49) in the first three diagnostic fields of the National Ambulatory Care Reporting System (NACRS). These codes have been previously validated to reliably identify patients with suicidal attempt (sensitivity of 44.8% [95% CI, 40.2-49.4] and specificity of 96.6% [95% CI, 95.9-97.2]) and self-harm behavior (sensitivity of 40.0% [95% CI, 36.2-43.9] and specificity of 98.2% [95% CI, 97.7-98.7]).¹⁴ The low sensitivity of these codes is an inherent challenge in all studies on suicide and is discussed further in the “Limitations” section. We excluded individuals who arrived in the ED but died immediately upon arrival, those transferred from another facility for admission or specialized care, and those not covered by the Alberta Health Care Insurance Plan (AHCIP) due to an inability to link them with other databases. For patients with multiple qualifying ED visits, only the first presentation during the study period was included. We excluded any ED encounters that could not be linked across both the NACRS and Edmonton/Calgary systems or had missing data.

Patients were classified as acutely intoxicated if they met at least one of the following criteria:

- An ICD-10-CA code specifically indicating acute alcohol use or intoxication (F10.0, R78.0, T51.0, X45, X65, Y15, Y90, Y91). These codes do not

capture chronic AUD but rather acute effects or poisoning.

- A blood alcohol concentration (BAC) ≥ 2 millimoles per liter (mmol/L) (9.2 milligrams per deciliter (mg/dL)) recorded during the ED encounter.

Given that not all patients underwent BAC testing and that measured levels can be influenced by time-to-test, this study included both clinical coding and laboratory data to minimize misclassification. There is the possibility that patients with alcohol intoxication might have been missed if neither code nor laboratory confirmation were available; similarly, not all coded patients may have had measured BAC. The value of 2 mmol/L (9.2 mg/dL) is the lowest detectable BAC with the assay used in Alberta. As the mean serum alcohol clearance occurs at a rate of 2–7 mmol/L per hour,¹⁵ it is unlikely that a patient would be clinically diagnosed as intoxicated with alcohol if their BAC was < 2 mmol/L. A common protocol in Alberta EDs is to measure BAC in those patients with suicide attempts or altered levels of consciousness. This helps guide the emergency physician in reassessing and refining their differential diagnosis. Breathalyzers are rare in Canadian EDs, are exclusively used by law enforcement, and their results are not part of the medical record.

Outcomes

The primary outcome was death by suicide within six months of the index ED visit, identified from provincial Vital Statistics records using *ICD-10-CA* underlying cause of death codes X60–X84. The six-month time frame was selected as it is the most commonly used period of time in studies regarding suicide behavior¹⁶ and represents the most at-risk period following an ED visit for suicidality.^{17,18} Secondary outcomes included all-cause mortality at 180 days, the proportion of ED patients placed under an involuntary mental health hold (Form 1 Admission Certificate) within ± 24 hours of their ED visit, the proportion of ED visits receiving a psychiatry consultation, hospital admission rates (encompassing both psychiatric and medical admissions), and the frequency of return ED visits at 30 days and at 180 days.

Data Sources and Linkage

We obtained data for this study from multiple administrative sources. The NARCS provided records for all ED encounters, including up to 10 diagnostic fields including most of the cohort data. The data undergoes chart abstraction by trained health record abstractors who follow guidelines set forth by the Canadian Institute for Health Information, while other information is interfaced directly from electronic health records, all of which are routinely used for administration research purposes in Alberta and Canada. Practitioner Claims data contained physician billing information and captured the use of involuntary hold codes (SOMB 08.12A). The Emergency Department Information

System (EDIS) and the Regional ED Information System (REDIS) supplied timestamps related to patient arrival, discharge, and any consultations. All patients seen in Canadian EDs receive a 5-level Canadian Triage and Acuity Scale (CTAS) score (1 = resuscitation; 2 = emergent; 3 = urgent; 4 = less urgent; and 5 = non-urgent) reflecting their severity at presentation and the timing of assessment. We used Alberta's Provincial Laboratory Data used to identify documented blood alcohol concentrations, while Vital Statistics provided information on dates and causes of death. Demographic data were obtained from the AHCIP registry (Provincial Registry). Patient information across these databases was linked deterministically via patient health card numbers. No manual chart review was performed. Any retrospective review is inherently subject to multiple sources of bias.^{19,20} Through the administrative design of this study's database, the automated and electronic nature of data entry, and the expertise of those performing data extraction and analysis, we sought to mitigate potential biases in the 10 areas where they are most likely to arise, as described by Kaji et al.²¹

Statistical Analysis

We described categorical variables with percentages, whereas continuous variables were reported with means and standard deviations for normally distributed variables or medians and interquartile ranges for non-normally distributed variables, as appropriate. For this study population, we compared the differences in those variables between patients with and without alcohol intoxication. Median differences with 95% confidence intervals and unadjusted odds ratio (OR) with 95% CI were reported for continuous and categorical variables, respectively.

We used the Fine and Gray multivariable competing risk model to estimate the hazard ratio (HR) of death from suicide within 180 days of the index ED visit.²² In this model, death from all-cause was considered as a competing risk since it eliminates the risk of death from suicide. We calculated the follow-up time as the number of days between the index ED visit date and the death date within 180 days or was censored at 180 days if the patient did not die. Univariate and multivariable competing risk models were run for all pre-selected variables of interest including age, sex, involuntary hold status, and presence of alcohol intoxication. We reported the unadjusted and adjusted sub-distribution HRs and the corresponding 95% CI. Other key risk factors (eg, comorbid psychiatric diagnoses, other substance use) were not reliably available in these administrative data and could not be included. We conducted all data analyses in SAS v9.4 (SAS Institute, Inc., Cary, NC). A *P*-value of < 0.05 was considered significant.

RESULTS

During the 10-year study period, 102,922 patients ≥ 18 years of age presented to participating Alberta EDs with

diagnostic codes indicating a suicidal attempt or self-harm. Of these, 44,871 were excluded for reasons such as non-Alberta residency, death upon arrival, transfer from another institution for admission, missing data, or missing linkage information, leaving 58,051 eligible patients for analysis (Figure 1). Among the final cohort, 17,488 (30%) were identified as acutely intoxicated with alcohol based on our case definition.

Baseline demographic and clinical characteristics are provided in Table 1. The overall median age was 34 years (IQR 24–48), and 53.5% of the patients were male. Compared with those who were not intoxicated, patients in the alcohol-intoxicated group more frequently arrived by ambulance (69.2% vs 49.3%; OR 2.32 [95% CI, 2.23–2.41]) and were more often male (57.5% vs 51.8%; OR 1.26 [95% CI, 1.22–1.31]). There was minimal difference in CTAS distribution between the two groups, with most patients triaged as CTAS levels 2 or 3.

A total of 671 patients (1.2% of the full cohort) had an ED visit for suicidal ideation (*ICD-10-CA* R45.8) within the six months preceding their index visit for self-harm or suicide attempt. This prior visit for suicidal ideation was more common among patients who were intoxicated at the time of their index presentation compared to those who were not (1.5% [256/17,488] vs 1.0% [418/40,563]; $P < .001$).

The median ED length of stay (LOS) was longer for the intoxicated group (411 minutes [IQR 255–640]) than for the non-intoxicated group (277 minutes [IQR 158–486]). Management patterns in the ED differed between groups, as shown in Table 2. Among intoxicated patients, 26% were placed under an involuntary mental health hold, compared with 16% of those who were not intoxicated (OR 1.92; 95% CI, 1.83–2.00). Psychiatric consultations were recorded for 15.8% of the intoxicated group vs 12.6% of the non-intoxicated group (OR 1.31; 95% CI, 1.24–1.37). Although a higher proportion of intoxicated patients received an involuntary hold, they had a lower hospital admission rate (10.8% vs 15.4%; OR 0.63; 95% CI, 0.60–0.67). Among patients who received an involuntary hold, the admission rate was 19% for the intoxicated group vs 40% for the non-intoxicated group (OR 0.35; 95% CI, 0.32–0.38), a difference illustrated in Figure 2. Return visits to the ED occurred in 19.8% of intoxicated patients and 18.3% of non-intoxicated patients at 30 days (OR 1.10; 95% CI, 1.05–1.15), increasing to 45.8% and 42.1%, respectively, at six months (OR 1.16; 95% CI, 1.12–1.20).

Mortality outcomes at six months are shown in Table 2. A total of 0.3% of patients in both the intoxicated and non-intoxicated groups died by suicide (OR 1.03; 95% CI, 0.75–1.40), and the median time from the index ED visit to

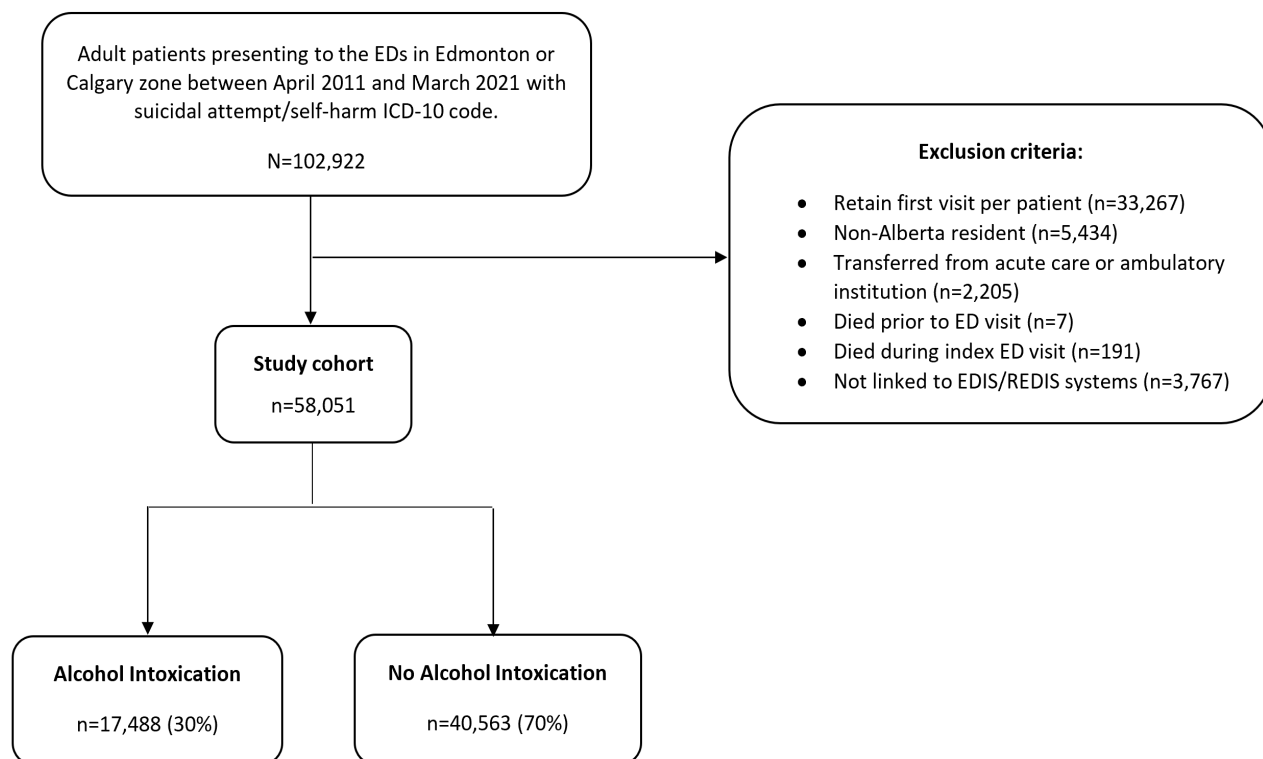


Figure 1. Flowchart showing derivation of the study cohort from 102,922 ED presentations for suicidal behavior to the final analytic sample of 58,051 patients, based on administrative data from 16 EDs in Alberta, Canada (2011–2021).

ED, emergency department. EDIS, Emergency Department Information System; ICD-10, International Classification of Diseases; REDIS, Regional Emergency Department Information System.

Table 1. Characteristics of patients presenting to the emergency department with suicidal behavior, stratified by alcohol intoxication status, in a retrospective cohort study of 58,051 patients across 16 EDs in Alberta, Canada (2011–2021).

	Total N = 58,051	Patients intoxicated with alcohol n = 17,488	Patients not intoxicated with alcohol n = 40,563	Unadjusted OR (95% CI) or median differences (95% CI)
Age (years), median (IQR)*	34 (24, 48)	33 (24, 47)	34 (24, 49)	1.00 (0.73 – 1.27)
Male sex (n [%])	31,056 (53.5)	10,058 (57.5)	20,998 (51.8)	1.26 (1.22 – 1.31)
CTAS score (n [%])				
1 – resuscitation	4,049 (7.0)	1,658 (9.5)	2,391 (5.9)	1.80 (1.68 – 1.94)
2 – emergent	31,298 (53.9)	9,962 (57.0)	21,336 (52.6)	1.22 (1.17 – 1.27)
3 – urgent	16,821 (29.0)	4,671 (26.7)	12,150 (30.0)	Ref
4 – less urgent	5,354 (9.2)	1,131 (6.5)	4,223 (10.4)	0.70 (0.65 – 0.75)
5 – non-urgent	520 (0.9)	61 (0.3)	459 (1.1)	0.35 (0.26 – 0.45)
Missing	9 (0.0)	5 (0.0)	4 (0.0)	-
Arrived by ambulance (n [%])				
Ambulance	32,193 (55.5)	12,136 (69.4)	20,057 (49.4)	2.32 (2.23 – 2.41)
No ambulance	25,858 (44.5)	5,352 (30.6)	20,506 (50.6)	0.43 (0.42 – 0.45)

Note: *3 missing data.

CTAS, Canadian Triage and Acuity Scale; OR, odds ratio.

Table 2. Emergency department (ED) factors and post-discharge outcomes among patients presenting with suicidal behavior, stratified by alcohol intoxication status, in a retrospective cohort study of 58,051 patients across 16 EDs in Alberta, Canada (2011–2021).

	Total N = 58,051	Patients intoxicated with alcohol n = 17,488	Patients not intoxicated with alcohol n = 40,563	Unadjusted OR (95% CI) or median differences (95% CI)
Health service outcomes (n [%])				
Form 1 billing by clinicians ^a	11,005 (19.0)	4,613 (26.4)	6,392 (15.8)	1.92 (1.83 – 2.00)
Any consultations	15,770 (27.2)	4,688 (26.8)	11,082 (27.3)	0.97 (0.94 – 1.01)
Psychiatric consultation	7,858 (13.5)	2,764 (15.8)	5,094 (12.6)	1.31 (1.24 – 1.37)
Disposition (n [%])				
Discharged	44,825 (77.2)	14,525 (83.1)	30,300 (74.7)	Ref
Admitted	8,121 (14.0)	1,890 (10.8)	6,231 (15.4)	0.63 (0.60 – 0.67)
Transferred	1,862 (3.2)	463 (2.6)	1,399 (3.4)	0.69 (0.62 – 0.77)
LWBS	1,975 (3.4)	259 (1.5)	1,716 (4.2)	0.32 (0.28 – 0.36)
LAMA	1,268 (2.2)	351 (2.0)	917 (2.3)	0.80 (0.71 – 0.90)
ED length of stay in minutes, median (IQR)	317 (181, 544)	411 (255, 640)	277 (158, 486)	-134.0 (-140.3 to -127.7)
Return ED visits within 30 days (n [%])	10,902 (18.8)	3,468 (19.8)	7,434 (18.3)	1.10 (1.05 – 1.15)
Number of ED visits, median (IQR)	1 (1, 2)	1 (1, 2)	1 (1, 2)	-
Return ED visits within 30 days due to suicide attempt	1,841 (3.2)	605 (3.5)	1,236 (3.0)	1.14 (1.03 – 1.26)
Number of ED visits, median (IQR)	1 (1, 1)	1 (1, 1)	1 (1, 1)	-
Return ED visits within 6 months (n [%])	25,106 (43.2)	8,013 (45.8)	17,093 (42.1)	1.16 (1.12 – 1.20)
Number of ED visits, median (IQR)	2 (1, 3)	2 (1, 3)	2 (1, 3)	-

^a: Specialties for physicians with Form 1 claim overlapping with ED visit include full-time emergency physician, emergency medicine – specialty, psychiatry – specialty, general practice, and generalists mental health physicians (ED setting only).

“Form 1” refers to an involuntary mental health hold under the provincial Mental Health Act.

ED, emergency department; LAMA, leave against medical advice; LWBS, leave without being seen; OR, odds ratio.

Table 2. Continued.

	Total N = 58,051	Patients intoxicated with alcohol n = 17,488	Patients not intoxicated with alcohol n = 40,563	Unadjusted OR (95% CI) or median differences (95% CI)
Return ED visits within 6 months due to suicide attempt	5,005 (8.6)	1,800 (10.3)	3,205 (7.9)	1.34 (1.26 – 1.42)
Number of ED visits, median (IQR)	1 (1, 1)	1 (1, 1)	1 (1, 1)	-
Death within 6 months (all-cause) (n [%])	1,102 (1.9)	263 (1.5)	839 (2.1)	0.72 (0.63 – 0.83)
Death within 6 months due to suicide (n [%])	186 (0.3)	57 (0.3)	129 (0.3)	1.03 (0.75 – 1.40)
Time from first presentation to death by suicide, days, median (IQR)	17.5 (3, 68)	21 (3, 82)	16 (3, 66)	-5.0 (-25.8 to 15.8)

†: Specialties for physicians with Form 1 claim overlapping with ED visit include full-time emergency physician, emergency medicine – specialty, psychiatry – specialty, general practice, and generalists mental health physicians (ED setting only).

"Form 1" refers to an involuntary mental health hold under the provincial Mental Health Act.

ED, emergency department; LAMA, leave against medical advice; LWBS, leave without being seen; OR, odds ratio.

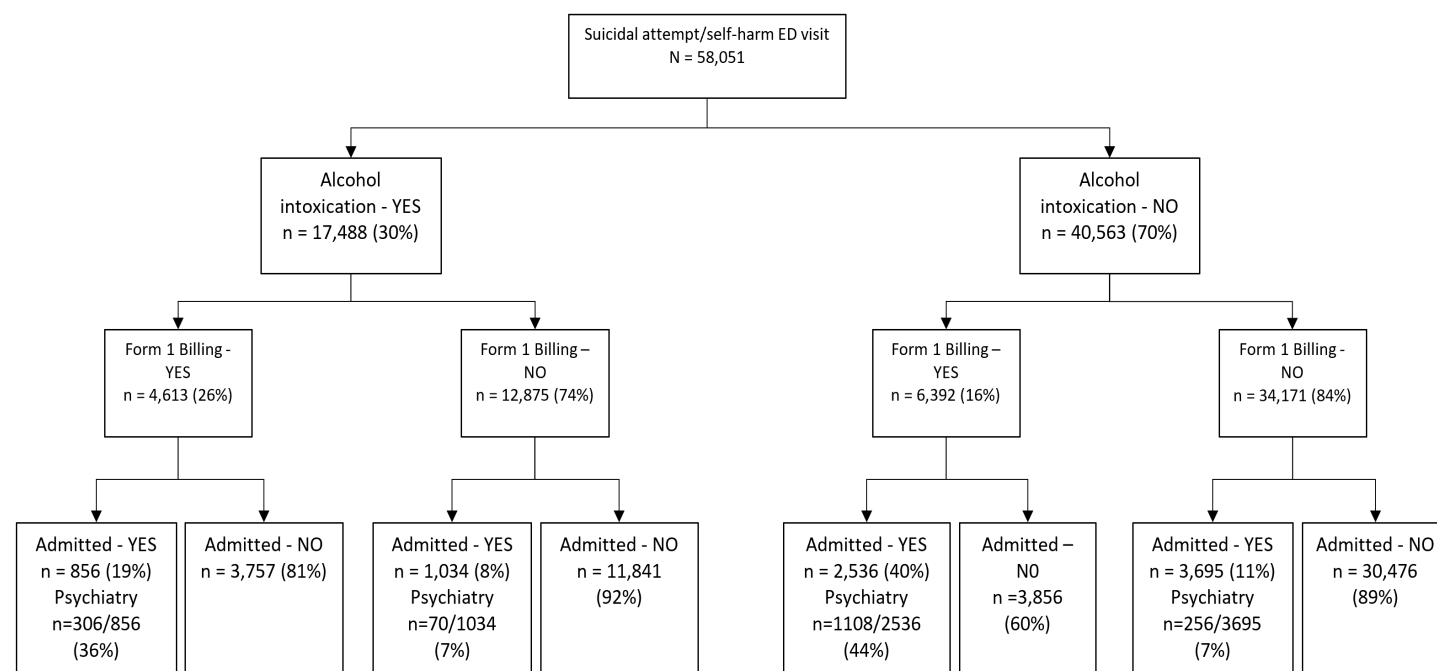


Figure 2. Breakdown of emergency department disposition outcomes among patients presenting with suicidal behavior, stratified by alcohol intoxication status, including rates of involuntary mental health hold, hospital admission, and psychiatric admission, in a retrospective cohort study of 58,051 patients across 16 EDs in Alberta, Canada (2011–2021).

FORM 1, involuntary mental health hold.

death by suicide was similar between groups (106 days [IQR 57–142] for intoxicated patients compared to 111 days [IQR 60–145] for non-intoxicated patients). All-cause mortality was 1.5% in the intoxicated group vs 2.1% in the non-intoxicated group (OR 0.72; 95% CI 0.63–0.83). Figure 3 presents the cumulative incidence curves for suicide-specific and all-cause mortality, with no statistically significant difference observed between the two groups in the death-by-suicide group but a significant early separation over the 180-day follow-up period for the all-cause mortality group. Supplementary Table

1 provides more extensive subgroup breakdowns for death by suicide and time to death while Supplementary Table 2 provides the subgroup unadjusted and adjusted HRs.

DISCUSSION

Key Findings

In this large, province-wide study of ED patients presenting with suicidal behaviors, acute alcohol intoxication was not associated with a significantly higher six-month risk of suicide-specific mortality compared to those who were not

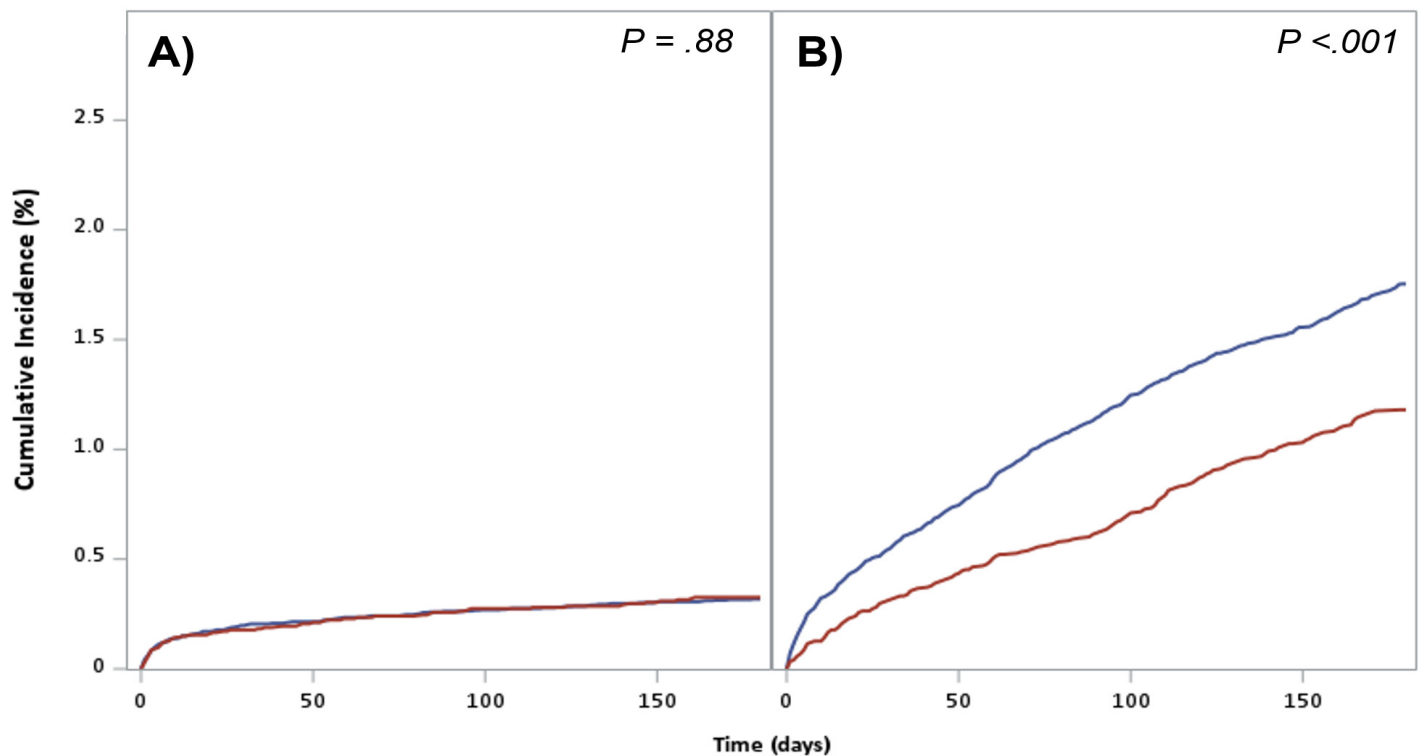


Figure 3. Cumulative incidence curves for six-month suicide-specific (A) and all-cause mortality (B) following emergency department (ED) presentation for suicidal behavior, stratified by alcohol intoxication status. Blue line indicates non-intoxicated patients while red line indicates intoxicated patients. Graphs are based on data from 58,051 patients across 16 EDs in Alberta, Canada (2011–2021).

intoxicated. This finding suggests that intoxication may not elevate suicide-specific risk beyond the already high baseline in this population. Although this finding might initially appear to contrast with the extensive literature linking chronic AUD to elevated suicide risk,^{3,5-7} it offers a more nuanced view of acute intoxication in the ED setting. This should not be interpreted as diminishing the well-established association between chronic AUD and suicide risk in the community. Instead, this finding is a reflection that in the acute ED context, intoxication does not appear to add additional short-term risk beyond an already high baseline. In particular, these results are consistent with studies indicating that acute alcohol use, in isolation, may not necessarily translate into increased short-term mortality.^{10,13} Rather than negating the established risks posed by chronic AUD, these data supplement existing knowledge by highlighting that the interplay between acute intoxication, ongoing alcohol misuse, and suicide risk may be more complex than previously recognized.

One possible explanation is that individuals who arrive intoxicated often undergo prolonged observation (including involuntary holds) to ensure they are cooperative and cognitively intact for a thorough psychiatric assessment.²³ In this study nearly one-fourth of intoxicated patients were placed under a hold, yet many of these patients were

ultimately discharged rather than admitted. These findings coincide with previous studies examining outcomes of intoxicated patients placed under involuntary holds.²⁴ It is plausible that intensive ED-based observation or acute interventions—such as brief crisis counseling or safety planning—could mitigate immediate suicide risk, particularly within the first few months post-ED visit.

Emergency Department Psychiatry Consultations and the Role of Emergency Physicians

In this cohort, most patients presenting to the ED for suicidal ideation or suicide attempt were managed without an in-ED psychiatry consultation. The proportion of psychiatric consults, however, was higher for those presenting with acute alcohol intoxication (15.8%) compared to the non-intoxicated group (12.6%). This small but significant difference is hypothesized to reflect a growing recognition among Canadian emergency physicians of the mortality impact of AUD on suicidality and highlights the physician's pivotal role in mental health management. Earlier research has raised concerns that acute alcohol intoxication might reduce the likelihood of an ED psychiatry consultation;²⁵ however, these data suggest a shift toward more frequent referral when intoxication is documented.

All-Cause Mortality and Potential Misclassification

When broadening the analysis to include all-cause mortality, we observed that patients who presented without acute alcohol intoxication were more likely to die in the subsequent six months. Although the overall six-month all-cause mortality for our cohort was 1.9%, this was only marginally higher than the background rate of 1.82% in the general ED population over the same period for ED patients in Alberta. This finding suggests that, even among a high-risk group such as those presenting with suicidality or self-harm, the absolute mortality risk remains close to that of typical ED patients. While this finding may reflect unmeasured confounders, such as chronic medical comorbidities or different patterns of substance misuse, it also raises questions about potential misclassification in cause-of-death reporting.²⁶ It is possible that some suicides in the non-intoxicated group were recorded under alternative categories, or that these patients succumbed to other conditions triggered or exacerbated by their suicidal crisis. Similar trends have been reported in previous population-based studies,²⁷ suggesting that temporal proximity to an ED visit for suicidality may be indicative of elevated risk for non-suicide external causes of death. Further investigation into the accuracy and methodology of provincial and federal suicide reporting systems could help clarify the true burden of suicide-related mortality in this population.

Extended Emergency Department Length of Stay and Recurrent Visits

Our results also confirm that acutely intoxicated patients with suicidality consume substantial ED resources. They had significantly longer LOS and were more likely to revisit the ED within 30 days and six months. Previous work has documented similar resource use patterns among patients requiring mental health evaluation while intoxicated,^{25,28} as well as those with alcohol involvement in trauma.²⁹ These findings reinforce the importance of targeted ED interventions, such as motivational counseling or linkage to addiction services, to reduce repeat visits and address longer term risks.

While our main analysis did not isolate suicidal ideation-only visits, we found that 1.2% of patients in the cohort had an ED visit for suicidal ideation within six months prior to their index presentation for self-harm or suicide attempt. This pattern was more common among patients who were intoxicated at the time of their index visit (1.5% vs 1.0%). Although a small proportion overall, this subgroup may represent individuals with recurring risk and comorbid substance use. The association between prior suicidal ideation presentations and intoxication at the time of a subsequent attempt highlights the potential importance of interventions for substance use disorder on an outpatient basis.

Acute vs Chronic Alcohol Use

It remains important to distinguish between acute

intoxication and chronic AUD. Long-standing AUD is well known to increase lifetime suicide risk,⁵⁻⁷ whereas this study specifically focused on ED presentations marked by acute intoxication. The absence of a clear mortality difference for suicide-specific death may indicate that the acute episode itself is not strongly associated with suicide within six months, or that ED-based safety measures could mitigate this risk. Nevertheless, repeated intoxication episodes and ongoing suicidal ideation could still amplify longer term risk beyond the scope of this study's follow-up period. Our findings, therefore, complement, rather than challenge, the extensive literature linking AUD to suicide risk.

Strengths

This is one of the largest population-based studies to date examining the intersection of acute alcohol intoxication and suicidality in patients presenting to the ED. By focusing on mortality outcomes and ED management patterns, this study addresses a significant gap in understanding the association between acute intoxication, post-discharge mortality rates, and ED resource utilization.

Implications and Future Directions

For emergency clinicians, these findings suggest that patients arriving with acute intoxication and suicidal behavior do not, in isolation, face a higher short-term risk of death by suicide than their non-intoxicated counterparts. However, both groups remain at elevated risk compared to the general population. System-level strategies remain essential, however, to address potential chronic AUD, comorbid psychiatric conditions, and the need for robust post-discharge planning. Future research should investigate whether substance use-related ED interventions such as brief motivational interviewing or urgent referrals to addiction services can reduce suicide or all-cause mortality.

Involuntary Holds in Alberta

In the Alberta healthcare system, the process for involuntary psychiatric holds may differ from other locales. Patients typically arrive either by ambulance or by self-presentation. Those arriving by ambulance may be doing so under a Form 10, an involuntary apprehension issued by police services that compels transfer to the ED for assessment. These patients cannot leave until they are evaluated by a physician, who must then determine whether the criteria for issuing a Form 1 (an involuntary hold permitting detention for up to 24 hours for psychiatric assessment) are met. If not, the Form 10 is rescinded and the patient regains the right to leave voluntarily.

Any patient who self-presents to the ED, including those with suicidal ideation and/or alcohol intoxication, are first triaged by nursing staff and placed in the general waiting area until an assessment room or stretcher becomes available. There is no mechanism to automatically detain these patients

prior to a physician's assessment, and until that assessment occurs they are legally free to leave the ED. Additionally, those arriving by ambulance also may be doing so voluntarily and, thus, there are no legal grounds to detain them in the ED until a physician assesses them to determine whether they warrant a Form 1 being issued.

The leaving without being seen (LWBS) and leaving against medical advice (LAMA) outcomes in our dataset reflect these operational nuances. Leaving without being seen refers to patients who arrive to the ED but depart before any physician contact, while LAMA applies to those who have been assessed by a physician but choose to leave before care is completed. In both instances, physicians must balance patient safety with the legal threshold for involuntary certification and revoking a person's autonomy. For example, a patient presenting with suicidal ideation may experience a reduction in acute risk after observation or crisis counseling, making continued detention unwarranted. While the physician may disagree with them leaving before receiving additional consultation, they cannot involuntarily hold the patient in the ED for this treatment if they do not meet the criteria delineated in a Form 1.

Understanding these distinctions is essential when interpreting the rates of LWBS and LAMA observed in our cohort. These events do not necessarily indicate deficiencies in care or oversight but rather reflect the legal and ethical framework governing psychiatric certification in Alberta, which emphasizes patient rights and proportionality in the use of involuntary holds.

LIMITATIONS

This study has several limitations. First, the use of *ICD-10-CA* codes to identify suicide attempts, self-harm, and acute alcohol intoxication may result in underestimation or misclassification, given that these codes often have modest sensitivity even if specificity is relatively high. Second, key variables such as psychiatric diagnoses, prior suicide attempts, and other substance use disorders were not consistently captured in the administrative data, potentially introducing unmeasured confounding. Third, because the study was conducted in a single Canadian province, the findings may not be generalizable to jurisdictions with different legal frameworks for involuntary holds, varying firearm availability, or distinct cultural attitudes toward alcohol and suicide.

Fourth, while alcohol is an immediately detectable substance of misuse tested commonly in the ED environment, other drug screening is rare in the ED setting given the time delay between collection and reporting and the cost of testing the multiple drugs that affect behavior. Finally, the study's observational design precludes causal inferences, as the observed associations may reflect residual confounding rather than a direct effect of acute intoxication. Nevertheless, by leveraging a comprehensive provincial database, this study was able to capture diverse ED settings and reliably ascertain

mortality outcomes within the critical six-month period following an ED visit for suicidal behavior.

CONCLUSION

In a large cohort of ED patients presenting with suicidal behavior, acute alcohol intoxication at the time of presentation was not associated with a higher risk of suicide-specific death over six months. These findings should be interpreted within the ED context and do not diminish the established role of chronic AUD as a major risk factor for suicide in community settings. Clinicians caring for intoxicated, suicidal patients should continue to monitor and manage these patients carefully, given their high rates of involuntary holds, extended ED stays, and frequent recidivism. Future research should explore the influence of underlying psychiatric comorbidities and other substances on suicide risk, as well as interventions to link these high-risk individuals to outpatient services for both mental health and potential alcohol use disorder treatment.

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Case Study and Qualitative Analysis of Emergency Department Community Advisory Council on Intimate Partner Violence

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Introduction: As part of a quality improvement initiative, our emergency department (ED) implemented a community advisory council consisting of leaders from five community-based organizations (CBO) that provide services for survivors of intimate partner violence. We used qualitative interviews with participants from the organizations to evaluate the council by identifying factors that promoted and hindered their engagement in this partnership between the community and the ED as well as best practices for future collaborations

Methods: We conducted five, 30-minute semi-structured interviews, one for each CBO representative on the council. Interview questions were based on validated toolkits for evaluating community-based participatory research. We conducted thematic analysis using a barriers and facilitators framework.

Results: Our focus on building relationships within the community advisory council facilitated collaboration between the ED and the CBOs. We identified structural barriers to and facilitators of the relationship-building process, as well as four behaviors that promoted relationship-building within the council. These behaviors included a joint problem-solving orientation, a culture of curiosity, shared empathy between emergency clinicians and CBO members, and a deeper understanding of barriers to caring for survivors of intimate partner violence in the ED. Themes regarding the impact of the council included the results of tangible projects as well as cultural shifts in the ED as perceived by leaders of the CBOs.

Conclusion: We share a case study of a collaboration between the ED and community-based organizations that illustrates barriers to and facilitators of engagement by leaders of these organizations in community-healthcare partnerships. The ED is a short but meaningful stop in recovery for many survivors, and a warm handoff to a CBO can be an essential next step in their care. When rooted in mutually respectful, trusting relationships, ED-CBO partnerships have the potential to enable survivor-centered, quality improvement efforts that work to improve the continuum of care between the ED and the community. [West J Emerg Med. 2026;27(1)114–120.]

INTRODUCTION

Background

Intimate partner violence is a public health concern with

high prevalence in the emergency department (ED).

Approximately 23% of partnered patients presenting to EDs in urban, safety-net hospitals have experienced intimate partner

violence.¹⁻³ At our hospital, an urban Level I trauma center and safety-net hospital, over 400 patients per year report current intimate partner violence during ED triage screening. This number underestimates the prevalence as it does not capture survivors who disclose later or those who are not comfortable disclosing. Previously, the American College of Emergency Physicians called for EDs to partner with community-based organizations (CBO) to provide care for survivors of intimate partner violence.⁴ Immediate referrals from the ED to CBOs increase the likelihood that survivors engage with support services,⁵ especially when these referrals include direct handoffs to CBOs.⁶⁻⁸

In 2023, as part of a quality improvement (QI) initiative using a human-centered design framework⁹ regarding ED care of survivors of intimate partner violence, our ED implemented a community advisory council consisting of leaders from five local CBOs that provide culturally relevant services for these survivors, including emergency hotlines, accompaniment when seeking medical or legal care, emergency and long-term housing, and counseling. This group partnered with ED staff to form a community-healthcare partnership. The goal of forming this partnership with CBO leaders was to seek their input on how ED staff could more effectively to connect survivors to their resources in the community. Through this partnership, CBO leaders acted as consultants for a QI initiative focused on intimate partner violence and ED-based patient education.

In its first year, the community-healthcare partnership conducted four meetings that included the community advisory council, emergency physicians, social workers, physician-leaders in intimate partner violence advocacy, and medical students to solicit input on developing survivor-centered care pathways in the ED (Appendix 1). Meetings involved discussions of survivors' experiences in the ED, a gap analysis of ED practices, a tour of the ED, and discussion of a resident training curriculum and patient education materials.^{10,11}

Objectives

After the first year of community-healthcare partnership meetings, we evaluated the community advisory council by using qualitative interviews with council members to explore the barriers to and the facilitators of CBO participation in the partnership. We sought to understand the CBO perspective on our collaboration, particularly with regard to providing meaningful connections to community resources for survivors seeking care in the ED.

METHODS

Setting

The community advisory council was formed according to our university's Center for Community Engagement guidelines. We compensated participants for their time at the university's suggested hourly rate.¹² We had funding for one

Population Health Research Capsule

What do we already know about this issue?

Survivors of intimate partner violence seen in the emergency department (ED) are more likely to engage with support services if the ED immediately refers them to community-based services.

What was the research question?

What factors encourage engagement by a community-based organization (CBO) in an ED-based community-healthcare partnership?

What was the major finding of the study?

This qualitative study identified relationship-building as central to effective ED-CBO collaboration.

How does this improve population health?

This study offers guidance for EDs seeking to collaborate with CBOs to improve their care of survivors of intimate partner violence.

year of quarterly meetings. To reflect the diversity of our patient population and the disproportionate impact of intimate partner violence in marginalized communities, we recruited representatives from CBOs that provide culturally relevant and identity-concordant care for survivors.

Study Design

Interviewers used a semi-structured interview guide developed by authors EK and CP based on validated toolkits for evaluating community-based participatory research projects, which includes a guide from the University of New Mexico and community engagement guidelines from the US Centers for Disease Control and Prevention (Appendix 2).¹³⁻¹⁶ All participants provided verbal consent to participate in the study. No identifying information was collected. Participants received a \$25 gift card in lieu of the hourly rate. Our organization's institutional review board determined this study was exempt (IRB #21-35510). Interviews lasted 30 minutes each and were conducted from June-October 2024. We interviewed all available participants, ie, the five CBO leaders (one from each organization).

Measurements and Analysis

Author EK conducted all interviews; SL co-conducted one interview. Interviews were conducted via videoconferencing, and they were recorded and transcribed using Zoom

teleconferencing software v6.0.11 (Zoom Communications, San Jose, CA). Authors EK, CP, and LK reviewed the transcripts for accuracy. Recordings and transcripts were stored within our institution's secure, cloud-based file collaboration software.

Authors EK and KJ coded the interview transcripts using Atlas.ti v24 software for qualitative analysis (Lumivero, LLC, Berlin, Germany). Our coding methods focused on enhancing credibility, dependability, and confirmability as per validated trustworthiness frameworks for establishing rigor in qualitative research.¹⁷ Following the code-recode strategy, we used two coders. EK was an "inside" coder, having participated in two of four community-healthcare partnership meetings; KJ was an "outside" coder who did not participate in the meetings. We applied a barriers and facilitators framework to understand participants' experiences with the partnership. Following the constant comparison approach, EK and KJ reviewed and open-coded one transcript at a time; they then met to refine the code book. Author CP independently reviewed the codes and met with EK to construct the codes into higher order themes. We kept a detailed audit trail in the code book. To allow for peer debriefing, the full investigator team met multiple times to discuss patterns and resolve any discrepancies.^{18,19}

RESULTS

We identified thematic barriers to and facilitators of ED-CBO collaboration in a QI setting, illustrated in the Table and the Figure. The primary theme was relationship-building as central to the formation, operation, and impact of a community-healthcare partnership. We organized sub-themes as follows: structural barriers, structural facilitators, behavioral facilitators of relationship-building, and the impact of these relationships.

Structural Facilitators of Relationship Building

Long-standing relationships between CBO leaders and physician-leaders in intimate partner violence advocacy facilitated the formation of the community advisory council and the community-healthcare partnership. Participants stated that they were more willing to join the partnership because they were invited by someone they trusted. Likewise, pre-existing relationships between the CBOs made it easier to begin collaborative work in the council.

Other structural facilitators included psychological safety, human-centered design exercises, and an in-person tour of the ED for the community advisory council. Psychological safety emerged from trust, clear communication, and prioritizing CBO perspectives. Human-centered design resonated with

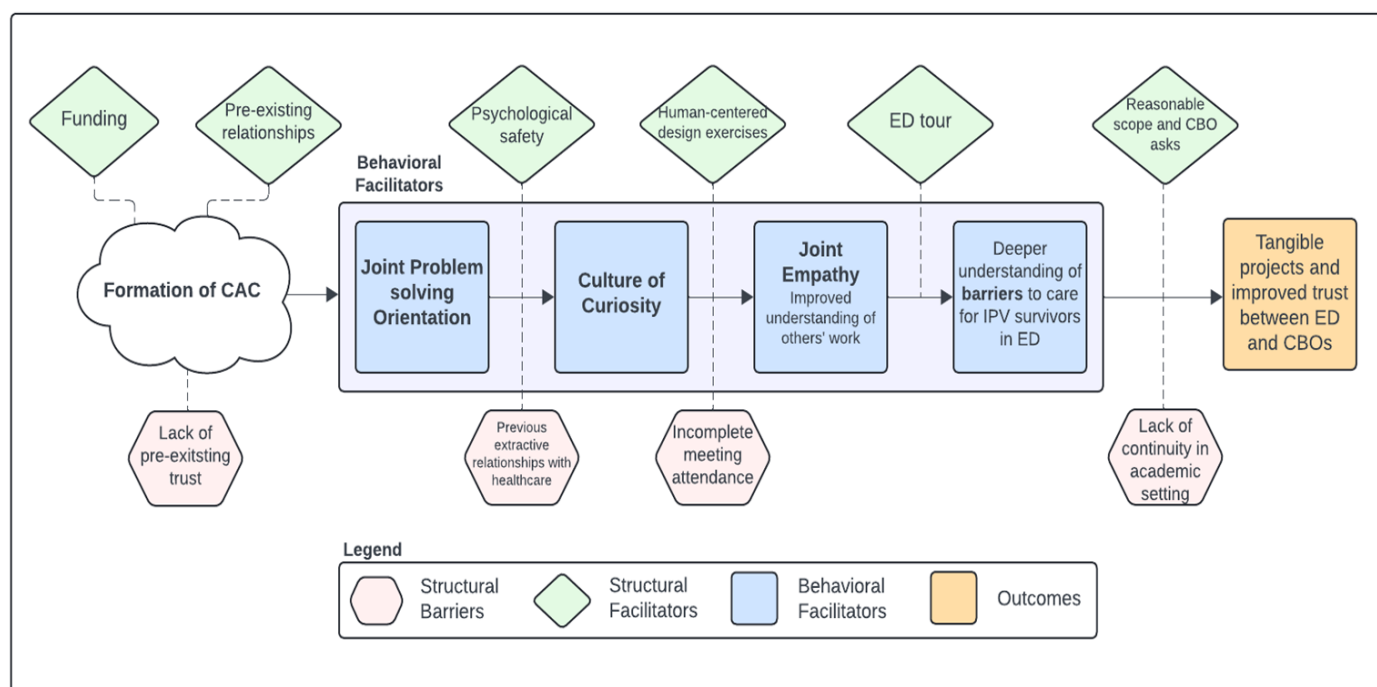


Figure 1. Flowchart illustrating barriers to and facilitators of collaboration between an emergency department and community-based organizations in the setting of a community advisory council focused on care for survivors of intimate partner violence.

Green trapezoids show structural facilitators, pink hexagons show structural barriers, blue squares show behavioral facilitators, and the orange square represents outcomes.

CAC, community advisory council; CBO, community-based organizations; ED, emergency department; IPV, intimate partner violence.

Table. Facilitators of and barriers to a collaboration between the emergency department and community-based organizations in the setting of a community advisory council.

Overarching facilitator	
Focus on relationships	<i>"I think pretty much all the time, relationships, like direct personal relationships, are what make anything work. So, no matter what, just the fact of having the partnership and meeting a couple of people just means that...any thickness that gets added into the relationship will help."</i> [2] <i>"I'm happy...to have other places or people that I could reach out to...it's all about making connections, right? ...that's huge, just [that] you can have a conversation with someone [in the ED]."</i> [3] <i>"I felt like it was a drive to, I don't know how to describe it...like deliverables, deliverables, deliverables, and it was more like I wanted the human aspect..."</i> [5]
Structural facilitators	
Pre-existing relationships with healthcare teams	<i>"I was happy to participate. I mean, there's that relationship and trust built already with Dr ... So I was like, of course, of course, we'll do it."</i> [1]
Pre-existing relationships between CBOs	<i>"There's something to...having your long-term collaborators that you're working with really steadily and closely and then you go into a new space with them..."</i> [1]
Psychological safety	<i>"...just ... being in [the ED] I was like, 'Wow, I don't know. I really don't know what to tell you.' And...my concern wasn't shut down at all. You know, the people who were present were very like, 'Okay, let's talk about that.' You know it, it was a very open space of 'Share your thoughts. That's why you're here. That's why we brought you here.' So there was no judgment. It was just listening. And it seems like a sincere like, 'I actually sincerely want to know what you're thinking about this.'"</i> [1]
Human-centered design exercises	<i>"Our day-to-day practice, since we opened, is so focused on creating that [human-centered approach]...I could tell that there was a similar brand of conscientiousness in designing the conversation."</i> [2]
Emergency department tour	<i>"I did the tour in the emergency room and it was...having us...give our feedback. So like, okay, they really care what we think, how we can make it better, how they can make it better."</i> [4]
Reasonable scope and asks for CBOs	<i>"I think the scope of what was proposed was reasonable...it's so nice when it's clear that somebody is going to be...responsible for driving it. And they're going to ask you about every part of the journey. So you're like a member of the car, you know. But you're not steering the car."</i> [2]
Structural barriers	
Absence of prior trust between EDs and CBOs	<i>"I think in general, people...feel like it's just complete luck of the draw when you go into a[n] institution; it's like, who you're going to get and what's going to happen to you is completely out of your control! And that you cannot count on continuity...It's just scary. So, I think just, you know, having any relationship always makes people feel a teeny bit more like, maybe everything isn't an unknown."</i> [2]
Previous extractive relationships with healthcare	<i>"I've definitely been a part of other committees where that wasn't present, where...it was kind of clear, it's like what would be helpful would be your buy-in. And how do we make this work versus oh, no, we're actually open to hearing that this...this is hard. And you don't need to have solutions, you know."</i> [1]
Incomplete meeting attendance	<i>"...the conversation...in May of 2023...had so many people there...the important perspectives needed to be captured, and when you don't have all of that there, things can get set up, and they are not taken into consideration how it's going to affect ABCDE. Right? You only have parts of the spokes there, and you have no ability to know how it's going to affect the rest of the spokes."</i> [3]
Lack of personnel continuity in an academic setting	<i>"...because there's a school component, there's always going to be rotation of people. So that just means that to make it sustainable...the succession, to make sure that somebody is there enough that they can pick it up without it falling down will be important."</i> [2]

CBO, community-based organization; DV, domestic violence; ED, emergency department; IPV, intimate partner violence.

Table. Continued.

Behavioral facilitators	
Joint problem-solving orientation	<i>“Coming together and having conversations and learning about what each other is, you know, doing and confronted with and where the challenges are, and how we might be able to work together to kind of answer some of those, or just learn, it’s nice. I think there’s real value in breaking out of your little silos.” [1]</i>
Culture of curiosity	<i>“I did feel there was a sense of real curiosity on behalf of the committee to kind of get our community, the DV community’s, input and kind of like just opinions and thoughts on what was going on, and assembling us together, and then actually having, like a culture of curiosity, I think, came through really nicely.” [1]</i>
Joint empathy—shared understanding of each other’s work	<i>“So [touring the ED] builds like an allyship, and again, just more kind of empathy...I remember those days, like at the shelter, people coming in...you don’t know what’s going to happen any given day. It’s hard. It’s hard to navigate. So having that experience, I think, gives us a better idea of how we might be able to work together.” [1]</i>
Deeper understanding of barriers to care for IPV survivors in the ED	<i>“I’m very visual. So like I was imagining like when we walk [through the ED], and they have to sit in there thinking that they might even be with their abuser sitting in there like, how can we know...how we can make it so they can be in a different room.” [4]</i> <i>“People are a lot more aware of, it’s not just about the medicine, but also starting to think about...where are we talking to [survivors]? How might somebody experience coming into that ER?”</i>

CBO, community-based organization; DV, domestic violence; ED, emergency department; IPV, intimate partner violence.

CBO leaders because of its similarities with trauma-informed care. Both approaches center empathy, trust, and autonomy, which connected the operations of the community-healthcare partnership with CBO practices. The ED tour built appreciation for ED staff and an understanding of ED resource limitations. Setting realistic goals and making reasonable requests of CBO representatives facilitated the council’s impact and productivity.

Structural Barriers to Relationship-building

Participants in the community advisory council described that some of their experiences with prior healthcare partnerships were a barrier to relationship-building in the community-healthcare partnership, as prior partners had sought CBO support without centering their feedback. Interruptions to relationship-building, including incomplete attendance at meetings due to scheduling challenges and a lack of personnel continuity within the partnership, impeded the process of strengthening connections.

Behavioral Facilitators of Relationship-building

We identified four sub-themes representing key behaviors that allowed for relationship-building in the community-healthcare partnership. First, CBOs and healthcare staff shared a **joint problem-solving orientation**—the understanding that the ED and CBOs share similar problems when caring for survivors of intimate partner violence and that collaboration is necessary to solve these problems. A culture of curiosity fostered a sense of partnership, referring to an environment where healthcare staff valued CBO perspectives and were

open to discussing difficulties without needing an immediate solution, which was facilitated by psychological safety. Using human-centered design exercises in the community-healthcare partnership meetings²⁰ helped build empathy between the council and the ED team. Placing advisory council members and their lived experiences at the heart of the problem-solving process allowed team members to better understand each other’s work. Ultimately, these behaviors created a deeper shared understanding of the barriers to care for survivors of intimate partner violence in the ED. The in-person tour of the ED was the key to facilitating this understanding.

Impact of Relationship-building

Forming relationships through the community-healthcare partnership led to tangible outcomes including a digital tool to help clinicians navigate resources,²¹ an intimate partner violence training curriculum for ED residents, and a second year of funding for the advisory council. They also improved trust: CBO leaders felt more comfortable interfacing with the ED after participating in the community advisory council because they knew that ED staff were aware of intimate partner violence and survivors’ needs.

DISCUSSION

Our findings suggest that the effectiveness of community advisory councils in QI efforts in the ED. depends not only on their composition but also on how relationships are built and sustained. The council became more than a consultative body: It evolved into a collaborative space where community and ED stakeholders could co-create solutions grounded in empathy, trust,

and cooperation. Structural facilitators enabled participation, while behavioral facilitators fostered alignment across different forms of expertise. These elements improved trust between the ED teams and CBO leaders, supporting critical connections between ED teams caring for survivors of intimate partner violence and CBO leaders who could offer long-term support.

Ultimately, we identified this foundation of trust as the key to our partnership. This is consistent with research on ED teamwork that establishes mutual trust and respect as a central tenet of effective ED teamwork.²² Future research should explore the roles of CBO members in ED teams and frameworks for understanding ED-CBO partnerships in the broader context of ED teamwork. This trust and teamwork also led to deliverables that inspired further work in this field, including our digital resource navigation tool²¹ and a two-part, trauma-informed care curriculum for ED residents. We can build on the general understanding of ED-CBO partnerships outlined here by studying what makes these partnerships successful in the context of a discrete project.

LIMITATIONS

Our small sample size and location at a single site limit the external validity of our findings. Interviewer reflexivity is a consideration as the primary interviewer participated in meetings of the community-healthcare partnership. Additionally, while the financial compensation (\$25 gift card) may have influenced what participants felt comfortable sharing, it was in line with standard practice at our institution.

As described in the “Methods” section of this paper, we used the trustworthiness framework to enhance internal and external validity, dependability, and confirmability.¹⁷ According to the principle of prolonged engagement, the longevity of our work with the CBOs supports our confidence in our findings and, thus, our internal validity. We also used triangulation (multiple authors reviewing the codebook) and peer debriefing to increase internal validity. We used thick description to enhance external validity by providing detailed contextual information about our study that will allow others to determine what aspects of our findings apply to their settings. Our coding and analysis methods, including the code-recode strategy, an audit trail, and reflecting on reflexivity, enhanced dependability and confirmability.

CONCLUSION

We present a case study that offers guidance for EDs seeking to partner with community-based organizations. When grounded in trust and mutual respect, these partnerships have the potential to strengthen the continuum of care, enabling survivor-centered quality improvement efforts that begin in the ED and extend into the community organizations that patients engage with after discharge.

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Prehospital and Emergency Care Perspectives to Define Pediatric Critical Illness and Injury

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Introduction: Timely identification of critically ill or injured children in prehospital and emergency settings remains a persistent challenge due to developmental variability, low case volumes in emergency medical services (EMS), and contextual limitations during field assessments. Existing frameworks to identify at-risk children often fail to capture the nuances of pediatric presentations, particularly in resource-limited or mass casualty settings. We aimed to explore prehospital and hospital-based clinician perspectives to inform a Delphi survey for the development of a consensus-driven definition of pediatric critical illness and injury.

Methods: We conducted a qualitative study using one semi-structured interview and two focus groups with participants with expertise in pediatric prehospital and hospital acute care. Participants were presented with a list of tools commonly used to assess the severity of illness in children in the emergency department and hospital-based settings. Interviews were conducted virtually, transcribed, coded using an iterative process, and thematically analyzed. We used key themes to inform the structure and priorities for a future Delphi survey.

Results: Six of the 12 invited participants took part in the study. Five major themes emerged: 1) prehospital indicators of critical illness (e.g., seizure, intravenous placement, cardiopulmonary resuscitation); 2) in-hospital markers of severity (e.g., air medical transport, intubation, diagnostic findings); 3) perceptions of existing triage tools (e.g., limited awareness or utility among paramedics); 4) differences in assessment approaches across roles and settings; and 5) specific triage challenges during mass casualty or disaster scenarios. Paramedics emphasized clinical actions as indicators of acuity, while physicians cited diagnostic findings and broader contextual indicators. Across roles, there was more agreement on the limitations of current triage and illness severity tools than on their utility.

Conclusion: We gained insights into key gaps in current pediatric triage systems, including limited applicability of existing tools in prehospital settings, variability in comfort with pediatric interventions, and the lack of alignment between paramedic action-based indicators and physician reliance on diagnostic findings. Role-specific experiences influence how critical status is assessed and highlight the value of integrating multidisciplinary insight. These findings inform future work focused on the development of consensus-based outcome measures that align with decision-making across prehospital and hospital environments. [West J Emerg Med. 2026;27(1)121–129.]

INTRODUCTION

The accurate and timely identification of critically ill or injured pediatric patients in prehospital and emergency settings is a persistent challenge in emergency medicine.¹⁻³ Pediatric presentations of acute conditions often differ significantly from those in adults, due to developmental variations,² conditions encountered,⁴ and social complexities.² Additionally, vital signs and other assessment information in children can fluctuate widely,⁵ even in minor emergencies. Prehospital emergency clinicians see far lower volumes of children compared to adults, inhibiting the rapid development of individual intuition for distinguishing critical illness in pediatric patients.⁶ Together, these factors introduce challenges in the triage process, transport decisions, and destination selection. Currently, there is a lack of standardization across settings in how children at risk for critical illness are assessed and managed.⁷ While emergency clinicians can rely on comprehensive assessments including clinical examinations, lab test results, and imaging data, prehospital clinicians often operate with limited time, tools, and contextual information.¹⁻³

Research in adults has identified prehospital factors associated with high risk of subsequent in-hospital deterioration. One model, for example, combined hypotension and bradypnea with other variables obtained in the prehospital setting to identify adults with sepsis and those who will require mechanical ventilation or experience in-hospital mortality.⁸ Another study demonstrated that a model including heart and respiratory rate had superior performance compared to clinical gestalt for identifying patients with sepsis.⁹ Among children, the prediction of critical illness has been limited by the lack of a consensus definition of and criteria for clinically relevant outcomes, a fact that is particularly challenging given the low rates of in-hospital mortality among admitted children.¹⁰ Research to identify critical illness among children with out-of-hospital emergencies is scant, with one study demonstrating limitations of using expert-derived cutoffs for vital signs.¹¹

More effective pediatric assessment tools and protocols are needed to ensure that care is prioritized correctly. Distinguishing between critical and non-urgent cases in routine prehospital encounters is essential for appropriately allocating resources, determining the safety of non-transport decisions, and guiding the destination for emergency care. Additionally, in disaster or surge scenarios, triage and destination decisions become even more consequential and bring additional challenges of constrained resources.¹² In this qualitative study, we sought to capture perspectives from prehospital, emergency, and critical care clinicians on how pediatric critical illness is recognized across settings. By exploring role-specific decision-making processes and perceived gaps in current tools, we aimed to generate foundational themes to guide the development of a Delphi survey. Our ultimate goal in this body of work was to derive more effective, usable models for triaging children experiencing emergencies and disasters.

Population Health Research Capsule

What do we already know about this issue?
Existing pediatric triage tools lack consensus and perform poorly in prehospital settings, making early identification of critical illness challenging.

What was the research question?
How do prehospital and hospital clinicians define and identify pediatric critical illness and injury?

What was the major finding of the study?
We identified five major themes and 12 subthemes describing clinician approaches to pediatric critical illness.

How does this improve population health?
Findings inform development of consensus tools to improve early recognition and triage of critically ill children across prehospital and hospital settings.

METHODS

Study Design and Setting

We performed a qualitative study using semi-structured interviews and focus groups to explore how clinicians assess and identify critical illness in pediatric patients across prehospital and hospital settings. Performance of this study was approved by the Institutional Review Board at Ann & Robert H. Lurie Children's Hospital of Chicago. We adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) guideline.¹³

Participants

Participants were recruited through purposive sampling to ensure representation from relevant clinical specialties (emergency medicine technician/paramedic, emergency physicians, critical care physicians) and institutions (children's hospitals and general hospitals). All participants provided verbal consent and were compensated \$35 for their time. Invitations were sent via email to 12 clinicians from the lead investigator's professional and academic networks, with the intent of including perspectives from both children's hospitals and general hospitals. Recruitment targeted clinicians with active pediatric emergency, prehospital, trauma, or critical care responsibilities, regardless of years of experience, and invitations were followed by one reminder email if no response was received. Six clinicians agreed to participate,

representing a range of clinical environments, including academic and community-based practice settings.

We collected data through two small focus-group discussions and one individual interview. This combination allowed both in-depth exploration of individual experiences and collaborative discussion among clinicians. The sample size was determined pragmatically, based on availability and willingness of clinicians across the targeted disciplines to participate. While small, the sample provided the necessary perspectives from key professional roles relevant to pediatric prehospital and hospital emergency care to inform item development for a subsequent Delphi survey. Our intent was not to achieve statistical significance or population representativeness but to generate exploratory insights across disciplines.

Interview Guide Development

We developed a semi-structured interview guide that allowed for iterative refinement based on emerging themes. In preliminary work, we reviewed relevant literature pertaining to prior research used to determine the presence of critical illness and/or injury among children in the emergency department,¹⁴⁻¹⁹ inpatient, and critical care settings.^{20,21} We developed a conceptual framework to identify factors associated with critical illness and/or injury and visualized relationships in a directed acyclic graph (Figure). The initial interview guide drew on elements from the graph and focused on topics such as the role of vital signs criteria, triage protocols, indicators of critical illness, and current assessment tools (Appendix). Pilot testing of interviews was done within the study group, with additional feedback obtained from pediatric emergency clinicians not involved with the study.

This directed acyclic graph illustrates hypothesized relationships between exposure (9-1-1 activation) and outcomes (eg, mortality, morbidities) in pediatric emergency care. The figure is intended to be read from the top left. The framework outlines key intermediary domains (including emergency medical system (EMS) response, ED arrival, assessment data, procedures/interventions/medications, diagnoses, hospital admission, and operating room use) that may influence or mediate the identification of critical illness or injury in children. Arrows represent proposed directional relationships between factors based on clinical reasoning and literature.

Data Collection

All interviews were concurrently conducted by two individuals: a trained research professional experienced in qualitative methods with a BA in Biology (AH; female) and a pediatric emergency physician investigator who conducts research on predictive models for applications in clinical care (SR; male) using an online platform (Zoom Communications, San Jose, CA). The participants were familiar with the overall goal of the research program prior to the initiation of interviews. Participants were informed that the physician interviewer was conducting research to develop prediction

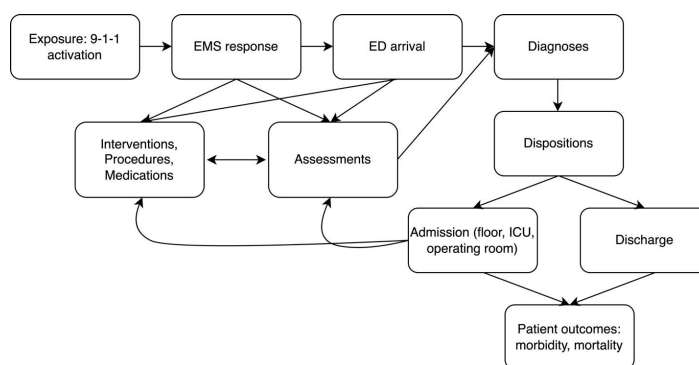


Figure. Conceptual framework of factors relevant to the identification of critical illness or injury among children transported to the hospital by emergency medical services.

EMS, emergency medical services; ED, emergency department; ICU, intensive care unit.

models using EMS data to identify children with critical illness and/or injury.

Sessions lasted approximately 60 minutes. Initial questions pertained to how clinicians may assess critical illness and/or injury in the prehospital and in-hospital setting. Next, to provide a common foundation for discussion, participants were given a brief (five-minute) overview of the study aims and examples of existing illness severity tools. The interview guide focused on several key domains: clinicians' current practices for distinguishing children who are sick vs not sick; how clinicians may interpret prehospital indicators of critical illness, including activation of protocols, measurements, interventions, and aspects of the patient care record most useful for triage; in-hospital indicators such as protocols, pathways, diagnoses, and outcomes signaling severity; perspectives on the utility and limitations of existing severity and triage tools; and anticipated changes in assessment and decision-making during disaster or mass casualty situations. After each session, members of the study team reviewed participant feedback and discussion flow, and minor adjustments were made to the phrasing and sequencing of questions to improve clarity and promote deeper engagement. Repeat interviews were not conducted.

Analysis

All interviews were video- and audio-recorded with participant consent using Zoom and professionally transcribed, with transcripts verified for accuracy by the study team. After all interviews were complete, one transcript was chosen at random to be coded by two members of the study team (LB, AH) using an initial codebook developed from the interview guide. Coders independently coded the transcript. Transcripts were not returned to participants for comment. The team met to review and reach consensus on code application (addressing any disagreements that may have occurred in code

application) and then revised the codebook. This process ensured consistency in coding and allowed for refinement of the thematic framework used in subsequent analysis. We assigned a primary and secondary coder to the remaining transcripts. The finalized codebook was applied across all transcripts to identify major themes and priorities. We used this process to generate consensus-based understanding of the clinical assessment of pediatric critical illness and to inform the development of decision support tools. Additional study team members who contributed to the interpretation of results were clinicians with experience in research and with varied clinical backgrounds (EMS, health services research, pediatric emergency medicine, and pediatric critical care).

RESULTS

We conducted three semi-structured 1:1 and small-group interview sessions between February–April 2024. Participants included six clinicians: four physicians with backgrounds in pediatric emergency medicine, critical care, and trauma surgery; and two paramedics with research experience. Five of the participants were based in urban settings, and one in a suburban setting. Four of the clinicians worked in a children's hospital, and two worked for local EMS systems. We identified several key themes related to the assessment of critical illness and injury in pediatric patients across prehospital and hospital settings through analysis of the transcripts.

These themes included the following: 1) prehospital indicators of critical illness; 2) in-hospital indicators of severity; 3) perceptions of existing clinical tools; 4) clinical assessment practices across settings and professional roles; and 5) considerations during disaster or mass casualty events. Within these themes, we identified 12 subthemes: procedural triggers of concern; mechanism of injury as a proxy; early physiological assessments; limitations of EMS impressions; transport mode as marker of acuity; monitoring and vital sign trends; diagnostic anchors of critical illness; knowledge and use gaps; practicality vs theory; dynamic nature of critical illness; institutional systems; triage and resource allocation; and contextual indicators of severity. A summary of these themes, with key quotes, is presented in the Table.

Prehospital Indicators of Critical Illness

Participants identified several critical signs and interventions that, when observed in the field, signaled the potential presence of serious illness or injury in pediatric patients. Paramedics highlighted the presence of seizures and placed emphasis on the performance of procedures, including cardiopulmonary resuscitation, respiratory assistance, and placement of intravenous (IV) access as key indicators of critical illness in the out-of-hospital setting, reflecting the paramedics' heightened concern. Notably, compared to adult patients, many prehospital clinicians reported limited comfort with pediatric IV insertion, which itself was recognized as a marker of critical illness. Unlike in adult EMS care, where IV

access is often established routinely, the difficulty and hesitation surrounding pediatric IV placement reflect both the severity of the patient's condition and the clinician's recognition of a critical situation.

In contrast to prehospital clinicians who focused on procedures, physicians referenced a broader set of clinical and contextual indicators that may identify severity of illness or injury among children in the prehospital setting. These included abnormal vital signs (eg, heart rate, blood pressure, oxygen saturation), concerning mechanisms of injury, and the use of immobilization devices. A depressed Glasgow Coma Scale score, endotracheal intubation, and the need for vasopressors were also identified as strong markers of critical illness. While physicians generally valued prehospital observations, one participant expressed skepticism about using prehospital impressions alone to define critical status (see Table).

In-Hospital Indicators of Severity

Although the care provided by prehospital clinicians typically concludes once a patient reaches the hospital, paramedics were asked to reflect on their thoughts about in-hospital factors that might indicate critical illness. One paramedic noted that in their geographic region, the use of air medical transport for a patient would strongly suggest critical illness. However, the participant acknowledged that this factor may not universally signify critical illness in other geographic settings, where the use of air transport might depend on different logistical or operational considerations.

Once the pediatric patient was in the hospital, physicians emphasized the importance of monitoring developmental appropriateness, changes in level of consciousness, and overall activity level. They considered clinical indicators, such as the need for a blood transfusion, presence of respiratory distress, or triggers for sepsis evaluation, strong signals of critical illness. Diagnostic imaging was also cited as essential for detecting severe conditions like spinal cord injuries or intracranial hemorrhage.

Perceptions of Existing Clinical Tools

Participants were presented with a list of tools commonly used to assess the severity of illness in children presenting to the hospital via EMS, which included the following: Pediatric Risk of Hospital Admission,²² Revised Pediatric Emergency Assessment Tool,¹⁵ Emergency Severity Index (ESI),¹⁴ Pediatric Risk of Mortality (PRISM),²³ the Pediatric Logistic Organ Dysfunction (PELOD) score,²¹ Injury Severity Score,²⁴ need for emergent trauma intervention,¹⁹ need for emergent intervention within six hours, and standardized triage assessment tool.¹⁸ Physician respondents were generally familiar with three of these tools (ESI, PRISM, and PELOD), although they did not use them for decision-making.

When presented with existing tools for assessing severity of illness, participants expressed mixed familiarity and utility. Physicians were familiar with some of these tools but noted

Table. Summary of key themes regarding indicators of pediatric critical illness with representative participant quotes obtained through semi-structured interviews of clinicians.

Theme	Sub-themes	Participant quote
Prehospital indicators of critical illness	Procedural triggers of concern	"I think a majority of paramedics are only mildly comfortable starting IVs, especially if you think of very small children. So if I'm reading a chart of a kid, say under 5, and I see intra(venous) access that immediately makes me think, okay, they recognize something, whether it be the level consciousness, blood pressure, whatever where they thought immediate intervention was necessary. A lot of paramedics do that sort of balance where they think like, I'm not comfortable with this. I don't really wanna do it so am I sure that I need to? So if then they perform the action, it speaks to [the idea that they] see something that is critically wrong." Participant 1d (Paramedic)
	Mechanism of injury as a proxy	"I think is a proxy for an assessment by the prehospital provider of the significance of a mechanism of injury like in what we're talking about blunt trauma. Specifically, whether it's a fall or a collision of some type of placement of a long spine board with a mobilization or rigid cervical collar. Both make me think that the prehospital provider was also worried about a potential significant mechanism of injury, and then therefore potentially a resultant critical injury." Participant 1b (Physician)
	Early physiological assessments	"Appropriate Glasgow Coma Scale assessments for prehospital providers could be very helpful. Because, again, that is a quick initial assessment that can give some information about the child status globally." Participant 1b (Physician)
	Limitations of EMS impressions	"I wonder if we're all dancing around the subject. Because I think that, short of the patient (who) required emergency intubation in the field, I don't want to speak for others, but I'm reflecting my own biases that EMS's impression should not determine critical illness." Participant 1a (Physician)
In-hospital indicators of severity	Transport mode as marker of acuity	"One of the biggest things that we see is just interfacility transport from the local hospital to the children center and this occurs often by ground.... So the children that we do fly are often what I would consider to be critically ill or injured, severe sepsis, intubated, receiving blood products, multi system, trauma, things like that, status epilepticus... But I think, at least from my experience, just the mere presence of air medical transport from a local hospital to a children's center is a pretty reliable indicator." Participant 1d (Paramedic)
	Monitoring and vital sign trends; diagnostic anchors of critical illness	"And so, as we look at regular routine monitoring, what kind of things are we looking at for those flags and then paying attention to the fever as well bring that fever down, and that bronchiolitis no longer breathing 80 and so I think some of those things, I think diagnoses are hard if you're looking prospectively. And then, of course, trauma so those kind of diagnoses with critical fractures, life and limb, threatening and spinal cord injuries, too." Participant 2a (Physician)
Perceptions of clinical goals	Knowledge and use gaps	"I knew of the injury severity score when I was practicing with the clinician, but we didn't use any of these other types of scales and from an EMS educational standard standpoint, it's not a part of the education... I don't know that a lot of prehospital clinicians are going to be considering some of these things." Participant 2d (Paramedic)
	Practicality versus theory	". . . So I think the thing that strikes me looking at these is that none of them will be available prehospital, and most of them won't even be known within the first minutes to hours of the in-hospital assessment. Many of them not until days later." Participant 1b (Physician)

limitations in their practical use during acute triage.

Paramedics reported minimal exposure to these tools and did not routinely use them in the field. Several participants emphasized that tools for use in the critical care setting are not available or useful in the early stages of care, particularly in prehospital contexts.

Clinical Assessment Across Settings and Professional Roles

Both physicians and paramedics discussed how children are currently assessed in their professional settings to determine whether they are critically ill or injured. Across professional roles, clinicians reported similar foundational

assessment steps: obtaining vital signs; evaluating airway, breathing, and circulation; and assessing overall clinical appearance. However, differences emerged in how these assessments were contextualized. Paramedics often relied on caregiver reports at the scene and followed Pediatric Advanced Life Support guidelines. In contrast, physicians incorporated additional data such as lab values, imaging, and tiered triage systems. Changes in assessment over the period of transport were also noted.

Disaster and Mass Casualty Contexts

Participants noted that triage and care practices shift

Table. Continued

Clinical assessment across settings and professional roles	Dynamic nature of critical illness	"One distinction that's worth making or teasing out is whether they're critically ill at their initial presentation versus they are critically ill after they respond to initial resuscitation... if they recover within an hour and they go to the general ward they're less ill than someone who has escalating interventions and pressures, etc, over the next 48 hours. And it what cut off does that matter?" Participant 1a (Physician)
	Institutional systems	"We have a tier system, which is a system for the emergency department physician to identify children who they believe have significant illness, that may require critical care and can essentially say you are, you know, tier 2 would mean based on our intervention we've done, this (patient) needs critical care moving forward, and we need to expedite having it." Participant 3a (Physician)
Disaster and mass casualty contexts	Triage and resource allocation	"I think, as with anything, the triage process is what changes, and when you have to start considering survivability and resource allocation to do the greatest good for the greatest number is the only time when that calculus really changes, and that can be something that's very difficult... So you might not be able to do things in your big fancy trauma bay with a dozen providers all around the patient... You may have to utilize spaces in creative ways, and delegate and sort of do field promotions for trainees with less oversight and less providers per patient." Participant 1b (Physician)
	Contextual indicators of severity	"I think, as with any traumatic injury that affects more than one person, you can glean severity from whether there were other fatalities on scene... whether it's a mass casualty disaster or otherwise unexpected mechanistic- or exposure-related information is probably more useful in that setting, especially if it's something otherwise intentional that could involve chemical, biologic, or nuclear exposure radiation is what I mean by that." Participant 1b (Physician)

EMS, emergency medical services; ICU, intensive care unit; IV, intravenous line.

significantly in disaster or mass casualty situations. Clinicians reported that decisions must often be made in resource-constrained environments, with adaptations such as providing care in non-traditional spaces and prioritizing patients based on survivability. Physicians emphasized that environmental context (eg, presence of other fatalities, chemical exposures) plays a larger role in assessing severity in such circumstances.

DISCUSSION

We collected qualitative data through discussions with clinicians to evaluate factors that may be indicative of clinically important illness and/or injury in children to inform a Delphi process for criteria that will ultimately be used in models for risk stratification. A wide array of approaches and prehospital factors that could potentially signal critical illness were reported, with clinicians generally noting limitations with existing systems used to risk stratify children with acute illness in the hospital. These findings may be used in the development of structured processes to determine outcomes for critical illness and/or injury for children in the prehospital setting.

The variability in assessment methods between paramedics and physicians underscores the need for a structured framework to ensure consistency in identifying critically ill children. Prior research has identified challenges in the prehospital assessment of children, a finding that highlights opportunities to improve the prehospital assessment.¹ We noted variable experiences that aligned with the different professional positions of the participants (ie, prehospital clinicians vs in-hospital physicians) and settings (ie, field vs emergency department). The identified

differences in assessment processes reflect the real-world constraints, decision points, and informational inputs available to each group. These distinctions are important to the development of Delphi items intended to create consensus-based outcome criteria for critical illness and/or injury for children transported to the hospital by EMS.

Our findings have broader implications for patient care and system design. By characterizing role-specific challenges and limitations of existing tools, this qualitative work provided the foundation for our subsequent Delphi process, which was intended to achieve consensus on data elements to include in hospital-based outcome measures for pediatric critical illness and injury among children who receive prehospital care. Establishing a structured definition through this stepwise approach can inform training, guide triage and transport decisions, and reduce variability in care, ultimately supporting safer and more consistent management of children across EMS systems. For example, paramedics were focused on procedural factors as being indicative of a higher level of concern (eg, peripheral IV line placement), suggesting an emphasis on clinical action by treating personnel. Notably, this approach does not capture the underlying reasoning for why an intervention was performed. For example, vascular access may be obtained as a precautionary measure by EMS clinicians who want to ensure access is available en route rather than because vascular access is necessary for treatment of critical status. Our data did not disentangle these contextual motivations or examine procedural interventions in relation to their triggers. In comparison, physician criteria were broader and incorporated

information such as mechanism of injury, vital signs, diagnostic testing, and the performance of in-hospital testing.

We found that perceptions of different structured rubrics also aligned with clinical background; all were identified to have limitations when considered as measures of critical illness and/or injury among children transported to the hospital by EMS. Paramedics reported relying on Pediatric Advanced Life Support algorithms and the use of prehospital protocols (particularly for cardiac arrest) to determine for patient acuity. One qualitative study of 17 paramedics identified several factors that make pediatric calls particularly difficult, specifically citing clinical complexities associated with pediatric patients and emphasizing the unique difficulties of determining acuity in the prehospital setting.² Given the limited role of vital signs in predicting the need for key interventions (including potentially life-saving interventions)^{25,26} and in-hospital outcomes,^{11,27} these findings underscore the importance of standardized clinical decision support tools and structured assessment frameworks in prehospital care. They also underscore the need to better define and validate field indicators of critical illness beyond vital signs alone, particularly in pediatric populations.

The results of our thematic analysis provide a foundation for item generation and prioritization in the early stages of tool or score development, especially for use in the prehospital setting. These include the incorporation of diagnoses, injury mechanisms, medications, interventions, and dispositions, which may inform the development of candidate criteria in future work. Our findings emphasize the value of incorporating multidisciplinary insights and perspectives on certain interventions (such as prehospital venous access in children) that may be useful as proxy measures for illness or injury severity. Further, the findings from this study provide several avenues to develop comprehensive frameworks to stratify children in the prehospital setting based on level of acuity. Participants identified limitations in current triage and severity tools, emphasizing the need for simple, real-time decision support adapted for pediatric care.

We undertook this qualitative effort to inform the design of a Delphi survey focused on the development of consensus-based outcome measures to define critical illness and injury. Importantly, the small sample size and participation rates carry implications beyond simple limitations. Only half of those invited participated, largely due to scheduling conflicts. Our recruitment efforts were focused on clinicians with greater exposure to the care of children with critical illness and injury, primarily those based at children's hospitals and in metropolitan areas. This approach allowed us to draw on the experience of clinicians who care for a higher volume of critically ill or injured children. In doing so, however, we did not recruit from community or rural settings and, thus, excluded the perspectives of clinicians practicing in those environments. While ensuring cross-disciplinary representation (EMS, emergency and critical care), this likely over-represents academic viewpoints. Future

work could use these results and drive toward thematic saturation by broadening recruitment strategies to capture additional experiences and perspectives from community and rural providers. Perspectives from first responders in rural areas with longer transport times may have yielded unique perspectives on decision-making in those contexts.

LIMITATIONS

Our findings are subject to limitations. While we conducted both individual and small-group interviews, the small sample size limits the generalizability of findings, although they remain valuable for informing the development of Delphi survey items. Our timeline was compressed to achieve the aim of developing the items within a short grant period. Participants were largely from academic or pediatric institutions in urban settings, which may be less reflective of experiences in community or rural settings and other parts of the US. Additionally, the views expressed may disproportionately reflect the experiences of physicians and paramedics with research backgrounds, potentially overlooking insights from clinicians with different roles or levels of research experience.

The fact that participants were aware of the interviewers' professional credentials and research focus may have influenced what they felt comfortable disclosing, particularly regarding uncertainties in pediatric care. We included a presentation within the session to ensure clarity in terminology, and we acknowledge this may have influenced participant responses. While we included paramedic respondents, just two participated. Many of the existing triage and severity tools that were presented during the sessions were unfamiliar or underused by prehospital personnel, which may have limited meaningful evaluation of the applicability of these tools in early field care. Although recurring concepts emerged across interviews, we cannot be certain that thematic saturation was reached. Additional participants from different geographic areas could potentially have contributed new perspectives. Thus, our findings should be viewed as exploratory and hypothesis-generating, serving as a foundation for future consensus work. Despite these limitations, the study offers valuable insights into current practices and considerations that can inform the development of more effective, consensus-driven criteria for identifying pediatric critical illness and injury.

CONCLUSION

We identified key factors used by clinicians to assess critical illness in pediatric patients across prehospital and hospital settings, revealing both common practices and role-specific differences. These insights support the need for the development of a structured, consensus-driven outcome measures that reflects real-world clinical judgment and can enhance triage, risk stratification, and decision-making in emergency care for children.

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Respiratory Illness-related Emergency Visits Among Children, COVID-19 and Beyond: Observing a Return to Seasonal Patterns?

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Introduction: The COVID-19 pandemic disrupted care-seeking and respiratory disease epidemiology across healthcare settings, notably for emergency department (ED) care. The scope of this disruption and whether patterns of ED visits have returned to predictable seasonal patterns is of interest in planning ED staffing and resource availability for future illness surges, pandemic or not. We evaluated ED visits for acute respiratory illness among children in a large, integrated healthcare delivery system to describe illness and patient characteristics in the years before, during, and after the pandemic peak.

Methods: We conducted a cross-sectional study of ED visits among patients 0-17 years of age to the 21 EDs of Kaiser Permanente Northern California, from January 1, 2018–December 31, 2019, pre-pandemic; January 1, 2020–December 31, 2021, pandemic; and January 1, 2022–March 31, 2024, post-vaccine (vaccines for children > 5 years of age approved and available). We electronically extracted eligible ED visits with acute respiratory infection diagnoses and a range of sociodemographic, medical comorbidity, and utilization characteristics.

Results: We observed 151,983 pediatric ED visits with eligible respiratory infection diagnoses, 49,912 (32.8%) visits pre-pandemic, 27,109 (17.8%) visits during the pandemic, and 74,962 (49.3%) visits post-vaccine. Eligible visits dropped every month from 6,361 in February 2020, just prior to the pandemic onset, to their lowest volume (243) in June 2020. In the post-vaccine period, visits peaked at 10,638 in November 2022, the highest of any month during the study period. Sex, race/ethnicity, and tobacco exposure were comparable over time, but the proportion of visits by patients with under-immunized diagnosis trended upward over time. Upper respiratory infection (30% pre-pandemic, 32% pandemic, and 33% post-vaccine periods), asthma (15% pre-pandemic, 12% pandemic, and 12% post-vaccine periods), and cough (9.9% pre-pandemic, 12% pandemic, and 12% post-vaccine periods), were the top three diagnoses across all periods.

Conclusion: In this cross-sectional study of acute respiratory illness-related ED visits in an integrated healthcare system, from 2022 onward seasonal variation in respiratory illness ED visits rebounded, with notable and unseasonal peaks in late 2022. COVID-19 appears to be a minor contributor to ED visits for pediatric respiratory illness. However, an increased overall and seasonal burden of ED visits has implications for surge planning and mitigation, with COVID-19 now being endemic and typical respiratory pathogens having resurfaced. [West J Emerg Med. 2026;27(1)130–139.]

INTRODUCTION

The COVID-19 pandemic changed the epidemiology of respiratory illnesses with repercussions for emergency care and preparedness. Among children, this impact was particularly notable, as respiratory infections are the top reason for pediatric emergency department (ED) visits.¹ Early pandemic COVID-19 mitigation strategies were associated with a dramatic decrease in non-COVID-19 viral respiratory infections that later rebounded.^{2,3} Pediatric ED visits for acute respiratory illnesses followed a similar pattern.⁴⁻⁶ With the return to previous activities including school attendance and travel, acute respiratory illnesses would be expected to rebound. But immunity gaps from decreased exposure to circulating viral pathogens and disrupted seasonal patterns of endemic respiratory viruses may also impact the severity, timing, and age distribution of acute respiratory illnesses and ED visits for these conditions.⁷⁻¹⁰ The fall 2022 respiratory syncytial virus (RSV) surge observed in the Northern Hemisphere was such an event, straining healthcare systems because of the severity and volume of illness.¹¹⁻¹³ Less is reported about the broader landscape of acute respiratory illness among children as the pandemic has become endemic, yet as ED leaders plan staffing and resource allocation, understanding whether and how ED visits for these conditions returned to pre-pandemic patterns is important. We thus describe ED visits for acute respiratory illness among children in a large, integrated healthcare delivery system in the years before, during, and after the pandemic peak.

METHODS

Study Setting and Design

We conducted a retrospective, cross-sectional observational study of ED visits among patients 0-17 years of age to the 21 EDs of Kaiser Permanente Northern California (KPNC) from January 1, 2018–March 31, 2024. Kaiser Permanente Northern California is an integrated healthcare delivery system serving over four million members with over 1.2 million ED visits annually. The KPNC members are similar sociodemographically and in health status to the surrounding communities.¹⁴ The Kaiser Foundation Institutional Review Board approved the study protocol and waived the requirement for informed consent.

All data were electronically extracted from the electronic health record (EHR) (Epic Systems Corporation, Verona, WI) by an experienced programmer (MS); no manual chart review was conducted. All ED visits during the study period with an eligible acute respiratory illness diagnosis and health plan membership were electronically extracted. Acute respiratory illness ED visits were extracted based on *International Classification of Diseases, 10th Modification (ICD-10)*-coded visit diagnoses (Appendix) based on the Pediatric Clinical Classification System (PE-CCS) (ref: <https://www.childrenshospitals.org/content/analytics/toolkit/pediatric-clinical-classification-system-peccs-codes> accessed March 4,

Population Health Research Capsule

What do we already know about this issue?

The COVID-10 pandemic broadly disrupted non-COVID-19 disease epidemiology and health care utilization. Seasonal disease surges, for which emergency departments plan staffing and resources, altered as well.

What was the research question?

How did respiratory disease emergency visits among pediatric patients alter during and after the COVID-19 pandemic?

What was the major finding of the study?

The early pandemic period saw a 91% decline in pediatric emergency visits for respiratory illness, with a slow rebound and resumption of seasonal patterns by late 2022.

How does this improve population health?

Disaster and surge planning for future pandemics and public health emergencies may take into account a protracted tail of impact on health care utilization as well as potential rebound surges in non-pandemic diseases.

2025). To ensure complete data were available from the EHR, we restricted the study group to patients with health plan membership at the time of the visit if <12 months of age, and nine of the prior 12 months for patients >12 months of age. We extracted patient characteristics and comorbidities that may be associated with ED use and with respiratory illness. Because social determinants of health including race or ethnicity, neighborhood deprivation and insurance status are associated with ED use among children, we included these measures.¹⁵ Sociodemographic variables include age, sex, race/ethnicity, neighborhood deprivation index (a measure of socioeconomic status that includes income, housing quality, employment and education data points at the ZIP code level), and tobacco exposure.

Medical comorbidities extracted were under-immunization ICD-10 diagnosis and chronic conditions from the PE-CCS. Because under-immunized children have different patterns of healthcare use and chronic conditions are associated with increased ED use, we included these characteristics to describe the study cohort.^{16,17} All variables were electronically extracted from structured data fields in the

EHR. The study adhered to components of best practices for data extraction defined by Worster et al (2005) including case selection criteria, clearly defined variables, and medical record identification.¹⁸

Descriptive Statistics

We calculated ED visits by month for included diagnoses and for all pediatric ED visits. Absence of a comorbidity was considered not having that diagnosis. Missing data are acknowledged in the tables, but as no inferential analysis was conducted, no adjustments for missing data were made. We divided the study into three periods: January 1, 2018–December 31, 2019 (pre-pandemic); January 1, 2020–December 31, 2021 (pandemic); and January 1, 2022–March 31, 2024 (post-vaccine). Visits were calculated by month for all ED visits and for respiratory illness ED visits. We collated descriptive data for each of the three observation periods.

RESULTS

After applying inclusion criteria, we observed 151,983 pediatric ED visits with eligible acute respiratory illness diagnoses. Patient characteristics are presented in Table 1; we noted 49,912 (32.8%) visits pre-pandemic; 27,109 (17.8%) visits during the pandemic period; and 74,962 (49.3%) visits post-vaccine. Sex, race/ethnicity, and tobacco exposure were comparable over time, but the proportion of visits by patients who were under-immunized trended upward over time.

The figure presents ED visits for all-cause, acute respiratory illness and COVID-19 illness during the study period by month. By quarter, pre-pandemic acute respiratory illness visits peaked in January–March 2019 at 15,959 visits. In the pandemic period, visits dropped to their lowest point in April–June 2020 (767 visits). At the pandemic onset, monthly visits dropped from 6,361 in February 2020 to 3,076 in March 2020 and further to 274 in April 2020, before reaching a nadir of 243 in June 2020.

For the winter quarter peak respiratory illness season (January–March), a nadir of 1,718 visits was reached in 2021, 11% of 2020 winter quarter volume. The following years' winter quarters—2022 (6,897, fourfold increase from 2021), 2023 (10,324, 50% increase from 2022) and 2024 (12,337, 20% increase from 2023)—saw a gradual rebound in ED visits. The monthly peak in ED visits occurred in November 2022 with 10,638 visits, with fall (October–December) quarter 2022 seeing 25,363 visits compared to the years prior and after (9,667 and 14,272 visits in fall quarters 2021 and 2023, respectively). COVID-19 diagnoses accounted for a minority of visits from 2020–2024. In Table 2, upper respiratory infection (30% pre-pandemic, 32% pandemic and 33% post-vaccine); asthma (15% pre-pandemic and 12% pandemic and post-vaccine); and cough (9.9% pre-pandemic, 12% pandemic and 11% post-vaccine) were the most common visit diagnoses.

DISCUSSION

In this cross-sectional study of acute respiratory illness-related ED visits in an integrated healthcare system, we noted a 91% decline in visits at pandemic onset (3,076 visits in March 2020 dropping to 274 visits in April 2020), followed by a trough and slow rebound, peaking at 10,638 visits in November 2022. Seasonal oscillation resumed in 2022 and continued into 2024. Patient characteristics were comparable across the study periods, with the three most common visit diagnoses (upper respiratory infection [30-33% of visits], asthma [12-15% of visits], and cough [9.9-12%]) stable across the three epochs.

Seasonal surges of respiratory illness before COVID-19 attenuated early in the pandemic, prompting uncertainty about the pandemic's longer term impact on seasonal respiratory illness epidemiology and severity.⁸ A few studies reported rebounding respiratory infection ED visits and hospital admissions in 2021 after social distancing restrictions were lifted, school attendance and travel normalized, and COVID-19 immunizations were widely available,^{19,20} but little is reported beyond 2021. We included a broader list of acute respiratory illness to understand ED use and demand and extended our observations into 2024.

Like other studies, we report a 90% drop in ED visits early in the pandemic, from winter quarter to spring quarter 2020, notable even after considering that winter is the traditional peak in seasonal acute respiratory illnesses.^{5,6} However, seasonal fluctuations in monthly visits resumed in 2022. While pre-pandemic winter quarters (January–March) noted the highest visit volumes (15,000-16,000 visits), in the post-vaccine period, quarterly visits peaked in fall 2022 (> 25,000 visits), earlier in the fall/winter respiratory illness seasons than prior to the pandemic. The marked peak observed in fall 2022 may arise from immunity gaps attributable to decreased individual and population respiratory-pathogen exposure intersecting with a return to usual activities.²¹ While deferred healthcare-seeking might impact ED volumes, this effect might be more substantial for primary care visits, and we would expect the variation observed mostly reflects the prevalence of illness.

The noticeable dip in ED use during the pandemic has raised questions about future ED volumes and staffing needs. As overall ED visits rebounded in 2021-2022 (but not to pre-pandemic levels), speculation ensued about consequent decreased ED workforce requirements.²² This concern, however, may be premature if our observation of progressive increases in ED visits four years after the pandemic holds true for all-cause ED visits as well as respiratory illnesses. Furthermore, COVID-19-associated healthcare worker attrition may exacerbate staffing challenges in future pandemics and recovery periods.²³ Finally, much disaster planning focuses on immediate response, but we report elevated ED volumes and notable monthly peaks up to four years after the pandemic onset. Future pandemic planning for

Table 1. Patient and visit characteristics of respiratory illness-related emergency department visits: pre-pandemic January 1, 2018–December 31, 2019; pandemic, January 1, 2020–December 31, 2021; and post-vaccine, January 1, 2022–March 31, 2024.

Characteristic	Overall N = 151,983 ¹	Pre-pandemic: n = 49,912 (32.8%) ¹	Pandemic: n = 27,109 (17.8%) ¹	Post-vaccine: n = 74,962 (49.3%) ¹
Age				
< 28 days	1,653 (1.1)	490 (1.0)	391 (1.4)	772 (1.0)
28 days to < 3 months	3,885 (2.6)	1,106 (2.2)	815 (3.0)	1,964 (2.6)
3 months to < 2 years	43,323 (29)	14,366 (29)	7,993 (29)	20,964 (28)
2 years to < 5 years	43,341 (29)	13,696 (27)	7,803 (29)	21,842 (29)
5 years to < 11 years	38,272 (25)	12,458 (25)	5,984 (22)	19,830 (26)
11 years to <1. 8 years	21,509 (14)	7,796 (16)	4,123 (15)	9,590 (13)
Sex ²				
Female	64,348 (42)	21,345 (43)	11,437 (42)	31,566 (42)
Male	87,620 (58)	28,562 (57)	15,670 (58)	43,388 (58)
Race and ethnicity				
American Indian/Alaskan Native	697 (0.5)	232 (0.5)	128 (0.5)	337 (0.4)
Asian	24,962 (16)	7,764 (16)	3,965 (15)	13,233 (18)
Black	19,721 (13)	7,396 (15)	3,777 (14)	8,548 (11)
Hispanic or Latino	53,195 (35)	17,228 (35)	9,373 (35)	26,594 (35)
Missing/Decline to state	11,895 (7.8)	3,273 (6.6)	2,097 (7.7)	6,525 (8.7)
Native Hawaiian or other Pacific Islander	2,692 (1.8)	943 (1.9)	486 (1.8)	1,263 (1.7)
White	38,821 (26)	13,076 (26)	7,283 (27)	18,462 (25)
Neighborhood Deprivation Index Quartile (1 = least deprived) ²				
1	23,033 (15)	6,353 (13)	3,769 (14)	12,911 (17)
2	37,914 (25)	12,468 (25)	6,737 (25)	18,709 (25)
3	47,238 (31)	15,532 (31)	8,150 (30)	23,556 (31)
4	43,722 (29)	15,540 (31)	8,440 (31)	19,742 (26)
Unknown	76	19	13	44
Tobacco exposure				
Current or former	1,087 (0.7)	426 (0.9)	188 (0.7)	473 (0.6)
Never	128,702 (85)	42,327 (85)	21,642 (80)	64,733 (86)
Passive exposure	9,388 (6.2)	4,523 (9.1)	2,053 (7.6)	2,812 (3.8)
Unknown/missing	12,806 (8.4)	2,636 (5.3)	3,226 (12)	6,944 (9.3)
Under immunization	22,912 (15)	6,066 (12)	4,149 (15)	12,697 (17)
Respiratory condition from PE-CCS ²	16,545 (11)	8,069 (16)	2,939 (11)	5,537 (7.5)
Tech-dependent condition from PE-CCS ²	3,095 (2.1)	943 (1.9)	560 (2.1)	1,592 (2.1)
At least one complex chronic condition from PE-CCS ²	33,633 (22)	13,246 (27)	5,970 (22)	14,417 (19)
ED length of stay ³	2.00 (2.00)	2.00 (2.00)	2.00 (2.00)	2.00 (2.00)
ED disposition				
Admitted	7,108 (4.7)	2,210 (4.4)	1,375 (5.1)	3,523 (4.7)
Discharged	144,875 (95)	47,702 (96)	25,734 (95)	71,439 (95)

¹n (%).²missing < 1%.³Median (interquartile range).

ED, emergency department; PE-CCS, Pediatric Clinical Classification System.

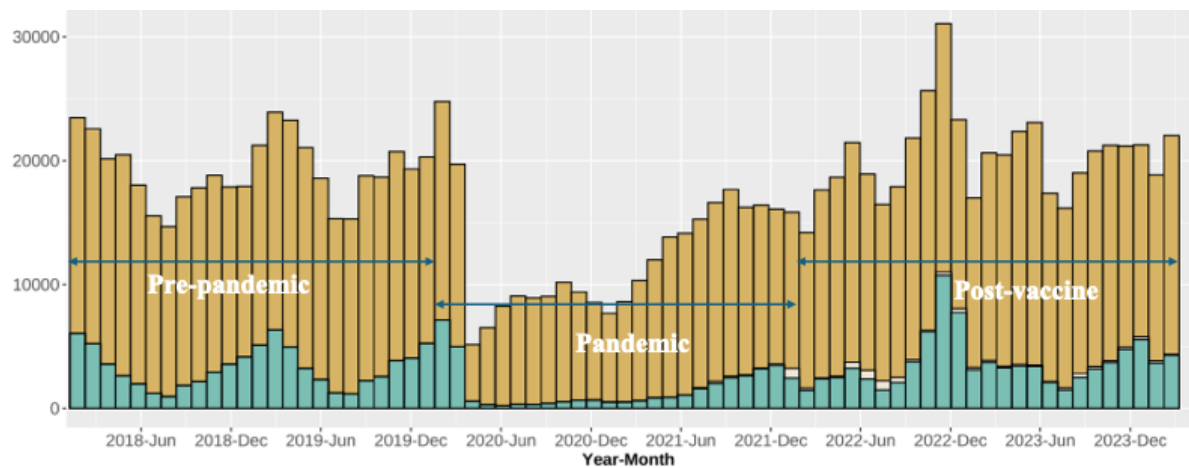


Figure Monthly emergency department (ED) visits for acute respiratory illness, January 1, 2018–December 31, 2019 (pre-pandemic); January 1, 2020–December 31, 2021 (pandemic); and January 1, 2022–March 31, 2024 (post-vaccine); 0-17 years of age. Orange (top column): total ED visits that were not respiratory illnesses; beige (middle column): COVID-19 infection; green (bottom column): acute respiratory illness (non-COVID-19).

ED staffing and resource allocation might consider possible monthly volatility and excess demand long after the acute pandemic phase.

Across the three observation periods, patients were comparable in age, race/ethnicity, socioeconomic status (Neighborhood Deprivation Index), and the frequency of

chronic conditions. This finding likely reflects that no major changes in health plan membership occurred during the study period. Nationally, ED visits followed similar trends across age, race, and ethnicity groups.²⁴ Tracking granular, stratified ED-visit patterns in future pandemics, disasters and recovery periods would promptly identify disproportionate effects on vulnerable groups. We did observe a trend of increased frequency of prior under-immunization diagnosis in the pandemic and post-vaccine periods. We could not ascertain whether this finding reflects missing or lagging COVID-19 vaccinations, influenza vaccine refusal, or a decline in routine childhood immunizations. Since a general decrease in immunization rates during the pandemic was also observed nationally,²⁵ our finding may mirror population-level immunization changes rather than increased illness vulnerability among children with under-immunization.

LIMITATIONS

Our study was limited by its retrospective nature, and we captured diagnoses coded by the emergency physician rather than by microbiology or imaging results that may have resulted after the ED visit. While influenza testing has rapid turnaround during an ED visit, respiratory viral polymerase chain reaction panels result after the ED visit in our facilities; therefore, the results would not have been available to inform the ED diagnosis. While only patients with health plan membership were included for data completeness, there were no major changes in health plan membership over the study period, and health plan members are similar to the surrounding communities demographically and in health status.¹⁴

CONCLUSION

We evaluated the frequency of pediatric ED visits for acute respiratory illness in the pre-, pandemic, and post-

Table 2. Most common emergency department visit diagnoses for each observation period: pre-pandemic January 1, 2018–December 31, 2019; pandemic, January 1, 2020–December 31, 2021; and post-vaccine, January 1, 2022–March 31, 2024.

Diagnosis category	Pre-pandemic n = 49,912 (32.8%)	Pandemic n = 27,109 (17.8%)	Post-vaccine n = 74,962 (49.3%)
Upper respiratory infection	15,143 (30%)	8,579 (32%)	24,613 (33%)
Asthma	7,508 (15%)	3,369 (12%)	9,302 (12%)
Cough	4,948 (9.9%)	3,300 (12%)	8,262 (11%)
Croup	6,097 (12%)	2,762 (10%)	7,457 (9.9%)
Influenza	5,949 (12%)	2,859 (11%)	7,029 (9.4%)
Pneumonia	3,793 (7.6%)	1,494 (5.5%)	4,400 (5.9%)
Bronchiolitis	3,032 (6.1%)	1,985 (7.3%)	4,618 (6.2%)
COVID-19 infection	0 (0%)	689 (2.5%)	4,907 (6.5%)
Shortness of breath	1,202 (2.4%)	1,093 (4.0%)	1,806 (2.4%)
Bronchitis	1,107 (2.2%)	390 (1.4%)	1,287 (1.7%)

Additional diagnoses (total of these diagnoses is 2.3%, 2.2% and 1.7%, of eligible visits for each period, respectively): bronchospasm, chest pain, respiratory distress, acute respiratory failure, stridor, laryngitis, lower respiratory tract infection, pneumonitis, complicated pneumonia, acute tracheitis, and laryngotracheitis.

vaccine periods, observing an initial flattening of ED visits followed by return to seasonal variation starting in 2022 with marked monthly surges in winter 2022. Future pandemic surge planning and mitigation strategies might consider the longer term impact of pandemic events on ED use, given that COVID-19 is now endemic and typical respiratory illnesses have resurfaced.

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Association of Shock Index and Variants with Mortality in Acute Pulmonary Embolism

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Introduction: Pulmonary embolism (PE) is common with potential for morbidity and mortality. Several PE risk-stratification tools exist; however, more granular and patient-specific indicators of potential decompensation or short-term mortality that can be easily obtained are needed for the bedside clinician to further sub-stratify risk and inform management decisions. We sought to determine the association of early emergency department (ED) measurement of the shock index (SI) and SI variants (modified SI, SI to peripheral oxygen saturation ratio, age-adjusted SI, respiratory-adjusted SI, and double product) and mortality among patients with acute PE.

Methods: This was an observational case-control study of adult patients who presented to the ED at a single health system (January 2021–April 2023) and had PE response team (PERT) activation for newly diagnosed acute PE. We evaluated the association of 30-day in-hospital mortality with the SI (heart rate/systolic blood pressure) and variants of the SI—modified SI = heart rate/mean arterial pressure; SI to peripheral oxygen saturation ratio = SI/peripheral oxygen saturation; age-adjusted SI = age x SI; respiratory-adjusted SI = SI x (respiratory rate/10); double product = systolic blood pressure x heart rate—in addition to the Simplified Pulmonary Embolism Severity Index (sPESI) and European Society of Cardiology (ESC) risk schema. We used the area under the receiver operating characteristic curve (AUC) to assess discriminatory efficiency of the SI and each variant with the primary outcome. Multivariable logistic regression measured the association between SI and variants with 30-day mortality.

Results: Of 121 patients included in the study, 12 (9.9%) died. The SI and variants were all significantly different between survivors and non-survivors ($P < .05$), while the sPESI was not different ($P = .30$). The age-adjusted SI had the highest discriminatory efficiency for mortality (AUC 0.82; 95% CI, 0.71–0.93), followed by the SI (AUC 0.78; 0.67–0.89), the SI/peripheral oxygen saturation (AUC 0.77; 0.65–0.90), double product (AUC 0.76; 0.61–0.91), modified SI (AUC 0.75; 0.61–0.90), ESC risk schema (AUC 0.71; 0.52–0.90), and the respiratory-adjusted SI (AUC 0.70; 0.54–0.87).

Conclusion: Among patients presenting to the ED who had a PERT activation for acute PE, the age-adjusted SI had the highest discriminatory efficiency for mortality, followed by the SI and its other variants. Further investigation regarding use of the age-adjusted SI for prognostication of acute PE and implications on PE management is warranted. [West J Emerg Med. 2026;27(1)137–145.]

INTRODUCTION

Background

Venous thromboembolism causes up to 100,000 deaths/year in the United States.¹ Risk scores such as the Simplified Pulmonary Embolism Severity Index (sPESI) and the

European Society of Cardiology (ESC) risk schema are used to identify patients with acute pulmonary embolism (PE) at high risk of death.^{2,3} However, simpler risk stratification is needed for the bedside clinician.

The shock index (SI) is a simple tool that can be readily

calculated at the bedside (SI = heart rate/systolic blood pressure) and has demonstrated promise in association with patient-centered outcomes. A higher SI is associated with worse outcomes in the generally ill, trauma, and hemorrhaging populations.⁴⁻¹⁵ The SI has also been applied to patients with acute PE as an additional indicator of potential for higher mortality.^{16,17} There are several variants of the SI: the modified SI (MSI); the SI to peripheral oxygen saturation ratio (SS); the age-adjusted SI (ASI); and respiratory-adjusted shock index (RASI).¹⁸ The double product (DP) (systolic blood pressure x heart rate) traditionally has been used as an indicator of myocardial strain during stress testing or exercise among patients with chronic cardiovascular disease.¹⁹ While the DP is not strictly a variant of the SI, it is another easily calculated bedside variable using patient vital signs, although it has not been studied among patients with acute PE. These variants may be better indicators of illness severity and more predictive of patient-centered, short-term outcomes. However, their characterization and application in patients with acute PE is limited.²⁰⁻²⁶

Importance

There is limited research into the SI variants and their association with short-term mortality in patients with acute PE. Risk stratification schema such as the ESC guidelines assign risk categories for patients, but most patients are intermediate risk. Further sub-stratification of individual-level risk may help identify patients who should more likely be admitted to the intensive care unit or receive some form of reperfusion therapy, for example. The use of specific markers of short-term mortality, such as the SI and variants, may further aid bedside clinicians and PE response teams (PERT) in management decisions among patients presenting to the ED with acute PE.

Goals of this Investigation

We sought to determine the association of early emergency department (ED) measurement of the SI and several SI variants with 30-day mortality for patients with acute PE.

METHODS

Study Design and Setting

This was an observational case-control study of all ED PERT activations between January 2021–April 2023 for patients diagnosed with acute PE at a single health system (Washington University in St. Louis/BJC HealthCare), which encompasses a large, urban, quaternary academic medical center as well as a mix of urban and suburban community medical centers. The PERT activation at our health system was recommended for patients with ESC-defined intermediate- and/or high-risk PE (Figure 1).³ We conducted this study in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines (Supplementary Table 1). Additionally, this study adhered to the following methodologic standards for emergency medicine

Population Health Research Capsule

What do we already know about this issue?
Pulmonary embolism (PE) is common with risk for morbidity/mortality. There is need for better predictors of mortality to inform management decisions.

What was the research question?
We sought to determine the association of the shock index and several variants with mortality among adults with PE.

What was the major finding of the study?
The age-adjusted shock index had the highest discriminatory efficiency for mortality (AUC 0.82; 0.71-0.93).

How does this improve population health?
The age-adjusted shock index may contribute to risk assessment to inform treatment decisions and could be incorporated into future risk prediction rules.

medical record review studies: abstractors training; case selection criteria; variable definition; performance monitoring; blinding to hypothesis; medical record identification; sampling method; and institutional review board approval.²⁷

Selection of Participants

We included adults (≥ 18 years) if they were diagnosed with acute PE by computed tomography (CT) and had activation of the PERT by the treating emergency clinician. Eligible patients were identified using the health system's internal PERT database. We excluded patients who underwent PERT activation from the floor or intensive care unit (ICU). Patients were followed from ED presentation until discharge from the hospital or death during index hospitalization, whichever came first. The study was approved by the institutional review board.

Measurements

Data was abstracted using high-quality chart review standards from the electronic health record by a trained abstractor (clinical research coordinator who completed institutional chart abstraction training) blinded to the study question and hypothesis, and managed using Research Electronic Data Capture hosted at Washington University in

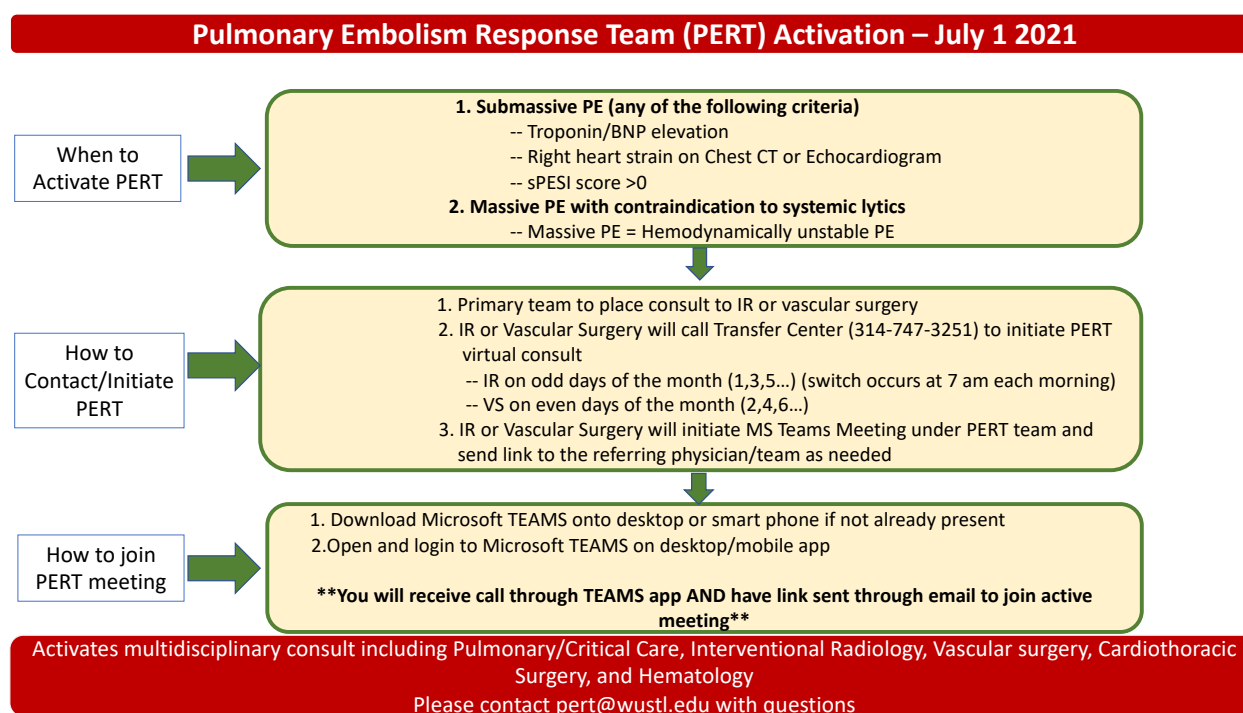


Figure 1. Recommendations and protocol for pulmonary embolism response team activation at Washington University in St. Louis, MO. *BNP*, B-type natriuretic peptide; *CT*, computed tomography; *IR*, interventional radiology; *PERT*, pulmonary embolism response team; *PE*, pulmonary embolism; *sPESI*, Simplified Pulmonary Embolism Severity Index; *VS*, vascular surgery.

St. Louis.^{28,29} A second trained abstractor verified data and outcomes for a subset of patients (pre-planned 50% of patients; resulting in 45% of included patients). Initial triage vital signs, baseline patient demographics, labs, and CT findings were used to retroactively calculate the SI, SI variants, sPESI, and ESC risk schema for each patient in the ED. Descriptions of the SI and variants, sPESI, and ESC risk schema are listed in Table 1. All variables extracted from the medical record, and definitions, are provided in Supplementary Table 2.

Outcome

The primary outcome was 30-day all-cause in-hospital mortality, defined as death in the hospital within 30 days from the time of initial ED triage for the index hospitalization. Patients were followed until either death or discharge. Those discharged alive prior to day 30 were considered to not have experienced the primary outcome.

Statistical Analysis

We described patient characteristics using descriptive statistics with median and interquartile range (IQR) for continuous variables and counts and percentages for categorical variables. Unadjusted analyses comparing the SI, variants, sPESI, and ESC schema between survivors and non-survivors were performed using chi-squared test for categorical data and

the Mann-Whitney *U* test for non-parametric continuous variables. We performed receiver operating characteristic (ROC) analysis and calculated the area under the curve (AUC) for discriminating the primary outcome as well as 95% confidence intervals (CI), and their statistical significance from the null of AUC = 0.5. We used the Youden index to determine the optimal cutoffs for each exploratory variable and its sensitivity as well as specificity for association with mortality.²⁹

We used multivariable logistic regression models to assess the association of the SI and variants with the primary outcome, while adjusting for potential confounders based on clinical plausibility (Supplementary Table 2). Final covariates were chosen using forward selection and included the following: age (except in the model assessing the ASI, to avoid redundancy); body mass index (BMI); and Charlson Comorbidity Index, due to their clinical importance and being the variables that were statistically associated with the primary outcome in univariate analyses. Adjusted odds ratios (aOR) and 95% CI were reported. All included patients had complete data for the primary outcome and covariates. We performed Kruskal-Wallis *H* tests to assess for differences between the mean ranks of the SI, variants, and sPESI stratified by ESC risk category. The alpha level was 0.05. Analyses were performed using SPSS Statistics v29 (IBM Corporation, Armonk, NY) and Stata v12.1 (StataCorp, LLC, College Station, TX).

Table 1. Description of the shock index and its variants as exploratory variables, as well as the sPESI and ESC risk schema, for retrospective study of their association with 30-day in-hospital mortality for emergency department patients with acute pulmonary embolism.

Exploratory variable	Definition	Computation
Shock Index (SI)	Quotient of the heart rate (HR) and systolic blood pressure (SBP)	$SI = HR/SBP$
Modified Shock Index (MSI)	Quotient of the HR and mean arterial pressure (MAP)	$MSI = HR/MAP$
SI to peripheral oxygen saturation ratio (SS)	Quotient of the SI and peripheral oxygen saturation (SpO_2)	$SS = SI/SpO_2$
Age-adjusted SI (ASI)	Product of the SI and age, in years	$ASI = SI \times \text{age}$
Respiratory-adjusted SI (RASI)	Product of the SI with the quotient of the respiratory rate (RR), in breaths/min, and 10	$RASI = SI \times (RR/10)$
Double Product (DP)	Product of the SBP and HR	$DP = SBP \times HR$
sPESI	High risk score defined as > 0, or yes to any of the components	Age > 80 years? History of cancer? History of chronic cardiopulmonary disease? HR ≥ 110 bpm? SBP < 100 mm Hg? $SpO_2 < 90\%$?
ESC risk schema	Low risk, intermediate-low risk, intermediate-high risk, or high risk	Low: sPESI=0 and no RV strain on TTE or CT Intermediate-low: sPESI > 0 and/or RV strain on TTE or CT, but negative troponin Intermediate-high: RV strain on TTE or CT and elevated troponin High: hemodynamic instability

sPESI, Simplified Pulmonary Embolism Severity Index; ESC, European Society of Cardiology; PERT, Pulmonary Embolism Response Team; SI, shock index; MSI, modified shock index; RASI, respiratory-adjusted shock index; DP, double product; HR, heart rate; SBP, systolic blood pressure; MAP, mean arterial pressure; SpO_2 , peripheral oxygen saturation; RR, respiratory rate; TTE, transthoracic echocardiogram; CT, computed tomography; bpm, beats per minute; mmHg, millimeters of mercury; RV, right ventricular.

RESULTS

Characteristics of Study Subjects

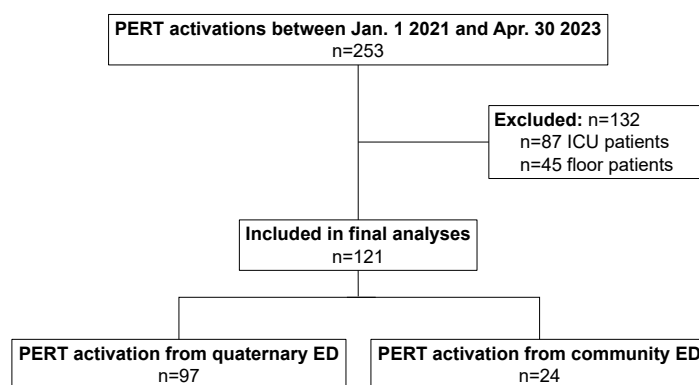
During the study period, 121 patients presenting to the ED with acute PE underwent PERT activation and were included in the analysis (Figure 2).

Baseline characteristics of the cohort, stratified by survivors and non-survivors, are summarized in Table 2. Ninety-seven (80.2%) had PERT from the quaternary academic medical center ED, while 24 (19.8%) were from regional community EDs within the health system. A total of 103 patients (85.1%) were classified as “high risk” by sPESI. The PERT recommended anticoagulant therapy alone most frequently ($n = 92$, 76%), followed by catheter-directed therapy ($n = 26$, 21.5%), and systemic thrombolysis in one patient (0.8%). Eighty-seven (71.9%) were admitted to an ICU.

Main Results

The primary outcome of 30-day in-hospital mortality occurred in 12 (9.9%) patients; median length of survival among those who died was 1 day (IQR 0.25-5.5). The SI, MSI, SS, ASI, and RASI were significantly higher, and DP significantly lower, in non-survivors as compared to survivors. However, there was no difference in sPESI classification (“high risk” or sPESI > 0) between survivors and non-survivors (Table 3).

The AUC for mortality was highest for ASI, followed by SI, SS, DP, MSI, ESC, and RASI, which were all significantly different from the null ($P < .05$) (Table 4).

**Figure 2.** Flow chart with exclusions for retrospective study investigating the association of the shock index and its variants with 30-day in-hospital mortality among adult patients presenting to the emergency department who underwent PERT activation for acute pulmonary embolism.

PERT, pulmonary embolism response team; ICU, intensive care unit; ED, emergency department.

Table 2. Baseline characteristics for patients who survived versus died from acute pulmonary embolism who had PERT activation, by shock index and its variants and association with 30-day in-hospital mortality.

	All patients (N = 121)	Survivors (n = 109)	Non-survivors (n = 12)
Age, years	62 (54-71)	62 (53-69.5)	68 (61.3-76.5)
Sex, female	58 (47.9)	52 (47.7)	6 (50)
Body Mass Index, kg/m ²	28.7 (25-35.3)	29.12 (25.5-35.3)	22.8 (17-35.3)
Race			
White	54 (44.6)	50 (45.9)	4 (33.3)
Black	62 (51.2)	54 (49.5)	8 (66.7)
Asian	0 (0)	0 (0)	0
American Indian/Alaska Native	1 (0.8)	1 (0.9)	0
Native Hawaiian/Pacific Islander	1 (0.8)	1 (0.9)	0
Comorbidities			
Charlson Comorbidity Index	4 (2-7)	3 (2-6.5)	7 (5-8.5)
Cancer	40 (33.1)	35 (32.1)	5 (41.7)
Hypertension	78 (64.5)	71 (65.1)	7 (58.3)
Diabetes mellitus	42 (34.7)	38 (34.9)	4 (33.3)
Congestive heart failure	23 (19)	18 (16.5)	5 (41.7)
Vitals			
Heart rate, bpm	113 (99-130)	113 (99-130)	117 (100-131)
Systolic blood pressure, mm Hg	123 (106-143)	127 (111-144)	94 (80-107)
Mean arterial pressure, mm Hg	95 (80.5-106)	96 (85-107)	74 (60-83)
Respiratory rate, rpm	20 (18-23)	20 (18-23)	20 (17-27)
SpO ₂	0.92 (0.87-0.97)	0.92 (0.87-0.97)	0.90 (0.86-0.97)
Location of PERT activation			
Quaternary emergency department	97 (80.2)	86 (78.9)	11 (91.7)
Community emergency department	24 (19.8)	23 (21.1)	1 (8.3)
Clot location(s)			
Main pulmonary artery or "saddle"	43 (35.5)	39 (35.8)	4 (33.3)
Segmental	102 (84.3)	92 (84.4)	10 (83.3)
Subsegmental	60 (49.6)	56 (51.4)	4 (33.3)
Clot percent obstruction, %	45.2 (24.8-56.8)	45.8 (25.2-61)	30.7 (3.2-51.8)
Right ventricular strain on CT	88 (72.7)	80 (73.4)	8 (66.7)
Right ventricular strain on TTE (n = 104)	53 (43.8) (n=104)	50 (50.5) (n=99)	3 (60) (n=5)
sPESI score	1 (1-2)	1 (1-2)	2 (0.25-3)
sPESI high risk	103 (85.1)	94 (86.2)	9 (75)
ESC pulmonary embolism severity			
Low risk	3 (2.5)	3 (2.8)	0 (0)
Intermediate-low risk	19 (15.7)	17 (15.6)	2 (16.7)
Intermediate-high risk	72 (59.5)	70 (64.2)	2 (16.7)
High risk	27 (22.3)	19 (17.4)	8 (66.7)
Initial PERT decision			
Anticoagulation alone	92 (76)	82 (75.2)	10 (83.3)
Catheter-directed therapy	26 (21.5)	24 (22)	2 (16.7)
Systemic thrombolysis	1 (0.8)	1 (0.9)	0
No treatment	2 (1.7)	2 (1.8)	0

PERT, Pulmonary Embolism Response Team; *bpm*, beats per minute; *mmHg*, millimeters mercury; *rpm*, respirations per minute; *SpO₂*, peripheral oxygen saturation; *CT*, computed tomography; *TTE*, transthoracic echocardiogram; *sPESI*, Simplified Pulmonary Embolism Severity Index; *ESC*, European Society of Cardiology.

Table 2. Continued

	All patients (N = 121)	Survivors (n = 109)	Non-survivors (n = 12)
First anticoagulant used			
Unfractionated heparin	96 (79.3)	86 (78.9)	10 (83.3)
Enoxaparin	22 (18.2)	20 (18.3)	2 (16.7)
Bivalirudin	1 (0.8)	1 (0.9)	0
Apixaban	0	0	0
None	2 (1.7)	2 (1.8)	0
Catheter-directed therapy device used (n = 23)			
Inari	22 (18.2)	21 (19.3)	1 (8.3)
Penumbra	1 (0.8)	0 (0)	1 (8.3)
Intraprocedural systemic thrombolysis given	2 (1.7)	2 (1.8)	0
Supplemental oxygen within 24 hours	95 (78.5)	84 (77.1)	11 (91.7)
NC	74 (61.2)	69 (63.3)	5 (41.7)
NIPPV	8 (6.6)	7 (6.4)	1 (8.3)
HHFNC	6 (5)	5 (4.6)	1 (8.3)
Ventilator	7 (5.8)	3 (2.8)	4 (33.3)
ICU admission	87 (71.9)	80 (73.4)	7 (58.3)
Vasopressors within 24 hours	27 (22.3)	20 (18.3)	7 (58.3)
ECMO used	3 (2.5)	2 (1.8)	1 (8.3)
Hospital length of stay, days	4 (3-8)	5 (3-8)	1 (0.25-5.5)
ICU length of stay, days (n = 87)	2 (1-3) (n = 87)	2 (1-3) (n = 80)	1 (0-4) (n = 7)
Cardiac arrest during admission	12 (9.9)	2 (1.8)	10 (83.3)
30-day in-hospital mortality	12 (9.9)	0 (0)	12 (100)

NC, nasal cannula; NIPPV, non-invasive positive pressure ventilation; HHFNC, heated and humidified high flow nasal cannula; ICU, intensive care unit; ECMO, extracorporeal membrane oxygenation.

There were significant differences in median SI ($P < .001$), MSI ($P < .001$), SS ($P < .001$), and ASI ($P < .001$) across the ESC risk categories, whereas no significant differences were observed for RASI ($P = .07$), DP ($P = .52$), and sPESI ($P = .28$) (Supplementary Table 3).

DISCUSSION

This was an observational, case-control study investigating the association between SI and several variants and 30-day all-cause mortality among patients with acute PE who underwent PERT activation. We found that the SI and variants were all significantly different between survivors and non-survivors of acute PE, while sPESI classification was not different between survivors and non-survivors. Furthermore, the ASI had the highest discriminatory efficiency for mortality, followed by the SI, SS, DP, MSI, ESC risk schema, and RASI.

Previous studies have demonstrated similar association of the SI with mortality in acute PE.¹⁶ However, prior to the present study, there were limited data evaluating the SI variants in acute PE. In a smaller retrospective study, the MSI correlated with markers of right ventricular dysfunction and pulmonary hypertension as well as PESI, and had greater association with mortality as compared to the SI.³⁰ Two other

retrospective studies had findings similar to our study, demonstrating that ASI had the highest discriminatory efficiency for mortality in patients with acute PE, as compared to the SI and PESI, with AUC similar to that reported in our study at 0.825 and 0.74, respectively.^{31,32} Furthermore, to our knowledge, our study is the first to investigate the use of RASI and DP in patients with acute PE.

Risk prediction scores such as the sPESI provide a sensitive tool to identify patients with PE at high risk of death. However, simpler tools that can be readily calculated at bedside promptly after the patient's arrival, and serially over time, offer the advantage of earlier and repeated risk stratification for this population at risk of early death. While ESC risk schema can inform initial PE risk and treatment decisions, further physiologically based and individualized risk sub-stratification may identify patients among the intermediate- risk group who are at risk for further decompensation despite management based on initial static risk assessment with ESC.

Incorporation of such tools such as the ASI could allow early identification of those who are at risk for worsening and may benefit from more aggressive reperfusion therapies such as systemic thrombolysis or catheter-directed therapies, or the

Table 3. Shock Index and variants, *sPESI, and European Society of Cardiology risk schema of survivors vs non-survivors of patients with acute pulmonary embolism.

	Survivors (n = 109), IQR	Non-survivors (n = 12), IQR	Unadjusted P-value	aOR (95% CI)	Adjusted P-value
SI	0.89 (0.73-1.11)	1.27 (0.98-1.35)	< .001	8.86 (1.42-55.31)	.02
MSI	1.18 (0.98-1.41)	1.60 (1.30-2.12)	< .001	5.96 (1.55-22.92)	.01
SS	0.98 (0.79-1.24)	1.36 (1.10-1.55)	< .001	6.24 (1.35-28.91)	.02
ASI	54 (37.75-69.07)	82.24 (62.25-104.75)	< .001	1.03 (1.01-10.6)	.01
RASI	0.44 (0.35-0.53)	0.56 (0.48-0.69)	.02	18.80 (0.68-521.93)	.08
DP	14208 (11497-17043.50)	10276 (8196-13075)	< .001	1.00 (1.00-1.00)	.04
sPESI high risk	94 (86.2)	9 (75)	.299	n/a	n/a
ESC low risk	3 (2.8)	0 (0)			
ESC intermediate-low risk	17 (15.6)	2 (16.7)			
ESC intermediate-high risk	70 (64.2)	2 (16.7)			
ESC high risk	19 (17.4)	8 (66.7)	< .001	n/a	n/a

*sPESI, Simplified Pulmonary Embolism Severity Index; aOR, adjusted odds ratio; ASI, age-adjusted shock index; DP, double product; ESC, European Society of Cardiology; MSI, modified shock index; RASI, respiratory-adjusted shock index; SI, shock index; SS, shock index to peripheral oxygen saturation.

Table 4. Receiver operating characteristic area under the curve for shock index and variants and ESC risk schema in discriminating 30-day in-hospital mortality for adult patients presenting to the emergency department who underwent PERT activation.

	AUC (95% CI)	Optimal cutoff	Sensitivity, %	Specificity, %	AUC compared to null, P-value
SI	0.78 (0.67-0.89)	0.95	91.7	61.5	< .001
MSI	0.75 (0.61-0.90)	1.58	58.3	88.1	< .001
SS	0.77 (0.65-0.90)	1.18	75	71.6	< .001
ASI	0.82 (0.71-0.93)	58.44	91.7	60.6	< .001
RASI	0.70 (0.54-0.87)	0.48	83.3	57.8	.01
DP	0.76 (0.61-0.91)	11615	75	73.4	< .001
ESC Risk Schema	0.71 (0.52-0.90)	3.5	66.7	82.6	.03

ESC, European Society of Cardiology; PERT, Pulmonary Embolism Response Team; AUC, area under the receiver operating characteristic curve; SI, shock index; MSI, modified shock index; SS, shock index to peripheral oxygen saturation; ASI, age-adjusted shock index; RASI, respiratory-adjusted shock index; DP, double product.

implementation of extracorporeal membrane oxygenation support, if worsening despite previously prescribed indicated therapies. While future study of the application of the ASI among patients with acute PE is needed, our study contributes to the available data that suggest its potential utility given its association with short-term mortality. Future directions may include examining trends in the ASI over time to identify patients who are not adequately responding to systemic anticoagulation alone or certain reperfusion therapies that may warrant management escalation. The ASI could also be considered for inclusion into future risk prediction scores and schema for patients with acute PE.

LIMITATIONS

Our study has several limitations. First, while we included all patients during our study period who had PERT activation, there are likely patients that had acute PE—potentially less

acutely ill given PERT activation at our institution is aimed at ESC-defined intermediate- and high-risk PE patients—who did not have PERT activated and are, therefore, not captured in our study; our findings, therefore, may not be generalizable to patients with ESC-defined low-risk PE. Second, this was a retrospective study with reliance on the vital signs first collected upon arrival to the ED. These vitals may not account for prehospital interventions. Furthermore, given the retrospective design, there is potential for unmeasured confounding. Third, this was a single health system study; thus, the findings require external validation.

Fourth, our primary outcome of short-term mortality occurred in only 12 patients and may have multifaceted etiologies contributing to death beyond the acute PE, and may miss patients discharged alive but who died after discharge. However, similar to sPESI and other PE risk-stratification tools, we feel that indices to aid in potentially predicting all-cause

short-term index hospitalization mortality in acute PE are patient-centered. Fifth, therapeutic interventions were at the discretion of the PERT and bedside team, and their potential effect on the primary outcome cannot be determined. Lastly, this study has a limited sample size and patients who experienced the primary outcome, resulting in wide 95% CIs in the adjusted analyses.

CONCLUSION

In this case-control study of patients presenting to the EDs of a single health system with acute PE, the ASI had the greatest association with in-hospital 30-day mortality, followed by the SI and its other variants. Future studies are needed to assess the clinical and therapeutic role of these findings, with future investigation of the application of the ASI to identify patients that may benefit from closer monitoring in the ICU, reperfusion therapy, and/or extracorporeal membrane oxygenation.

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External Validation of a Novel Lung Injury Prevention Score for the Emergency Department

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Introduction: Despite numerous randomized controlled trials, lung protective ventilation and prone positioning remain the only therapies shown to have a survival benefit in acute respiratory distress syndrome (ARDS). A National Heart, Lung, and Blood Institute workshop on the future of clinical research in ARDS suggested that identification of at-risk patients earlier in their clinical course would allow implementation of prevention strategies and facilitate study of these interventions. To this end, the Lung Injury Prevention Score (LIPS) was derived and validated to identify patients at risk of developing ARDS upon hospital admission, and the Emergency Department Lung Injury Prevention Score (EDLIPS) was subsequently derived and internally validated. For this study, we sought to externally validate EDLIPS.

Methods: We performed a validation study of EDLIPS, using data from a large, multicenter trial—the Vitamin D to Improve Outcomes by Leveraging Early Treatment (VIOLET) trial. After identifying patients who met VIOLET inclusion criteria while in the ED, variables comprising EDLIPS were extracted for each patient. We calculated area under the receiver operating characteristic curves (AUC) of EDLIPS for the VIOLET dataset.

Results: We identified a total of 1,270 patients. The mean age was 56, and 55% were male. The incidence of ARDS was 8.1%. EDLIPS discriminated patients who developed ARDS from those who did not with an AUC of 0.786 (95% CI, 0.740-0.832), nearly identical to its performance in the original study, which yielded an AUC of 0.784 (95% CI, 0.748-0.820).

Conclusion: We successfully validated a risk-prediction model for the identification of ED patients at risk for ARDS in a large cohort of critically ill patients. The development of ARDS prevention trials will involve collaboration with other clinical groups, such as emergency physicians, to enroll patients as early as possible in their clinical course. EDLIPS is the first tool of its kind to undergo external validation, and it can aid in the identification of ED patients at risk for the development of ARDS. [West J Emerg Med. 2026;27(1)146–151.]

INTRODUCTION

Acute respiratory distress syndrome (ARDS) is recognized as a major cause of morbidity and mortality in critically ill patients. Despite numerous randomized controlled

trials, lung protective ventilation and prone positioning remain the only therapies shown to have a survival benefit.¹⁻⁶ According to the “two-hit” model of ARDS development, a pre-ARDS state exists following initial lung injury.⁷

Interventions in this state could result in significant syndrome mitigation or prevention. Delayed recognition of at-risk patients likely contributed to failed prevention trials.⁸ The short interval between risk exposure and development of ARDS and the small percentage of patients at risk of ARDS who ultimately develop the syndrome make enrollment in preventative studies challenging.⁹⁻¹⁰ As noted by a National Heart, Lung, and Blood Institute (NHLBI) workshop on the future of clinical research in ARDS, identification of at-risk patients early in their clinical course would allow earlier implementation of prevention strategies and facilitate study of these interventions.¹¹ To this end, the Lung Injury Prevention Score (LIPS) was derived and validated to identify patients at risk of developing ARDS upon hospital admission.⁸ This score was derived from a mixed population, with 78% of patients admitted from the emergency department (ED) and 22% of patients admitted following high-risk, elective surgery.⁸

Although ARDS is classically thought of as an intensive care unit (ICU) syndrome, it can develop as soon as several hours after initial ED presentation.¹² When used in a prospective fashion to identify ED patients at high risk for ARDS, LIPS significantly underperformed.⁵ Given the heterogeneous cohort used to initially derive LIPS, investigators have subsequently endeavored to identify patients at risk of developing ARDS from more specific cohorts.¹³⁻¹⁵ Kor et al performed a subgroup analysis of a large, multicenter observational study to develop a risk-prediction model for postoperative patients at risk of developing ARDS.¹³

The ED Lung Injury Prevention Score (EDLIPS) was derived from a sample of 4,361 ED patients for the identification of ED patients at risk for ARDS.¹² Compared to LIPS, EDLIPS identifies patients at risk for ARDS from a more extensive index of presenting symptoms and predisposing conditions. Although EDLIPS performed similar to LIPS in the original derivation cohort, this risk-prediction model has not been externally validated.¹² To address this, we used the Vitamin D to Improve Outcomes by Leveraging Early Treatment (VIOLET) trial cohort.¹⁶ In the current study, we validate EDLIPS in an independent sample of critically ill patients.

METHODS

Study Design

This was a validation study of EDLIPS, using data from a large, prospective, multicenter trial—the VIOLET trial.¹⁶⁻¹⁷ This was a secondary analysis of de-identified trial data from the VIOLET study, conducted under a prior single institutional review board-approved protocol. The present validation study was approved by the NHLBI Prevention and Early Treatment of Acute Lung Injury (PETAL) Network.

Study Population

From April 2017–July 2018, 44 United States hospitals enrolled adult patients who were admitted to the ICU with at least one acute risk factor for death or lung injury that

Population Health Research Capsule

What do we already know about this issue?

Acute respiratory distress syndrome (ARDS) is a major cause of morbidity and mortality with few effective therapies. Research has shifted toward ARDS prevention.

What was the research question?

Can the ED Lung Injury Prevention Score (EDLIPS) discriminate ED patients who develop ARDS from those who do not in an external cohort?

What was the major finding of the study?

EDLIPS successfully discriminated patients who developed ARDS from those who did not with an AUC of 0.786 (95% CI, 0.740-0.832)

How does this improve population health?

EDLIPS can aid in the identification of at-risk ED patients to support future ARDS trials and bedside interventions.

contributed to their need for ICU admission and who screened positive for vitamin D deficiency. Acute risk factors for death or lung injury included pneumonia, aspiration, smoke inhalation, lung contusion, pancreatitis, sepsis, shock, and mechanical ventilation for acute respiratory failure. The primary end point was 90-day, all-cause, all-location mortality. Notably, ARDS prevention was a main focus of the VIOLET trial, as it was designed to include patients at higher risk for ARDS. LIPS was calculated for each patient upon enrollment, and patients were prospectively monitored for the development of ARDS within the first seven days of hospitalization. ARDS was diagnosed according to the Berlin definition.¹⁸

Study Variables

For this validation study, the above cohort was restricted to those patients who met VIOLET inclusion criteria while in the ED. Variables comprising EDLIPS were extracted from the trial database for each patient. We treated any missing data as an absent disease state or a normal variable, following the same methodology as the original EDLIPS study. Baseline characteristics, illness severity, and incidence of ARDS were also obtained from the database. The primary outcome was development of ARDS within seven days of hospital admission.

Statistical Analysis

The primary analysis assessed the predictive capability of

EDLIPS in distinguishing those patients who developed ARDS from those who did not. We performed statistical analysis using R, package *vR.4.5.1* (The R Institute for Statistical Computing, Vienna, Austria). Discrimination of EDLIPS performance was evaluated through the calculation of area under the receiver operating characteristic curves (AUC). Additionally, we computed corresponding positive and negative predictive values and their associated 95% confidence intervals.

RESULTS

We identified 1,270 patients meeting inclusion criteria in the VIOLET cohort and included them in this validation study. The mean age was 56, and 55% of patients were male. The mean Sequential Organ Failure Assessment score was 5, and 28-day all-cause, all-location mortality was 14.6%. The mean EDLIPS score was 6.80. The incidence of ARDS was 8.1% (Table 1).

Of the patients identified, 757 had all variables needed to calculate EDLIPS. Most of the incomplete data were due to the absence of a serum albumin level or serum pH. EDLIPS discriminated VIOLET patients who developed ARDS from those who did not with an AUC of 0.786 (95% CI, 0.740-0.832), nearly identical to its performance in the original study, which yielded an AUC of 0.784 (95% CI, 0.748-0.820) (Figure 1). When we omitted missing data, the AUC remained unchanged (0.79, 95% CI, 0.73-0.83).

DISCUSSION

Over the last decade, particularly in the wake of the COVID-19 pandemic, US hospitals have witnessed a dramatic increase in ED crowding and boarding. Peterson et al reported that the majority of increased volume was due to high-acuity patients.¹⁹ Increased ED boarding is associated with increased rate of hospital mortality and greater length of stay (LOS).²⁰ Additionally, ED boarding of critically ill patients is associated with a variety of poor outcomes, including increased ICU LOS, prolonged mechanical ventilation, and higher mortality.²¹ Up to 7% of at-risk ED patients will develop ARDS, most within two days of presentation.⁷ Following trends toward early risk stratification and goal-directed therapy in other disease processes, emphasis has shifted toward early ARDS identification, with the goal of ARDS mitigation or prevention.¹¹

In this external validation study, we confirmed the predictive capability of EDLIPS in distinguishing patients who developed ARDS from those who did not in a large, independent cohort of critically ill ED patients at risk for ARDS. Indeed, the predictive capability of EDLIPS remained robust, even when all missing data were excluded from analysis. This is the first time that EDLIPS has been validated in this fashion. The development of ARDS prevention trials will require tools to rapidly identify and enroll ED patients early in their clinical course. EDLIPS can aid in the identification and risk stratification of ED patients at risk of developing ARDS. Furthermore, EDLIPS may have a current role at the bedside. As ED patients who are

admitted to the ICU spend prolonged time boarding in the ED, EDLIPS could be applied to identify high-risk patients for focused interventions, such as lung protective ventilation to avoid ventilator-associated lung injury.

LIMITATIONS

The VIOLET study used the modern, Berlin definition of ARDS, whereas the original EDLIPS study utilized the 1994 American-European Consensus Conference (AECC) definition. As a result, there are several differences in the diagnostic criteria used in the two cohorts.¹⁸ A major change in the Berlin definition was removal of the term “acute lung injury” to describe mild forms of ARDS. Additionally, the Berlin definition removed the requirement of a pulmonary artery wedge pressure < 18 millimeters of mercury, refined chest radiograph criteria, and added a minimal positive end expiratory pressure requirement. Although the original EDLIPS cohort used the AECC definition, it incorporated two criteria that were ultimately included in the Berlin definition—timing of ARDS diagnosis and risk factors for ARDS. Using a dataset with ARDS identification and adjudication identical to the original EDLIPS study was prohibitive, especially given that the definition of ARDS changed in the decade between the two datasets. Notably, a study by Kim et al found that the original LIPS accurately predicted the development of ARDS as diagnosed by the Berlin definition, suggesting durability of these risk-prediction models.²²

Although smaller than the original EDLIPS derivation cohort, the VIOLET cohort used in this study represents one of the largest available datasets of critically ill patients at risk for ARDS. Furthermore, the availability of large datasets investigating ARDS development as a primary outcome is severely limited. Since this work was a secondary analysis of trial data, our work is subject to the usual limitations of using data not collected specifically for this purpose.

The VIOLET study only enrolled patients after the clinician’s decision to admit the patient to the ICU, introducing the potential for selection bias and limiting generalizability. Additionally, no data were collected on ED LOS. Given that prolonged ED LOS is associated with worse outcomes in critically ill patients, ED LOS represents a potentially uncontrolled confounder. However, all patients in the cohort met inclusion in the ED with an average time from inclusion to randomization of < 7 hours. Now that the NHLBI PETAL Network has ended, future ARDS investigations will require new, large, multicentered datasets of ARDS patients with a greater focus on ED patients.

CONCLUSION

We successfully validated a risk-prediction model for the identification of ED patients at risk for ARDS in a large cohort of critically ill patients. Further work is needed to assess efficacy in all comers to the ED. This is the first such tool to undergo external validation, and it can aid in the identification of at-risk ED patients to support future trials and bedside interventions.

Table 1. Demographic data and cohort characteristics of patients included in a study of the predictive capability of the Emergency Department Lung Injury Prevention Score (EDLIPS).

Characteristic	All (N = 1,270)	No ARDS (n = 1,167)	ARDS (n = 103)	P-values
Age (mean)	56	56	58	.35
Sex				
Male (%)	703 (55.4)	646 (55.4)	57 (55.3)	> .99
Female (%)	567 (44.6)	521 (44.6)	46 (44.7)	
Race and ethnicity				.04
Black (%)	279 (22.0)	261 (22.4)	18 (17.5)	
Non-Black Hispanic (%)	66 (5.2)	59 (5.1)	7 (6.8)	
Non-Hispanic White (%)	692 (54.5)	641 (54.9)	51 (49.5)	
Other (%)	36 (2.8)	35 (3.0)	1 (1.0)	
Not available (%)	197 (15.5)	171 (14.7)	26 (25.2)	
EDLIPS variables				
Aspiration (%)	63 (5.0)	45 (3.9)	18 (17.5)	< .001
Pneumonia (%)	456 (35.9)	397 (34.0)	59 (57.3)	< .001
Sepsis (%)	441 (34.7)	411 (35.2)	30 (29.1)	.26
Shock (%)	451 (35.5)	420 (36.0)	31 (30.1)	.28
Lung contusion (%)	40 (3.1)	39 (3.3)	1 (1.0)	.31
Smoke inhalation (%)	2 (0.20)	2 (0.20)	0 (0.0)	> .99
Long bone fracture (%)	19 (1.5)	18 (1.5)	1 (1.0)	.97
Brain injury (%)	21 (1.7)	18 (1.5)	3 (2.90)	.52
Cardiac surgery (%)	9 (0.7)	9 (0.8)	0 (0.0)	.78
Aortic surgery (%)	3 (0.2)	3 (0.3)	0 (0.0)	> .99
Acute abdomen (%)	14 (1.1)	12 (1.0)	2 (1.9)	.72
Diabetes mellitus (%)	139 (10.9)	131 (11.2)	8 (7.8)	.36
Cirrhosis (%)	68 (5.4)	61 (5.2)	7 (6.8)	.65
Chemotherapy (%)	125 (9.8)	114 (9.8)	11 (10.7)	.90
Obesity (%)	471 (37.1)	420 (36.0)	51 (49.5)	< .001
Acidosis (%)	446 (35.1)	367 (31.4)	79 (76.7)	< .001
FiO ₂ > 0.35 (%)	618 (48.7)	516 (44.2)	102 (99)	<0.001
Albumin <3.5 (%)	942 (74.2)	864 (74.0)	78 (75.7)	.80
SpO ₂ <95% (%)	860 (67.7)	775 (66.4)	85 (82.5)	< .001
Illness severity				
SOFA score (mean)	5	5	9	< .001
Mechanical ventilation (%)	362 (28.5)	264 (22.6)	98 (95.1)	< .001
Vasopressor use at baseline (%)	403 (31.7)	357 (30.6)	46 (44.7)	< .001
EDLIPS score (mean)	6.80	6.57	9.38	< .001
28-day mortality (%)	185 (14.6)	149 (12.8)	36 (35.0)	< .001
Time from randomization to intent to admit to ICU (hours)	6.77	6.77	6.8	.93

P-values were calculated using the Student *t*-test for continuous variables; chi-square test for categorical variables.

ARDS, acute respiratory distress syndrome; EDLIPS, emergency department lung injury prevention score; FiO₂, fraction of inspired oxygen; ICU, intensive care unit; SOFA, Sequential Organ Failure Assessment; SpO₂, oxygen saturation.

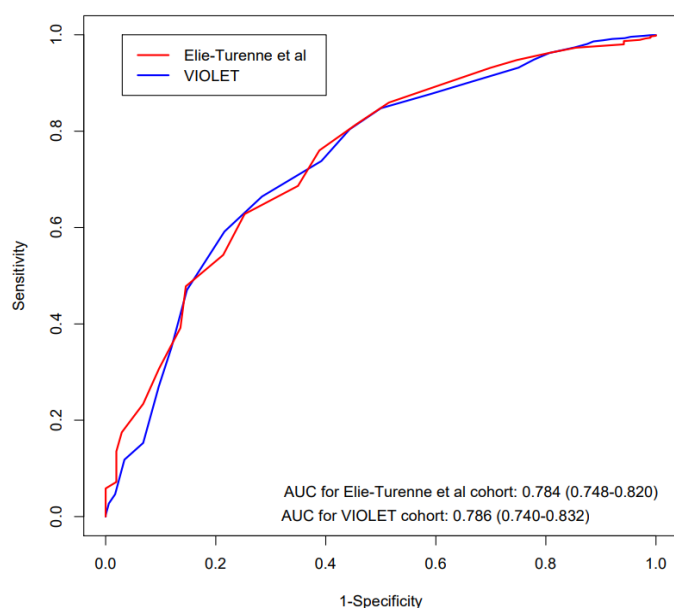


Figure 1. Area under the receiver operating characteristic curves comparing EDLIPS* performance in the original derivation cohort and the VIOLET** dataset with missing data considered absent disease state or a normal variable.

AUC, area under receiver operating characteristic curve;

*EDLIPS, ED Lung Injury Prevention Score; **VIOLET, Vitamin D to Improve Outcomes by Leveraging Early Treatment trial.

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Retrospective Analysis of Disparities in Timing of Prehospital and Emergency Department Pain Management by Sex and Age

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Introduction: Acute long bone fractures, such as femur and humerus fractures, frequently lead to emergency department (ED) visits and require timely pain management. However, disparities in analgesia administration persist across age and sex. This study investigates how these intersecting patient characteristics affect the timing and receipt of analgesia in both prehospital and ED settings.

Methods: We conducted a retrospective cohort study of adults (≥ 18 years of age) presenting to a Level I trauma center ED in 2022 with femur or humerus fractures. Demographics, analgesia timing, and receipt in both prehospital and ED settings were extracted from medical records. Our analysis included all forms of initial analgesic administration, including both narcotic and non-narcotic medications. We further categorized treatments to distinguish between any analgesia and narcotic analgesia. Multivariable Poisson and logistic regression models were used to assess disparities, adjusting for triage acuity, arrival method, initial pain score, and prehospital analgesia.

Results: Among 553 patients, 75% were ≥ 65 of age and 63% were female. Older adults experienced significantly longer delays to ED analgesia compared to younger adults (median 81 vs 44 minutes; +54.9% adjusted delay; $P < .001$) and were less likely to receive prehospital analgesia (44% vs 66%; odds ratio 2.52; $P < .001$). Sex-based disparities were also evident: females waited longer than males for ED analgesia (median 76 vs 57 minutes; +12.9% adjusted delay; $P < .001$). Among those who received prehospital analgesia, females waited 43% longer than males for subsequent ED pain treatment (median 72 vs 30 minutes; $P < .001$).

Conclusion: Age and sex disparities exist in both prehospital and ED pain management for long bone fractures. Older adults were less likely to receive prehospital analgesia and experienced prolonged delays in the ED. Female patients had longer ED wait times for analgesia, especially following prehospital treatment administered by emergency medical services responders. [West J Emerg Med. 2026;27(1)152–158.]

INTRODUCTION

Acute fractures are a common reason for emergency department (ED) evaluation, and managing these injuries requires balancing timely pain control with appropriate fracture care. However, pain management in the ED is often

delayed and undertreated,¹⁻² with variations influenced by both patient and clinician factors.³⁻⁹ Clinicians may hesitate to prescribe opioids to younger patients due to concerns about addiction and misuse,¹⁰ while prescribing pain medication for older adults (> 65 years of age) is often complex due to

multimorbidity, polypharmacy, altered drug metabolism, and the risk of opioid-induced delirium.¹¹⁻¹² These factors contribute to oligoanalgesia in this population, impacting their quality of life.

Disparities in analgesia delivery have been documented across patient characteristics, including age, sex, and ethnicity.^{3-5,7-8} Sex-based differences, particularly in the management of chronic musculoskeletal pain, are well-documented, with women often receiving less effective pain control.¹³ Older adults are disproportionately affected by osteoporotic fractures, which occur earlier in women due to their earlier onset of bone loss.¹⁴ In this study we investigated sex and age disparities in the delivery and timing of analgesia for patients with acute long bone fractures, focusing on femur and humerus fractures. These fractures, hallmark injuries of osteoporosis, often carry significant morbidity and demand prompt and effective pain management. The intersection of sex- and age-related differences in acute fracture pain management, both in the prehospital and the hospital setting, particularly in geriatric patients, remains unclear.

METHODS

This retrospective cohort study included patients ≥ 18 years of age who presented to a single, Level 1 trauma center ED between January 1–December 31, 2022, with a final diagnosis of a femur or humerus fracture. The ED has an annual volume of approximately 80,000 visits. Patients were identified through diagnostic codes in the electronic health record (Epic Systems Corporation, Verona, WI), and all eligible patients during the study period were included. We used a consecutive sampling method to ensure inclusion of all eligible cases. Data were abstracted using standardized data collection forms. Abstracted variables included patient age, biologic sex, fracture type, means of arrival (emergency medical services [EMS] vs private vehicle), whether pain medication was administered in the prehospital and ED settings, and time from ED arrival to analgesia administration.

We abstracted analgesic administration as two binary variables: any analgesia (yes/no), and any opioid (yes/no). We did not collect data on specific nonopioid analgesics (eg, acetaminophen, non-steroidal anti-inflammatory drugs, ketamine). For patients transported by EMS, prehospital medication administration data were extracted from the EMS database. Due to frequent inaccuracies in recorded administration times, only the presence or absence of prehospital analgesia was recorded. We did not include nerve blocks and non-pharmacologic treatments in our analysis as they were not used as initial interventions in either the prehospital or ED setting. In contrast, both administration and timing of analgesia were reliably recorded in the ED.

One author SM with extensive experience with the EMS database trained a second abstractor. Abstractor performance was monitored throughout data collection. To minimize bias, the abstractor collecting prehospital data was blinded to the

Population Health Research Capsule

What do we already know about this issue?

Disparities in emergency pain management by age and sex exist, but their interaction across prehospital and emergency department settings is poorly understood.

What was the research question?

Do age and sex impact timing and likelihood of analgesia in prehospital and emergency care for long bone fractures?

What was the major finding of the study?

Older adults experienced significantly longer delays to ED analgesia compared to younger adults (81 vs 44 min; 54.9% longer; $P < .001$), as did females (76 vs 57 min; 43% longer; $P < .01$).

How does this improve population health?

Findings highlight vulnerable groups—older adults and females—at risk for delayed pain care, informing targeted, equitable interventions.

study hypothesis until after data collection was complete. We evaluated interobserver reliability on a subset of cases, with complete agreement ($\kappa = 1.0$) observed across all abstracted variables. Missing data were infrequent and are described where applicable in the results. No imputation was performed; we conducted analyses using available case data. **Regarding triage levels**, patients with similar injuries may have been assigned different Emergency Severity Index (ESI) levels based on presenting vital signs, comorbidities, or initial pain severity. To account for this, we included ESI level as an adjustment variable in all regression models, and Table 1 was updated to ensure internal consistency across comparisons.

This study adhered to all 12 recommended methodological elements for retrospective chart review as outlined by Worster and Bledsoe,¹⁵ including clearly defined case selection criteria, standardized variable definitions, abstractor training and monitoring, blinding to the study hypothesis, use of abstraction forms, assessment of interobserver reliability, and appropriate handling of missing data. The Institutional Review Board (IRB) deemed the study exempt, and consent was waived by the IRB.

DATA ANALYSIS

We divided patients into two age groups: adults (18-64 years) and older adults (≥ 65 years of age). Older adults were further stratified into 65-84 years and ≥ 85 years of age for

Table 1. Patient demographics and emergency department visit characteristics for long bone fractures as part of a retrospective cohort study examining age and sex disparities in prehospital and emergency department pain management.

	Adults, 18-64 (n = 139)	Older Adults, ≥ 65 (n = 414)	All Patients (N = 553)
Patient demographics			
Age, years			
Median (Q1, Q3)	56 (38, 60)	81 (73, 87)	76 (64, 85)
Sex, n (%)			
Female	65 (46.8%)	284 (68.6%)	349 (63.1%)
Male	72 (51.8%)	128 (30.9%)	200 (36.2%)
Unknown/Did not disclose	2 (1.4%)	2 (0.5%)	4 (0.7%)
Fracture location, n (%)			
Femur	70 (50.4%)	315 (76.1%)	385 (69.6%)
Humerus	69 (49.6%)	99 (23.9%)	168 (30.4%)
Means of arrival, n (%)			
EMS arrival	91 (65.5%)	338 (81.6%)	429 (77.6%)
Non-EMS arrival	48 (34.5%)	76 (18.4%)	124 (22.4%)
Triage ESI, n (%)			
Level 1-2	34 (24.5%)	42 (10.1%)	76 (13.7%)
Level 3-4	104 (74.8%)	371 (89.6%)	475 (85.9%)
Unspecified acuity	1 (0.7%)	1 (0.2%)	2 (0.4%)
Treatment characteristics			
Time in treatment, minutes			
Median (Q1, Q3)	225 (148, 338)	270(198, 356)	262 (183, 355)
ED length of stay, minutes			
Median (Q1, Q3)	292 (180, 381)	303 (227, 398)	301 (216, 397)
Any analgesia, n (%)			
No	26 (18.7%)	90 (21.7%)	116 (21.0%)
Yes	113 (81.3%)	324 (78.3%)	437 (79.0%)
Any opioid, n (%)			
No	40 (28.8%)	138 (33.3%)	178 (32.2%)
Yes	99 (71.2%)	276 (66.7%)	375 (76.4%)
Arrival to pain medication, minutes			
Median (Q1, Q3)	44 (19, 88)	81 (41, 144)	72 (31, 132)
Clinician to pain medication, minutes			
Median (Q1, Q3)	19 (5, 48)	46 (17, 96)	37 (14, 83)

ED, emergency department; EMS, emergency medicine services; ESI, Emergency Severity Index; Q, quartile.

sensitivity analyses. Sex was categorized as male or female based on hospital records.

The primary outcome of interest was the time from patient arrival in the ED to analgesia administration. We analyzed time to analgesia administration using multiple Poisson regression, with adjustments for triage ESI, means of arrival, prehospital analgesia, and initial pain score. Results were reported as adjusted percent differences (APD) with 95% CI. We conducted a secondary analysis to evaluate whether patients arriving at the ED via EMS received prehospital analgesia. Receipt of prehospital analgesia was

compared between age groups and sex using univariable logistic regression. We report results with odds ratios (OR) and 95% CI.

RESULTS

Cohort Characteristics

A total of 553 patients with a femur or humerus fracture were included in this study; 414 (74.9%) were older adults (≥ 65 years of age), and 139 (25.1%) were adults 18-64 years (Table 1). We collected initial pain scores for all patients and included those scores in our adjusted models. Female patients

comprised 63.1% (n = 349) of the fracture patients while males accounted for 36.2% (n = 200).

Age Analysis

Older adults experienced significantly longer wait times for pain medication after arriving in the ED compared to adults ≤ 64 years of age, with a median time of 81 minutes (IQR 41-144; Table 2) vs 44 minutes (IQR 19-88) (APD +54.9%, 95% CI 50.9-59.1%, $P < .001$; Table 3) after adjusting for triage ESI, first pain score in the ED, means of arrival, and prehospital analgesia.

In the prehospital setting, adults ≤ 64 years of age (66.3%) were more than twice as likely to receive analgesia compared to older adults ≥ 65 (43.8%, OR 2.52, 95% CI, 1.53-4.14, $P < .001$), and older adults 65-84 years of age were significantly more likely to receive prehospital analgesia compared to those aged ≥ 85 years (OR 1.72, 95% CI, 1.09-2.70, $P = .02$). Upon arrival to the ED via EMS, older adults who did receive prehospital pain medication experienced a significantly longer wait for additional pain management in the ED compared to younger adults (median 68 vs 30 minutes, APD +77.2%, 95% CI, 68.8-86.0%, $P < .001$), even when adjusting for initial pain score and triage ESI. Older adults arriving to the ED via private vehicle experienced significantly longer delays in receiving pain medication compared to adults ≤ 64 years of age, with an adjusted difference of approximately 33% after accounting for triage ESI and pain scores (median 101 vs 70 minutes, APD +32.8%, 95% CI, 15.7-52.4%, $P < .001$).

Sex Disparities

Overall, female patients experienced longer delays in

analgesia administration than males in the ED, with a median wait time of 76 minutes (IQR 41-135) vs 57 minutes (24-118). After accounting for means of arrival, prehospital analgesia, triage ESI level, and first pain score in the ED, females had a 13% longer wait for pain medication compared to males (APD +12.9%, 95% CI, 10.6-15.3%, $P < 0.001$). Among younger adults there was no difference in time to pain medication between females and males (median 49 vs 39 minutes; APD +1.0%, 95% CI, -3.7% to +5.9%, $P = .68$). However, older adult females waited significantly longer for pain medication compared to older adult males (median 83 vs 70 minutes; APD +5.0%, 95% CI, 2.5-7.5%, $P < .001$).

No sex differences were observed in prehospital analgesia administration (49.2% for females vs 47.7% for males, OR 1.06, 95% CI, 0.71-1.58, $P = .76$). However, among EMS-arriving patients who received prehospital analgesia, females waited 43% longer for additional pain medication in the ED compared to males (median 72 vs 30 minutes, APD +43.0%, 95% CI, 7.2-49.0%, $P < .001$). This difference in time to pain medication among EMS-arriving patients was significant among both age groups; adult females waited 59% longer than adult males (median 51 vs 21 minutes; APD +59.0%, 95% CI, 45.3-73.9%, $P < .001$) whereas older adult females waited 28% longer than older adult males (median 74 vs 43 minutes; APD +27.7%, 95% CI, 14.8-42.0%, $P < .001$).

DISCUSSION

This analysis demonstrates clear age- and sex-based disparities in the timeliness of analgesia administration for patients with acute femur and humerus fractures across the prehospital and ED settings. Older adults, especially those aged

Table 2. Summary of pain medication administered for patients presenting to the emergency department with femur or humerus fractures.

	EMS Arrival			Non-EMS Arrival
	All Patients	No Prehospital Analgesia	Prehospital Analgesia	
Received any analgesia, n (%)				
Age group, n (%)				
Adults, 18-64	113 / 139 (81.3%)	27 / 34 (79.4%)	47 / 57 (82.5%)	39 / 48 (81.3%)
Older adults, 65+	324 / 414 (78.3%)	142 / 192 (74.0%)	122 / 146 (83.6%)	60 / 76 (78.9%)
Sex, n (%)				
Male	153 / 200 (76.5%)	64 / 87 (73.6%)	57 / 73 (78.1%)	37 / 47 (78.7%)
Female	281 / 349 (80.5%)	103 / 137 (75.2%)	112 / 130 (86.2%)	68 / 85 (80.0%)
Time from ED arrival to analgesia, minutes				
Age group, median (Q1, Q3)				
Adults, 18-64	44 (19, 88)	47 (19, 73)	30 (15, 66)	70 (25, 149)
Older adults, ≥ 65	81 (41, 144)	85 (50, 149)	68 (41, 124)	101 (30, 171)
Sex, median (Q1, Q3)				
Male	57 (24, 118)	81 (42, 125)	30 (16, 59)	96 (35, 166)
Female	76 (41, 135)	83 (44, 139)	72 (44, 121)	86 (23, 154)

ED, emergency department; EMS, emergency medicine services; Q, quartile

Table 3. Comparison of time from emergency department arrival to first pain medication for long bone fractures by patient age and sex.

	Patients, n (%)	Arrival to first pain med in the ED, minutes	Adjusted percent difference (95% CI)	P-value
All Patients ¹				
Age Group				
Adults, 18-64	113 (25.9%)	44 (19, 88)	Reference	---
Older adults, > 65	324 (74.1%)	81 (41, 144)	+54.9% (+50.9%, +59.1%)	< .001
Sex				
Male	153 (35.3%)	57 (24, 118)	Reference	---
Female	281 (64.7%)	76 (41, 135)	+12.9% (+10.6%, +15.3%)	< .001
EMS Arrival with No Prehospital Analgesia ²				
Age Group				
Adults, 18-64	27 (16.0%)	47 (19, 73)	Reference	---
Older adults, > 65	142 (84.0%)	85 (50, 149)	+73.0% (+63.7%, +82.9%)	< .001
Patient Sex				
Male	64 (38.3%)	81 (42, 125)	Reference	---
Female	103 (61.7%)	83 (44, 139)	+6.1% (-5.0%, +18.5%)	.29
EMS Arrival with Prehospital Analgesia ²				
Age Group				
Adults, 18-64	47 (27.8%)	30 (15, 66)	Reference	---
Older adults, > 65	122 (72.2%)	68 (41, 124)	+77.2% (+68.8%, +86.0%)	< .001
Patient Sex				
Male	57 (33.7%)	30 (16, 59)	Reference	---
Female	112 (66.3%)	72 (44, 121)	+43.0% (+37.2%, +49.0%)	< 0.01
Non-EMS Arrival ²				
Age Group				
Adults, 18-64	39 (39.4%)	70 (25, 149)	Reference	---
Older adults, 65+	60 (60.6%)	101 (30, 171)	+32.8% (+15.7%, +52.4%)	< 0.001
Patient Sex				
Male	37 (25.2%)	96 (35, 166)	Reference	---
Female	68 (64.8%)	86 (23, 154)	-6.8% (-20.4%, +9.0%)	0.38

¹Percent difference was adjusted for triage ESI, first pain score in the ED, means of arrival, and prehospital analgesia.

²Percent difference was adjusted for triage ESI and first pain score in the ED.

ED, emergency department; EMS, emergency medicine services; ESI, Emergency Severity Index.

≥85 years, experienced significant delays in receiving analgesia in both prehospital and ED settings, even after adjustment for triage ESI, initial ED pain score, means of arrival, and prehospital analgesia. Female patients, regardless of age, have historically experienced delays in pain management, with the disparities being most pronounced in geriatric females > 65 years of age.^{16, 17} This finding aligns with prior research suggesting oligoanalgesia in women, possibly due to biases in pain perception or assumptions about their pain tolerance.^{16, 17}

Although our data suggest that sex disparities may be narrowing in the adult cohort, any inference of “progress” should be made cautiously, as this was a singlecenter, retrospective, cohort study. In the non-EMS cohort, there was no significant difference in pain medication administration or

wait times between females and males (median 86 vs 96 minutes, $P = .38$). Additionally, while female adults waited less time than male adults (median 67 vs 82 minutes, $P < .001$), older females and males (> 65) had nearly identical wait times (median 101 vs 99 minutes, $P = .09$).

Because our primary aim was to examine timeliness of analgesic administration, rather than the adequacy of pain control, we did not include patient-reported relief measures. Timely analgesic administration for long bone fractures was a previously reported metric for the Joint Commission and a Centers for Medicare and Medicaid Services quality measure in 2013, highlighting the importance of prompt and equitable pain control. Although not a current Joint Commission metric, pain management remains central to its standards. These

delays are particularly concerning given that femur and humerus fractures are hallmark injuries of osteoporosis, a condition that predominantly affects older adults. Women begin to experience osteoporotic fractures typically after 65 years of age due to earlier onset of bone loss, while men—whose higher peak bone mass offers temporary protection—often sustain such fractures later, commonly after age 80.¹⁸ These age thresholds directly correspond to the populations in our study who were least likely to receive prehospital analgesia and who experienced the longest delays in pain treatment upon ED arrival, despite representing the majority of fracture cases.

Age-related delays in pain management may stem from concerns about opioid-induced delirium in older adults, as opioids are associated with an approximately 2.5-fold increased likelihood of delirium in geriatric patients.¹⁹⁻²⁰ However, decisions about pain medication should consider the clinical setting and involve a thorough, risk-based assessment. While this risk warrants caution, it should not preclude the timely use of non-opioid analgesics or appropriately dosed opioids, particularly for severe pain. Other potential mechanisms for the observed differences include under-reporting or atypical reporting of pain by older adults; implicit or cognitive biases from clinicians; variations in EMS and ED protocols; and operational constraints such as ED crowding, boarding, and staffing. Critically, none of these mediators were measured in our dataset, and they should, therefore, be viewed as hypothesis-generating only.

The disparity in prehospital analgesia administration by age also raises concerns. Adults 18-64 years of age were significantly more likely to receive pain medications en route to the ED compared to older adults. Among geriatric patients, those ≥ 85 years of age were particularly vulnerable to undertreatment, despite presenting with similar or greater pain scores. Although many institutions, including ours, have protocols to guide analgesia administration based on pain scores, these systems may not sufficiently account for generational differences in pain expression. Older adults may under-report their pain compared to younger patients, which could unintentionally contribute to undertreatment.

Implications for Practice and Research

This study adds to the evidence of age- and sex-based disparities in acute pain management. Future work should more precisely identify the drivers of these disparities. It should also prospectively evaluate solutions such as the following: protocolized, geriatric-aware multimodal pathways (opioid-sparing and regional anesthesia options); standardized assessment with mandated reassessment and patient-reported outcomes; clinician-focused strategies (education on pain in older adults, bias-aware training, audit-and-feedback); decision support/order sets that default to early non-opioid therapy; EMS standing-order refinement; and system-level actions addressing crowding, staffing, and documentation

accuracy to determine whether these approaches shorten time to effective analgesia without increasing harm.

LIMITATIONS

While this study has certain limitations, it also presents valuable opportunities for further research. The retrospective design, while limiting causal inferences, provides a strong foundation for identifying key disparities in pain management. Conducted at a single Level I trauma center, the findings offer important insights that future studies can build upon to assess generalizability across diverse settings. The analysis of prehospital analgesia highlights the need to explore factors such as clinician experience, clinician sex, and implicit bias in future investigations. Additionally, refining biologic sex categorization to better capture gender identity and incorporating more nuanced age stratification can enhance our understanding of patient experiences. Expanding the scope beyond femur and humerus fractures to include other injuries could further enrich findings. While this study primarily focuses on pharmacologic pain management, integrating non-pharmacologic strategies into future research may provide a more comprehensive view of pain treatment approaches.

CONCLUSION

Age- and sex-based disparities in pain management for long bone fractures persist across both prehospital and ED settings. Despite the presence of robust pain protocols, older adults—particularly those ≥ 85 years of age—remain at increased risk for delayed or absent analgesia, although sex-based disparities appear to be narrowing. Because femur and humerus fractures are hallmark injuries of osteoporosis, affecting both older women and men, our focus on the intersection of age and sex across the entire care trajectory reflects a need to improve pain management for this vulnerable and growing patient population. Addressing these disparities requires both system-level changes, such as protocol refinement and training, and clinical-level improvements in clinician assessment and decision-making.

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Incidence of Solar Retinopathy and Photokeratitis in US Emergency Departments Surrounding the April 2024 Total Solar Eclipse

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Introduction: Viewing a solar eclipse without proper eye protection can lead to ocular injuries such as solar retinopathy or photokeratitis. The April 8, 2024, solar eclipse in the southern and eastern United States presented a rare opportunity to assess the public health impact of such events on eye-related emergency department (ED) visits.

Methods: We identified a total of 1,774 ED visits for eye injuries across both periods. There were 853 visits before the eclipse and 921 visits after, showing no statistically significant difference ($X^2 = 1.432$, $P > .05$) between the two time periods.

Results: We identified a total of 1,774 ED visits for eye injuries across both periods. There were 853 visits before the eclipse and 921 visits after. The chi-square statistic ($X^2 = 1.432$, degree of freedom = 1, $P > .05$) indicated no statistically significant difference in the incidence of eye injuries between the two time periods.

Conclusion: Despite concerns regarding eclipse-related eye injuries, we found no statistically significant increase in ED visits for ocular pain or photokeratitis following the April 8, 2024, solar eclipse. These results suggest that public education campaigns promoting safe eclipse viewing may have been effective. Ongoing efforts are warranted to continue promoting ocular safety during future eclipses. [West J Emerg Med. 2026;27(1)159–162.]

INTRODUCTION

The April 8, 2024, solar eclipse provided an opportunity for a large part of the United States, from Texas to Maine, to witness the moon completely obscure the sun. Approximately 32 million people across 15 states were in the path of totality,¹⁰⁻¹¹ and an even larger population—including tens of millions outside this path—observed a partial eclipse. Variations in weather conditions along the viewing path influenced visibility and could have affected exposure risk. An additional one to four million people are estimated to have

traveled in the US to view the eclipse.¹²

Viewing a total or partial eclipse can be dangerous to the human eye without proper protection. Looking directly into the sun can cause visual disturbances, collectively known as solar retinopathy, as well as corneal injuries such as photokeratitis. These affect different structures of the eye and should not be considered synonymous. Public health authorities, including the National Aeronautics and Space Administration and the American Academy of Ophthalmology, caution against any unprotected direct solar viewing. This condition is characterized by symptoms

such as dark spots in the field of vision, light sensitivity, headache, and distortion of shapes.¹³ Symptoms may not be immediately apparent, manifesting a few hours to days following even a few seconds of exposure of the very sensitive fovea centralis to high-energy light.¹⁴ There is no specific treatment for solar retinopathy, and most cases resolve over time.⁵

Considerable public health education occurs in advance of these events to encourage safe eclipse viewing. Examples include the distribution of eclipse glasses certified by the International Organization for Standards, televised safety campaigns, and school-based educational initiatives. While these efforts are assumed to influence viewing behaviors, we did not directly measure public awareness or protective practices, and any inference about effectiveness should be interpreted with caution. While there have been scattered reports of solar retinopathy after previous eclipse events,¹⁻⁹ to our knowledge a large-scale review of emergency department (ED) visits for solar retinopathy following an eclipse has not been undertaken. We present here our findings of ED visits in the US for solar retinopathy surrounding the solar eclipse of April 8, 2024. We acknowledge our study terms may not fully capture all such cases.

METHODS

Data Source

We abstracted the data used in this study from Epic Cosmos, a dataset created in collaboration with a community of Epic health systems (Epic Systems Corporation, Verona, WI) representing more than 270 million patient records from over 1,500 hospitals and 35,000 clinics from all 50 states. The database provides details regarding various types of patient visits within the hospital setting, including linked diagnosis, treatments, and other discrete data points, allowing for analysis of numerous health conditions with a highly representative and distributed patient population (Epic Cosmos). We acknowledge that limiting our study to ocular pain and photokeratitis may exclude other eclipse-related diagnoses such as solar retinopathy, scotoma, or macular edema, potentially biasing results.

This study was determined to be exempt from review by the Institutional Review Board of the Allegheny Health Network as it does not meet the definition of Human Subjects Research according to the 45 Code of Federal Regulations (CFR) 46.102(f).

Study Period

The study focused on the week immediately preceding (April 1-7, 2024) and the week including and following the solar eclipse of 2024 (April 8-14, 2024). This time frame was chosen to capture any potential changes in the incidence of eye-related injuries associated with viewing the solar eclipse and to capture patients who initially were within the pathway of viewing the eclipse but then may have returned to their homes before seeking medical treatment for eye injuries. This may not capture early preparatory or delayed eclipse-related injuries.

Population Health Research Capsule

What do we already know about this issue?
Viewing eclipses without eye protection can cause solar retinopathy or photokeratitis, but population-level data on eclipse injuries are limited.

What was the research question?
Did emergency department (ED) visits for ocular pain or photokeratitis increase after the April 8, 2024, solar eclipse?

What was the major finding of the study?
ED eye visits: 853 before vs 921 after eclipse, $P > .05$, no significant increase.

How does this improve population health?
Findings suggest eclipse safety campaigns were effective, supporting continued public education to prevent vision injuries.

Inclusion Criteria

Patients included in this study were those who had been diagnosed with *International Classification of Diseases, 10th Revision (ICD-10)* codes for ocular pain or photokeratitis in all ED visits within the specified study periods (Table 1). No exclusion criteria were applied, including for age or sex.

Data Extraction

On July 20, 2024, we queried the Epic Cosmos database to extract patient records with the *ICD-10* codes (Table 1) during the specified time periods. The query was limited to ED visits. We captured both the patients seen in the ED for the above *ICD-10* codes as well as the total number of visitors

Table 1. International Classification of Diseases, 10th Revision, codes for eye injuries used in analysis of emergency department visits surrounding the April 8, 2024, solar eclipse in the United States.

Diagnosis	ICD-10 Code
Ocular pain, left eye	H57.12
Ocular pain, right eye	H57.11
Ocular pain, unspecified eye	H57.10
Photokeratitis, left eye	H16.133
Photokeratitis, right eye	H16.132
Photokeratitis, bilateral	H16.131
Photokeratitis, unspecified	H16.139

ICD-10, International Classification of Diseases, 10th Revision.

at contributing EDs over the period. We further acknowledge that ultraviolet keratitis and related ocular injuries may be coded under a variety of *ICD-10* diagnoses, including conjunctivitis (H10) and other non-specific ocular complaints.

Statistical Analysis

We conducted a chi-square test of independence to compare the incidence of eye injuries before and after the solar eclipse. The significance level for the chi-square test was set at .05. We calculated the degrees of freedom based on the categories of eye injuries vs no eye injuries and pre- or post-eclipse with a critical value of 1 to either reject or accept the null hypothesis. This enabled us to assess whether the solar eclipse had a measurable impact on the incidence of eye injuries in the participating population of the Epic Cosmos database. We hypothesized that there would be no significant difference in the proportion of eye injuries seen in the EDs participating in Epic Cosmos before and after the solar eclipse.

RESULTS

We conducted a chi-square test of independence to compare the number of ocular injuries before and after the solar eclipse. The observed frequencies are shown in Table 2. The calculated chi-square (X^2) value was 1.432 based on the observed and expected frequencies. The degree of freedom was determined to be $(2-1) \times (2-1) = 1$. At the .05 significance level, the critical value for one degree of freedom is 3.841. Since the computed X^2 value (1.432) is less than the critical value (3.841), we do not reject the null hypothesis. Therefore, there is no statistically significant difference in the number of eye injuries before and after the solar eclipse.

DISCUSSION

This study offers valuable insight into the impact of the 2024 solar eclipse on ocular injuries reported in EDs across the US. Although significant public awareness campaigns emphasizing eye protection may lead one to believe eye

injuries such as solar retinopathy are prevalent following a solar eclipse, our analysis of data from this database revealed no statistically significant increase in eye injuries following this eclipse. The observed frequencies of eye injuries before and after the event, 853 before and 821 after, did not deviate significantly from what would have been expected in a typical two-week period without an eclipse, as demonstrated by the chi-square test.

The public health education referenced here encompasses both media-based safety warnings and the distribution of protective eyewear; however, we did not assess individual awareness or protective behaviors. The broad coverage of the eclipse in media outlets accompanied by warnings from health authorities may have reduced risky eclipse-viewing behaviors, leading to fewer incidents of solar retinopathy than might have been anticipated. Thus, this hypothesis-generating study did not find a statistically significant increase. While these findings may be consistent with preventive measures, the data do not allow causal attribution.

Another explanation could lie in the nature of the injuries themselves. Solar retinopathy, while concerning, does not always lead to immediate symptoms. As noted in previous studies, the onset of symptoms may be delayed by several hours or even days after exposure, perhaps leading to under-reporting of cases, as some individuals may not seek medical attention immediately.⁶ Additionally, minor cases of visual disturbance may either resolve without medical attention or be misclassified in hospital databases, limiting our ability to detect these cases.

LIMITATIONS

This study, like all retrospective chart reviews, has inherent limitations that may affect the results and conclusions drawn from those results. Missing, inaccurate, or incomplete records are all potential limitations. Patients may have inaccurately reported the cause of their injury, which would have resulted in them being coded under a different *ICD-10* code. It is also possible that patients may have presented after the study period or may have presented to a primary care physician, optometrist, or ophthalmologist instead of presenting to the ED. The inclusion of the more general *ICD-10* code of ocular pain certainly captures more eye injuries than those related to the eclipse; however, even if ultraviolet keratitis were coded as the more general ocular pain, we would still expect to see an increase in total cases if there were more injuries during the study period.

Inclusion of data covering the entire United States could have masked a result that may have been observed had we only included data from within the path of the eclipse. However, as millions traveled from all over the world for the event, we believed that including all the visit data in Epic Cosmos would provide the most comprehensive picture of all ocular injuries during the study period, accounting for people who left the area of the eclipse before seeking treatment. Inclusion of data

Table 2. Comparison of observed and expected frequencies of eye injuries vs. all other diagnoses before and after the April 8, 2024, solar eclipse using emergency department data from a nationwide database.

Period	Eye injuries	No Eye injuries*	Total
Before			
Observed	853	842,017	842,870
Expected	878	841,991	
After			
Observed	921	857,873	858,794
Expected	896	857,889	
Total	1,774	1,699,890	1,701,664

*"No eye injuries" includes all other ED visits for any diagnosis during the respective time frames.

covering the entire US could have masked a result. Additionally, injury incidence may vary depending on whether viewers were within the path of totality or they observed a partial eclipse.

Despite these limitations, this study has several strengths. The use of the Epic Cosmos database, which contains over 270 million patient records, allowed for a comprehensive analysis across a wide geographical region, enhancing the generalizability of our findings. Moreover, the clear definition of the study period, as well as the inclusion of specific ICD-10 codes for eye injuries, provided a focused examination of the potential effects of the eclipse on ocular health. Future studies could benefit from a longer follow-up period to capture delayed presentations of solar retinopathy, as prior literature indicates that symptoms can emerge days to weeks after exposure.

CONCLUSION

We did not find a statistically significant increase in eye injuries following the solar eclipse of April 2024 in the US. These findings may reflect the potential benefit of preventive public health measures; however, given the limitations, caution is warranted in interpreting this as evidence of effectiveness. Public education will be essential in the lead up to future eclipses to ensure that the general population remains aware of risks and takes appropriate precautions when viewing these awesome celestial events.

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We Are Not Okay

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Abstract [West J Emerg Med. 2026;27(1)163–166.]

The morning was already going to shit. I almost made it out of the house on time, but then I found ants in my granola. After I'd already sprinkled it on my carefully prepped yogurt with banana slices. I decided to sacrifice a few more minutes so I could still have half a breakfast, but I only had frozen bananas left and the second iteration was not particularly visually appealing. I ran out of my apartment with the garbage in one hand, container in the other, cursing that once again all my noble punctual intentions were bamboozled by a generous serving of executive dysfunction.

I was heading in for my least favorite shift - ED admissions. Since the hospital can't be bothered to actually deal with their boarding issue, their solution was to create an additional shift for an attending EM physician to act as an internist and round on the boarding patients while they waited for space upstairs. It's a thankless job consisting mostly of being yelled at by families for things completely out of your control, cajoling the nurses to not forget about the orders you put in since they still have new arrivals to deal with, and once again saying "no, I don't know when there will be a bed on the ward" - all while trying to practice medicine outside of your specialty. They would never ask a cardiologist to consult on acute kidney injury, but somehow it's fine for me to be adjusting blood pressure medications and evaluating hyponatremia.

I had already been informed that I was being pulled off shift for a few hours to participate in a biological mass casualty drill being run by the health ministry. When I arrived there were fifteen ED boarders, five of them over twenty four hours. I had just a couple of hours to try and see as many as I could, order home meds, request further diagnostic tests and open consults. It seems the ants were an omen. I should have just gone with my typical and chosen coffee with a side of violence.

I'm trying to calculate the appropriate basal insulin dose for the DKA-er and order antibiotics for the suspected cholangitis when the drill begins. It's not my first time. Being disaster fellowship trained, and spending my first five years as an attending practicing during a global pandemic and multiple wars, I am used to both running and participating in all kinds

of simulations. I try to ignore how many suits are here. This is why I hate the day shift.

Four bright orange bean bag dolls are unceremoniously thrown onto the gurneys in beds nine and ten. I go in with the nurse and we start the performance. As we read the information cards, the scenario becomes clear: multiple patients with high fever, some with respiratory symptoms, some with signs of meningitis. I call the infectious disease consultant and the department head to report the suspicion of a contagion. We're told to gown up and transfer the patients to the negative pressure room. Gown, N95 mask, face shield, then gloves. I crack a joke about the perfect scenario to trigger our PTSD. The nursing supervisor gives me a dirty look and tells me to pay attention to the donning poster. We go into the room and the facilitator says that doll three, a 24-week pregnant woman, is now coding. I am joined by the nurse who pulls up the code cart, and our chief resident who half-heartedly starts tapping his palm on the doll's middle in what are supposed to be chest compressions. I give the facilitator a wicked grin, lost behind my mask. You want to screw with me, I'm all in. I call for a thoracotomy tray and OB to get down here now for a resuscitative hysterotomy. Their faces are priceless. They decide to give me ROSC before I cut through the orange plastic and the filling spills everywhere. They tell us we can admit the patient to the ICU. I'm chuckling to myself. Meanwhile, we're informed that incident command has declared the need to open a "biological ED" to isolate the suspected patients as they arrive. Everything is progressing as expected.

I don't know exactly when it happened. I was fine, really. A bit hungry, since I never did eat my second attempt at breakfast; a bit annoyed that I had to participate in a fictitious disaster while the ED really was going up in flames. First, it was just the itchiness of the gown. Then, the pressure of the mask straps around my face. It was hot, and I couldn't see because the face shield was foggy. I remember that I could never see because of the stupid face shield. And breathing, when did breathing become this hard? My chest felt tight and I heard buzzing in my ears. I looked around and there were twenty people in the room, half holding clipboards, talking and talking and talking and

meanwhile I just need to leave, to get out, to take off the dumb mask and go back to my patients. But I don't because it's a drill and it's not real and we have to impress the health ministry and I'm getting stank eye from nursing management as I try to adjust my mask to let in some air.

I feel it building. That panic, impending doom, the activation of my limbic system and I know exactly what is happening and still I am overwhelmed. I start with box breathing. Loud, long inhale through the nose, hold, loud, long exhale through the nose, hold. I plant my feet on the ground and lean against the wall so I can feel where every part of my body is in contact with the hard surface, willing myself to be grounded by the tactile sensation. I curl my hands into fists and dig my nails into my palms hard enough to leave a mark. I tell myself I am fine.

The resident is standing next to me chatting with the nurse, but he turns, noticing the change. He is a good friend and he knows me, recognizes that I am too quiet, too still. "You okay?" I brush it off and nod. He isn't fooled. He keeps eyeing me.

We finally move to the biological ED. It's our observation unit, a closed five bed ward next to the main ED, which during the COVID-19 pandemic was used to isolate the suspected and confirmed cases. The way there, the space, walking around with our gowns and masks, is familiar. The computers, the rooms, the equipment, everything is exactly as it would be in a real event, because this is exactly what we did when it really happened. And suddenly, the drill speeds up. They bring in the dolls two and three at a time. They are thrown into corners and I can't keep track of how many patients there are and they're supposed to be opening electronic charts for everyone, but some of them are missed. The infectious disease physician pops up once more and I ask him for an update of what to do with the patients. Antibiotics? Testing? Dispo? He gives me the recommendations, and then he leaves.

One of the facilitators comes over and starts quizzing me on appropriate doffing procedure. And I answer: yes, of course I know, first gloves and then mask and then gown, um, no, I mean gown first then mask last after cleaning my hands.... And she smiles at me condescendingly and tells me it's ok to say I don't remember and that I would refer to the sign that is posted in the doffing area. And I want to scream because I do remember, I was there, and I did it over and over and I never looked at any sign because I was running in between patients and who has time to look at a sign. She marks something on her clipboard and walks away, the nurse manager scurrying after her.

There are so many people walking around and looking and talking and making a fuss, but I am trying to find which patient is which and write in their charts because they're all the same and they all have the same symptoms and everyone is alone and I have no staff and there's no vaccine and people just keep dying and.... Wait, no. This is a drill. You are fine. This is not real. These are dolls and this already happened. But

the feeling keeps growing, and I am holding on by a thread. I sit at the computer and type because it's the only thing I can do. I don't trust myself to open my mouth and speak or I will scream or cry or stab someone.

The nurse wants to know why I haven't admitted anyone yet. Admit them, sure, why not. I'll keep typing in the chart to get that going. I write the same story, the same symptoms, the same treatment for everyone. Three, four, five patients. There are still at least seven more? Eight? I'm not sure. They call me from incident command to ask for an update on how many patients. I don't know. Ten? Twelve? The dolls are stacked in the beds and on chairs and they brought in so many in a row that not everyone has a chart yet and I'm just trying to figure out who's who. Twelve, I say into the phone, unconfidently. And then my nurse chimes in nonchalantly, "And one deceased."

My heart ceases to beat. I feel an impact in the center of my chest as if I just took a helmet shot from a linebacker.

"What do you mean, one deceased?"

"EMS brought one in, she's dead."

It's surging again, the feeling that I'm about to tumble off the edge of a cliff. I have been clinging to the ledge for so long, watching stones crumble as I take every step, carefully, so carefully, as not to lose the footing I've crafted out of grit and numbness and apathy, the cheapest tender for building my fort of resilience that is based on a foundation of lies, with all the stability of a house of cards anchored to sand.

"How come I didn't know there was one dead?" I hear the pitch of my voice rising, vibrating towards hysteria even as I fight to keep it even, steady.

The nurse has already moved on to the next doll being brought in. I get out of my chair and go to the bed in the corner room, the only one with a door instead of a curtain, where three dolls are stacked. I pretend to be reading the cards tied around their necks, gathering information, participating.

But I don't see anything. There is a whining in my ears and the buzzing in my head is crescendoing into a roar. I feel blood rushing to my face as suddenly my heart which was stopped and frozen goes into overdrive and then all I am is the pounding of my pulse and my vision is blurred as I feel my eyes stinging. And I can't breathe I can't breathe I CAN'T BREATHE but I take a long inhale through my nose and I count –

one

because I am here and

two

this isn't happening right now and

three

it already happened it's over and

four

when I open my eyes I won't see her, the French lady that I killed, I killed her because I didn't know she was suffocating to death in this bed in this exact bed and I didn't know, no one told me her blood gases weren't normal and she was alone

and her family was at home and everyone was the same and there was no space and they were here and I was here and she couldn't breathe and I can't breathe I can't breathe I CAN'T CAN'T CAN'T –

COUNT!

five. Hold.

The roaring is there, but I have managed to envelope it in a translucent cage that holds it and dulls the noise. It is occupying almost all of my mental space and crowding out all logical processes and I just need to get out of here before I lose it completely. Normal human interaction is too distracting, as all my cognition is focused on keeping the tempest contained. I give myself simple tasks. Walk back to the desk. Sit down. Type. Typing I can do. The same chart, over and over. Click through the checklist. Close the admission. Open the next chart. Repeat. Breathe. Remember to breathe.

My resident, my friend sitting next to me is also in a foul mood. He is post night shift and has been in the hospital for over 24 hours. "I'm out of here, fuck this bullshit. You good?" He knows I'm not. Knows I'm not myself. But I don't turn to him because he will see, see that my eyes have gone dead and empty and are reflecting the edge of the abyss at which I stand. I keep them on the computer, not seeing, hands on the keyboard, fingers tapping out a rhythm to keep me tethered to this time and place. I manage a single arm shrug. He claps me on the shoulder and gets up, leaving me alone amongst the nurses and the managers and the observers from the health ministry who all have no clue that I am teetering on the edge and I am barely, barely managing to keep from falling off.

My phone rings. It's the medical director. I answer with a grunt. "We're ending the drill, you're dismissed."

The pounding is back in my ears. It sounds like words now. Get out. Get out. Get out. I stand and rip off my gown. The nurse manager gives me a horrified look and ushers me to the door, to the doffing area. She starts chastising me, but I don't really hear her. I'm dismissed, I tell her, I'm not here, I'm done, I'm done, I'm done. I pull at my N95 and the elastic snaps as I toss it in the direction of the trash, not caring to see if I missed.

Head down, I exit into the crowded ED. I need a minute, just a minute because the mask is off but I still feel the air thick and hot as I'm struggling to fill my lungs. I ignore everyone and put one foot in front of the other, not sure where I'm going, just somewhere; first to the triage room but that's full of people, and then out to the lobby but still too many people, and I thrust my sunglasses on my face as I exit the ambulance bay doors, where I'm met by sunshine and noise and people, people everywhere. They're chatting and smoking and drinking coffee and calling out greetings; and there's too many of them and they can all see me and I need just a minute because I can see the monsoon coming and I don't know how to face it because I know it won't, but also, I am absolutely certain it will obliterate me.

Back resting against the stone pillar of the overhang, I dial my friend who was in with me. Maybe he hasn't left yet. He answers after one ring.

"Do you have a cigarette?" I manage to get out. I don't smoke. He knows I don't smoke, and he quit, but sometimes on shift we stand outside and we share one while we take a break.

"No, but –"

"Okay, nevermind." The roaring is at maximum volume.

"Don't be stupid. One second."

I hang up and I see a gaggle of the patient transport techs coming towards me. They stand right next to me and I know I need to move because I feel moisture on my cheeks and I can't explain and they are going to ask me things but I can't think, can't move, can't anything.

"You good, doc? You want a glass of water?"

I shake my head and contort my face into what I think is a polite smile. Apparently unconvincingly, because they start to come closer, again offering to get me something, and I back up because I just can't –

I see my friend exit the ambulance bay doors. In three strides he is in front of me. He takes one look at my face. "Shit. We need two. Here." He puts the cigarette between my fingers. In a word he's bummed a second cigarette and a lighter off one of the techs. He lights his own then motions to me as he holds up the flame. I'm shaking now, so badly that my hair almost catches. I take a drag and sink onto the stone bench beside me. "No. Not here." He grabs me by the elbow and leads me over behind the cars to the fence. People can still see us but it's better, a little more private. He looks at me.

"What happened?"

I just stare. Take another cathartic disgusting drag from the cigarette.

"Do you want to talk about it?"

I don't even know what to say. I open my mouth and out comes a pathetic whimper, the only thing I can express because finally, finally, finally the cresting and roaring is everywhere and the wave engulfs me as it breaks. My shoulders shake violently. I've forgotten how to exhale, in an effort to contain the muchness of it, and so I am silently, hysterically, sobbing, tears rolling down my face, choking on my own breath. Arms pull me in and suddenly there is a barrier around me and my face is in his shoulder and just that is enough to create a refuge where I remember to exhale, and I am crying for real now, loud and gasping and uncontrollable. I am trembling and fluttering like an untethered sail and this is the raft to which I am clinging while I am buffeted by the aftermath of the storm.

It was one minute or five minutes or five years. And apparently I had survived the torrent of emotions because I slowly uncurled my fingers from the back of his scrub shirt and stepped back. I took another long drag from the cigarette. I turned away, embarrassed, because now I have to pick up my broken pieces and try to pretend I'm whole again. Because

this is what we do. If I can't handle this, I have no business being here.

"This is so dumb." It's the only thing I can manage to say, as I press the butt of the cigarette into the top of the metal railing. I feel my ears burning.

He punches me in the arm "Don't be a dumbass. You're too judgemental with yourself. Stop."

I finally feel like I can get a full breath. I take a deep one in, and slowly release, as he asks again, quietly, "What happened?"

I shrug. I open my mouth and I intend to give some non-answer but then it just tumbles out - that it was nothing and everything and for them it was just a drill but how oblivious do you have to be to design a scenario that had us literally relive some of the worst parts of our professional lives. And that I am ashamed that this is the thing that got to me because it's not like I haven't seen shit and I haven't seen people die horrible deaths and we've been through multiple fucking wars and this, this is the thing that set me off. Because my dumb amygdala doesn't know that each experience is different, because it's not it's all one big stress response and despite all the therapy and effort I never have enough time or emotional capital to fortify and maintain the foundation that protects me from this loop, so I just have to anticipate its collapse at inopportune moments.

Again, since I'm remembering how, I exhale.

"Seems like your therapist is going to be getting some extra money for the vacation fund, eh?"

I crinkle my nose and chuckle despite myself. "If I ever find time to go see her."

I look at him, and, inexplicably, I feel like the air I'm breathing is clearer, the shame I'm carrying is lighter. Because he gets it and he's not judging me and he's not pitying me and

he's not doing anything at all except that he didn't leave and that is everything. Because I found a small patch of stable ground, a respite from the free fall, and I don't have to stand here alone.

And for the rest of the day when everyone asks, I answer that I am fine because I am fine. I'm fine and this is what we do: we run our resilience Ponzi schemes and we pretend it's not disintegrating beneath us, even as we renovate the facade with new paint and flowers and podcasts about burnout. Because even as I am falling, falling, falling off that cliff, once in a while I manage to grab on to a crack in the stone and drag myself, beaten and bloody, onto the ledge, where I see others like me and we punch each other in the arm and make bad jokes and rage and cry and share a cigarette and tell each other we're going to be fine.

But we are not okay.

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Retrospective Comparison of Empiric Antivenom vs. Expectant Treatment for Eastern Coral Snakebites

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Introduction: The coral snake is the only native elapid in North America. Their venom contains potent neurotoxins. Historically, all confirmed/presumed bites were treated with antivenom whether or not symptoms were present. Production of antivenom ceased in 2003. The resultant national shortage prompted clinicians to investigate alternative treatment strategies such as a wait-and-see approach where antivenom is held until signs of systemic toxicity manifest. Now that production has resumed there is limited research available comparing these two treatment paradigms, empiric administration vs the wait-and-see approach. Our objective in this study was to compare outcomes of the two treatment paradigms to determine whether one is associated with better patient outcomes.

Methods: This was a retrospective analysis of coral snakebite cases reported to the Florida Poison Information Center Network from January 1, 1998–December 31, 2021. We collected demographic, clinical, and outcome variables. Patients were stratified into two groups, empiric antivenom administration vs the wait-and-see approach in patients who were asymptomatic in terms of systemic symptoms at the time of initial presentation to the emergency department. We used multivariable logistic regression models, controlling for whether the bite occurred during the North American Coral Snake Antivenin (NACSA) shortage period (yes/no), age, sex, and whether systemic effects developed (yes/no), to determine differences between study groups in the incidence of the main outcomes: intensive care unit (ICU) admission; intubation; and death, as well as ICU and hospital length of stay.

Results: We analyzed 301 cases: 171 (56.8%) empiric; and 130 (43.2%) wait-and-see. Patients in the empiric treatment group had approximately three times higher likelihood of ICU admission (empiric 121 [75.2%] and wait-and-see 71 [56.8%]), odds ratio [OR] 3.047, $P = .05$). There was no difference in the incidence of intubation (empiric 2 [1.2%] and wait-and-see 1 [$<1\%$]), OR 2.486, $P = .63$) or in ICU length of stay (OR 0.485, $P = .08$). Of the patients treated with NACSA (191), adverse reactions to the antivenom occurred in 38 (19.9%) patients—35 patients in the empiric group and three in the wait-and-see group who later received antivenom. Of these 38 patients, eight (21.1%) experienced an anaphylactic reaction.

Conclusion: Empiric North American Coral Snake Antivenin administration was associated with higher ICU admissions and with a considerably higher risk of adverse reactions, which may serve to impose caution when treating empirically. [West J Emerg Med. 2026;27(1)67–176.]

INTRODUCTION

In North America there are three species of native coral snakes. However, only two species, *Micrurus fulvius* (Eastern coral snake) and *Micrurus tener* (Texas coral snake) produce highly potent venom and, therefore, are of high clinical concern. Their venom contains potent neurotoxins that bind the muscarinic acetylcholine receptors at the neuromuscular junction and may lead to neurologic symptoms such as paresthesias, diplopia, ptosis, difficulty swallowing, muscle weakness, and respiratory paralysis. Symptoms may be delayed as late as 13 hours post envenomation.¹ Only one documented death has been reported in the literature due to an envenomation from an Eastern coral snake. Of note, this patient failed to seek medical attention/treatment after the bite.²

The package insert for Pfizer's North American Coral Snake Antivenin (NACSA) recommends it not be administered prophylactically to asymptomatic patients (listed under contraindications section of package insert).³ Historically, all patients with a presumed or documented coral snake envenomation were recommended to receive empiric NACSA treatment regardless of symptoms.⁴ The reason for this recommendation likely stems from NACSA's inability to reverse neurologic symptoms once present. However, NACSA may limit further progression of these symptoms, potentially preventing the need for mechanical ventilation in cases where respiratory muscle weakness has not yet developed.

An unintentional consequence of the empiric approach is the administration of antivenom in cases of "dry bites," which occur when no venom is introduced into the patient after a bite. The rate of dry bites is unknown but may be as high as 50%.⁵ Additionally, published rates for adverse reactions to NACSA administration are quite high (up to 18%).⁴ Unlike North American crotalid antivenoms, which are Fab or F(ab')₂ fragments, NACSA is a whole immunoglobulin G antibody, likely contributing to its high immunogenicity rate. Therefore, empiric NACSA administration in a person who may not have been envenomated, may potentially result in unnecessary treatment and risk development of a significant adverse drug reaction.

The production of NACSA was discontinued in 2003 leading to a national shortage of the only approved coral snake antivenom approved by the US Food and Drug Administration (FDA), prompting the FDA to extend the expiration date of certain NACSA lot numbers.⁶ During this shortage, the treatment paradigm shifted, and many experts adopted a "wait-and-see" (WaS) approach, recommending NACSA at the first sign of systemic toxicity, rather than empirically treating all confirmed/suspected bites. In recent years, the availability of NACSA has increased due to the resumption of product manufacturing. Research is limited comparing the two treatment paradigms (empiric vs WaS) to determine whether one approach is associated with better patient outcomes and reduced healthcare costs. Specifically, it is unknown whether delaying NACSA

Population Health Research Capsule

What do we already know about this issue?
Coral snakebites can cause severe neuromuscular symptoms; however, North American Coral Snake Antivenin (NACSA) use carries a high rate of adverse effects.

What was the research question?
Was a wait-and-see approach associated with improved outcomes compared to empiric antivenom in asymptomatic coral snakebite patients?

What was the major finding of the study?
Empiric vs wait-and-see adverse reactions were 20.5% vs 2.3%, OR 1.46, 95% CI 0.405-5.258, and ICU admission 75.2% vs 56.8%, OR 3.05, 95% CI 1.02-9.57, P = .05.

How does this improve population health?
Findings support cautious antivenom use in asymptomatic bites to reduce risk of adverse drug reactions, and emphasizes importance of ICU monitoring for delayed neuromuscular symptoms.

treatment until onset of systemic symptoms leads to increased morbidity, extended intensive care unit (ICU) stays, or prolonged mechanical ventilation. Existing research, albeit limited, suggests similar patient outcomes with either approach.⁴

Our primary objective was to compare the incidence of intubation, hospital and ICU length of stay (LOS), and National Poison Data System (NPDS) outcome code (death, major, moderate, minor, no effect) between the empiric and WaS treatment groups.⁷

METHODS

Study Design and Population

This was a retrospective observational cohort study of cases managed by the Florida Poison Information Center Network (FPICN) and was approved by the University of Florida Institutional Review Board. The FPICN consists of three poison centers, located in Jacksonville, Miami, and Tampa, which assess, triage, and provide management recommendations to healthcare facilities (HCF) and the public in the state of Florida and the US Virgin Islands. A unique patient chart is created for each exposure call made to the FPICN and is stored in the FPICN's electronic medical records database. This database includes nationally standardized coded data elements, following codes provided by America's Poison Centers' NPDS, as well as non-coded or free-text fields (ie, notes) where additional information related

to the exposure can be documented. Additional non-NPDS data fields added to the FPICN's system unilaterally enhance data surveillance and patient management capabilities.⁷

We completed a query of the FPICN database for human coral snake exposures occurring between January 1, 1998–December 31, 2021 using NPDS generic codes related to “coral snake” exposures. Cases were excluded if 1) the patient was symptomatic from the bite (other than pain and allergic reaction to snake venom) at the time of presentation; 2) the exposure did not involve an actual bite; 3) the patient was monitored for less than 24 hours post exposure at a HCF; or 4) the NPDS medical outcome code was “not followed,” “unable to follow,” or “exposure probably not responsible for effect.” We followed the guidelines described by Worster et al for elements that should be included in studies involving data collected from medical charts.⁸ All elements were performed, except that abstractors were not blinded to the study objectives and variables with missing data were excluded from data analysis.

Variables Collected

After defining variables to be collected and receiving training, four independent non-blinded reviewers (MS, AD, CC, AF) extracted data from the FPICN database using a standardized data collection tool. A fifth reviewer (CU) then performed a secondary review and with a sixth reviewer (SS) resolved any conflicting coding. Inter-rater reliability was 99%, with only 10 instances requiring resolution.

Demographics and Bite Characteristics

Collected demographics and characteristics of the bite included age, sex, date of bite, whether the snake matched the physical description of an Eastern coral snake (black-headed, with red and yellow contiguous bands) (ie, positive coral snake identification), whether the snake had to be forcibly removed (a classic feature characteristic of coral snakebites),⁹ anatomical location of the bite, whether the bite broke skin, presence of scratches or abrasions, redness, or edema around the bite site, and whether the bite occurred during the time period of NACSA shortage 2003-2019 (as determined after email correspondence with Pfizer representative).

Clinical Effects

The following NPDS clinical effects were collected: decreased level of consciousness; ptosis; diplopia; blurred vision; nausea; emesis; dysphagia; dysphonia; numbness or paresthesias; fasciculations; weakness; seizures; paralysis; respiratory depression; pain; any allergic reactions to the snake venom itself, and whether a death occurred. Systemic clinical effects were defined as having any of the following: decreased level of consciousness; ptosis; diplopia; blurred vision; nausea; emesis; dysphagia; dysphonia; numbness or paresthesias; fasciculations; muscular weakness; seizures; paralysis; and respiratory depression.

Adverse Effects of North America Coral Snake Antivenin

Adverse effects related to NACSA administration included anaphylaxis, angioedema, pruritus, dermal reactions (hives, rash, and/or welts), shortness of breath, and hypotension (defined as systolic blood pressure < 100 mm Hg or diastolic blood pressure < 60 mm Hg). Treatments and interventions provided for NACSA adverse effects were also collected, including intubation, epinephrine, antihistamines, and corticosteroids.

Clinical Outcomes

Clinical outcome data collected included hospital and ICU admission (yes/no), LOS (days), intubation for respiratory failure from snakebite (yes/no), and NPDS medical outcomes (no effect, minor effect, moderate effect, major effect, death). See Supplemental Materials for NPDS outcome definitions.⁷

Data Analysis

Patients were stratified into two groups (empiric vs WaS) based on NACSA administration in patients who were asymptomatic (in terms of systemic effects) at the time of initial presentation to the emergency department. (ED). Patients in the “empiric” group were those who received NACSA and were asymptomatic. Patients in the WaS group did not receive antivenom upon initial presentation and were also asymptomatic. Patients who had symptoms at the time of presentation were excluded from this analysis. Since group assignment was designated based on NACSA administration at the time of ED presentation in patients who were asymptomatic, it was possible for patients who were initially asymptomatic (thus meeting study inclusion) to later manifest symptoms necessitating antivenom treatment. These patients were retained in the study as our objective was to determine best approaches for NACSA administration in patients who are asymptomatic at the time of ED presentation.

Logistic regressions were run to determine differences in demographics (age, sex, whether bite occurred during NACSA shortage year [yes/no]) and snakebite [positive identification of coral snake [yes/no] and snake forcibly removed (yes/no)] between the empiric and WaS groups.

Multivariable Regressions

We used multivariable logistic regression models, controlling for whether the bite occurred during the NACSA shortage period (yes/no), age, sex, and whether systemic effects developed (yes/no), to determine differences between study groups in the incidence of ICU admission, intubation, and death, as well as ICU and hospital LOS. The ICU and hospital LOS were modeled using a multivariable zero-inflated negative binomial regression. Missing or unknown data were dropped from the analysis. We performed all statistical analyses in R 4.1 (The R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Demographics and Snakebite Characteristics

We identified 1,082 cases based on the search criteria. Of these cases, 781 were removed based on exclusion criteria, leaving 301 cases for analysis. Of the 301 cases, 171 were grouped into the empiric group and 130 in the WaS group (Figure 1).

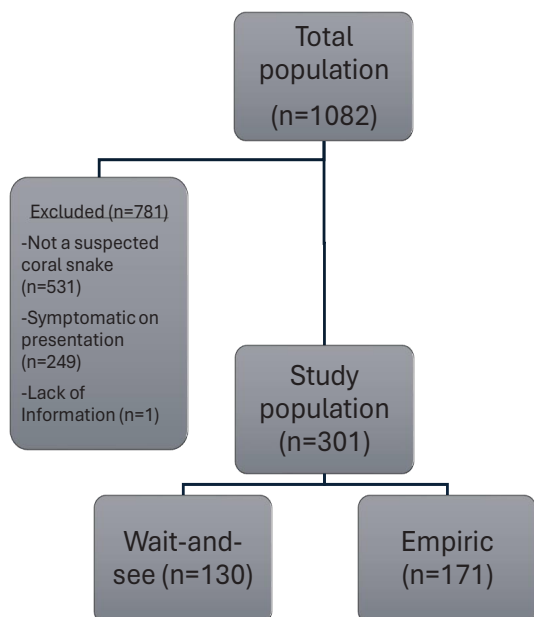


Figure 1. Patient screening and inclusion for empiric antivenom administration vs wait-and-see approach in cases of coral snake envenomation.

Twenty (15.4%) patients in the WaS group were later administered NACSA after development of systemic effects. Figure 2 depicts the number of patients in each group per year over the study period. Prior to 2006 the empiric treatment paradigm was the more common approach. Starting in 2007, however, more patients were managed using the WaS

approach with a peak in 2008. Over the study period, the empiric treatment approach declined from 2008 to 2012. The predominance of one treatment paradigm over the other varied year to year since the initial cessation of NACSA production and continued to fluctuate even after production resumed.

Table 1 provides demographics and bite characteristics for each group. Mean age ($P = .93$) and sex distribution ($P = .58$) were similar between groups. Most of the patients managed using the WaS approach presented during the NACSA shortage period (87.7%, $P < .01$). Positive coral snake identification ($P = .01$) and forcible removal of the snake ($P < .01$) were more common in the empiric group than the WaS group.

Clinical Effects and Treatments

Table 2 compares clinical effects from the bite between groups. Most patients did not develop systemic effects (empiric [103, 60.2%]; WaS [94, 72.3%]). No patients developed seizures, fasciculations, or diplopia. No bites resulted in death. One report each of dysphonia and paralysis were noted in the empiric group. One patient in the WaS group developed respiratory depression and was subsequently intubated.

Adverse Effects. Of of North America Coral Snake Antivenin

Table 3 compares NACSA adverse effects and subsequent interventions between groups that were reported to the FPICN. A total of 191 patients received antivenom. All patients in the empiric group (171) received NACSA, and 20 (15.4%) patients in the WaS group (130) received NACSA later in their clinical course once systemic symptoms developed. (See Table 2 for characterization of symptoms.) Of the 191 patients treated with NACSA, 38 (19.9%) developed an adverse reaction to the antivenom itself (35 in the empiric and three in the WaS group), and eight (21.1%) of these 38 patients had an anaphylactic reaction. Overall, the most common adverse reactions reported were hives/rash/welts (12%), itching (12%), and shortness of breath (5.2%). In the empiric

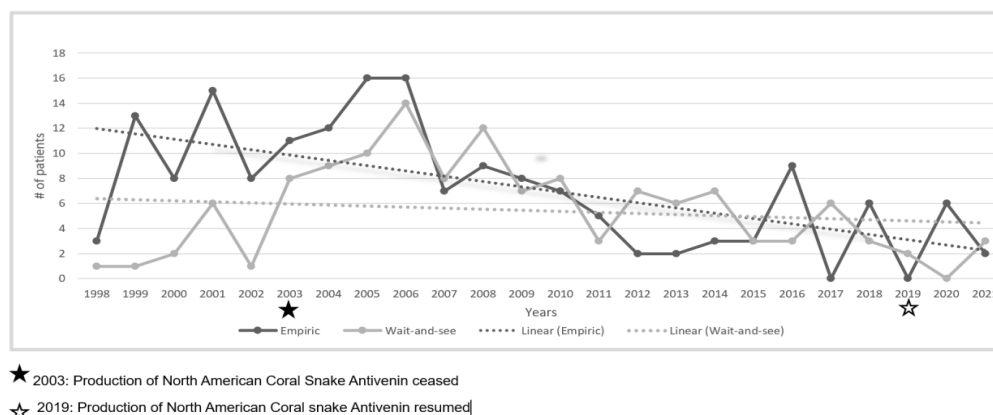


Figure 2. Demographics and snakebite characteristics for empiric antivenom administration vs wait-and-see treatment approach for coral snake exposures managed by the Florida Poison Information Center Network.

Table 1. Demographics and snakebite characteristics for empiric antivenom administration vs wait-and-see treatment approach for coral snake exposures managed by the Florida Poison Information Center Network.

Demographics	Empiric (171, 56.8%)	Wait-and-see (130, 43.2%)	Overall (301, 100%)
Age*	35 [23,46]	37 [18,49]	37 [20,47]
Female	20 (11.7)	19 (14.6)	39 (13)
Male	151 (88.3)	111 (85.4)	262 (87)
Pediatric (<18 years)	28 (16.4)	30 (23.1)	58 (19.3)
Shortage year			
Yes	116 (67.8)	114 (87.7)	230 (76.4)
No	55 (32.2)	16 (12.3)	71 (23.6)
Snakebite characteristics			
Positive snake Identification/ description			
Yes	144 (84.2)	108 (83.1)	252 (83.7)
No	6 (3.5)	15 (11.5)	21 (7)
Unknown	21 (12.3)	7 (5.4)	28 (9.3)
Snake forcibly removed			
Yes	60 (35.1)	27 (20.8)	87 (28.9)
No	44 (25.7)	70 (53.8)	114 (37.9)
Unknown	67 (39.2)	33 (25.4)	100 (33.2)
Bite broke skin			
Yes	118 (69)	66 (50.8)	184 (61.1)
No	19 (11.1)	45 (34.6)	64 (21.3)
Unknown	34 (19.9)	19 (14.6)	53 (17.6)
Fang marks/puncture wound			
Yes	86 (50.3)	56 (43.1)	142 (47.2)
No	36 (21.1)	55 (42.3)	91 (30.2)
Unknown	49 (28.7)	19 (14.6)	68 (22.6)
General area of bite			
Finger	92 (53.8)	75 (57.7)	167 (55.5)
Hand/Arm	50 (29.2)	26 (20)	76 (25.3)
Leg/foot/toe	12 (7.1)	17 (13.1)	29 (9.6)
Other/unknown	17 (9.9)	12 (9.2)	29 (9.6)
Edema			
Yes	62 (36.3)	27 (20.8)	89 (29.6)
No	63 (36.8)	91 (70)	154 (51.2)
Unknown	46 (26.9)	12 (9.2)	58 (19.3)

*Median (interquartile range).

group 68 adverse effects to the NACSA were reported in 35 (20.5%) individual patients. A total of five adverse effects to NACSA were reported in three individual patients within the WaS group. Within the empiric group two patients required intubation secondary to adverse effects from NACSA.

Multivariable Logistic Regression Models

Table 4 displays the results of the regression analysis. The empiric group was more likely to be admitted to the ICU

($P = .05$) and hospital ($P = .03$) compared to the WaS group. However, there were no statistical differences when looking at the incidence of intubation, average ICU LOS, average hospital LOS, and NPDS medical outcome codes.

DISCUSSION

In this study, we compared two treatment approaches, empiric NACSA administration vs the WaS approach, for suspected coral snake envenomation to determine temporal

Table 2. Clinical effects in empiric antivenom administration vs wait-and-see treatment approach for coral snake exposures managed by the Florida Poison Information Center Network.

Systemic clinical effects	Empiric (171, 56.8%)	Wait-and-see (130, 43.2%)	Overall (301, 100%)
Developed systemic effects			
Yes	68 (39.8)	36 (27.7)	104 (34.6)
No	103 (60.2)	94 (72.3)	197 (65.4)
Decreased level of consciousness			
Yes	1 (<1)	1 (<1)	2 (<1)
No	170 (99.4)	129 (99.2)	299 (99.3)
Ptosis			
Yes	1 (<1)	2 (1.5)	3 (1.0)
No	170 (99.4)	128 (98.5)	298 (99.0)
Blurred vision			
Yes	1 (<1)	3 (2.3)	4 (1.3)
No	170 (99.4)	127 (97.7)	297 (98.7)
Emesis			
Yes	5 (2.9)	4 (3.1)	9 (3.0)
No	166 (97.1)	126 (96.9)	292 (97.0)
Dysphagia			
Yes	2 (1.2)	0 (0.0)	2 (<1)
No	169 (98.8)	130 (100)	299 (99.3)
Paresthesia			
Yes	21 (12.3)	18 (13.8)	39 (13)
No	150 (87.7)	112 (86.2)	262 (87)
Muscular weakness			
Yes	3 (1.8)	3 (2.3)	6 (2.0)
No	168 (98.2)	127 (97.7)	295 (98.0)
Nausea			
Yes	6 (3.5)	3 (2.3)	9 (3.0)
No	165 (96.5)	127 (97.7)	292 (97.0)
Allergic reaction to snake venom			
Yes	3 (1.8)	1 (<1)	4 (1.3)
No	168 (98.2)	129 (99.2)	297 (98.7)

trends and differences in patient outcomes and hospital resource utilization. We found the prevalence of the two approaches differed over time. The incidence of hospital and ICU admissions differed between groups. There were no differences between groups in incidence of intubation, ICU or hospital LOS, or in NPDS medical outcomes. Additionally, we found relatively high rates of adverse effects after NACSA administration. Based on our study population, outcomes after a potential coral snakebite are overall generally positive, with no deaths reported and relatively few cases designated as having a major NPDS medical outcome.

Use of the two treatment approaches varied over the study

period. The production of NACSA ceased in 2003. Until that time, the empiric approach was more common and remained so even during the initial years after production of NACSA ceased, likely due to hospitals having a reserve of NACSA in stock. However, in 2007, for the first time during our study period, the WaS approach became more common, peaking in 2008. After 2008, use of each treatment approach fluctuated year to year, likely due to a multitude of factors, including extension of NACSA lot-expiration dates by the FDA, changes in management practices fostered during the NACSA shortage, relatively few NACSA administrations per year, and antivenom procurement issues.

Table 3. Antivenom adverse effects and interventions in empiric antivenom administration vs wait-and-see treatment approach for coral snake exposures managed by the Florida Poison Information Center Network.

	Empiric (171, 89.5%)	Wait-and-see (20, 10.5%)	Overall (191, 100%)
Antivenom Adverse Effects (AAE)			
Anaphylaxis from antivenom			
Yes	8 (4.7)	0 (<1)	8 (4.2)
No	163 (95.3)	20 (100)	183 (95.8)
Systolic < 100 mm Hg			
Yes	2 (1.2)	0 (<1)	2 (1)
No	166 (97)	20 (100)	186 (97.4)
Unknown	3 (1.8)	0 (<1)	3 (1.6)
Diastolic < 60 mm Hg			
Yes	4 (2.3)	0 (<1)	4 (2.1)
No	164 (95.9)	20 (100)	184 (96.3)
Unknown	3 (1.8)	0 (<1)	3 (1.6)
Angioedema			
Yes	3 (1.8)	0 (<1)	3 (1.5)
No	168 (98.2)	20 (100)	188 (98.5)
Itching			
Yes	20 (11.7)	3 (15)	23 (12.0)
No	151 (88.3)	17 (85)	168 (92.4)
Hives, rash, welts			
Yes	21 (12.3)	2 (10)	23 (12.0)
No	150 (87.7)	18 (90)	168 (88.0)
Shortness of breath			
Yes	10 (5.8)	0 (<1)	10 (5.2)
No	161 (94.2)	20 (100)	181 (94.8)
Interventions for AAE			
Intubation			
Yes	2 (1.2)	0 (<1)	2 (1)
No	169 (98.8)	20 (95)	189 (99)
Epinephrine			
Yes	8 (4.7)	0 (<1)	8 (2.7)
No	163 (95.3)	19 (95)	182 (95.3)
Unknown	0 (<1)	1 (5)	1 (<1)
Antihistamines			
Yes	32 (18.7)	3 (15)	35 (18.3)
No	137 (80.1)	16 (80)	153 (80.1)
Unknown	2 (1.2)	1 (5)	3 (1.6)
Steroids			
Yes	25 (14.6)	3 (15)	28 (14.7)
No	144 (84.2)	16 (80)	160 (83.8)
Unknown	2 (1.2)	1 (5)	3 (1.6)

We were curious to see whether certain snakebite characteristics may contribute to a clinician's decision to

empirically treat. Positive coral snake identification and forcible removal of the snake were characteristics associated

Table 4. Multivariable logistic regression models comparing study outcomes between empiric antivenom administration and wait-and-see treatment approach.

	Empiric (171, 56.8%)	Wait-and-See (130, 43.1%)	OR (95% CI)	P-value
Hospital admission			4.536 (1.206, 19.890)	.03
Yes	170 (99.4)	118		
No	1 (0.6)	12		
Hospital length of stay*			1.517 (0.831, 2.911)	.19
Days	1 [1,2]	1 [1,2]		
Admitted to ICU			3.047 (1.024, 9.573)	.05
Yes	121 (75.2)	71 (56.8)		
No	40 (24.8)	54 (43.2)		
Unknown	10	5		
ICU length of stay (days)			0.485 (0.210, 1.058)	.08
0	4 (3.3)	0 (<1)		
1	83 (68.6)	54 (76.1)		
2	27 (22.3)	14 (19.7)		
3	4 (3.3)	2 (1.5)		
≥ 4	2 (1.7)	1 (1.4)		
Unknown	1 (<1)	0 (<1)		
Intubation			2.486 (0.071, 171.253)	.63
Yes	2 (1.2)	1 (<1)		
No	169 (98.8)	129 (99.2)		
NPDS outcomes code			1.475 (0.935, 2.369)	.10
Major effect	7 (4.1)	2 (1.5)		
Moderate effect	33 (19.3)	23 (17.7)		
Minor effect	123 (71.9)	82 (63.1)		
No effect	8 (4.7)	23 (17.7)		

*Median (interquartile range).

ICU, intensive care unit; OR, odds ratio; NPDS, National Poison Data System.

with the empiric treatment approach. Forcible removal of the biting snake, with little to no localized symptoms or evidence of bite marks, is a unique characteristic of coral snakebites as they have short, fixed front fangs, and often latch onto victims and deliver venom through a chewing action. (Note: chewing is not required to deliver venom.)¹⁰

Notably, pediatric patients were less likely to receive empiric treatment. Several factors may explain this, including higher proportion of pediatric cases occurring during the antivenom shortage, limited information about the snake encounter, limited access to antivenom, or heightened clinician concern regarding the risk of serious allergic reactions. Further studies are needed to determine treatment considerations/patterns for pediatric populations with coral snake envenomations.

Interestingly, despite the increased likelihood of hospital and ICU admissions in the empiric group, we found no

difference between groups in either hospital or ICU LOS, intubation incidence, or NPDS outcomes, suggesting that both groups had similar clinical severity and that receipt of NACSA alone may have been the driving factor for ICU admission. This finding is concerning. The FPICN recommendation after a suspected coral snakebite is to perform hourly neurological examinations for at least 24 hours, *regardless* of patient symptoms (whether present or absent) or administration of antivenom. This frequency of assessment is generally only feasible in an ICU setting, and its recommendation based upon data demonstrating the potential development of delayed neurological effects.¹ Thus, there should not have been a difference in the number of ICU admissions or hospital admissions between the groups. Potential factors contributing to this difference could have been ED crowding, prolonged boarding times, or clinician underestimation of the potential morbidity associated with coral snake envenomations.

Patients not monitored in an ICU may be at risk for delayed identification of systemic symptoms from the venom or allergic reactions from the antivenom, possibly leading to adverse outcomes.

In our cohort, a relatively low incidence (5%) of serious neuromuscular symptoms (such as ptosis, blurred vision, dysphagia, and muscular weakness) developed after envenomation. However, a relatively high percentage of patients (~20%) developed an adverse reaction to the NACSA administration. Currently the package insert advises not to provide NACSA to asymptomatic patients.³ This recommendation is likely due to the high rate of adverse effects previously noted in the literature, which was again demonstrated in this study.⁴ The incidence of intubation in this cohort was too low for accurate comparisons between groups; however, it should be noted that two of the three patients requiring intubation in our cohort, were intubated due to adverse reactions attributed to NACSA administration rather than the neurotoxic effects of the venom itself. Given these results collectively, the likelihood of developing systemic symptoms needs to be weighed against the possible risks associated with empiric NACSA administration, provided that patients are monitored in an ICU setting for the recommended time. Additional studies are needed to further understand the risk-benefit profile of empiric antivenom vs a wait-and-see approach when managing coral snake envenomations.

Poison information centers or local experts should emphasize to treating clinicians the risk of adverse effects that may result due to administration of NACSA and/or the possibility of delayed neurological symptoms due to the envenomation, along with the importance of proper monitoring and duration of evaluation for all patients after a coral snakebite. Regardless of the treatment strategy, all patients with a coral snake envenomation should be transported to a facility that has NACSA or that can procure sufficient NACSA.

LIMITATIONS

There are several limitations that should be noted. First, this study was a retrospective chart review of cases reported to the FPICN. As with all poison center data, data are reported by the caller/HCF and are subject to recall bias and reporting of limited or incomplete data, depending on what information is available at the time of the initial call and during follow-up calls made by the poison center staff. Second, all potential NACSA adverse effects that may have developed days to weeks after hospital discharge, such as serum sickness, could not be reliably reported secondary to limited patient follow-up. Thus, the incidence may be higher than what is reported in this paper. Third, there was inconsistent monitoring frequency by HCFs. The FPICN recommendations are to monitor for 24 hours using hourly neurological examinations. However, due to staffing, bed availability, and other factors, some HCFs did not follow these recommendations; therefore,

it is possible that serious symptoms did manifest but were not identified or reported by the HCF. Fourth, it is notable that a higher percentage of patients in the empiric treatment group developed systemic effects, despite the fact that the primary goal of antivenom is to prevent primary development/progression of systemic toxicity. This apparent discrepancy may reflect a tendency to empirically treat patients with clinical features suggestive of more severe envenomation—such as bites that broke the skin and forcible snake removal—both of which were more common in the empiric group. Alternatively, subtle early signs of systemic toxicity may have been under-recognized in the WaS group, potentially contributing to differences in outcomes.

Fifth, we were unable to determine how many patients from our cohort were envenomated and how many received a “dry” bite (a bite where little to no venom is released). Sixth, there is ambiguity regarding the exact timing of when NACSA production ceased and when it resumed. We used estimated time frames based on our knowledge of the NACSA supply within our network’s treatment area and FDA notices, as well as communications with Pfizer. Additionally, our analysis focused on the incidence of systemic symptoms; therefore, we did not evaluate the presence of localized symptoms other than pain and edema. However, we do not feel this limitation impacts our findings as localized symptoms after a coral snakebite are not common and the focus of this study was examining clinical symptoms used to determine indications for NACSA administration.

CONCLUSION

Empiric administration of North American Coral Snake Antivenin was associated with higher ICU admissions. However, there was no difference in ICU length of stay, intubation incidence, or clinical outcome measures. Given the relatively high risk of adverse effects from NACSA administration and low incidence of neuromuscular symptoms following envenomation, clinicians should exercise caution when considering empiric treatment.

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Assessment of Mental Health in Healthcare Workers Involved in Care of Victims of the 2017 Las Vegas Mass Shooting

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Introduction: Mass shooting incidents (MSI) are single events injuring four or more victims, and they occur in the United States on average every 12.5 days. Studies have examined the psychological impact of MSIs on witnesses and surviving victims. However, the mental health of healthcare workers involved in the care of MSI victims requires further examination. We explored the association between work-related stress and symptoms of depression, anxiety, and post-traumatic stress disorder (PTSD) in healthcare workers involved in the 2017 Las Vegas mass shooting.

Methods: Surveys were distributed to 170 healthcare workers involved in the care of victims of the largest MSI in US history, the 2017 Las Vegas Route 91 Harvest Festival (58 people killed, 413 wounded by gunshot or shrapnel). Fifty healthcare workers (29.4% response rate; 68% female), 29–71 years of age, responded to demographic questions followed by the Beck Anxiety Inventory, Beck Depression Inventory-II (BDI-II), Patient Health Questionnaire-9 (PHQ-9), PTSD Checklist for the *Diagnostic and Statistical Manual of Mental Disorders, 5th Ed*, and the Health & Safety Executive Management Standards Indicator Tool, between October 15, 2022–March 15, 2023.

Results: Results showed that work-related stress was significantly associated with symptoms of depression (BDI-II: $P < .001$, 22.9% variance; PHQ-9: $P < .05$, 20.5% variance) and PTSD ($P < .001$, 26.8% variance). No significant differences in symptom severity (work-related stress, anxiety, depression, and PTSD) were found between participants involved in critical care and non-critical care ($P > .05$). In addition, healthcare workers reported higher symptoms of depression (5.18 vs 2.91, $P < .001$), and lower symptoms of anxiety (8.84 vs 22.35, $P < .05$) than normative data of the general population.

Conclusion: Healthcare workers reporting a higher risk of work-related stress were more likely to report more symptoms of depression and PTSD. Healthcare workers involved in critical and non-critical care reported similar symptoms of anxiety, depression, PTSD, and work-related stress. Moreover, healthcare workers involved in the care of the Las Vegas mass shooting victims were more likely to report more symptoms of depression and fewer symptoms of anxiety than samples of the general population. Given the novelty of this study, the unpredictability of MSIs, and the current limitations, we offer recommendations for future studies. [West J Emerg Med. 2026;XX(X)XXX–XXX.]

INTRODUCTION

Mass shooting incidents (MSI) are characterized as single events encompassing four or more deaths, not including the shooter.¹ They occur in the United States on average every 12.5 days.² These incidents require specialized medical response and cause extensive psychological distress. Within the context of MSIs, psychological distress and trauma are generally discussed from the perspective of the victims involved in the traumatic event and occasionally by the support system surrounding them, such as healthcare workers.³ Healthcare workers who experience an MSI may be affected by post-traumatic stress,⁴ leading to a disruption in professional and personal life, sleep disturbances, depression, anxiety, and psychological distress.² Post-traumatic stress disorder (PTSD) ranges between 2.2–24% of healthcare workers exposed to traumatic experiences.⁴ Often, psychological diagnoses go unrecognized,⁵ possibly by clinicians not reporting symptoms.⁶

Las Vegas Mass Shooting

On October 1, 2017, a 64-year-old assailant initiated a mass shooting at the Route 91 Harvest Festival in Las Vegas, Nevada. The assailant fired into a crowd attending the annual country music festival, killing 58 people, wounding 413 (gunshot or shrapnel related), and injuring approximately 456 (non-gunshot related), establishing the deadliest mass shooting of civilians in US history.⁷ The victims were transported by emergency services or self-transported to nearby trauma centers where healthcare clinicians triaged victims.⁸ Healthcare workers were quickly overwhelmed by the influx of critically injured victims.

A distinct characteristic of the Las Vegas MSI was the high volume of critically injured victims whom the healthcare workers had to treat and interact with, accompanied by the high number of family members and friends seeking information about their loved ones. The combination of this high volume of patients with the expected intensity of the response makes this case unique in healthcare. In addition to caring for the victims, healthcare workers were responsible for addressing families and friends who quickly overwhelmed the standard support mechanisms.³ Although most clinicians subjected to traumatic experiences do not develop PTSD symptoms,⁸ this accumulation of duties (victim plus family care) may lead healthcare workers to face an unexpected emotional toll as second victims.⁹ Rapid mental health support for the healthcare workers involved in the care of victims is encouraged, grouping them based on similar experiences,¹⁰ thereby helping to reduce gaps in support resources.⁵

Present Study

We selected mental health evaluation tools for this study based on the potential psychological impact of stressful and traumatic events^{2,4} and on the few studies^{2,3,4} addressing the psychological impact on healthcare workers involved in the care of MSI victims. The novelty of this study lies in its

Population Health Research Capsule

What do we already know about this issue?

Mass shooting incidents occur in the US on average every 12.5 days; they require specialized medical responses and cause extensive psychological distress.

What was the research question?

Was there an association between work-related stress and symptoms of depression, anxiety, and post-traumatic stress disorder (PTSD)?

What was the major finding of the study?

Participants had work-related stress associated with depression (BDI-II: $P < .001$; PHQ-9: $P < .05$) and PTSD ($P < .001$).

How does this improve population health?

The results suggest the need for mental health support for healthcare workers even years after a traumatic event, such as a mass shooting incident.

psychological assessment of healthcare workers through the lens of work-related stress. Our goal was to examine the relationship between work-related stress and symptoms of depression, anxiety, and PTSD.

We aimed to explore the psychological differences (work-related stress, and symptoms of depression, anxiety, and PTSD) between healthcare workers involved in critical care (trauma bay, emergency department, operating room, and intensive care unit) and in non-critical care (administration, floor unit, rehabilitation, and family center). In addition, we used normative data to compare differences in psychological symptoms between the general population and healthcare workers in one hospital that received MSI victims.^{11,12,13,14} We hypothesized the following: 1) higher levels of work-related stress would be associated with symptoms of anxiety, depression, and PTSD; 2) healthcare workers involved in critical patient care would report higher levels of anxiety, depression, and PTSD symptoms than workers in non-critical patient care; and 3) healthcare workers involved in the care of the MSI victims would report higher levels of symptoms of anxiety, depression, and PTSD than the general population.

METHODS

Participants

We contacted 170 healthcare workers who had responded to the Las Vegas MSI at the Sunrise Hospital and Medical

Center on October 1 and October 2, 2017; they learned of the study through facility newsletters, emails, unit leadership announcements, and word-of-mouth. Fifty healthcare workers (29.4% response rate) 29-71 years of age (45.02 ± 9.80) returned the completed surveys, 16 of whom were males (32%) and 34 females (68%). Participants included 41 workers (82%) involved in critical patient care and nine (18%) in non-critical care. Participation was voluntary and anonymous, with no compensation provided.

Procedures

We conducted this study at an American College of Surgeons-verified Level II trauma center in the Southwestern US. The Sunrise Hospital and Medical Center Institutional Review Board (IRB) exempted the study (IRB #22-1004). Participants were recruited via convenience sampling from October 15, 2022–March 15, 2023. All healthcare workers who responded on October 1 and October 2, 2017 (identified through administrative records) to the Las Vegas MSI at Sunrise Hospital and Medical Center were invited to complete the anonymous, pen-and-paper questionnaires. Invitations were extended during leadership meetings and unit meetings, and via weekly facility emails and word of mouth. We used two survey delivery methods (in person and US Postal Service). Of the 170 packets sent, 50 were returned (six via US Mail and 44 in person). To guarantee participant anonymity, demographic information was limited to the respondent's age, sex, and the unit in which they worked. No duplicate surveys were identified based on the participants' age and sex.

We opted to use US Mail and in-person delivery as opposed to an online format to achieve a higher response rate.¹⁵ In both the in-person delivered and mailed survey packets, the pen-and-paper questionnaire provided single-step instructions, used single-sided pages, and allowed the use of any writing tool as suggested by Phillips et al.,¹⁶ as a strategy to improve the overall response rate. Forty-four packets were returned in person and six by standard postal delivery. The participant response rate (29.4%) met the minimum standard reported by Phillips et al.¹⁷ Non-response bias may have been affected by specific demographic characteristics (ie, age and sex) of the non-respondents and the length of each survey, as well as the lack of financial incentive to participate.¹⁶ The convenience sample was composed of a diverse group 29-71 years of age, 68% females, and 32% males. The female response rate suggests that non-response bias in the current study was mitigated to some extent.¹⁶ Attempts to improve the participation rate involved weekly announcements made by facility team leaders to potential participants.

Materials

We used five psychometrically validated questionnaires to assess the participants' psychological symptoms. The Health & Safety Executive Management Standards Indicator Tool

(HSE-MSIT, which assesses the participant's risk of work-related stress,¹⁸ is a 35-item, 5-point Likert scale (1-5) tool, with the total score determined by the average of the items. Higher scores in the HSE-MSIT indicate a lower risk of work-related stress.¹⁸ The HSE-MSIT's Cronbach alpha for the current sample was .65. The Beck Anxiety Inventory (BAI), used to assess general anxiety,¹¹ is a 21-item, 4-point Likert scale (0-3), with a total score ranging from 0-63. A total anxiety score between 0-7 is considered minimal, 8-15 mild, 16-25 moderate, and 26-63 severe.¹⁹ The BAI Cronbach α for the current sample was 0.94. Normative baseline scoring was calculated from the BAI.¹¹ The Beck Depression Inventory (BDI-II), which assesses symptoms of depression,²⁰ is a 21-item, 4-point Likert scale (0-3), with a total score ranging from 0-63. A total depression score between 0-7 is considered minimal, 8-15 mild, 16-25 moderate, and 26-63 severe.¹⁹ The BDI-II Cronbach alpha for the current sample was 0.95.

Normative baseline scoring was calculated from Whisman's 2015 study using the BDI-II.¹² We also used the Patient Health Questionnaire-9 (PHQ-9) to assess symptoms of depression.²¹ The PHQ-9 is a 9-item, 4-point Likert scale (0-3), with a total score ranging from 0-27. Total depressive symptoms scores between 0-4 are considered minimal, 5-9 mild, 10-14 moderate, 15-19 moderately severe, and ≥ 20 severe.¹⁹ The PHQ-9's Cronbach alpha for the current sample was 0.90. We calculated normative baseline scoring from the PHQ-9 general population study.¹³

We assessed PTSD symptoms using the PTSD Checklist for the *Diagnostic and Statistical Manual of Mental Disorders*, 5th Ed (PCL-5).²² The PCL-5 is a 20-item, 5-point Likert scale (0-4) tool with a total score ranging from 0-80. A cut-point of 31-33 is considered reasonable as a provisional diagnostic criterion for PTSD.²³ The PCL-5 Cronbach alpha for the current sample was 0.969. Normative baseline scoring was calculated from Blevins's 2015 PCL-5 initial evaluation study.¹⁴

Statistical Analyses

We present demographic characteristics and descriptive statistics as mean, standard deviation, and percentage. Linear regression analyses were performed to assess the relationships between work-related stress and symptoms of anxiety, depression, and PTSD. For critical vs non-critical comparative analyses, we assessed normality using the Shapiro-Wilk test. Variables not normally distributed were analyzed using the Mann-Whitney U test. We performed group comparisons between healthcare workers and normative data via one-sample *t*-tests. Missing data was treated via listwise deletion. We analyzed data using SPSS Statistics v29 (IBM Corp, Armonk, NY) with an alpha level of .05.

RESULTS

Demographic Characteristics

Table 1 presents the demographic characteristics of the participants.

Descriptive Statistics

Of the 49 participants who responded to the BAI, three (6.1%) were classified as experiencing severe anxiety, five (10.2%) moderate, 13 (26.5%) mild, and 28 (57.1%) minimal.¹⁹ Of 46 participants whose depression symptoms were measured using the BDI-II total scores, five (10.9%) were classified as experiencing severe depression, 10 (21.7%) moderate, 13 (28.3%) mild, and 18 (39.1%) minimal.¹⁹ Based on the PHQ-9 total scores of 50 participants, three (6%) were classified as experiencing severe depression, five (10%) moderate, 13 (26%) mild, and 29 (58%) none to minimal.¹⁹ The PTSD analysis of 48 participants was based on a cut-point score of 31²³; 11 (22.9%) had scores compatible with PTSD provisional diagnosis, and 37 (77.1%) had scores below the cut-point for provisional PTSD diagnosis.

Relationship Analyses

We found a significant regression for symptoms of depression (BDI-II), $F 12.807$, $P < .001$. The correlation between work-related stress and symptoms of depression is $-.479$ (medium effect). Approximately 22.9% of the variance in symptoms of depression is accounted for by its linear relationship with work-related stress. As per the PHQ-9, we found a significant regression for symptoms of depression, $F 11.854$, $P < .05$. The correlation between work-related stress and symptoms of depression was $-.453$ (medium effect). Approximately 20.5% of the variance in symptoms of depression is accounted for by its linear relationship with work-related stress. A significant regression was found for symptoms of PTSD, $F 16.854$, $P < .001$. The correlation between work-related stress and symptoms of PTSD is $-.518$ (large effect). Approximately 26.8% of the variance in symptoms of PTSD is accounted for by its linear relationship with work-related stress. Lastly, we found no significant regression for symptoms of anxiety (BAI), $F 2.648$, $P = .11$. The correlation between work-related stress and symptoms of anxiety is $-.233$. Approximately 5.4% of the variance in symptoms of anxiety is accounted for by its linear relationship with work-related stress.

Table 2 presents the data of the Mann-Whitney U tests performed to compare whether there was a significant

Table 1. Demographic characteristics of healthcare workers who responded to a mental health evaluation survey five years after the 2017 mass shooting incident in Las Vegas, Nevada.

Characteristics / group	Critical care	Non-critical care	Total
Total N (SD)	41 (82)	9 (18)	50 (100)
Age (SD)	45.53 (10.0)	42.50 (8.6)	45.02 (9.8)
Male n (%)	15 (93.8)	1 (6.2)	16 (32)
Female n (%)	26 (76.5)	8 (23.5)	34 (68)

difference in anxiety, depression, PTSD, and work-related stress risk between healthcare workers involved in critical care and those engaged in non-critical care. Results revealed no significant differences in symptoms of anxiety (BAI: $U = 142.500$, $P = .87$), depression (BDI-II: $U = 168.500$, $P = .55$; PHQ-9: $U = 161.500$, $P = .69$), PTSD ($U = 157.000$, $P = .81$), and risk of work-related stress (total: $U = 148.000$, $P = 1.00$; demand: $U = 170.000$, $P = .53$; control: $U = 102.000$, $P = .18$; manager's support: $U = 141.500$, $P = .85$; peer support: $U = 162.500$, $P = .67$; relationships: $U = 195.000$, $P = .17$; role: $U = 105.500$, $P = .21$; and change: $U = 126.500$, $P = .53$) between healthcare workers involved in critical care and non-critical care.

Comparative Analyses Between Healthcare Workers and Normative Data

Table 3 presents the results of the one-sample t -tests performed to explore whether there was a significant difference in symptoms of anxiety, depression, and PTSD between the current sample of healthcare workers and the general population.^{11,12,13,14} Results demonstrated significantly lower levels of anxiety symptoms ($P < .001$) in healthcare workers (8.84 ± 10.49) than in the general population (22.35 ± 12.36), based on BAI scores.¹¹ The PHQ-9 results showed higher levels of symptoms of depression ($P < .05$) in healthcare workers (5.18 ± 5.48) than in the general population (2.91 ± 3.52).¹³

Table 2. Comparative analyses between critical care and non-critical care healthcare workers in mental health survey regarding psychological effects of 2017 mass shooting incident in Las Vegas.

	n	Mean Rank		P-value
		Critical	Non-critical	
Anxiety (BAI-I)	45	23.15	22.31	.87
Depression (BDI-II)	45	22.45	25.56	.55
Depression (PHQ-9)	45	22.64	24.69	.69
PTSD (PCL-5)	45	22.76	24.13	.81
Work-related stress (HSE-MSIT)	45	23.00	23.00	1.00
Demand	45	22.41	25.75	.53
Control	45	24.24	17.25	.18
Manager's support	45	23.18	22.19	.85
Peer support	45	22.61	24.81	.67
Relationships	45	21.73	28.88	.17
Role	45	24.15	17.69	.21
Change	45	23.58	20.31	.53

BAI-I, Beck Anxiety Inventory; BDI-II, Beck Depression Inventory; PHQ-9, Patient Health Questionnaire-9; PCL-5, PTSD Checklist for DSM-5; PTSD, post-traumatic stress disorder; DSM-5, *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition*; HSE-MSIT, Health & Safety Executive Management Standards Indicator Tool; PTSD, post-traumatic stress disorder.

Table 3. Comparative analyses between healthcare workers and general population in levels of anxiety, depression and post-traumatic stress disorder.

	Normative sample	Current sample	p	95% CI	
				Lower	Upper
Anxiety (BAI-I)	22.35 ± 12.36	8.84 ± 10.49	< .001*	-16.5254	-10.5011
Depression (BDI-II)	9.14 ± 8.45	11.61 ± 10.76	.06	-.7282	5.6655
Depression (PHQ-9)	2.91 ± 3.52	5.18 ± 5.48	< .05*	.7127	3.8273
PTSD (PCL-5)	15.42 ± 14.74	17.54 ± 17.69	.21	-3.0143	7.2576

* $P < .05$.

Normative data was obtained as follows: Beck Anxiety Inventory (BAI),¹¹ Beck Depression Inventory-II (BDI-II),¹² Patient Health Questionnaire-9 (PHQ-9),¹³ PTSD Checklist-5 (PCL-5).¹⁴

PTSD, post-traumatic stress disorder.

However, no differences in symptoms of depression were found in the BDI-II ($P = .06$).¹² In addition, no significant differences were found in symptoms of PTSD ($P = .21$) between groups.¹⁴

DISCUSSION

Previous studies have emphasized the impact of MSI on victims directly affected by the event rather than its potential impact on second victims, such as the healthcare workers who provide care for these patients.²⁴ The present study explores the relationship between work-related stress and symptoms of depression, anxiety, and PTSD in healthcare workers involved in the care of the Las Vegas MSI victims. It explores the psychological differences (work-related stress, and symptoms of depression, anxiety, and PTSD) between healthcare workers involved in critical care (trauma bay, emergency department, operating room, and intensive care unit) and non-critical care (administration, floor unit, rehabilitation, and family center). Critical care workers were thought to have been exposed to more severe injuries compared to non-critical care workers. In addition, we compared the differences in psychological symptoms between healthcare workers involved in the care of the MSI victims and normative data of the general population. An analysis of workers not involved in the care of MSI victims would have provided a better comparison, but due to the length of time from the MSI, the team did not have access to those workers.

Healthcare workers reporting higher levels of work-related stress were more likely to report higher levels of symptoms of depression. This finding converges with previous studies reporting significant associations between occupational stress and symptoms of depression.^{25,26} As the leading cause of disability among individuals between 15-44 years of age, 6.7% of the US population has experienced at least one significant depressive episode over the preceding 12 months.²⁷ In the current sample, prevalence rates were approximately twice this rate. The higher incidence of depression in the current sample may be due to repetitive exposure to patients' traumatic injuries, such as the Las Vegas MSI, rather than the

type of work performed, as critical care and non-critical care workers demonstrated similar symptoms of depression. Although the symptoms of depression were higher in the current sample than the normative data when addressed through the PHQ-9, the symptoms were not confirmed by the BDI-II. The selection of two instruments to assess symptoms of depression was based on previous differences found in the congruence, when categorizing levels of severity, between the PHQ-9 and the BDI-II, with suggestions that the BDI-II tends to categorize more patients as experiencing severe depression than the PHQ-9.²⁸ The differences in results may highlight the differences in the questionnaire characteristics, including item design and the length of the questionnaires,²⁸ as shown by a slight difference in the Cronbach alpha. Despite these differences, both questionnaires have excellent internal consistency, meeting the standards for clinical assessments.

Healthcare workers reporting higher levels of work-related stress were more likely to report higher levels of PTSD symptoms. Similarly, previous studies have suggested that stressors experienced at work are a risk factor for developing symptoms of PTSD.²⁹ While PTSD affects 3.6% of the US general population,²⁷ 23% of participants in the current study reported scores meeting the criteria for provisional PTSD diagnosis. The latter results are consistent with higher PTSD prevalence estimates found in other studies.⁴ However, no differences were found in symptoms of PTSD between the current sample and the normative data from the general population. Moreover, no differences in symptoms of PTSD were found between critical care and non-critical care healthcare workers. This finding suggests a potential ramification of repetitive exposure (direct or indirect) to patients' traumatic injuries, such as those inflicted during the Las Vegas MSI.

As a response to stress, generalized anxiety disorder affects 3.1% of the US population.²⁷ Although using a different instrument (BAI), the current findings indicate that 6.1% of participants reported symptoms of severe anxiety, 10.2% moderate, 26.5% mild, and 57.1% minimal. Healthcare

workers in the current sample reported lower symptoms of anxiety than the normative data from the general population. This finding suggests that healthcare workers may become desensitized due to repeated exposure to traumatically injured patients.³⁰ However, these differences could not be observed between critical care and non-critical care workers, suggesting that the direct or indirect care of MSI victims may not impact symptoms of anxiety.

LIMITATIONS

This study has limitations that should be acknowledged. First, the surveys were collected nearly five and a half years after the MSI. This decision was made to avoid additional psychological trauma to the healthcare workers. Second, the COVID-19 pandemic caused a further delay, potentially influencing the symptom severity identified in the study. Third, the unpredictable nature and magnitude of MSIs prevented baseline data collection for comparative analyses and could have provided a more robust comparison. Fourth, although a mitigation attempt was made, non-response and self-selection bias may have impacted our findings. Factors such as survey length, emotional difficulty, salience, and non-compensation all could have impacted participation and responses.¹⁶ Fifth, the cross-sectional design prevents any causality assumptions. Sixth, the small sample size may impose limitations on the generalizability of the results. Lastly, the anonymous data collection prevents any follow-up examinations.

Despite these limitations, our preliminary study has established the foundation for future studies to address potential associations between work-related stress and mental health symptomatology in healthcare workers involved in the care of victims of MSIs. Future studies are encouraged to collect data from healthcare workers in the same workplace who were not involved in the MSI, for a direct group comparison. Researchers are encouraged to provide an incentive (eg, financial) to potentially increase participation,¹⁶ and to collect data closer to the occurrence of the MSI to mitigate potential confounding events. However, given the potential detrimental effect of data collection being conducted sooner, a mental health support strategy is recommended to mitigate any potential harm.

CONCLUSION

Healthcare workers reporting a higher risk of work-related stress were more likely to report higher levels of depression and PTSD symptoms. No differences were found in self-reported symptoms of anxiety, depression, PTSD, and work-related stress between healthcare workers involved in critical care and non-critical care. Healthcare workers involved in the care of the Las Vegas mass shooting victims reported higher levels of depression symptoms and lower levels of anxiety symptoms than samples of the general population. As a practical application, the results suggest the necessity of mental health support for the healthcare workers even years

after a traumatic event such as an MSI. When working with healthcare workers impacted by traumatic events, clinical mental health workers are encouraged to address work-related stress and symptoms of depression and PTSD during the treatment plan.

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Emergency Department Visit-Severity Algorithm for Immediate Care Clinic Visits

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Background: Immediate care clinics (ICC) account for a significant portion of acute, low-severity visits that preclude the use of resources from an emergency department (ED). Given the chronic issue of ED crowding and its detrimental effects on quality of care and health system efficiency, understanding and optimizing the use of ICCs for non-emergent visits could significantly alleviate pressures faced by EDs and improve patient satisfaction, as well as control the overall cost of care. This study describes the application of the Billings/Ballard severity algorithm to ICC visits over a seven-year period and compares the findings to previously published ED literature.

Methods: We obtained data from ICC visits within a large, academic health system. The analytical sample included 306,395 visits from 125,063 unique patients. We describe ICC patient characteristics and the Billings/Ballard severity classification. We used negative binomial regression analysis to evaluate the associations between patient characteristics and total visits to ICCs and primary care physician (PCP), and multivariate regression analysis to assess the relationship between ICC visit severity and patient characteristics, controlling for multiple visits per patient. The algorithm was also used to identify and classify the most common International Classification of Diseases, 9th and 10th modifications (ICD-9/10) diagnosis codes by severity.

Results: In total, 9.17% of ICC visits were classified as emergent, 81.25% as non-emergent, 0.79% as indeterminate, and 8.79% as unclassified, compared to literature-reported ED distributions of 37.90% emergent, 45.08% non-emergent, 11.32% indeterminate, and 5.70% unclassified. The ICC visits included a greater proportion of non-emergent presentations. The ICD-9/10 diagnosis distribution revealed a distinct ICC environment compared with that of the ED. The most frequent diagnoses among emergent ICC visits included chest pain, asthma exacerbation, and shortness of breath, while non-emergent visits were predominantly for upper respiratory tract infections. Within one year at the same healthcare system, 47% of patients had repeat ICC visits and 41% had primary care follow-up.

Conclusion: These results demonstrate that immediate care clinics deliver predominantly non-emergent care as intended (81% vs 45% in the ED), potentially reducing ED crowding and validating current clinician- and patient-initiated referral practices. High rates of repeat ICC visits (47%) and follow-up with primary care physicians (41%) within the same healthcare system suggest these facilities foster care continuity while providing accessible, non-emergent care alternatives. However, user disparities persist as self-pay and uninsured patients show lower overall ICC use, while uninsured and publicly insured individuals present with emergent conditions more frequently than privately insured patients. These findings inform care-seeking education and health service delivery while highlighting the need to improve ICC accessibility across insurance types to optimize efficiency and patient outcomes. [West J Emerg Med. 2026;27(1)184–193.]

INTRODUCTION

Immediate care clinics (ICC), also known as urgent care centers, emerged in the United States in the 1970s and subsequently experienced rapid growth during the mid-2000s as part of a larger trend to deliver convenient, cost-effective medical services.¹⁻³ The urgent care model has become a common source of timely and convenient care in the US healthcare system.^{4,5} To date, four models exist along the spectrum of consumer-driven care: immediate care clinics; free-standing emergency centers; retail or convenience clinics; and walk-in clinics.² These alternate sources of care are not standardized in their delivery models but rather mutually aim to deliver patient care within the gap between physician office visits and hospital-based emergency departments (ED). Although the practice environments of emergency care, immediate care, and primary care are distinct, they sometimes overlap, and a myriad of factors influence patient decisions concerning when and where to choose care. For example, patients are often tasked with self-identifying time-sensitive conditions and balancing cost, convenience, insurance coverage, and location.^{6,7}

In the US, causes of ED crowding include high costs of healthcare and access to other sources of care by uninsured and underinsured patients challenged in accessing a regular source of care that may be less costly.⁸⁻¹¹ In theory, ICCs offer solutions to reduce specific system issues such as ED crowding, rising health expenditures, and access for patients who lack a usual source of care.^{8,12-14} However, while ICC charges for patients are often less expensive than those for an ED visit, there is evidence that immediate care use may increase net healthcare spending.⁶ Examining factors related to emergency care, immediate care, and primary care use has implications for shaping access to care (eg, meeting primary care needs and continuity of care), insurance provider operations (eg, guiding payees toward lower cost care), and healthcare businesses (eg, expanding healthcare systems operations).

Researchers at New York University developed an algorithm to characterize and assess the severity associated with ED visit diagnoses, which was subsequently validated by Ballard et al (2010) using data from a single, integrated delivery system that included members from a commercial insurance plan and Medicare.^{15,16} The Billings/Ballard algorithm has been revised and applied to describe the severity of ED visits in diverse settings.¹⁷⁻¹⁹ The paucity of ICC clinics in the late 1990s and early 2000s suggests that patients who now seek treatment in an ICC may have otherwise visited the ED during the development and validation of the Billings/Ballard algorithm. In addition, observation of ED crowding has led researchers to find that a proportion of patients could be treated more appropriately in an ICC setting.^{8,20-22} Taken together, these data suggest a likely overlap of cases between EDs and ICCs. Accurate triage based on case mix between ICC and ED environments is critical to optimizing resource use, maintaining timely access for high-

Population Health Research Capsule

What do we already know about this issue?

The Billings/Ballard algorithm is a previously validated emergency department (ED) severity algorithm that categorizes visits based on diagnosis codes.

What was the research question?

Can the Billings/Ballard algorithm characterize immediate care clinic (ICC) visits' severity distribution patterns?

What was the major finding of the study?

Visits to ICCs were 81.25% non-emergent and 9.17% emergent vs ED rates of 45.08% and 37.90%, respectively.

How does this improve population health?

This evidence enables healthcare systems to optimize resource allocation and supports patient education for appropriate site selection, improving efficiency.

acuity cases, and minimizing unnecessary healthcare expenditure.

Our objective in this study was to characterize ICC visits over a seven-year period, apply the Billings/Ballard severity algorithm to classify visit severity, and examine factors associated with ICC and primary care use. We analyzed patterns of ICC use including demographics, insurance status, and subsequent healthcare visits (ICC revisits, primary care physician [PCP] visits, and ED visits within 24 hours) to understand how ICCs function within the larger healthcare system. Additionally, we compared ICC severity distributions with those previously reported in the emergency medicine literature.

METHODS

This was a retrospective review of data from five ICCs affiliated with a single, academic healthcare system between January 1, 2013–December 31, 2019. Our goal was to describe ICC visits over a seven-year period and describe the application of the Billings/Ballard algorithm to ICC visits. These ICCs are affiliated with a single, academic healthcare system that also includes two community hospitals, one university hospital, more than 20 primary care clinics, and three EDs located within a 50-mile radius. (Many other ICCs and EDs are also located within this 50-mile area.) We obtained the data used in this study from electronic health records. The Institutional Review

Board for the Protection of Human Subjects deemed this study exempt. Our study adhered to key methodological standards for retrospective chart review research as outlined by Worster and Bledsoe including abstractor training, case selection criteria, variable definition, abstraction forms, blind to hypothesis, sampling method, missing-data management plan, and institutional review board approval.²³

The study population consisted of 333,069 visits to the ICCs. We excluded 2,370 (0.7%) visits for which *International Classification of Diseases*, 9th and 10th modifications (*ICD 9/10*) diagnosis codes were missing. Additionally, after the application of the Billings/Ballard algorithm and alignment with the original Billings/Ballard methodology, we excluded 24,304 (7.2%) visits that were associated with an injury, mental health, alcohol use disorder, or substance use disorder categorization only. Of these, most of the patients were excluded because of injury. The final analytical sample included 306,395 distinct visits to an ICC during the study period, corresponding to 125,063 unique patients (Figure 1). As injury could constitute a high diagnostic category for the ICC, we also calculated total visits to the ICC, including injury, mental health, and visits for alcohol use disorder and substance use order (Supplementary Table 1). In our study, the unit of analysis consisted of the ICC visit. In cases where visits were associated with multiple *ICD 9/10* diagnosis codes, the *ICD codes* were aggregated at the visit level, and the severity of the ICC visit was associated with the most severe *ICD* code as classified by the Billings/Ballard

algorithm.

Variable and Measures

The primary outcome was ICC visit severity classification (emergent, non-emergent, or indeterminate) as determined by the Billings/Ballard algorithm. Secondary outcomes included healthcare use patterns following ICC visits such as ICC revisits, PCP visits, and ED referrals. Patient demographic characteristics (age, insurance status, race, ethnicity, sex) and prior healthcare use (total ICC and PCP visits) served as predictor variables in our analyses.

We queried patient demographic characteristics available from the EHR that have been shown to be associated with healthcare use. These included age, insurance status, race, ethnicity, and sex.²⁴ We also queried the number of primary care visits, as this variable has previously been shown to be associated with urgent care use.²⁵⁻²⁷ Patient age was defined at the time of the ICC visit and categorized as < 18 years of age, 18-20.9, 21-25.9, 26-39.9, 40-64.9 years, or ≥ 65 years of age. Race (White, Black, Asian, other), ethnicity (non-Hispanic and Hispanic), and sex (female and male) were self-reported by the patients. Insurance status was classified as private, Medicare, Medicaid or other governmentally insured, self-paying or uninsured. We calculated revisits to any of the ICCs within 30 days, 90 days, six months and one year. The frequency of the same healthcare system PCP visits within 30 days, 90 days, six months, and one year after the ICC visit was also calculated. We also examined whether the ICC visit resulted in a same healthcare system ED referral within 24 hours. Finally, we calculated the total ICC and total PCP visits within the same healthcare system for a patient during the study period.

We classified ICC visits based on the original Billings algorithm methodology validated by Ballard et al (Supplementary Figure 1) using the discharge *ICD 9/10* diagnosis codes. According to this algorithm, each *ICD 9/10* code is assigned a likelihood probability for each of the following categories: 1) non-emergent; 2) emergent, primary care treatable; 3) emergent, ED care needed and preventable; and 4) emergent, ED care needed and not preventable.¹⁶ We compared the sum of the probabilities of the non-emergent and emergent primary care-treatable categories to the sum of the emergent ED care needed (preventable) and emergent ED care needed (not preventable) categories.¹⁵ The largest likelihood probability determined the final classification of a visit as non-emergent or emergent. Visits with an equal probability of being non-emergent or emergent were categorized as indeterminate. According to this classification scheme, we classified ICC visits into emergent, non-emergent, and indeterminate categories. Like Ballard et al, we excluded visits classified as injury-only or “other.” Given that a single visit may contain multiple *ICD* diagnosis codes, ICC visits are categorized by the most severe *ICD 9/10* code according to the algorithm. The classification of visits into one of three categories (non-emergent, indeterminate, emergent) by Ballard et al has been demonstrated to reliably predict hospitalization

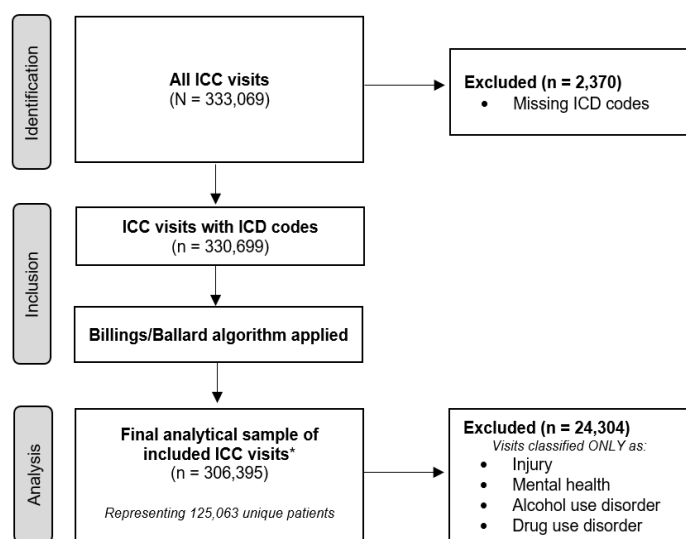


Figure 1. Flow diagram of immediate care clinic visit selection showing application of exclusion criteria for Billings/Ballard algorithm analysis.

*Supplementary analysis comprises all visits with *ICD* codes (n = 330,699), including injury, mental health, alcohol use disorder, and substance use disorder categorizations.

ICC, immediate care clinic; *ICD*, International Classification of Diseases.

and death within 30 days following an ED visit.¹⁵

Statistical Analysis

We used univariate analysis to analyze the characteristics of the ICC visits and subsequent ICC, PCP, and ED visits. We described both the severity of the ICC visits over the study period and the payor type. We applied negative binomial regression analysis to examine the association between patient characteristics and the total number of ICC and PCP visits over the study period. The results are presented as incident rate ratios (IRR) with confidence intervals. Negative binomial regression appropriately accounts for over-dispersed count outcome variables, such as the number of ICC and PCP visits during the study period. The unit of analysis for these regressions was the unique patients who visited the ICC during the study period. These analyses controlled for the number of times each patient visited the ICC. We then performed random effects logistic regression analysis for odds ratios (OR) and 95% confidence intervals to examine factors associated with emergent visits compared to non-emergent visits while controlling for multiple visits per patient. Missing data were included in the regression analysis as a separate category (missing data were < 1-3% for all variables); however, these data are not reported in Table 1. We performed all analyses using Stata 17 (StataCorp LLC, College Station, TX). The statistical significance was assessed at the $\alpha = 0.05$ level.

RESULTS

Table 1 displays population characteristics and same healthcare system use for patients at multiple, suburban ICCs in Illinois from 2013–2019. No significant changes in patient descriptive characteristics were found across the study timeframe; as a result, we present data for all study years combined. The median number of ICC visits by patient was 4 (interquartile range 2, 8) over seven years. There were 9.19%, 20.8%, 33.18%, and 47.56% of patients who revisited an ICC within a 30-day, 90-day, six-month, and one-year period, respectively; and 7.89%, 19.93%, 30.88%, and 41.14% of patients who visited their PCP within a 30-day, 90-day, six-month, and one-year period, respectively. Additionally, 1.9% of patients presented to an ED of the same healthcare system within 24 hours of their initial ICC encounter.

Table 2 shows the results of the Billings/Ballard algorithm applied to the ICC setting. The distributions within each of the severity categories remained constant over the study period and are reported as seven-year totals. Of 306,395 ICC visits, 91.21% were classified by the algorithm. We found that 9.17% of the patients were classified as emergent, 0.79% as indeterminate, and 81.25% as non-emergent.

Table 3 classifies the severity categories by payor type to examine differences in ICC use by insurance coverage. The association between the Billings/Ballard algorithm and payor type was statistically significant ($P < .001$). Within each payor category, 15.67% of Medicare visits were classified as emergent, followed by 9.31% of uninsured or self-paying

visits, 8.38% of privately insured visits, and 7.84% of Medicaid and other governmental insurance visits.

Conversely, within each payor category, 82.68% of Medicaid and other governmental insurance visits were classified as non-emergent, followed by 82.14% of privately insured visits, 75.52% of uninsured or self-paying visits, and 74.62% of Medicare visits.

Table 4 displays the factors associated with the total number of ICC and PCP visits in the same healthcare system during the study period. For the model with total ICC visits as the outcome variable, identifying as male (IRR 0.98; CI, 0.98-0.99), being > 40 years of age (IRR 0.99; CI, 0.98-0.99) or > 65 years of age (IRR 0.94; CI, 0.92-0.96), and identifying as White (IRR 0.94; CI, 0.94-0.95), Asian (IRR 0.91; CI, 0.88-0.93), or other (IRR 0.93; CI, 0.92-0.95) were associated with a decreased incidence of ICC use. Identification as Hispanic was associated with a greater incidence of ICC use (IRR 1.05; CI, 1.04-1.06). Compared to patients with private insurance, patients with Medicare (IRR 1.04; CI 1.02-1.07) or Medicaid (IRR 1.11; CI, 1.10-1.12) were associated with a greater incidence of ICC presentation, while uninsured and self-pay patients were associated with a decreased incidence of ICC presentation (IRR 0.93; CI, 0.90-0.95). A positive association between patient PCP visits and ICC presentation was observed within the same healthcare system.

With respect to the model in which total PCP visits were the outcome variable, all age groups, compared to those 26-39.9 years of age, demonstrated a positive association with PCP visits, where the highest incidence rate of PCP presentation was for patients < 18 years of age (IRR 3.06; CI, 2.94-3.18) and > 65 years of age (IRR 3.00; CI, 2.78-3.23). Being White (IRR 1.37; CI, 1.32-1.43), Asian (IRR 1.40; CI, 1.27-1.54), and identifying as “other” (IRR 1.39; CI, 1.31-1.47) race was associated with more frequent PCP visits than Black identification. Identification as Hispanic was associated with decreased incidence of PCP visits (IRR 0.65; CI, 0.63-0.68). Compared to patients with private insurance, patients insured by Medicare were more likely to have a greater incidence of PCP presentation (IRR 1.64; CI, 1.53-1.75), while those who were uninsured or self-pay were more likely to have a decreased incidence of PCP presentation (IRR 0.43; CI, 0.39-0.48). There was no difference in the incidence of PCP visits between patients who were covered by Medicaid and those with private insurance coverage.

Table 5 shows factors associated with ICC presentation for emergent visits compared to non-emergent visits. Being male (OR 1.27; CI, 1.23-1.31), 40-64.9 years of age (OR 1.44; CI, 1.37-1.51), ≥ 65 years (OR 1.73, CI 1.59, 1.89), identifying as Hispanic (OR 1.12; CI, 1.06-1.18), having Medicare (OR 1.44; CI, 1.33-1.56) or Medicaid (OR 1.09; CI, 1.0-1.14) coverage, and being self-paying or uninsured (OR 1.14; CI 1.00-1.30) were significantly associated with increased odds of ICC presentation for an emergent visit. Factors significantly associated with decreased odds of emergent visits to the ICC

Table 1. Patient characteristics and healthcare use at multiple suburban immediate care clinics in a study applying an emergency department severity algorithm to immediate care clinic visits (N= 306,395; 2013-2019).

Patient characteristics	2013-2019	
	Frequency (n)	Percentage (%) ^a
Number of ICC Visits per patient: median; IQR; range	2; IQR 1-4; range 1-71	
Number of PCP Visits per patient: median; IQR; range	0; IQR 0-9; range 0-232	
Sex		
Female	183,726	59.96%
Male	122,666	40.04%
Age		
< 18 years	99,823	32.58%
18 - 20.9 years	11,487	3.75%
21 - 25.9 years	17,668	5.77%
26 - 39.9 years	47,933	15.64%
40 - 64.9 years	92,104	30.06%
≥ 65 years	37,024	12.08%
Race		
White	215,962	70.57%
Black	41,323	13.50%
Asian	5,529	1.81%
Other ^b	35,313	11.54%
Ethnicity		
Non-Hispanic	245,006	80.02%
Hispanic	54,693	17.86%
Insurance Status		
Private	215,349	70.28%
Medicare	36,400	11.88%
Medicaid and other governmentally insured	50,810	16.58%
Self-pay and uninsured	3,836	1.25%
Revisits to ICC (cumulative)		
Within 30 days	28,185	9.19%
Within 90 days	63,749	20.80%
Within 6 months	101,688	33.18%
Within 1 year	145,744	47.56%
Visit to PCP after ICC visit (cumulative)		
Within 30 days	24,185	7.89%
Within 90 days	61,088	19.93%
Within 6 months	94,628	30.88%
Within 1 year	126,080	41.14%
ED Visit		
Within 24 hours	5,848	1.90%

^aColumn percentages may not total 100% due to missing values in some of the variables.^bOther race categories include Alaska Native, Native American, multiracial, Native Hawaiian, and other Pacific Islander. ED, emergency department; ICC, immediate care clinic; IQR, interquartile range; PCP, primary care physician.

Table 2. Comparison of the Billings/Ballard algorithm applied to immediate care clinic visits and emergency department (ED) visits in a study applying an ED severity algorithm to immediate care clinic visits.

Ballard Algorithm Visit Classification	Data from current ICC study (N = 306,395)	Ballard et al (ED) ^{a,b}
Emergent	9.17%	37.90%
Indeterminate	0.79%	11.32%
Non-emergent	81.25%	45.08%
Unclassified	8.79%	5.70%
Total	100.00%	100.00%

^aData source: Medical Care. 2010;48(1):58-63. <https://doi.org/10.1097/MLR.0b013e3181bd49ad>.¹⁵

^bOriginal Ballard percentages were based on total classified visits. Percentages were recalculated to include unclassified visits. ED, emergency department; ICC, immediate care clinic.

included younger age, < 18 years (OR 0.61; CI, 0.58-0.65), 18-20.9 years of age (OR 0.71; CI, 0.64-0.78), or 21-25.9 years of age (OR 0.83; CI, 0.76-0.90), identifying as White (OR 0.75; CI, 0.71-0.79) or Asian (OR 0.67; CI, 0.59-0.75), and presenting to the ICC more than once, 2-3 ICC visits (OR 0.90; CI, 0.8-0.94), 4-5 ICC visits (OR 0.86; CI, 0.82-0.91), and 6-9 ICC visits (OR 0.93; CI, 0.88-0.98). The same healthcare system PCP visit, irrespective of the frequency of PCP visits, was positively associated with the frequency of an emergent visit in patients within the same healthcare system.

Supplementary Table 1 displays a comparison of the results of the Billings/Ballard algorithm applied in an ICC setting with those of an ED inclusive of injuries, alcohol use disorder, substance use disorder, and mental health-related visits, where injuries are reported separately. The larger denominator in this supplementary analysis (N = 330,699 vs 306,395 in the main analysis) reflects the inclusion of visits classified as injury, mental health, alcohol use disorder, or substance use disorder that were excluded from the primary analysis. According to our data, 15.27% of the ICC visits were associated with an injury ICD 9/10 code. In Supplementary

Table 2, we present the five most common ICD codes according to the Billings/Ballard severity categorizations. The most frequent emergent ICD 9/10 diagnosis codes were for chest pain, asthma exacerbation, shortness of breath, pneumonia, and acute obstructive laryngitis. The most frequent non-emergent ICD 9/10 codes included acute pharyngitis, upper respiratory tract infections, cough, streptococcal pharyngitis, and acute bronchitis.

DISCUSSION

These results characterize ICC use patterns within a suburban academic healthcare system and demonstrate distinct severity distributions between ICCs and EDs, while also revealing the dynamics between ICCs, EDs, and PCPs. Further iterations of the Billings/Ballard algorithm have been applied within the ED environment to obtain a more systematic perspective of visit characteristics, including the addition of a separate injury category with subcategorizations, as well as mental health, alcohol use disorder-, and substance use disorder-related visits.¹⁹ Our initial analysis focused on the original Billings/Ballard algorithm to demonstrate a proof of concept in applying the algorithm in the ICC setting, but we also provide a comparison of a derivative of the Billings/Ballard algorithm (Supplementary Table 1). While Ballard et al reported 37.90% emergent ED visits in their integrated delivery system (Table 2), applying the Billings/Ballard algorithm to nationally representative National Hospital Ambulatory Medical Care Survey data yielded 13.43% emergent visits as reported by Lemke et al (2020).^{15,19} Our ICC emergent rate of 9.17% is lower than reported ED rates in the literature, suggesting that ICCs function as intended to serve lower acuity conditions.

Non-emergent visits constituted a greater proportion of visits in the ICC than in the ED. Among ICC visits, 9.17% were classified as emergent and 81.25% as non-emergent, in contrast to 37.90% and 45.08%, respectively, among ED visits reported in the literature.¹⁵ Notably, ICCs accounted for a much smaller proportion of indeterminate visits (0.79%) than EDs (11.32%), possibly reflecting patients' self-triage decisions for ambiguous or uncertain symptoms. The ICCs were primarily used for lower acuity conditions, particularly

Table 3. Billings/Ballard algorithm classification by type of payor in a study applying an emergency department severity algorithm to immediate care clinic visits^a (N = 306,395; 2013-2019).

Ballard algorithm classification	Percentage distribution by type of payor			
	Medicare	Medicaid	Private	Uninsured/Self-Pay
Emergent	15.67	7.84	8.38	9.31
Indeterminate	1.19	0.92	0.68	0.99
Non-emergent	74.62	82.68	82.14	75.52
Unclassified	8.52	8.56	8.79	14.18
Total (%)	100	100	100	100

^aChi-squared test significant, $P < .001$.

Table 4. Multivariable regression analysis examining the association between patient demographics, primary care physician visits, and total immediate care clinic use in a study applying an emergency department severity algorithm to immediate care clinic visits^a (N = 125,063; 2013-2019).

	Total PCP ^b visits Incident rate ratio (IRR) (95% CI)	Total ICC visits Incident rate ratio (IRR) (95% CI)
Sex (Ref. Female)		
Male	0.87 *** (0.85, 0.90)	0.98 *** (0.98, 0.99)
Age at first ICC visit (Ref. 26 - 39.9 years)		
< 18 years	3.06 *** (2.94, 3.18)	1.01 (0.99, 1.02)
18 - 20.9 years	2.28 *** (2.12, 2.45)	1.01 (0.99, 1.03)
21 - 25.9 years	1.60 *** (1.51, 1.70)	1.00 (0.99, 1.02)
40 - 64.9 years	2.13 *** (2.05, 2.21)	0.99 * (0.98, 0.99)
≥ 65 years	3.00 *** (2.78, 3.23)	0.94 *** (0.92, 0.96)
Race (Ref. Black)		
White	1.37 *** (1.32, 1.43)	0.94 *** (0.94, 0.95)
Asian	1.40 *** (1.27, 1.54)	0.91 *** (0.88, 0.93)
Other ^c	1.39 *** (1.31, 1.47)	0.93 *** (0.92, 0.95)
Ethnicity (Ref. Non-Hispanic)		
Hispanic	0.65 *** (0.63, 0.68)	1.05 *** (1.04, 1.06)
Insurance status at first ICC visit (Ref. Private)		
Medicare	1.64 *** (1.53, 1.75)	1.04 *** (1.02, 1.07)
Medicaid and other governmentally insured	1.04 (1.00, 1.08)	1.11 *** (1.10, 1.12)
Self-pay and uninsured	0.43 *** (0.39, 0.48)	0.93 *** (0.90, 0.95)
Total PCP visits at the same health system (Ref. 0)		
1 - 4	-----	1.07 *** (1.06, 1.08)
5 - 12	-----	1.08 *** (1.06, 1.09)
13 - 29	-----	1.10 *** (1.09, 1.11)
30 - 232	-----	1.13 *** (1.11, 1.14)

* $P < .05$, ** $P < .01$, *** $P < .001$.

^aNegative binomial regression, regressions controlled for number of years patient has visited the ICC.

^bSame healthcare system primary care physician.

^cOther race categories include Alaska Native, Native American, multiracial, Native Hawaiian, and other Pacific Islander.

ICC, immediate care clinic; IRR, incident rate ratio; IQR, interquartile range; PCP, primary care physician.

respiratory infections, and were less likely to receive patients with conditions more common in EDs, such as wounds, syncope, abdominal pain, and urinary tract infections (Supplementary Table 2).¹⁵ Additionally, visit severity varied by patient demographics and payor characteristics, whereby uninsured or self-pay patients were underrepresented in both ICC and primary care visits.

To our knowledge, this is the first study to apply and describe the Billings/Ballard algorithm in the setting of immediate care clinics, and it addresses a notable gap in the literature. The successful classification of 91.21% of visits across a large, demographically diverse patient population demonstrates the algorithm's applicability to ICC environments. While this evidence shows that ICCs predominantly serve privately insured patients (70.28% vs 66.5% nationally), the finding that uninsured patients were less likely to use either

ICCs or PCPs highlights persistent access disparities in non-emergency, acute care settings.^{28,29,33} Additionally, the positive association between PCP use and ICC visits within our healthcare system challenges the concern that ICCs disrupt primary care relationships, suggesting instead that these settings may function as complementary components of integrated care delivery.^{25,26} These patterns, combined with the distinct severity distributions between ICCs and EDs, provide essential data for optimizing acute-care resource allocation.

The clinical implications of these findings are particularly relevant to emergency medicine. Clearer delineation between the case mix of ICCs and EDs may facilitate more appropriate patient self-triage and reduce the burden of low-acuity visits on strained EDs as well as improve the allocation of emergency care resources. Furthermore, the observed associations between visit severity, patient characteristics, and

Table 5. Multivariate regression analysis examining patient demographics and healthcare use associated with emergent vs non-emergent immediate care clinic (ICC) visits in a study applying an emergency department severity algorithm to ICC visits^a (N= 306,395; 2013-2019).

	Odds ratio (95% CI)
Sex (Ref. Female)	
Male	1.27 *** (1.23, 1.31)
Age (Ref. 26-39.9 years)	
<18 years	0.61 *** (0.58, 0.65)
18 - 20.9 years	0.71 *** (0.64, 0.78)
21 - 25.9 years	0.83 *** (0.76, 0.90)
40 - 64.9 years	1.44 *** (1.37, 1.51)
≥ 65 years	1.73 *** (1.59, 1.89)
Race (Ref. Black)	
Asian	0.67 *** (0.59, 0.75)
Other ^a	0.79 *** (0.73, 0.85)
White	0.75 *** (0.71, 0.79)
Ethnicity (Ref. Non-Hispanic origin)	
Hispanic origin	1.12 *** (1.06, 1.18)
Insurance type (Ref. Private)	
Medicare	1.44 *** (1.33, 1.56)
Medicaid, other governmentally insured	1.09 *** (1.03, 1.14)
Self-Pay and uninsured	1.14 * (1.00, 1.30)
Total ICC visits (Ref. 1 visit, 17.4%)	
2-3 visits (26.23%)	0.90 *** (0.86, 0.94)
4-5 visits (18.3%)	0.86 *** (0.82, 0.91)
6-9 visits (20.35%)	0.93 ** (0.88, 0.98)
10-71 visits (17.66%)	1.00 (0.94, 1.06)
Total PCP visits at the same health system (Ref. 0)	
1-4	1.10 *** (1.05, 1.15)
5-12	1.16 *** (1.11, 1.22)
13-29	1.21 *** (1.15, 1.27)
30-232	1.36 ** (1.28, 1.44)

* $P < .05$, ** $P < .01$, *** $P < .001$.

^aRandom-effects logistic regression analysis; the regression analysis controlled for multiple visits per patient.

^bOther race categories include Alaska Native, Native American, multiracial, Native Hawaiian, and other Pacific Islander.
ICC, immediate care clinic; PCP, primary care physician.

insurance status offer actionable insights for clinicians and healthcare system leaders aiming to align acute care delivery with clinical urgency. It also highlights opportunities to reduce healthcare costs by supporting site-appropriate care and aligning with evolving reimbursement structures.

This study establishes the feasibility of applying the Billings/Ballard algorithm to ICC settings, providing a standardized method for comparing severity distributions across acute care environments. Our findings highlight the

importance of distinguishing the roles of ICCs and EDs to promote appropriate patient use, reduce avoidable ED burden, and support the delivery of timely, high-acuity emergency care. These pre-pandemic data demonstrate the algorithm's utility in classifying ICC visits and provide a reproducible framework for characterizing ICC acuity patterns in other healthcare systems and time frames.

LIMITATIONS

Despite the strengths of including data from multiple ICCs and primary care clinics associated with an academic healthcare system, a large sample of diverse patient populations, and multiple years of data, this study has limitations. The examination of the severity of ICC visits at five suburban ICCs in Illinois associated with an academic medical center may not be representative of healthcare systems in other states or across the country. Moreover, the ICCs spanned into suburban regions of a large metropolitan area, which may or may not be applicable to other areas across the country. Demographic and geographic differences may exist for other ICCs not affiliated with an academic medical center. Furthermore, ICD 9/10 coding errors and the novel application of the Billings/Ballard algorithm to ICC settings may have led to misclassification of visit severity, potentially biasing our regression estimates. However, the high classification rate (91.21%) and clinically meaningful patterns observed support the algorithm's utility despite these potential limitations.

CONCLUSION

This study demonstrates the successful application of the Billings/Ballard algorithm to immediate care clinic settings. Compared to previously published ED severity category distributions, we found a lower proportion of emergent and indeterminate visits and a greater proportion of non-emergent visits within the ICC, revealing that ICCs predominantly serve their intended population of patients with lower acuity conditions. A review of the most frequent diagnosis codes in the ICC and ED revealed distinct conditions comprising the emergent and non-emergent categories in each setting. In addition, we found disparate patterns of ICC use based on various patient characteristics, including age, race, ethnicity, and insurance status. Our results help to characterize the same healthcare system ICC usage at an academic medical center, as well as the interplay between PC and ED settings.

By delineating the role of ICCs within the acute care landscape, our study provides evidence to guide healthcare system optimization in access, efficiency, and cost control. For emergency physicians, these findings support confident referral of stable, low-acuity patients to ICCs, potentially alleviating ED crowding and allowing focus on higher acuity cases. Healthcare system administrators can use these data to optimize resource allocation and develop evidence-based triage protocols. For policymakers, the disparities in ICC use by insurance status

highlight the need for targeted interventions to improve access for uninsured and underinsured populations. Public health initiatives should communicate these severity differences through patient-facing tools that guide appropriate selection of care site, ultimately improving healthcare efficiency, patient satisfaction, and cost effectiveness.

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An Organized Approach to Using Large Language Models for Medical Information

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Introduction: ChatGPT and other large language models (LLM) have increased in popularity. Despite the rapid rise in the implementation of such technologies, frameworks for implementing appropriate prompting techniques in medical applications are limited. In this paper we establish the nomenclature of “variable” and “clause” in the prompting of a LLM, while providing example interviews that outline the utility of such an approach in medical applications.

Methods: In this study assessing the LLM ChatGPT-4, we define terms used in prompting procedures including “input prompt,” “variable,” “demographic variable and clause,” “independent variable and clause,” “dependent variable and clause,” “generative clause,” and “output.” This methodology was implemented with three sample patient cases from both a patient and physician perspective.

Results: As demonstrated in our three cases, precise combinations of variables and clauses that consider the patient’s age, gender, weight, height, and education level can yield unique outputs. The software can do so quickly and in a personalized, patient-specific manner. Our findings demonstrate that LLMs can be used to generate comprehensive sets of educational material to augment current limitations, with the potential of improving healthcare outcomes as the use of LLM is further explored.

Conclusion: The framework we describe represents a unique attempt to standardize a methodology for medical inputs into a large language model. Doing so expands the potential for outlining patient-specific information that can be implemented in a query by either a patient or a physician. Most notably, future projects should consider the specialty- and presentation-specific input changes that may yield the best outputs for the desired goals. [West J Emerg Med. 2026;27(1)194–204.]

INTRODUCTION

Technology has entered an era of rapid progress with the advent and implementation of artificial intelligence (AI). Large language models (LLM), such as ChatGPT (developed and released by OpenAI, available at chat.openai.com), are among the fastest growing internet applications since their release in late 2022.¹ Initial iterations of ChatGPT were bounded by 175 billion parameters, making them the most

comprehensive LLMs to date.²

The rapid rise in the use of LLMs like ChatGPT has recently entered the medical field, yet their reliability, safety, and clinical relevance remain underexplored.^{3–5} Existing studies have evaluated LLMs’ ability to answer medical knowledge questions, generate novel research ideas, and translate medical documentation. ChatGPT has demonstrated high accuracy on publicly available United States Medical

Licensing Examination Step 1 and Step 2-Clinical Knowledge questions and has been used in specialties such as plastic surgery to identify topics for exploration in systematic reviews.^{6,7} Additionally, ChatGPT showed high accuracy in generating responses to general medical questions.⁸ Furthermore, one study demonstrated that ChatGPT responses to patient questions have been rated highly for both quality and empathy.⁹

Despite the potential of LLMs to revolutionize the medical field, limitations exist in the current capabilities of such software. Most notably, conversational models like ChatGPT have depicted prevalent and pervasive “hallucinations” in their outputs.¹⁰⁻¹² These are generally known as fabricated LLM outputs and are often noted in medical applications as falsified references to medical literature that do not exist.¹³⁻¹⁶ Hallucinations in LLMs pose a significant challenge to the successful implementation of LLMs in medical settings, as variations in input structure and clarity significantly influence model outputs.¹⁷ Implementing a standardized prompting framework may mitigate hallucinations by ensuring consistent, well-structured inputs that guide LLMs toward more accurate and clinically relevant outputs.^{4,18,19} In this paper our goal was to present a unique iteration of standardizing medically relevant LLM search strategies by proposing a framework of “clauses” and “variables.” The framework introduced here has the potential to personalize the answers that LLMs provide to patients while ensuring a level of control over the entry methodology used to develop medical outputs from LLMs.

METHODS

Operational Definitions (Figure 1)

Variable

A variable limits the bounds of LLM processing. Variables specify the parameters that guide the model’s reasoning and are expressed within clauses. Three variable types are used in this framework:

- Demographic variable (DMV) defines patient background (eg, “52-year-old male, weight 221 lbs”).
- Independent variable (IV) represents the primary concern or condition (eg, “diagnosis of type 2 diabetes”).
- Dependent variable (DPV) reflects specialty-specific details or measurable outcomes (eg, “blood glucose level 152 mg/dL” or “recommended metformin regimen”).

Clause

A clause connects variables into meaningful sentences within the input prompt. Each clause narrows how the LLM processes information. Four clause types structure medically relevant prompts:

- Demographic clause (DMC) links demographic variables (eg, “I am a 52-year-old male patient living in Miami”).
- Independent clause (IC) introduces the main clinical concern (eg, “I was just diagnosed with type 2 diabetes”).

Population Health Research Capsule

What do we already know about this issue?
Patient education materials are not tailored to the patient’s background and are written at a reading level above the average patient’s comprehension.

What was the research question?
Can a large language model (LLM) generate personalized, patient-specific education materials using structured clinical prompts?

What was the major finding of the study?
Across three cases, structured prompts generated unique outputs tailored to patient demographics, demonstrating personalization.

How does this improve population health?
Structured LLM prompts generating personalized, accessible education may improve patient understanding, engagement, and adherence.

LEGEND	
Input Prompt:	Types:
Variable: A variable limits the bounds of LLM processing. A variable is written in terms of a clause that connects the variable to other segments of the input prompt into ChatGPT.	<u>Demographic Variable (DMV)</u> Independent Variable (IV) Dependent Variable (DPV)
Clause: A clause is a group of words (containing at least a subject and predicate) that conveys part of an idea. Clauses can be connected to one another to create further bounds upon the processing of the LLM in question.	Demographic Clauses (DMC) Independent Clauses (IC) Dependent Clauses (DPC) Generative Clause (GC)

Figure 1. Left column: term definitions; right column: color-highlighted phrases and abbreviations delineate text breakdown. LLM, large language model.

- Dependent clause (DPC) adds measurable or treatment-specific details (eg, “My blood glucose came back as 152 mg/dL, and my doctor recommended metformin”).
- Generative clause (GC) specifies the task for the model, integrating all prior clauses into a focused request (eg, “Please explain why this treatment was recommended, and provide a comprehensive overview tailored to my case”).

Annotated Input Prompt 1	
Hello, I am a 52-year-old male patient. I am 6'2" and weigh 221 lbs. I live at home in Miami with my daughter and I own my own small business. The highest level of education I have achieved is completing my <u>associate's degree</u>.	Hello, I am a DMV patient. I am DMV and weigh DMV. I live at DMV and I DMV. The highest level of education I have achieved is completing my DMV
A	B
I was just diagnosed with type 2 diabetes.	I was just diagnosed with IV.
C	D
My blood glucose just came back as 152mg/dL. My doctor recommended that I take metformin, alter my diet, and exercise daily.	My DPV just came back as DPV. My doctor recommended DPV.
E	F
What advice do you have for best managing my type 2 diabetes? Can you also explain to me why my doctor recommended this specific treatment regimen, given the information I have provided you about myself. Can you make this response extremely comprehensive to provide me with an in-depth understanding of what is going on."	What advice do you have for best managing my IV? Can you also explain to me why my doctor recommended this specific treatment regimen, given the information I have provided you about myself? Can you make this response extremely comprehensive, to provide me with an in-depth understanding of what is going on?
G	H

Figure 2. Example of ChatGPT annotated input prompt for a patient perspective regarding their diagnosis of Type II Diabetes (scenario 1).
A,B) Demographic clause with demographic variables.
C,D) Independent clause with independent variables.
E,F) Dependent clause with dependent variables.
G,H) Generative clause.
All variables within each clause have been codified as bolded letters. Color-highlighted phrases in left column delineate text breakdown by type of clause.
DMV, demographic variables; IV, independent variables; DPV, dependent variables.

The generative clause serves as the culmination of the system, effectively optimizing the abstraction of relevant information while reducing the likelihood of false or incomplete outputs.

Input Prompt Construction

An input prompt is the complete entry submitted to ChatGPT. Each prompt is built sequentially using the three variable categories (DMV, IV, DPV) embedded within the four clause types (DMC, IC, DPC, GC). This layered design standardizes inputs, ensuring clarity and reproducibility across queries. A fully annotated input prompt is shown in Figure 2.

Quantitative Analysis

We analyzed all prompts generated by the LLM for word count and readability via a Flesch-Kincaid Reading Ease (FKRE) score. The FKRE score is a readability formula evaluating how easy a text is to read based on average sentence length and average number of syllables per word. The FKRE scores range from 0- 100, with higher scores indicating easier reading levels. Full quantitative analysis of readability can be found in Table 1.

RESULTS

Annotated Input Prompts

We structured and annotated six different input prompts to provide broad examples of the outlined prompting structure (Figures 4A-B, S1A-D). Three of these prompts were written from the patient perspective (Figures 4A, S1A, C), and three from the physician perspective (Figures 4B, S1B, D) to further illustrate prompting utility. All annotated input prompts yielded an output, with scenario 1 included in the paper (5A, B), and two addition scenarios (2, 3) included as supplemental figures (S2A-S2D).

Quantitative Analysis

We calculated word count and readability via FKRE scores for each LLM output. The FKRE scores range from 0-100, with higher scores indicating easier reading levels (Table).

DISCUSSION

Overview

There is currently limited research exploring the standardization of input prompts for LLMs in the medical field. Prior studies have shown that unstructured input prompts to an LLM yield significant deficiencies in their generated output, pointing to a need to explore the quality of structured input prompts.²⁰ Our goal in this paper was to establish a reproducible and systematic approach to healthcare-related inputs to LLMs.

There are many benefits to developing and refining such a framework for input prompting techniques.¹⁹ Firstly, the outlined patient-specific information in medical queries can help tailor responses more effectively to individual patients. A comparison of Figure 3 and Figure 5A clearly depicts this difference in output. ChatGPT provided detailed information

Table. Word count and readability via FKRE scores for each LLM output.

	Word count	FKRE score
Unstructured input prompt	415	51.4
Patient perspective – diabetes	948	49.8
Physician perspective – diabetes	408	79.8
Patient perspective - outpatient TJA	760	39.7
Physician perspective - outpatient TJA	528	62.6
Patient perspective - adolescent STI education	524	52.6
Physician perspective - adolescent STI education	383	65.7

FKRE, Flesch-Kincaid Reading Ease score (0-100 scale, higher scores are easier to read); TJA, Total Joint Arthroplasty; STI, sexually transmitted infection.

Interview 1: Unstructured

Hello, I was just diagnosed with hyperglycemia and type 2 diabetes. What advice do you have for best managing my type 2 diabetes?

I'm really glad you reached out — getting a new diagnosis like type 2 diabetes can feel overwhelming, but with the right tools and support, it is absolutely manageable. Here's a clear and actionable guide to help you take control of your health:

1. Understand Your Diagnosis

Type 2 diabetes means your body is not using insulin effectively (insulin resistance), and over time, your pancreas may not make enough insulin. This causes high blood sugar (hyperglycemia), which, if left uncontrolled, can affect your heart, kidneys, eyes, nerves, and more.

2. Lifestyle Changes Are Your Foundation

These are often more powerful than medications early on:

A. Nutrition

- *Focus on whole, unprocessed foods: vegetables, lean proteins, whole grains, nuts, and healthy fats.*
- *Limit simple carbohydrates and sugar: avoid sugary drinks, white bread, desserts, and processed snacks.*
- *Control portion sizes: use the plate method—½ veggies, ¼ lean protein, ¼ complex carbs.*
- *Watch for hidden carbs in sauces, dressings, and drinks.*

B. Physical Activity

- *Aim for at least 150 minutes/week of moderate-intensity aerobic activity (eg, brisk walking, biking).*
- *Add resistance training 2–3 times/week (eg, weights, resistance bands) to improve insulin sensitivity.*
- *Start gradually and find something you enjoy to help make it a habit.*

C. Weight Management

If you're overweight, even a 5–10% weight loss can dramatically improve blood sugar control and reduce insulin resistance.

3. Monitor Your Blood Sugar

- *Your provider may recommend a glucometer to check your blood sugar levels at home.*
- *Ask what your target range should be (often 80–130 mg/dL fasting and <180 mg/dL after meals).*
- *Keep a log of your readings to see how food, activity, and medications affect your levels.*

4. Medications

- *If prescribed metformin or other medications, take them as directed.*
- *Never adjust doses on your own—always talk to your provider first.*
- *Ask about side effects and when you should contact your care team.*

5. Regular Medical Follow-Up

- *A1c blood test every 3–6 months (goal usually < 7%).*
- *Cholesterol, blood pressure, kidney function, and eye exams at least yearly.*
- *Foot exams at every visit—diabetes can cause nerve damage and poor healing.*

6. Build Your Support Team

- *Primary care physician or endocrinologist*
- *Registered dietitian (especially one certified in diabetes education)*
- *Pharmacist, diabetes educator, or counselor if needed*
- *Family and friends—include them so they can support your changes*

7. Stay Informed and Empowered

- *Consider a diabetes education program (ask your provider for referrals).*
- *Use trusted sources like:*
- *CDC Diabetes*
- *ADA (American Diabetes Association)*
- *MyPlate.gov*

Figure 3. Unstructured ChatGPT input prompt and generated output for a patient perspective regarding their diagnosis of diabetes (scenario 1).

Output generated by GPT-4 on July 22, 2025.

CDC, Centers for Disease Control and Prevention.

Annotated Input Prompt 1: Patient Perspective - Diabetes

"Hello, I am a 52-year-old male patient. I am 6'2" and weigh 221 lbs. I live at home in Miami with my daughter and I own my own small business. The highest level of education I have achieved is completing my associate's degree. I was just diagnosed with hyperglycemia and type 2 diabetes. In the emergency department, my blood glucose just came back as 152mg/dL and I had an HbA1c level of 6.8%. My doctor recommended that I take 500 mg metformin twice a day, alter my diet, and exercise daily. What advice do you have for best managing my hyperglycemia and type 2 diabetes? Can you also explain to me why my doctor recommended this specific treatment regimen, given the information I have provided you about myself. Can you make this response extremely comprehensive, in order to provide me with an in-depth understanding of what is going on."

Figure 4A. Chat GPT annotated input prompt for a patient perspective regarding their diagnosis of diabetes (scenario 1). Color-highlighted phrases delineate text breakdown by type of clause

Annotated Input Prompt 2: Physician Perspective - Diabetes

"Hello, I am a primary care specialist. I am treating a 52-year old, male patient. He is 6'2" and weighs 221 lbs. He lives at home in Miami with his daughter and owns his own small business. This patient's highest level of education is an associate's degree. I am currently managing this patient's hyperglycemia and type 2 diabetes. I recommend that he start treatment with 500 mg metformin twice a day, alter his diet and exercise daily to help him manage his condition. Can you help me develop a complimentary handout that I can give this patient to facilitate their treatment compliance? Can you personalize this handout to the patient, based on the information I have provided above?"

Figure 4B. Chat GPT annotated input prompt for a physician perspective regarding a care plan for their patient with a diagnosis of type 2 diabetes (scenario 2).

Color-highlighted phrases delineate text breakdown by type of clause.

about the medication prescribed (metformin), specific advice on dietary changes, and explicit guidelines for a recommended exercise regimen when properly prompted. On the other hand, the unstructured input prompt elicited a broader but shallower output from ChatGPT. This comparison underscores the capability of ChatGPT and other LLMs to change output information presentation in clinical vignettes when given additional patient-specific information in the initial input prompt.

Additionally, although LLMs like ChatGPT have unparalleled flexibility in their understanding of input prompts, this flexibility introduces variability, potential inaccuracies in the content, and bias in the output information provided. The structure outlined in this paper may provide a foundation for future research into the medical applications of LLMs by offering a systematic way to assess input prompts.

Input Prompt Structure

As shown in the three cases, combinations of specific variables and clauses can provide unique outputs that may significantly enhance patient education and serve as a supportive tool for physicians in patient care. Each input prompt starts with a set of demographic clauses, each

composed of demographic variables. We chose demographic variables that have been shown in the literature to have a substantial impact on patient care outcomes, while remaining concise.^{13,21} More research needs to be done to determine the optimal number and combination of demographic variables that can consistently produce the best outputs from LLMs. It is likely that the best combinations of demographic clauses and variables are contingent on the independent clause.

Following each set of demographic clauses is the independent clause, containing the independent variable. The independent clause is unique to each medical scenario and can be thought of as a sentence that represents the patient's chief concern. Most notably, chief concerns vary widely among different medical specialties.²² Thus, independent clause structuring could be crucial for optimizing the LLM's understanding of the independent variable. Dependent variables, housed within various dependent clauses, follow the independent clause. As shown in the example input prompts, the dependent clause structuring changed depending on the specific elements of the independent clause and variable. Subsequently, this input prompt element becomes the most challenging to further research and optimize for specialty-specific goals in LLM use. Finally, the last section of our

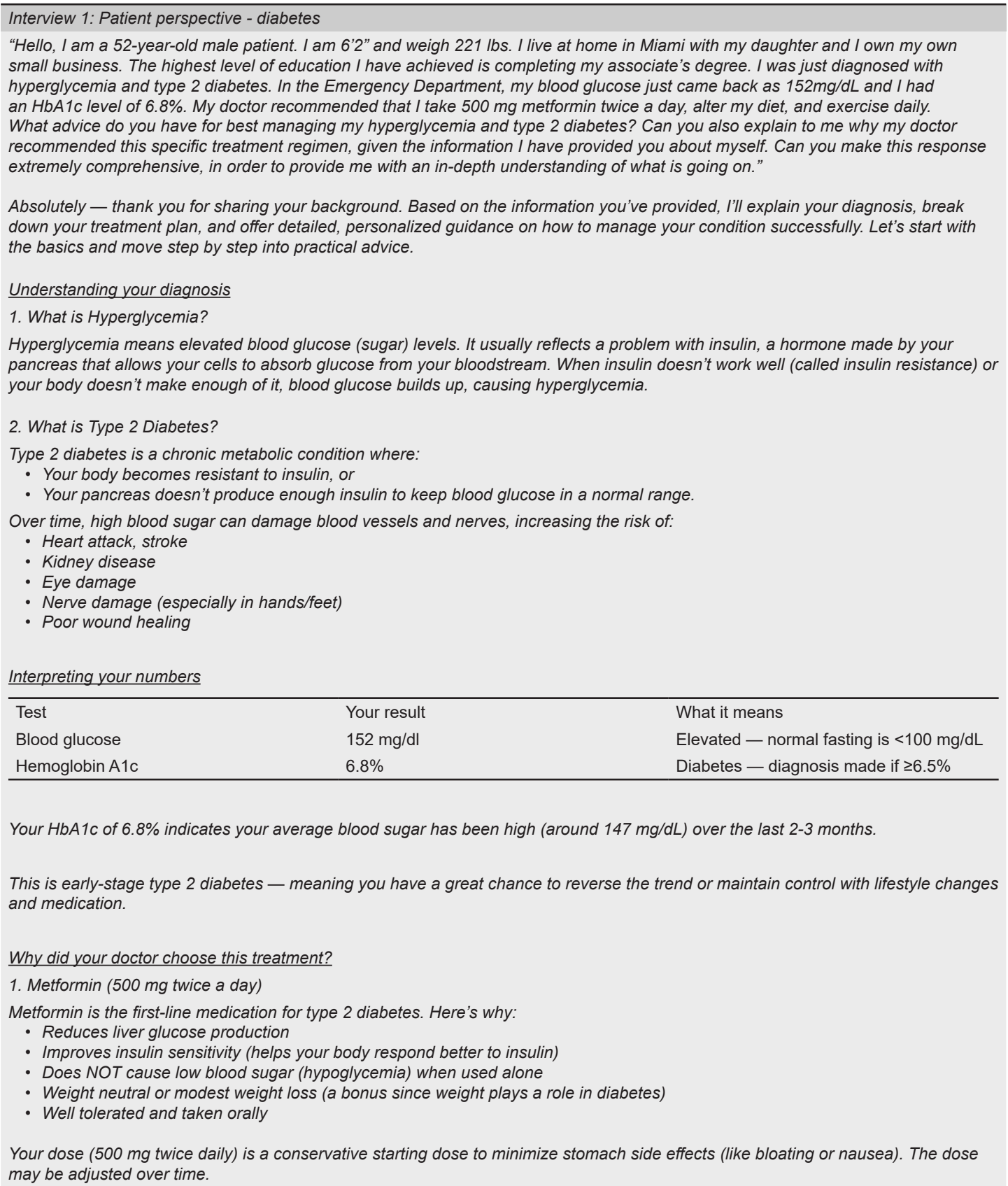


Figure 5A. Chat GPT input prompt and generated output for a patient perspective regarding their diagnosis of type 2 diabetes (scenario 1). Output generated by GPT-4 on July 22, 2025, <https://openai.com>.

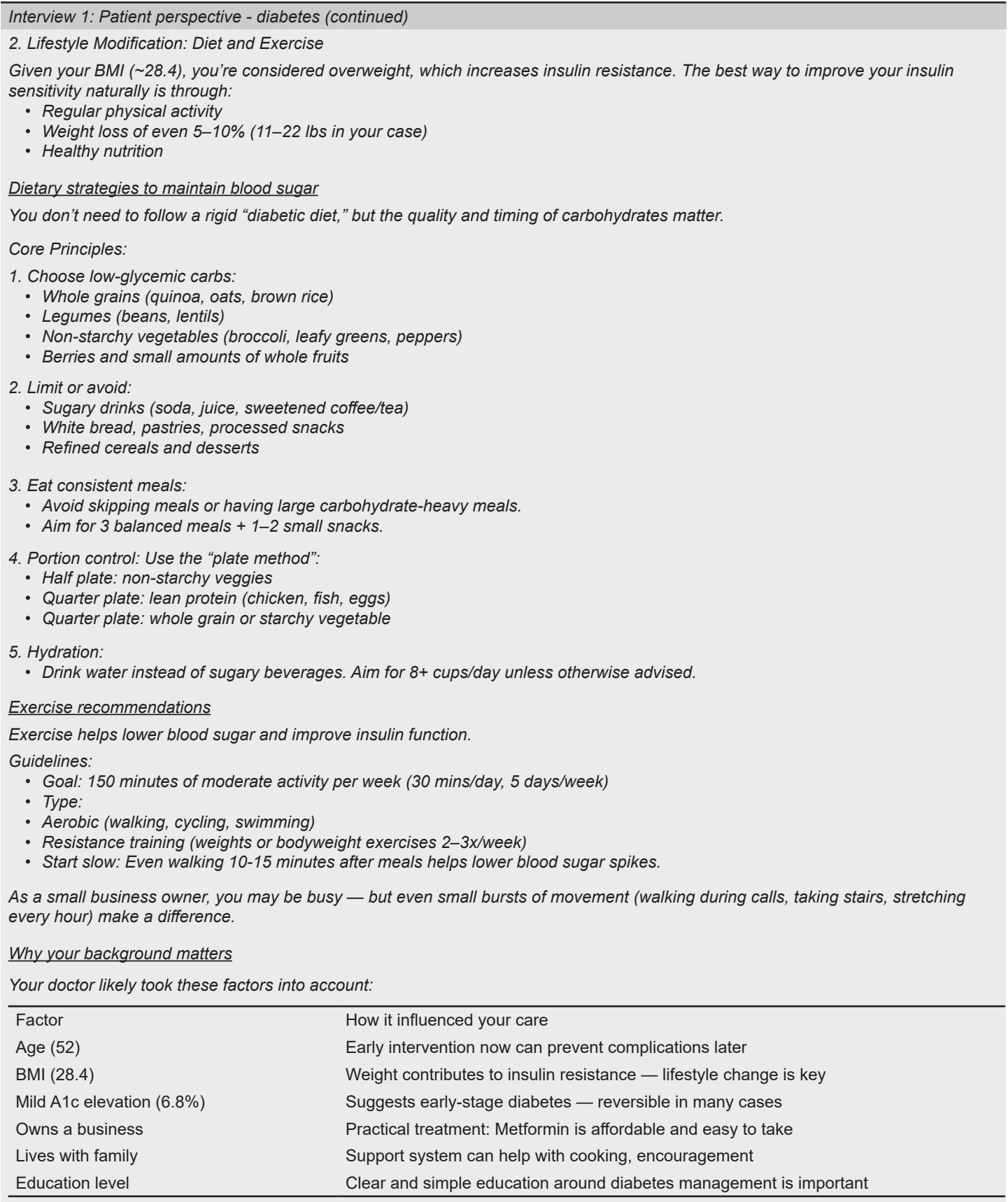


Figure 5A. Continued.
BMI, body mass index.

<i>Interview 1: Patient perspective - diabetes (continued)</i> <u>Putting it all together – your action plan</u> Medication • Take metformin 500 mg twice a day (usually with breakfast and dinner) • If stomach upset occurs, take it with food and speak to your doctor about extended-release options Diet • Shift to whole, minimally processed foods • Reduce sugary drinks and refined carbs • Control portion sizes Exercise • Start with walking 15–30 minutes/day • Add strength training if possible Tracking • Monitor blood sugar if advised (some doctors recommend home glucose testing early on) • Track weight, energy, food choices in a journal or app • Follow up with your doctor in 3 months — they'll recheck your A1c <u>When to seek help</u> Call your doctor if you experience: • Very high blood sugar consistently (>250-300 mg/dL) • Very low blood sugar symptoms (shaking, sweating, confusion — though unlikely with metformin alone) • Stomach issues that don't go away • Fatigue, blurry vision, or frequent urination that worsens <u>Key takeaways for you</u> • You've caught this early — a 6.8% A1c is manageable and often reversible. • Metformin is safe, affordable, and highly effective for newly diagnosed patients. • Diet and exercise changes are the foundation of diabetes management — they'll help more than any medication alone. • You don't need perfection — just small, consistent improvements. If you'd like, I can also help you: • Create a 7-day meal plan • Set up a simple exercise calendar • Draft questions for your next doctor visit You're not alone in this — you've already taken the most important step by seeking to understand your diagnosis. Let me know how else I can support you.
--

Figure 5A. Continued.

methodology for structuring medically related LLM input prompts is the generative clause. As goals for LLM use can range widely, future research is recommended for optimization of this prompting component.

Quantitatively, the outputs were assessed for their FKRE level. Outputs intended for patient consumption interestingly scored lower on the FKRE scoring system than physician-intended outputs, showing a limitation of the models in attempting to tailor the information to the intended audience. Although other work has shown LLMs to be capable and proficient at tailoring their information to intended populations, this paper shows data contrary to these findings, suggesting another area for continued research and optimization.

Clinical Significance - Scenario 1: Type 2 Diabetic

Type 2 diabetes is prevalent, affecting over 30 million residents of the US in 2022.²³ Management of diabetes is complex and often requires various interventions, including pharmaceuticals, dietary changes, and exercise.^{18,24,25} This

multivariable approach to diabetes requires significant lifestyle changes, which can be challenging for patients to sustain over long periods.

One of the most popular approaches to combat limitations in diabetes management has been the use of programs focused on diabetes self-management education (DSME), which have been proven to help lower A1C levels.²⁶ The DSME can be personalized and often comes in many forms, depending on many factors.²⁷ The output generated in both the patient and physician diabetes scenarios (Figure 5A, 5B) shows the potential benefit of using an LLM as a part of DSME. Each response is tailored specifically to the individual based on the details provided within the demographic, independent, and dependent clauses (Figure 5A,B). Thus, the outputs demonstrated in this paper show the potential of GPT-4 in providing pertinent information tailored to the example patient scenario. These LLMs can potentially break down one of the most significant hindrances in type 2 diabetes management, socioeconomic status, by providing access to a digital form of DSME.²⁸

"Hello, I am a primary care specialist. I am treating a 52-year-old, male patient. He is 6'2" and weighs 221 lbs. He lives at home in Miami with his daughter and owns his own small business. This patient's highest level of education is an associate's degree. I am currently managing this patient's hyperglycemia and type 2 diabetes. I recommend that he start treatment with 500 mg metformin twice a day, alter his diet and exercise daily to help him manage his condition. Can you help me develop a complimentary handout that I can give this patient to facilitate their treatment compliance? Can you personalize this handout to the patient, based on the information I have provided above?"

Title: Your Personalized Type 2 Diabetes Management Plan

Dear [Patient's Name],

You have been diagnosed with type 2 diabetes, a condition where your body has trouble using sugar (glucose) the right way. This can lead to high blood sugar, which can harm your heart, kidneys, eyes, and nerves over time.

Your Medication: Metformin 500 mg (Twice Daily)

You will start taking metformin, a medication that helps lower your blood sugar by:

- Reducing sugar made by your liver
- Helping your body use insulin better

Take it with food to help avoid stomach upset. If you miss a dose, take it as soon as you remember — unless it's close to your next dose. Do not double up.

Healthy Eating Tips (No Need to Be Perfect!)

Because you're a busy small business owner, here are simple tips that fit your lifestyle:

Instead of this...:	Try this instead...:
Sugary drinks (soda, juice);	Water, unsweetened tea, or sparkling water
White bread or rice;	Whole-grain bread or brown rice
Large portions;	Use a smaller plate and stop when you're 80% full
Skipping meals;	Eat 3 balanced meals per day to keep blood sugar steady

Try the "Plate Method":

- ½ plate = non-starchy vegetables (broccoli, spinach, peppers)
- ¼ plate = lean protein (chicken, turkey, beans)
- ¼ plate = whole grains or starchy foods (brown rice, sweet potatoes)

Exercise That Works for Your Life

Even just 30 minutes a day of activity helps control blood sugar. You don't have to go to the gym! Ideas for You:

- Walk around the block or nearby park before/after work
- Do stretches or light movement while watching TV with your daughter
- Park farther away at stores to get in extra steps

Start small and build up — every bit counts.

Your Goals

Goal	Target
Weight	~200-210 lbs (talk to your doctor for a specific goal)
HbA1c	Below 7.0%
Blood sugar (fasting)	80-130 mg/dL

Your Next Steps

1. Start metformin 500 mg twice daily with meals.
2. Track your meals and activity in a small notebook or app.
3. Follow up with your doctor in 3 months to check progress.
4. Get lab tests as needed (blood sugar, HbA1c, cholesterol, kidney tests).

You've Got This

Managing diabetes doesn't mean being perfect. It means doing your best every day — and getting support when you need it. As a dad, business owner, and provider, taking care of your health means you're taking care of your family, too.

Sincerely,
[Your Name]
Primary Care Specialist

Figure 5B. Chat GPT input prompt and generated output for a physician perspective regarding a care plan for their patient with a diagnosis of type 2 diabetes (scenario 2). Output generated by GPT-4 on 7/22/25, <https://openai.com>.

LIMITATIONS

This study has several limitations. We did not assess inter-rater reliability across independent users applying this framework, nor did we systematically test how altering single variables might change the generative clause output. Future work should incorporate reproducibility testing with agreement metrics (eg, the Cohen kappa) and sensitivity analyses of variable perturbations to strengthen the robustness of this framework. Second, the conceptualized framework was tested on only three scenarios, restricting generalizability across medical specialties or to more complex medical scenarios. Third, the methodology of this study remains conceptual and without formal validation, as it serves primarily as a foundation for future empirical work. Future studies are required to enhance the generalizability and reproducibility of this foundational work. Lastly, further work needs to be conducted to assess the feasibility of implementing such infrastructures, to mitigate concerns regarding patient privacy and compliance with laws mandating protection of sensitive health information as they relate to new technologies in clinical workflows.

CONCLUSION

Establishing more standardized prompting methodologies is crucial for maximizing the utility of large language models. This paper introduces a prompting methodology to improve the accuracy and relevance of medical outputs for both patients and clinicians. We applied this methodology to three patient case examples, demonstrating its potential in clinical contexts. Future research should explore specialty- and presentation-specific prompting strategies to further enhance model performance.

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Adherence to Accelerated Diagnostic Protocol for Chest Pain in Five Emergency Departments in Canada

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Introduction: In this study we sought to assess the extent to which emergency physicians adhered to an institutional protocol for rapid chest pain assessment that incorporates a high sensitivity troponin I (hs-TnI) assay. We also sought to characterize clinical outcomes stratified by protocol adherence.

Methods: We conducted a retrospective cohort study that included all adult patients presenting to five major metropolitan hospital emergency departments (ED) with suspected cardiac chest pain who had at least one troponin measured. The study period was November 9, 2020–June 20, 2022. The primary outcome was protocol adherence for indeterminate-risk and high-risk patients, as defined by the protocol in use at the time of each patient's presentation to hospital. Adjusted odds ratios (aOR) are reported with associated 95% confidence intervals.

Results: A total of 14,027 patients were included in the study, among whom 8,962 (63.9%) were classified as low risk, 4,064 (29.0%) as indeterminate risk, and 1,001 (7.1%) who were in the high-risk/rule-in group. Overall, 35.9% of patients had care that adhered to the chest pain pathway protocol—22.1% of indeterminate-risk patients and 91.6% of high-risk/rule-in patients. Protocol adherence among indeterminate-risk patients was 6.6% when the initial troponin was in the range of 4-19 nanograms per liter (ng/L) and 75.4% for initial troponin levels 20-99 ng/L. Male sex was most strongly associated with protocol adherence; among those receiving adherent care, 65.8% were male compared to 34.2% female (aOR 1.67; 95% CI, 1.46-1.91). Patients in the non-adherent group with an initial troponin 4-19 ng/L experienced a significantly higher incidence of major adverse cardiac events (4.5% vs 1.7%, $P < .001$), compared to those in the low-risk group.

Conclusion: Adherence to proposed assessment protocols for patients presenting to the ED with chest pain was low. This lack of adherence appears to disproportionately affect females and is associated with poor outcomes. Improving adherence to evidence-based guidelines in this setting is urgently needed. [West J Emerg Med. 2026;27(1)205–213.]

INTRODUCTION

Protocolized care for common conditions is increasingly prevalent within the emergency department (ED) setting. Despite their evidence-based development and implementation,¹⁻³ little is known regarding the extent to which clinicians are compliant/adherent to the protocols. Widespread use of electronic health record systems within EDs facilitates more comprehensive assessments of adherence to these protocols.⁴

Within the realm of acute coronary syndromes, adherence to certain protocols within the ED has previously been documented to be low. Protocol adherence may reflect the timing of troponin draws, the number of repeat troponin tests required, when to seek cardiology consultation, and when to arrange outpatient stress testing.⁵ Accelerated protocols have become mainstream since the widespread adoption of high-sensitivity troponins.^{1,2} These protocols have been shown to decrease ED length of stay, without a corresponding increase in 30-day major adverse cardiac events (MACE) and, in many cases, reducing MACE.¹

Non-adherence to these protocols poses a potential safety risk. One of the more common initial accelerated diagnostic pathways was the HEART Pathway.⁶ Secondary analysis of the primary research demonstrated that among the relatively small sample size of 141 patients, 20% were not investigated as outlined in the protocol.⁷ Fortunately, they did not identify any increase in MACE among these patients; however, the small sample size limited the detection of these rare events.

Our urban health system with several tertiary-care hospitals EDs, in collaboration with cardiology and laboratory medicine, has implemented accelerated diagnostic protocols associated with high-sensitivity troponin (hs-Tn) assays. All sites are staffed 24 hours/day almost exclusively by Royal College or Family Medicine-Emergency Medicine graduates and receive a variety of learners throughout the year. These changes represent an ideal opportunity to study physician adherence to this important diagnostic protocol as well as the possible changes in patient outcomes based on protocol-compliant care. Furthermore, the relative recency of establishing new protocols may provide insight into whether recurrent protocol changes accelerate waning compliance. Our goal in this study was to explore protocol adherence to an institutional diagnostic protocol for the workup of chest pain in the ED, with a secondary focus on major outcomes (eg, consultation, admission, and adverse events) after the introduction of the protocol.

METHODS

Ethics

The study was approved by the University of Alberta Health Research Ethics Board (HREB) at the University of Alberta, in Edmonton, Alberta, Canada (reference ID: Pro00145421). Approval was also obtained to access electronic health records from several administrative databases. Through a waiver of informed consent provided by the HREB, we did not obtain written informed consent from

Population Health Research Capsule

What do we already know about this issue?
Accelerated protocols for assessment of chest pain have become mainstream in emergency departments; they are safe and improve efficiency.

What was the research question?
We sought to assess the extent of physician adherence to rapid chest pain assessment protocols.

What was the major finding of the study?
Overall, 35.9% of patients had care that adhered to the chest pain pathway protocol.

How does this improve population health?
Patients receiving non-adherent care with a single troponin measurement have worse outcomes. Further research into strategies to improve compliance is warranted.

any patients whose data were included in the study. Operational and administrative approvals were provided by Alberta Health Services (AHS), and a data-sharing agreement was signed. The physicians practicing during the study period were unaware of any studies at the time of data collection.

Design

We conducted a retrospective cohort study of all adult patients (> 17 years of age) presenting to the five major EDs in the Edmonton area (University of Alberta Hospital, Sturgeon Hospital, Misericordia Hospital, Grey Nuns Hospital, and Royal Alexandra Hospital, minimum annual ED census > 48,000) with chest pain of cardiac origin who had at least one troponin ordered during their ED visit. Chest pain of cardiac origin is defined as a Canadian Triage and Acuity Scale (CTAS) score of II (emergent) and excludes chest pain patients assessed as CTAS I (Resuscitation) and CTAS III (urgent, although assessed as non-cardiac).

The study period was November 9, 2020–June 20, 2022. This corresponds to the introduction of a chest pain assessment protocol using a hs-TnI assay (Beckman Coulter Diagnostics, Brea, CA) and three-hour protocol across the five EDs.² The Beckman hs-TnI assay demonstrated excellent precision and achieved a coefficient of variation of $\leq 10\%$ at the overall 99th upper reference limit of 18 nanograms per liter (ng/L) across all five sites. The limit of detection was

established at 3 ng/L. There were significant educational efforts made in advance of the protocol implementation. A brief video was created and distributed together with a “Survival Guide” to emergency physicians and internal medicine and cardiology physicians, zone wide. A paper-based version of the protocol was distributed to all participating EDs. Emergency clinicians received an in-service on use of the protocol and had the opportunity to ask questions or clarify details. Finally, immediately prior to implementation, a laboratory bulletin was sent through Medical Affairs’ secure e-mail channels to remind staff of the upcoming changes.

Protocol

Results are sub-classified based on cumulative or serial (“delta”) troponin results that map out to the three risk categories of the chest pain protocols (see Appendix A). Negative/low-risk patients require the following:

- Single hs-TnI test value ≤ 3 ng/L and symptoms > 3 hours; *OR*
- Serial hs-TnI tests: first and second test value < 20 ng/L and delta (0-3 hours) ≤ 5 ng/L.

To be classified as indeterminate risk, patients require the following laboratory criteria:

- Single hs-TnI test value between 4-99 ng/L; *OR*
- Serial hs-TnI tests:
 - First test value < 20 ng/L and delta (0-3 hours) 5-25 ng/L; *OR*
 - First test value 20-99 ng/L and delta < 5 ng/L; *OR*
 - First test value 20-99 ng/L and delta 5-25 ng/L.

Similarly, to be considered high-risk, the following criteria must be met:

- Any single hs-TnI value ≥ 100 ng/L; *OR*
- Serial troponin tests:
 - First test value 20-99 ng/L and delta > 25 ng/L.

Details regarding the timing of any individual patient’s chest pain onset were not available in this retrospective, administrative data study. Given that the indeterminate- and high-risk groups always require further ED management they represent ideal targets for assessment of protocol adherence. The following patients were excluded from the analysis: those with ST-segment elevation myocardial infarction, those who left without being seen by a qualified physician or nurse practitioner, and patients without at least one high-sensitivity troponin measurement. Additionally, non-residents of Alberta were excluded due to lack of available post-ED outcome data. In the event of multiple visits, we included the data from the initial visit for each patient.

Data Sources

We accessed province-wide administrative databases to obtain retrospective data. All the datasets accessed are

maintained and updated in the AHS Enterprise Data Warehouse and are linked using unique patient identifiers. Specifically, the following were used: National Ambulatory Care Reporting System, which captures all ED visits across provinces using *International Classification of Disease and Related Health Problems, 10th Revision, Canada* [ICD-10-CA] diagnostic codes and patient basic demographics); the Emergency Department Information Tracking System captures ED visits in Edmonton and possesses information regarding patients clinical and demographic characteristics; Connect Care and AHS Lab datasets provide information about the laboratory investigations performed during the ED visits; provincial diagnostic imaging contains records about the imaging investigations (eg, chest radiographs, computed tomography) performed during ED visits; Provincial Registry and Alberta Vital Statistics capture death within 30 days of ED discharge; Practitioners Claims (captures all physician billing claims and includes several visit diagnoses); and Discharge Abstract Data, which captures all hospital admissions and interventions. We observed optimal chart review practices: data extractors were trained; data and variables were clearly defined; databases were defined as above; sampling methods were clear; and institutional and ethics approval was obtained.⁸

Outcomes

Our primary outcome was protocol adherence, defined as follows:

- No serial troponin measurement for the indeterminate group; *OR*
- First hs-TnI value > 99 ng/L with no cardiology consult or hospitalisation; *OR*
- Serial hs-TnI delta > 25 ng/L, with no cardiology consult or hospitalisation.

Secondary outcomes included any differences in demographics and clinical outcomes (30-day MACE, stroke, myocardial infarction [MI], death, and cardiac interventions) based on protocol adherence. Further, we also sought to evaluate protocol adherence as a function of 1) time since protocol implementation and 2) magnitude of initial troponin result.

Given the significant disparity in protocol adherence between high-risk and indeterminate-risk groups, we elected to focus specifically on the outcomes within the indeterminate-risk group to avoid unintentionally highlighting differences between the risk groups, rather than differences between protocol adherence and non-adherence.

Statistical Analysis

We calculated descriptive statistics for all included patients. Baseline differences between the chest pain pathway classification and comorbidities are reported. We reported data using means and standard deviations, medians and interquartile ranges or proportions with 95% confidence

intervals, as appropriate. Comparisons were made using the Student *t*-test for continuous parametric data and Wilcoxon test for continuous non-parametric data; dichotomous data was compared using a chi-squared test. We used a multivariable logistic regression to explore the factors associated with adherence. Primary outcome results were considered statistically significant at a 2-tailed *P*-value < .05. For all other tests, significance was set at *P* < .001.

RESULTS

Demographics

A total of 14,027 patients met criteria for inclusion. Of these patients, 8,962 (63.9%) met hs-TnI result criteria for the negative/low-risk group. There were 4,064 (29.0%) and 1,001 (7.1%) patients in the indeterminate- and high-risk/rule-in groups, respectively. Median age was 53 (IQR 40-65) in the negative/low-risk group compared to 65 (IQR 52-76) amongst indeterminate patients. Indeterminate- or high-risk patients were also more likely to arrive by ambulance. Similar trends are observed across a range of relevant pre-existing conditions.

Table 1 illustrates the demographic differences between the protocol adherent and non-adherent patient groups in the indeterminate- and high-risk cohorts. The median age for

protocol-adherent patients was older (68 vs 63 years of age; *P* < .001). Male sex was more common in the adherent group (65.8% vs 55.4%, *P* < .001). Ambulance arrival was significantly higher in the adherent group (54.7% vs 35.9%, *P* < .001). A history of hypertension, coronary artery disease, diabetes, and diabetes mellitus were all more common among patients for whom the protocol was followed.

Protocol Adherence

Overall, 35.9% of patients experienced protocol-adherent care (Table 2). The proportions varied between the two subgroups with 22.1% of indeterminate-risk patients and 91.6% of high-risk/rule-in patients receiving protocol-adherent care. Of the 84 high-risk patients who did not experience protocol adherence, 54 were due to an elevated initial troponin without corresponding consultation/ hospitalization. Among indeterminate-risk patients receiving non-adherent care, only 9.4% had a recent ED visit with a recorded troponin value. Adherence over time is shown in the Figure. There was a trend towards decreased compliance over time (*P* = .002).

In the indeterminate-risk group, we divided initial troponin results into increments of 10 to assess whether there were obvious cutoffs for adherence (Table 3). Adherence when the

Table 1. Demographic characteristics between patients presenting to five Canadian emergency departments with chest pain receiving protocol adherent or non-adherent care.

Patient demographics	Total N = 5,065	Non-adherent n = 3,249	Adherent n = 1,816	P-value
Age (years), Median (IQR)	65 (53, 76)	63 (50, 74)	68 (57, 80)	< .001
Male sex (n [%])	2,993 (59.1)	1,799 (55.4)	1,194 (65.8)	< .001
Mode of arrival (n [%])				
EMS	2,161 (42.7)	1,167 (35.9)	994 (54.7)	< .001
Time of day (n [%])	5,064	3,249	1,815	< .001
Daytime (8:01 AM - 4 PM)	2,223 (43.9)	1,466 (45.1)	757 (41.7)	
Evening (4 PM -12 AM)	1,940 (38.3)	1,263 (38.9)	677 (37.3)	
Early morning (1 AM - 8 AM)	901 (17.8)	520 (16.0)	381 (21.0)	
Pre-existing conditions (n [%])				
Hypertension	2,638 (52.1)	1,591 (49.0)	1,047 (57.7)	< .001
CAD	1,727 (34.1)	803 (24.7)	924 (50.9)	< .001
Diabetes mellitus	1,411 (27.9)	806 (24.8)	605 (33.3)	< .001
Atrial fibrillation	1,111 (21.9)	628 (19.3)	483 (26.6)	< .001
Stroke	691 (13.6)	390 (12.0)	301 (16.6)	< .001
Asthma	285 (5.6)	196 (6.0)	89 (4.9)	.09
Heart failure	718 (14.2)	320 (9.9)	398 (21.9)	< .001
COPD	494 (9.8)	293 (9.0)	201 (11.1)	.02
Charlson Comorbidity Index Score				
Median (IQR)	1 (0, 2)	1 (0, 2)	1 (0, 3)	<0.0001

Adherent and non-adherent groups include both indeterminate- and high-risk patients.

CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; EMS, emergency medical services.

Table 2. Proportion of indeterminate- and high-risk patients experiencing protocol-adherent care amongst patients presenting to five Canadian emergency departments with cardiac chest pain during the study period.

	Total 5,065	Indeterminate 4,064	High Risk 1,001
Protocol adherence			
Yes, n (%)	1,816 (35.9)	899 (22.1)	917 (91.6)
ED visits within the prior 6 months and received a troponin test	215 (11.8)	129 (14.4)	86 (9.4)
No, n (%)	3,249 (64.2)	3,165 (77.9)	84 (8.4)
ED visits within the prior 6 months and received a troponin test	312 (9.6)	297 (9.4)	15 (17.9)
Non-Adherent Category			
No second troponin measurement for the indeterminate group	3,165	3,165	NA
First hs-TnI value > 99 ng/L, with no consult or hospitalization	54	NA	54
Serial hs-TnI delta > 25 ng/L, with no consult or hospitalization	39	NA	39

ED, emergency department; hs-TnI, high-sensitivity troponin I, ng/L, nanograms per liter.

initial troponin was 4-9 nanograms per liter (ng/L), or 10-19 ng/L was 2% and 21%, respectively, and rose to 78% when the troponin was 20-29 ng/L. We conducted a multivariable logistic regression analysis exploring variables associated with protocol adherence among indeterminate- and high-risk patients. Variables included time since protocol introduction (per six months), sex, age (in five-year increments), Charlson Comorbidity Index score, and initial troponin result (per 10 ng/L). After adjustment, male sex had the strongest association with protocol adherence (adjusted odds ratio [aOR] 1.67; 95% CI, 1.46-1.91). Age (aOR 1.11; 95% CI, 1.09-1.14) and initial troponin result (aOR 1.05; 95% CI, 1.04-1.06) were weakly associated with adherence. There was no difference between

adherence across the five sites ($P = .002$).

Outcomes

There were significant differences in the outcomes between patients who received protocol-adherent care and those who did not (Table 4). More patients experiencing protocol-adherent care were admitted to hospital (33.8 vs 19.0%, $P < .001$). The time to initial physician assessment was significantly lower amongst patients receiving protocol-adherent care, 69 (37, 124) minutes, compared to 89 (45, 157) minutes (median difference -20 minutes; 95% CI, -25.7 to -14.3). The overall median ED length of stay was reduced by

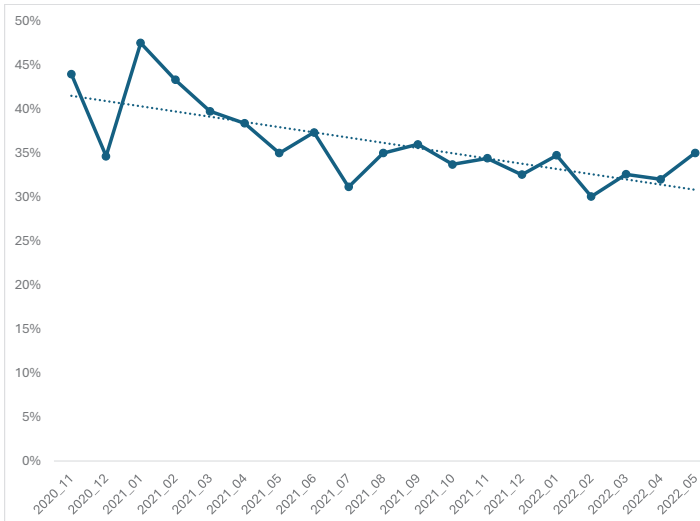


Figure. Protocol adherence for patients presenting to emergency departments with chest pain by month after the introduction of an accelerated chest pain assessment protocol at five Canadian emergency departments.

Table 3. Protocol adherence for indeterminate-risk patients presenting to five Canadian emergency departments with cardiac chest pain during the study period, based on initial troponin measurement.

hs-TnI (ng/L)	Total	Non-adherent	Adherent	Adherent %
Initial				
4-9	2,496	2,422	74	3%
10-19	610	479	131	21%
20-29	482	106	376	78%
30-39	255	70	185	73%
40-49	148	36	112	76%
50-59	93	21	72	77%
60-69	76	17	59	78%
70-79	57	18	39	68%
80-89	49	18	31	63%
90-99	35	8	27	77%
	4,301	3,195	1,106	

hs-TnI, high-sensitivity troponin I assay; ng/L, nanograms per liter.

226 minutes (95% CI, -250.6 to -201.4) amongst patients who did not receive protocol-adherent care. Patients in the adherent-care category experienced significantly higher proportions of MI, cardiac interventions, death, and MACE.

We compared the outcomes of patients in the low-risk group to those of patients who received non-adherent care but were potentially low risk if they had an appropriate serial troponin (NA-LST [non-adherent, low single troponin] (ie, single troponin 4-19 ng/L). Patients in the NA-LST group experienced significantly higher MACE (4.5% vs 1.7%, $P < .001$; Table 5). Admissions (14.2% vs 5.0%, $P < .001$) and ED consultations (17.2% vs. 10.7%, $P < .001$) were also higher in the NA-LST group.

DISCUSSION

In a large, urban, multicenter analysis of patients presenting to the ED with suspected cardiac chest pain, we evaluated

adherence and outcomes associated with a novel institutional chest pain assessment pathway employing hs-TnI. We note the following: Overall adherence to the protocol was extremely low; protocol adherence appeared poorest for patients with a low initial troponin as well as amongst those lacking conventional cardiac risk factors; and while non-adherence is associated with many factors, the strongest association was seen in female patients. Finally, patient outcomes were worse among patients with a low initial troponin receiving non-adherent care. Using robust and linked administrative data, this evaluation provides a detailed evaluation of chest patient assessment in five EDs in one Canadian region.

Using a large sample over two years, we collected patients at high risk for cardiovascular diseases based on risk factors. Despite this, nearly two in three patients were classified as presenting with negative/low-risk chest pain. A larger proportion of older and male patients were assigned to the

Table 4. Outcomes for patients presenting to emergency departments with cardiac chest pain, stratified to indeterminate risk based on protocol-adherent vs non-adherent care after the implementation of accelerated pathways using a high-sensitivity troponin assay at five Canadian emergency departments.

N	Total 4,064	Non-adherent 3,165	Adherent 899	P-value	median differences (95% CI)
Disposition (n {%})				< .001	
Admitted	904 (22.2)	600 (19.0)	304 (33.8)		
Discharged	2,975 (73.2)	2,424 (76.6)	551 (61.3)		
Transferred	123 (3.0)	86 (2.7)	37 (4.1)		
LAMA	62 (1.5)	55 (1.7)	7 (0.8)		
Emergency physician initial assessment time (median {IQR})	4051 84 (42, 151)	3153 89 (45, 157)	898 69 (37, 124)		20.0 (14.3 to 25.7)
ED length of stay (median [IQR])					
Overall	415 (299, 611)	372 (272, 525)	598 (455, 899)		-226.0 (-250.6 to -201.4)
Discharged	375 (276, 498)	343 (258, 456.5)	506 (412, 646)		-163.0 (-181.0 to -145.0)
Chest imaging (n [%])					
Chest radiograph	3,523 (86.7)	2,697 (85.2)	826 (92.9)	< .001	
Chest CT	461 (11.3)	331 (10.5)	130 (14.5)	< .001	
V/Q	50 (1.2)	24 (0.8)	26 (2.9)	< .001	
ED consultation (n [%])					
Yes	1,088 (26.8)	662 (20.9)	426 (47.4)	< .001	
Clinical outcomes within 30 days (n [%])					
Stroke	20 (0.5)	12 (0.4)	8 (0.9)	.05	
MI	126 (3.1)	62 (2.0)	64 (7.1)	< .001	
Cardiac interventions [‡]	169 (4.2)	102 (3.2)	67 (7.5)	< .001	
Death	81 (2.0)	46 (1.5)	35 (3.9)	< .001	
MACE*	443 (10.9)	234 (7.4)	209 (23.3)	< .001	

Values are n (%) or median (IQR). Boldface on values indicates a statistically significant result.

[‡]Cardiac interventions include coronary artery bypass graft surgery and percutaneous coronary intervention.

*MACE is defined as a composite of all-cause death, hospitalization for heart failure, hospitalization or/and ED visit for stroke or MI, or cardiac interventions.

ED, emergency department; LAMA, leaving against medical advice; MI, myocardial infarction; MACE, major adverse cardiac event; V/Q, ventilation/perfusion.

Table 5. Outcomes among patients presenting to emergency departments with cardiac chest pain and confirmed negative/low-risk stratification, compared to those with a single troponin 4-19 ng/L (i.e. non-adherent but potentially low risk).

N	Total 11,855	Negative 8,962	Single troponin 4-19 ng/L 2,893	P-value	median differences
Disposition (n {%})				< .001	
Admitted	862 (7.3)	452 (5.0)	410 (14.2)		
Discharged	10,677 (90.1)	8,320 (92.8)	2,357 (81.5)		
Transferred	210 (1.8)	135 (1.5)	75 (2.6)		
LAMA	105 (0.9)	54 (0.6)	51 (1.8)		
Died	1 (0.01)	1 (0.01)	0		
Emergency clinician initial assessment (median [IQR])	11,822 86 (45, 154)	8,939 84 (44, 151)	2,883 95 (49, 163)		-11.0 (-15.5 to -6.5)
ED length of stay (median [IQR])					
Overall	376 (280, 501)	379 (284, 497)	367 (269, 516)		12.0 (3.9 to 20.1)
Discharged					
Chest imaging (n [%])					
Chest radiograph	10,558 (89.1)	8,072 (90.1)	2,486 (85.9)	< .001	
Chest CT	1,191 (10.1)	882 (9.8)	309 (10.7)	.19	
V/Q	122 (1.0)	98 (1.1)	24 (0.8)	.22	
ED Consultation (n [%])					
Yes	1,453 (12.3)	955 (10.7)	498 (17.2)	< .001	
Clinical outcomes within 30 days (n [%])					
Stroke	23 (0.2)	13 (0.2)	10 (0.4)	.03	
MI	34 (0.3)	24 (0.3)	10 (0.4)	.50	
Cardiac interventions [‡]	134 (1.1)	81 (0.9)	53 (1.8)	< .001	
Death	46 (0.4)	17 (0.2)	29 (1.0)	< .001	
MACE*	285 (2.4)	155 (1.7)	130 (4.5)	< .001	

Values are n (%) or median (IQR). Boldface on values indicates a statistically significant result.

[‡]Cardiac interventions include coronary artery bypass graft surgery and percutaneous coronary intervention.

*MACE is defined as a composite of all-cause death, hospitalization for heart failure, hospitalization or/and ED visit for stroke or MI, or cardiac interventions.

CT, computed tomography; ED, emergency department; LAMA, leaving against medical advice; MI, myocardial infarction;; MACE, major adverse cardiac event; V/Q, ventilation/perfusion.

indeterminate- and high-risk groups, and more patients had higher comorbidity index scoring. While it makes intuitive sense that patients with higher troponin results are more likely to be older and have more baseline comorbidities, other factors contributed to these findings.

Despite extensive efforts to educate clinicians and reporting the hs-TnI results with the protocol recommendations in the EHR,^{2,3} clinicians' overall adherence to the protocol was low. There were observed variations between severity sub-groups. Adherence appeared to decline after implementation (a so-called "decay"). Adherence decay is not limited to the ED. This phenomenon has been observed in outpatient settings as well (eg, rheumatologists treating patients with rheumatoid arthritis exhibited significantly lower protocol adherence three years after a protocol was rolled out⁹). We examined adherence at individual hospital sites and

found similar non-compliance across all sites. Moreover, compliance with patients in the high-risk category was higher than those in the indeterminate-risk category. Educational strategies such as meetings or distributed educational materials have been shown to improve protocol adherence.⁴ Perhaps distributing these at more regular intervals (ie, annually) rather than solely during the rollout of the protocol could help combat decay.

There are a few possible explanations for adherence decay. Adherence among clinicians managing high-risk patients was generally good, approaching 92%. This may indicate that cardiologists being consulted support these hs-Tn upper-limit cutpoints and emergency clinicians face fewer barriers to patient transfer, or that emergency clinicians are less comfortable deviating from evidence-based protocols in patients who they feel may have a higher risk of poor

outcomes. Conversely, indeterminate-risk patients were much less likely to receive per-protocol adherent care. Patients in the indeterminate-risk category received non-adherent care when initial troponin were elevated but below 99 ng/L. As outlined in the protocol, these patients should have received a second hs-TnI measurement.

Subgroup analysis of patients by their initial troponin value revealed a clear distinction between clinician management of patients with initial troponins, which theoretically could have placed the patient into the low-risk/rule-out group (NA-LST). Overall protocol adherence with an initial troponin < 20 ng/L was only 6.6%. It is possible that these patients would have had a troponin measurement that would have led them to be classified in the low-risk group; however, without the second measure, the true classification is impossible to know. Any troponin level above this threshold (hs-TnI > 20) had adherence rates approaching 70-80%. While this level of adherence is more in keeping with previously published literature,⁷ it does not reflect on the protocol or the expectation of the developers.

There are several possible explanations for this low compliance: either clinicians are misinterpreting the protocol, or they feel comfortable with a single troponin measurement in many of these patients. It is also possible that some of the behavior is driven by concerns for expedient discharges/efficiency in the face of ED crowding, either intentionally or subconsciously. Anecdotally, many patients have chronic mild elevations in their high-sensitivity troponins that in our system can be reviewed easily on the EHR. Many physicians are comfortable with a single troponin if it is in keeping with the patient's known mild chronic elevation. We sought to quantify this by examining the number of patients who had a recent ED visit (within six months) and a prior troponin test (Table 2). Only 9.4% of patients who received non-adherent care had a recent troponin level to reference (and only 70% of these patients had an elevated result), suggesting that chronic troponin elevations are not a major driver of protocol non-compliance.

Treating these NA-LST patients the same as low-risk patients is unsafe. The risk of MACE for NA-LST was more than double (2.65x) compared to patients with protocol-adherent, low-risk care, presumably due to reclassification into the indeterminate-risk group. The fact that NA-LST patients had more consults and admissions does suggest that clinicians appreciate some risk difference, even in the face of protocol non-adherence.

Initial troponin results were not strongly correlated with protocol adherence and seemed to be less important to protocol adherence than the passing of the upper margin of a potential low-risk troponin value (hs-TnI, 20). Male sex was the variable most strongly associated with protocol adherence (aOR 1.67; 95% CI, 1.46-1.91). Patients identified as male more commonly received protocol-adherent care, which is in keeping with previous research showing that patients identified as female are significantly less likely to receive

serial troponin measurements, or evidence-based treatments, when presenting to the ED with chest pain.^{10,11}

Table 1 illustrates the demographic differences between the two patient cohorts. Patients who received protocol-adherent care were more likely to have several traditional cardiac risk factors. They were more likely to be male, older, arrive by ambulance, have a history of hypertension, coronary artery disease, diabetes, and heart failure. Clinicians use a multifactorial approach when assessing a patient presenting with chest pain; while protocols driven by lab values are important, clinicians seem likely to be more cautious with a patient who has higher risk based on their past medical history than someone who is young and lacking in conventional risk factors. Correspondingly, clinical outcomes between the indeterminate-risk patients receiving non-adherent care vs adherent care (Table 4) seem to reflect a difference in risk profiles.

Shorter ED LOS among patients receiving non-adherent care almost certainly reflects early discharge rather than improved care. This is a potentially dangerous finding in a setting of increased pressure to combat ED crowding and drive down LOS; physicians with a higher proportion of non-adherent care may have "better" LOS metrics. Patients who received protocol-adherent care were 78% more likely to be admitted to hospital. The proportion of patients experiencing an MI, or MACE within 30 days, was over three times higher among indeterminate-risk patients receiving protocol-adherent care. While there is limited evidence to suggest the protocol-adherent care is leading to worse clinical outcomes, it is far more likely that these patients represent higher baseline-risk individuals.

LIMITATIONS

There are several important limitations to this study. First, all included sites operate within a single city in the Canadian healthcare system; this system provides healthcare services to all registered citizens without direct charge. Second, we obtained data from administrative databases, which are limited by their retrospective nature, and by what data were collected contemporaneously by clinicians. Important behavioral risk factors such as smoking, obesity, alcohol use, exercise, and diet are not well captured in these databases.

Third, by excluding CTAS III patients it is probable we overlooked many cases of cardiac chest pain; however, this was considered acceptable given the multitude of non-cardiac related issues triaged as a CTAS III chest pain that may appropriately be worked up in a non-protocolized fashion. Details regarding the timing of any individual patient's chest pain onset were not available in this retrospective, administrative-data study, which limited our ability to accurately assess which patients were managed according to protocol in the negative/low-risk group. It is possible that patients received non-protocol indicated additional troponin measurements (ie, a repeat troponin for a patient with an

initial troponin undetectable with pain present >3 hours) but were unable to discern this.

Fourth, the designated subgroups were based exclusively on troponin results. The nature of chest pain (typical, atypical) or its duration (hours vs days), the electrocardiogram (ECG) results (eg, normal, non-specific changes, dynamic ST changes, flipped or hyperacute T-waves, etc) or historical factors used in other accelerated diagnostic protocols (ADPs) (eg, HEAR or HEART) were not considered.⁷ Abnormal ECG appearances may prompt appropriate deviations in care from our protocol and could have been falsely regarded as non-adherent care in our study. Finally, protocol non-adherence may be driven by a multitude of factors (ie, clinical/administrative/etc), which cannot be assessed retrospectively.

CONCLUSION

Compliance with multidisciplinary, evidence-based, and widely disseminated protocols for patients presenting to the ED with chest pain in this healthcare system was low, especially for patients with initial low-level hs-TnI measures. Approximately one in three patients presenting to the ED with chest pain received protocol-adherent care from emergency physicians. They were more likely to follow the protocol in patients who have traditional risk factors for coronary artery disease, which has implications for patients who may present with atypical symptoms and fewer risk factors, especially women.¹¹ Patients receiving non-adherent care with a single troponin measurement did have worse outcomes. Clearly, patients with a minimally elevated initial troponin who did not have a repeat level sent are receiving sub-optimal and potentially dangerous care. Further research into strategies to improve compliance is warranted. Changes such as automatic EHR notifications, regular educational updates, or reflex-ordering may be effective.

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Emergency Department Presentations of West Nile Virus

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Introduction: Maricopa County, Arizona, experienced its largest West Nile virus outbreak in 2021, with 1,487 cases and 101 deaths, in the midst of the COVID-19 pandemic. We sought to describe initial presentations of emergency department (ED) patients ultimately diagnosed with West Nile virus and determine how often patients presented to the ED before their diagnosis. To assist with disease recognition during future outbreaks, we examined in detail cases where emergency physicians initially did not suspect West Nile virus.

Methods: We reviewed records from May–December 2021 for patients with a positive West Nile virus result and at least one ED visit within 15 days. Data included age, sex, race, Emergency Severity Index (ESI) score, number of ED visits, chief complaint, vital signs, blood or cerebrospinal fluid (CSF) testing, diagnosis, and disposition. We excluded cases with only immunoglobulin G-positive results or outpatient tests, leaving 147 cases.

Results: Among 147 ED West Nile virus cases, the median patient age was 67 years, with patients being predominantly male (66.7%) and White (97.3%). The most common presenting chief complaints included fever (23.8%), headache (17.7%), and generalized weakness (11.6%). Emergency physicians initiated testing for the virus in 63 cases (42.9%). Patients dispositioned ($n = 84$, either discharged or admitted) from the ED without initiation of testing tended to be older (median 73 vs 62 years, $P < .001$), with higher triage respiratory rate (mean 19.4 vs 18.3 breaths per minute, $P = .05$) and lower triage oxygen saturation (median 96% vs 97%; $P = .02$). Emergency physicians predominantly performed CSF testing ($n = 42$ patients) over serum testing ($n = 21$ patients). Patients tested via CSF had lower ESI scores than those tested via serum (ESI score of 1–2 45.3% vs 14.3%, $P = .03$).

Conclusion: Emergency physicians did not initiate testing in 57.1% of initial ED encounters of patients ultimately found to have West Nile virus. During West Nile virus outbreaks, emergency physicians should stay vigilant for less acute presentations, such as generalized weakness in elderly patients, along with typical presentations including fever and headache, to avoid delayed diagnosis. [West J Emerg Med. 2026;27(1)214–218.]

INTRODUCTION

In 2021, Maricopa County in Arizona faced its largest recorded West Nile virus outbreak, with 1,487 reported cases and 101 fatalities.¹ Notably, neuroinvasive disease occurred in 956 of the identified cases.¹ Emergency departments (ED) play a pivotal role in the early identification and management of

infectious diseases like West Nile virus. However, variability in ED presentation can challenge recognition of the virus, especially when an outbreak takes place within the setting of the COVID-19 pandemic.

Most emergency physicians (EP) are aware of more common symptoms of neuroinvasive West Nile virus, which

can present as meningitis, encephalitis, or acute paralysis. Patients with neurological involvement may present with fever, altered mental status, headaches, tremors, ataxia, bulbar dysfunction, stroke-like syndromes, myelitis, visual disturbance, and seizure activity.² Gastrointestinal (GI) symptoms, including diarrhea, nausea and vomiting, also may predominate. However, presenting symptoms also include more vague complaints such as generalized weakness, malaise, chills, rash, fatigue, arthralgias, myalgias, and lymphadenopathy. Less commonly, patients may experience inflammatory processes of other organ sites, including ocular inflammation, myocarditis, hepatitis, and pancreatitis; rhabdomyolysis, stiff person syndrome, and autonomic instability have also been reported.²

Treatment for West Nile virus remains supportive, with ongoing trials investigating potential benefits from immunoglobulin and interferon. Despite the limited treatments available, prompt diagnosis remains essential, as delayed diagnosis may complicate public health efforts including targeted mosquito control, which could limit a spreading outbreak. Additionally, early diagnosis may decrease hospital resource use pursuing alternative diagnoses, providing more rapid answers to concerned patients and families.

To better understand characteristics of ED patients with West Nile virus, we conducted a retrospective chart review of encounters within the Mayo Clinic Arizona ED during the peak of the 2021 virus outbreak. We sought to describe clinical features and demographics of ED patients ultimately diagnosed with West Nile virus and frequency of presentation to the ED before their diagnosis. We examined in detail cases where EPs initially did not suspect the presence of the virus to assist with disease recognition during future outbreaks.

METHODS

The Mayo Clinic Arizona ED is a tertiary-care facility in Phoenix, Arizona, which in 2021 served approximately 47,000 patients per year with 24 rooms and up to nine hallway spaces. All ED patients were treated by residency-trained EPs without nurse practitioner or physician assistant involvement. Approximately 5% of ED cases involved a rotating resident. All patients admitted to “observation status” and “inpatient status” were treated by inpatient hospitalists and, therefore, were considered “admitted” in our study. The EPs ordered West Nile virus diagnostics based on their clinical impression of a patient; if inpatient teams determined a patient needed a lumbar puncture after admission, radiology or neurology was engaged to perform the procedure.

Admission orders were placed to hospitalists after a phone discussion. Patients placed in progressive care or critical care units would move to their hospital bed only after evaluation by the accepting service, whereas patients admitted to floor wards would move upstairs after the phone conversation was complete. We manually reviewed charts to determine whether the EP or the hospitalist placed each West Nile virus test order.

Population Health Research Capsule

What do we already know about this issue?

Clinical presentations of West Nile virus can vary greatly, potentially complicating emergency department (ED) diagnosis.

What was the research question?

We sought to describe clinical features of ED patients ultimately diagnosed with West Nile virus and frequency of presentation before diagnosis.

What was the major finding of the study?

Most common chief complaints were fever (23.8%), headache (17.7%), and weakness (11.6%). Emergency physicians tested in 63/147 cases (42.9%). Those dispositioned without testing were older (median 73 vs 62 years; $P < .001$).

How does this improve population health?

More comprehensive testing of the elderly with vague presentations may foster early diagnosis and public health interventions to limit spread.

No specific education was provided to EPs during the virus outbreak regarding testing recommendations.

We performed a retrospective chart review to examine ED presentations of West Nile virus during the 2021 outbreak. We collected data from May–December 2021, coinciding with the peak of the outbreak.¹ We extracted data from our hospital’s electronic health record, creating a database of all patients with a positive blood (serum antibody or whole blood polymerase chain reaction [PCR]) or cerebrospinal fluid (CSF) result for West Nile Virus and at least one visit to the ED within 15 days of the positive test. The incubation period for the virus is typically 2–14 days; thus, we selected 15 days to potentially catch early ED visits related to the start of illness. We excluded charts with only IgG-positive results, as these would have represented a past but not active infection. We also excluded charts with tests ordered outside our ED or inpatient settings, as pre-existing knowledge of a patient’s positivity for the virus may have affected ED presenting complaints or evaluation decisions. The final sample was comprised of 147 cases. One author (KJ) performed chart review to categorize patients, and a second author (NH) performed a secondary chart review to confirm correct categorization, with differences adjudicated by a third author (WM). We provide a PRISMA diagram displaying exclusions with counts as Appendix 1.

We extracted demographic information including age, sex, and race, clinical indicators including Emergency Severity Index (ESI) score, chief complaint, initial vital signs, and primary ED diagnosis, and diagnostic information including whether physicians performed blood or CSF tests for West Nile virus. Although most patients receiving viral blood testing underwent serum antibody testing, nine patients underwent whole blood PCR testing for West Nile virus; as the diagnostic process for both tests entailed a blood draw, we grouped these patients together as having received “blood” testing. We categorized patients who received both CSF and blood tests under CSF testing due to the more invasive nature of the lumbar puncture. Meningitis panels did not automatically include West Nile virus testing, and separate CSF order for the virus had to be placed.

All West Nile virus tests were shipped out-of-state for analysis.³ The CSF and serum antibody tests were run at the receiving laboratory on Monday, Wednesday, and Friday, and whole blood PCR testing was performed daily Monday through Friday. Physicians were aware of the send-out nature of testing for West Nile virus and were not aware that whole blood PCR testing was run more frequently than serum antibody or CSF testing. Number of ED visits within 15 days of a positive West Nile virus test and ultimate disposition were recorded along with timing of the testing, including whether it was performed at the initial or subsequent ED visit. We evaluated whether patients were tested for WNV by the ED or whether the patient was admitted undifferentiated to an inpatient team. We compared the chief complaints between cases diagnosed by the ED and those not tested by an EP. A triage nurse categorized patient chief complaint via choices available in the electronic health record; options available to our nursing staff are provided in Appendix 2. Chief complaints of nausea and vomiting were combined to explore GI manifestations.

We summarized continuous variables using medians and interquartile ranges (IQR), while categorical variables were summarized using frequencies and percentages. We used the Kruskal-Wallis rank sum test for continuous variables and the Fisher exact test for categorical variables to compare groups of interest. A *P*-value of < .05 was considered statistically significant. We performed statistical analyses using R v4.1.2 (R Foundation for Statistical Computing, Vienna, Austria). All recommended methodological criteria described by Worster et al were followed other than abstractor blinding to hypothesis, which was not feasible as our first author served as abstractor. Chart review entailed recording of objective data from the health record; however, to limit potential bias, a secondary review was performed by an additional author to confirm agreement with patient categorization.⁴ The Mayo Clinic Arizona Institutional Review Board reviewed this study via expedited review procedures and deemed it exempt.

RESULTS

We analyzed 147 West Nile virus ED presentations.

Median patient age was 67.0 years of age (IQR 20.5) with male (66.7%) and White (97.3%) predominance, consistent with county-wide findings from the Maricopa County Department of Public Health’s post-epidemic report.¹ The ESI breakdown was as follows: ESI 1, two cases (1.4%); ESI 2, 62 cases (42.2%); ESI 3, 81 cases (55.1%); ESI 4, two cases (1.4%); and ESI 5, 0 cases (0.0%).

We present EP testing decisions categorized by chief complaint in Table 1. Three patients, deemed unlikely to have initial presentations related to West Nile virus, were grouped together as “other” (chief complaints of urinary frequency, vascular access problem, and head injury).

The EPs tested patients during the first visit in 63 of 147 cases (42.9%). Twenty-two cases were tested and then discharged during their initial visit. The EPs admitted 104 cases during their initial visit; among these, they conducted West Nile virus testing in 41 cases. In patients discharged without testing on their first visit (21 cases), EPs performed the virus testing during a second ED visit in 17 cases and a third ED visit in four cases.

When comparing patients tested by an EP during the index visit to those who went untested by an EP, EPs initiated

Table 1. West Nile virus emergency department chief complaints during index visit.

No ED test (N = 84)	ED test (N = 63)
Fever (18)	Headache (20)
Weakness – generalized (13)	Fever (17)
Shortness of breath (8)	Altered mental status (6)
Altered mental status (6)	Nausea/vomiting (6)
Headache (6)	Weakness – generalized (4)
Nausea/vomiting (6)	Fatigue (3)
Abdominal pain (5)	Chest pain (2)
Fall (4)	Flu symptoms (1)
Other (3)	Generalized body aches (1)
Back pain (2)	Seizures (1)
Diarrhea (2)	Shortness of breath (1)
Dizziness (2)	Syncope (1)
Fatigue (2)	
Acute neurological problem* (1)	
Chest pain (1)	
Chills (1)	
Flu symptoms (1)	
Leg pain (1)	
Stroke-like symptoms (1)	
Vertigo (1)	

*Upon chart review, “acute neurological problem” meant bilateral lower extremity weakness.
ED, emergency department.

West Nile virus testing during the initial visit in younger patients (median [IQR] 62 [19] years tested vs 73 [14.2] years untested, $P < .001$), patients with higher oxygen saturation (97% [3] tested vs 96% [3] untested, $P = .02$), and lower respiratory rates (mean [SD] 18.3 (3.1) breaths/minute tested vs 19.4 (3.8) untested, $P = .05$). Patient sex, race, ESI, systolic blood pressure, temperature, and pulse rate were not associated with the EP's decision to initiate testing during the initial ED visit.

The 21 patients discharged without West Nile virus testing were older (median [IQR] 77 [10] years of age discharged without testing vs 65.5 [21.8] tested or admitted, $P = .002$) and had lower temperatures (36.8 °C [0.6] not tested vs 37.2 °C [1.3] tested or admitted, $P = .02$) than those who received testing either inpatient or in the ED. The EPs discharged without testing patients with the following chief complaints: fever (three cases); "other" (three cases); abdominal pain (two cases), generalized weakness (two cases), and one case each of altered mental status, back pain, chest pain, chills, diarrhea, dizziness, fall, fatigue, flu symptoms, headache, and nausea/vomiting.

The EPs admitted but did not test patients with the following chief complaints: fever (15); generalized weakness (11); shortness of breath (8); altered mental status (5); nausea/vomiting (5); and headache (5). This category also included three cases each of falls and abdominal pain, and one case each of acute neurological problem, back pain, diarrhea, dizziness, fatigue, leg pain, stroke-like symptoms, and vertigo. We display EP-selected admission diagnoses for admitted patients who did not receive EP-ordered testing in Table 2, grouped intuitively for easy viewing. Of 63 patients who were admitted without EP-ordered West Nile virus testing, the inpatient team ordered the testing on 34 patients within 24 hours of patient arrival, with 49 patients receiving testing

within 48 hours.

Forty-two patients diagnosed in the ED underwent CSF testing while 21 patients were diagnosed by serum alone. Age, sex, race, temperature, pulse rate, systolic blood pressure, respiratory rate, and oxygen saturation were not associated with the EP's decision to test via CSF vs serum. Patients tested via CSF had lower ESI scores compared to serum (ESI score of 1-2, 45.3% vs 14.3%; $P = .03$).

DISCUSSION

Of 147 West Nile virus cases, 21 patients required a return visit to the ED for diagnosis. Although some of these visits may have been for unrelated illnesses, the 15-day return visit timeframe suggests at least some of these may have represented a missed diagnosis at the index visit. Similarly, although our EPs recognized the severity of illness and admitted 104 initial visits, EPs only tested 41 of those patients for the virus. This suggests diagnostic difficulties related to broad initial ED West Nile virus presentations. Prior research supports this; in one study, only 5% of initially asymptomatic viremic West Nile virus blood donors were correctly diagnosed when ultimately seeking medical care.^{2,5}

West Nile virus patients whom the EP declined to test tended to be older, with higher respiratory rates and lower oxygen saturations. Examining the cases that received no viral test during the initial ED visit, although many patients presented with typical meningitis or encephalitis complaints such as fever, headache, and altered mental status, many of the possible missed opportunities involved GI or respiratory issues, symptoms that have been shown to represent neuroinvasive disease.^{2,6,7} The EPs also commonly declined to test patients with vague complaints such as generalized weakness, falls, dizziness and fatigue; during other outbreaks, generalized weakness has been associated with ultimate diagnosis of encephalitis.⁸ In contrast, EPs did an excellent job testing the majority of West Nile virus headache chief complaints, which likely explains the CSF predominance of EP-initiated testing.

Examining Table 2, we find admission diagnoses that fit known West Nile virus presentations, such as stroke-like syndromes and rhabdomyolysis, along with more vague diagnoses such as generalized weakness. The diversity of possible presentations likely creates diagnostic difficulties for EPs functioning in a high-paced clinical environment. In five cases, EPs admitted a patient for presumed urinary tract infection who ultimately was diagnosed with West Nile virus; prior studies suggest that EPs may over-diagnose urinary tract infections in elderly patients.⁹ The EPs may have anchored on alternate pathology (such as a suggestive urinalysis) to explain weakness or confusion, especially in elderly patients and, therefore, may have not pursued testing for West Nile virus. Our EPs also declined to test 18 admitted patients with fever-related diagnoses for the virus. Our hospital serves many immunocompromised patients with transplants and cancer;

Table 2. Admission diagnoses for patients not receiving emergency department testing for West Nile virus.

Admitted, No ED test (N = 63)
Electrolyte-related diagnoses: diabetic ketoacidosis, hyponatremia
Fever-related diagnoses: fever (concern for COVID-19), fever of unknown origin x12, fever with chill, sepsis x3, SIRS
Gastrointestinal diagnoses: abdominal pain, diarrhea, intestinal obstruction, nausea and vomiting
Muscular diagnoses: back pain, myositis, rhabdomyolysis
Neurological diagnoses: aphasia, confusion, encephalopathy, headache, meningitis x3, migraine, myelitis, stroke, vertigo
Respiratory diagnoses: pleural effusion, pneumonia x3, shortness of breath x4
Other: acute renal failure, alcohol withdrawal, generalized weakness x8, hip fracture, palpitations, urinary tract infection x5
ED, emergency department; SIRS, systemic inflammatory response syndrome.

thus, EPs may have anchored on bacteremia as the underlying cause of fever, leading to delayed diagnosis of West Nile virus.

Emergency physicians may benefit from directed educational interventions during known outbreaks to keep West Nile virus “top of mind” and on the differential, especially for vague complaints or rare West Nile virus presentations. Posted information discussing West Nile virus presentations or formal testing protocols could increase ED-based diagnosis, thereby decreasing the use of hospital resources to pursue alternative diagnoses and providing more rapid answers and early access to experimental treatments to patients and family.

LIMITATIONS

Site EP and patient characteristics may have affected results. Our hospital cares for many elderly, immunocompromised patients; this may have altered patient presenting symptoms or staff testing patterns, as this population suffers increased risk of neuroinvasive disease.^{2,10} Alternately, as West Nile virus-infected immunocompetent patients may not be symptomatic, some West Nile virus-positive ED encounters may have had symptoms representing other concurrent illnesses.⁸ Additionally, our study did not include patients with positive West Nile virus tests in external hospitals or patients who tested positive outside the ED or in inpatient settings; there likely were patients who were discharged from our ED without initial West Nile virus testing and re-presented elsewhere and thus were not examined in our study. Although we attribute orders placed by an EP to his or her own clinical acumen, it is feasible that some tests were performed at the request of the inpatient team. Physician knowledge of the West Nile virus outbreak may have affected testing decisions, especially as the outbreak progressed. The EPs may also have viewed patient presentations differently in the setting of the concurrent COVID-19 pandemic.

CONCLUSION

Emergency physicians did not initiate testing in 57.1% of initial ED encounters of patients ultimately found to have West Nile virus. During outbreaks of the virus, EPs should stay vigilant for less acute presentations, such as generalized weakness, GI complaints, and shortness of breath, particularly in elderly patients, alongside the more typical presentations of headache and fever. Emergency department leadership in areas prone to West Nile virus should consider creating educational materials or testing protocols to assist EPs, especially during active outbreaks.

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First-Generation Antihistamine Use in Geriatric Emergency Department Patients: Retrospective Review

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Introduction: First-generation antihistamines are frequently used in the emergency department (ED) but are discouraged in older adults due to increased adverse drug effects. Whether concerns about adverse drug effects apply to the ED is uncertain, as ED-specific data are limited, and risks with single-dose administration may differ from risks with chronic use. In this study we assessed frequency of use, adverse drug effects, and indications of first-generation antihistamines administered to older adults during ED visits.

Methods: This retrospective cohort study identified adults ≥ 65 years of age who received first-generation antihistamines from January 1–December 31, 2022 in the ED at a single, urban, academic medical center. Abstractors blinded to study hypotheses identified indications for use and adverse effects through chart review. Indications other than severe allergic reactions and continuation of home use were classified as potentially inappropriate. We evaluated sex, age ≥ 85 , history of cognitive impairment, drug received, and number of doses for association with adverse drug effects by regression analysis.

Results: First-generation antihistamines were administered in 261 encounters (3% of geriatric ED encounters). Median patient age was 71 (range 65–107, interquartile range [IQR] 67–77) and 60.5% were female. Adverse drug effects occurred in 15% of encounters, with delirium ($n = 20$, 7.7%) and urinary retention ($n = 11$, 4.2%) being the most common. On multivariate analysis, patient age ≥ 85 , history of cognitive impairment, and receipt of multiple doses were associated with elevated risk of adverse drug effects, with risk ratios of 5.5 (95% CI, 2.7–11.4), 3.1 (95% CI, 1.8–5.4), and 1.9 (95% CI, 1.1–3.6), respectively. Indications were classified as potentially inappropriate in 92% of encounters. Diphenhydramine was most used in patients with headache ($n = 53$, 30.1% of doses) and history of iodinated contrast media reaction ($n = 46$, 26.1% of doses), while hydroxyzine was most used for anxiety ($n = 51$, 60% of doses). The kappa value between abstractors was 0.84, indicating excellent agreement.

Conclusion: Emergency department use of first-generation antihistamines in older adults, especially those ≥ 85 years of age and with prior cognitive impairment, was associated with infrequent but clinically significant harm. Most use was potentially inappropriate. Prophylactic use of diphenhydramine for patients with a prior reaction to iodinated contrast media emerged as a common indication. [West J Emerg Med. 2026;27(1)219–224.]

INTRODUCTION

The American Geriatric Society's Beers Criteria identifies potentially inappropriate medications for which the risk of adverse effects may outweigh anticipated benefits for older adults. These criteria were initially created to address long-term medication prescriptions in nursing home patients and categorized medications as ones to avoid, those to use with caution, or those that should be dosed renally. In an early version of the Beers Criteria, diphenhydramine and other antihistamines were included as potentially inappropriate medications.¹ Subsequently, this caveat was directed more specifically to first-generation antihistamines; adherence to these recommendations has been widely used as a quality measure.² The criteria are intended for use in many settings, including acute care; however, there is limited evidence on the use and safety of Beers-listed medications administered to older adults during emergency department (ED) visits, in which single-dose administration predominates over long-term medication use.

Approximately 1% of all ED visits are for acute allergic reactions where antihistamines remain a part of the standard treatment regimen.^{3,4} The Beers Criteria recommends avoiding first-generation antihistamines in older adults except when treating severe allergic reactions due to the risk of falls, worsening delirium, urinary retention, and excessive sedation. Second-generation antihistamines are less sedating, cause fewer side effects, and are generally considered a good alternative to first-generation antihistamines in the geriatric population.² We examined the use of first-generation antihistamines in geriatric patients in an urban, academic ED. We assessed the number and types of adverse drug effects, risk factors for these adverse effects, indications for use, and appropriateness of indication.

METHODS

Study Objective

Our primary objective was to quantify the number of patients receiving first-generation antihistamines. Secondary outcomes include indications for antihistamine use, appropriateness of indication, the number and types of adverse drug events, and risk factors for adverse drug effects.

Study Setting and Criteria

We conducted this study at an academic ED in the Midwestern United States, using visits from January 1–December 31, 2022. During that time frame, there were 45,293 patient encounters at the ED study site, with 8,664 (19.1%) encounters for patients ≥ 65 years of age. We drafted a list of frequent indications for administration of first-generation antihistamines, which was reviewed by a geriatrician, an emergency physician, and two pharmacists. The team pre-specified anaphylaxis, angioedema, and severe allergic reactions with oral or airway involvement to be appropriate indications, as the study site does not have a parenteral second-generation antihistamines on formulary. Continuation of home medications was considered possibly

Population Health Research Capsule

What do we already know about this issue?

Beers Criteria identify first-generation antihistamines as potentially inappropriate medications for use in older adults due to adverse drug effects.

What was the research question?

Among geriatric emergency department (ED) visits, what are the types of adverse drug effects associated with first-generation antihistamines, and what are the risk factors?

What was the major finding of the study?

Only 8.4% of indications were appropriate; age ≥ 85 and cognitive impairment increased the risk of adverse drug effects ($P < .001$).

How does this improve population health?

Known risks of first-generation antihistamines are relevant to acute use in the ED, and considerable opportunity exists to decrease potentially inappropriate use.

appropriate, and all other indications were considered potentially inappropriate.

Data Acquisition

We performed a retrospective cohort study of adults ≥ 65 years of age who were administered first-generation antihistamines by any route. We followed best practices for chart review research, including training abstractors with fictional records prior to data collection, using standardized abstraction forms, monitoring abstractor performance, and blinding abstractors to the study objectives until after data collection was complete.⁵⁻⁷ Cases were identified using the pharmacy-completed medication order function in the Epic electronic health record (EHR) (Epic Systems Corporation, Verona, WI). We developed a data abstraction form to collect the following parameters: patient age; sex; history of cognitive impairment (defined as dementia or traumatic brain injury without return to baseline documented within the EHR); a notation of which first-generation antihistamines the patient received (diphenhydramine or hydroxyzine); any adverse drug effects observed within 48 hours post-administration; and indication for use.

For inpatients, we reviewed physician and nursing notes and checked orders for possible adverse drug effects, such as an order for Foley placement. For patients released on their index visit, the EHR was reviewed to check for return visit

within 48 hours. An adverse drug effect of delirium required that this be included in problem lists or diagnoses. Documentation of increased confusion without a diagnosis of delirium was counted as “confusion.”

Following abstractor training, the data abstraction form was piloted on 10 charts by each abstractor with direct supervision from the senior author (CB) to ensure accurate coding. Approximately 10% of encounters were coded by both abstractors to assess concordance of coding, and a kappa value was calculated. Charts with uncertain datapoints were flagged for review by the study team and resolved by consensus. This study was approved by the Institutional Review Board at Saint Louis University.

Data Analysis

We compared patient sex, history of cognitive impairment, type of antihistamine, and single vs multiple doses between two subsets of patients: those 65-84 years of age; and those ≥ 85 of age. We also evaluated independent variables associated with adverse drug effects. Using chi-square tests or Fisher exact tests we calculated the crude rates of adverse drug effects in each subset and assessed the association between age and adverse drug effects events. The adjusted association of adverse drug effects events was determined using multiple logistic regression. We calculated adjusted risks of adverse drug effects in each subset using marginal probabilities based on multiple Poisson regression modeling modified with estimation of robust standard error.^{8,9} All statistical tests were two-tailed with an alpha at 0.05.

RESULTS

There were 261 encounters where geriatric patients

received a first-generation antihistamine (3% of all geriatric encounters). The median age of all patients was 71 (range 65-107, IQR 67-77), and 60.5% were female. Multiple doses were administered during 21 encounters, with a total of 322 doses administered. Adverse events were seen in 39 encounters, including 20 cases of delirium (20/261 7.7%), 11 cases of urinary retention (11/261 4.2%), 10 cases of excessive sedation (10/261 3.8%), two falls (2/261 0.8%), and one episode of confusion (1/261 0.4%). Five patients suffered more than one adverse drug effect (Table 1). On univariate analysis, only a prior history of cognitive impairment was associated with adverse drug effects. Indications were classified as appropriate or possibly appropriate in 22 encounters (8.4%) (Table 2).

On multivariate analysis, patients ≥ 85 years of age had an adjusted risk ratio of 5.5 (95% CI, 2.7-11.4) for adverse drug effects compared to patients < 85 ($P < .001$, Table S1). Patients with known cognitive impairment had an adjusted risk ratio of 3.1 (95% CI, 1.8-5.4) for adverse drug effects compared to those without cognitive impairment. Additionally, patients receiving multiple doses per encounter had almost twice the risk for adverse drug effects with an adjusted risk ratio of 1.9 (95% CI, 1.1-3.6). Patient's sex and type of drug (diphenhydramine vs hydroxyzine) were not associated with adverse drug effects. The kappa was 0.84, indicating excellent agreement between the abstractors.

DISCUSSION

In this cohort, first-generation antihistamines were administered during 3% of all geriatric patient ED visits. While the total number was low, geriatric patients continue to receive these potentially inappropriate drugs. A 2009 chart review

Table 1. Patient demographics in a study of adverse drug effects associated with first-generation antihistamine use in older adults in the emergency department.

	All (N = 261)	Age < 85 (n = 249)	Age ≥ 85 (n = 12)	P-value*
Patient characteristics	%	%	%	
Female	60.5	61.0	50.0	.55
First-generation antihistamine				.76
Diphenhydramine	67.4	67.1	75.0	
Hydroxyzine	32.6	32.9	25.0	
Multiple doses	8.1	8.0	8.3	1.00
Prior cognitive impairment	14.8	14.7	16.7	.69
Adverse drug effect yes (n, %)**	39 (14.9%)	31 (12.5%)	8 (66.7%)	< .001
Delirium		16	4	
Urinary retention		8	3	
Sedation		8	2	
Fall		2	0	
Confusion		1	0	

*P-values reflect chi-square tests comparing frequencies by age groups. For cells with fewer than five counts, Fisher exact tests were used.

**Some patients had more than one adverse drug effect.

Table 2. Appropriateness of indications for first-generation antihistamine use in older adults in the emergency department.

	N (% doses)	Appropriate
Diphenhydramine		
Headache	53 (30.1%)	No
History of IV contrast reaction	46 (26.1%)	No
Pruritus	30 (17.0%)	No
Anaphylaxis	9 (5.1%)	Yes
Angioedema	7 (4.0%)	Yes
Insomnia	5 (2.8%)	No
Agitation	5 (2.8%)	No
Akathisia prophylaxis	5 (2.8%)	No
Contrast reaction	3 (1.7%)	Yes
Urticaria	1 (0.6%)	Yes
DRESS syndrome	1 (0.6%)	Yes
Other	11 (6.2%)	No
Hydroxyzine		
Anxiety	51 (60.0%)	No
Insomnia	11 (12.9%)	No
Pruritus	11 (12.9%)	No
Agitation	5 (5.8%)	No
Home medication	1 (1.2%)	Possible
Psychosis	1 (1.2%)	No
Other	5 (5.8%)	No

DRESS, drug reaction with eosinophilia and systemic symptoms; IV, intravenous.

reported that diphenhydramine was administered to 9% of hospitalized elders.¹⁰ Meurer et al found that diphenhydramine ranked among the top five most commonly administered potentially inappropriate medications in geriatric ED visits, and hydroxyzine among the top seven, based on a national sample from 2000–2006.¹¹ In a more recent study using a national database, at least one Beers-listed potentially inappropriate medication was administered during the ED visit or prescribed on discharge for 5.9%, with diphenhydramine given in 10.1% of these visits.¹²

Indications varied by agent but were considered inappropriate on 92% of visits. Our institution approves use of first-generation antihistamines in the most severe of allergic reactions, but this is controversial. Guidelines advise against use of first-generation antihistamines for anaphylaxis due to risk of masking symptoms and delays to definitive treatment with epinephrine.¹³ Non-sedating second-generation antihistamines are considered first-line agents for urticaria and other cutaneous allergic reactions, with intravenous (IV) cetirizine being found to be non-inferior to IV diphenhydramine.^{14, 15}

Reported iodinated contrast media allergy was the indication for first-generation antihistamines in 26% of our

cohort. This was unexpected. In the most similar previous study, only 2% of diphenhydramine doses were possibly related to iodinated contrast media allergy, with the stated indication being “preprocedure (cardiac catheterization).”¹⁶ That study, published in 2001, included hospitalized patients; our data may be more reflective of modern ED practice. Our finding reveals a gap in guidance: prophylaxis of iodinated contrast media reaction is not directly addressed in the Beers Criteria or even the more recent, ED-specific Geriatric Emergency Medication Safety Recommendations (GEMS-Rx) criteria, which were published while our study was underway.¹⁷ The GEMS-Rx criteria, like the Beers Criteria, recommend against first-generation antihistamines in older adults except for “allergic reactions.” However, this allowance likely does not include iodinated contrast media reaction prophylaxis, as the recommendation is referenced to an anaphylaxis guideline that suggests against using antihistamines for iodinated contrast media reaction prophylaxis.¹⁸ Second-generation antihistamines may be equally effective at limiting iodinated contrast media reactions.¹⁹ The 2024 American College of Radiology *Manual on Contrast Media* describes diphenhydramine as “optional” and “not evidence-based” for premedication, and it allows use of a second-generation antihistamine for treatment of non-severe iodinated contrast media reactions.²⁰

There are better alternatives for most other indications. The American Headache Society advises against the use of diphenhydramine for migraine treatment in the ED, regardless of age.²¹ Another common indication for first-generation antihistamines was insomnia. However, the sleep aid ramelteon is considered first-line for treatment of insomnia in elders if behavioral interventions and improvements in sleep hygiene fail.²²

The number of adverse drug effects found in this retrospective chart review was lower than previously reported in other contexts. Prior studies suggest delirium may occur in up to 8% of hospitalized patients, and a new urinary catheter was placed in 8% of hospitalized patients receiving diphenhydramine.¹⁶

While the Beers Criteria are the most widely used guidelines in the US regarding medication appropriateness in older adults, not all authors agree that the Beers Criteria should be used in the ED.²³ Hammouda et al found that 18% of elderly patients receive a prescription for potentially inappropriate medications upon discharge from the ED.²⁴ Harrison et al found that 76% of geriatric patients received a new prescription for a Beers-listed medication.²⁵ Neither study found an increased risk of return visits or adverse drug effects in these cohorts of discharged patients.

Future studies should explore opportunities for quality improvement initiatives promoting the use of alternative medications and to clarify the rate of adverse drug effects when substituting second-generation antihistamines. Limiting use of first-generation antihistamines in “headache cocktails” and for

prophylaxis of reported iodinated contrast media reactions would appear to have the highest yield. Electronic health record alerts have been shown to reduce potentially inappropriate prescribing in elderly patients.^{26, 27}

LIMITATIONS

The study team pre-specified first-generation antihistamines as appropriate for treatment of severe allergic reactions given their rapid onset of action and parenteral administration, as no parenteral second-generation antihistamine was available for cases with airway involvement due to formulary restrictions at our study site. A Delphi panel of experts in geriatric emergency medicine also noted first-generation antihistamines to be appropriate in this instance.¹⁷

Despite our use of best practices for retrospective chart review studies, this methodology may be insensitive for detection of adverse drug effects. We searched the medical record for adverse drug effects occurring up to 48 hours after medication administration in hospitalized patients and looked for possibly related repeat ED visits within our healthcare system in the same time frame for discharged patients but may not have captured all of them. Additionally, this study did not explore drug-drug interactions or other factors that may contribute to adverse drug effects.

CONCLUSION

We found that in a Midwestern academic ED, geriatric patients continue to receive first-generation antihistamines despite the availability of safer alternatives. We found a lower risk of adverse drug effects associated with first-generation antihistamines among geriatric patients than expected compared to existing data. However, antihistamine-associated adverse drug effects remained substantial and disproportionately affected older geriatric patients and those with pre-existing cognitive impairment. These results suggest that non-sedating second-generation antihistamines are preferable for most indications in this patient population.

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Comparison of Unhoused and Domiciled Patients Evaluated for Trauma in a Level II Trauma Center

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Introduction: California has one of the highest rates of homelessness in the United States. Unhoused individuals often have complex medical and behavioral health disorders, frequently complicated by substance use disorders. They have a significant risk of sustaining traumatic injuries. This report compares unhoused and domiciled patients treated at our Northern California trauma center.

Methods: In this retrospective analysis of trauma patients we used data extracted from our institution's Trauma Quality Improvement Program Trauma Registry for January 1, 2019–April 22, 2022 and compared characteristics of unhoused and domiciled individuals. All unhoused patients in the registry were included in the analysis, as well as an equal number of domiciled patients who were randomly selected during the same time frame. We described and compared demographic and clinical characteristics.

Results: Of 8,529 patients in the registry, 181 (2.1%) were unhoused, and we selected 181 domiciled patients to compare. Unhoused patients were more likely male (83% vs. 61%, $P < .001$) and younger (48.8 ± 12.3 vs. 55.8 ± 23.7 years, $P < .001$). Both cohorts had similar Injury Severity Scores. However, unhoused patients had a higher rate of hospital admissions (76.8% vs. 61.9%, $P < .001$) and longer hospital stays than domiciled patients (4.0 [IQR 2.0–9.0] days vs. 3.0 [IQR 1.0–6.0] days, respectively; $P = .02$). A higher proportion of unhoused patients received alcohol- (85.6% vs. 74.6%, $P = .01$) and drug screening (56.4% vs. 30.4%, $P < .001$) than domiciled patients. Of those screened for urine drugs, unhoused patients had a higher positive rate (76.5% vs. 50.9%, $P < .001$). Unhoused patients were more frequently injured by assault (30.4% vs. 8.8%, $P < .001$) or pedestrian strike (21.5% vs. 3.3%, $P < .001$), whereas more domiciled patients were injured in falls (46.4% vs. 21.5%, $P < .001$) and motor vehicle accidents (29.8% vs. 8.3%, $P < .001$). Falls were most common in the oldest quartile for both groups. In both cohorts, a “sharp object” was the most common mechanism of assault injury (40.0% vs. 37.5%, respectively). Assault by firearm occurred in 14.5% of unhoused and 18.8% of domiciled patients. Overall mortality was 2.2%, with no significant difference between groups (1.7 vs. 2.8%, $P = .70$).

Conclusion: Unhoused patients were predominantly younger males with a higher incidence of substance use disorder and greater likelihood of injuries from assault and pedestrian strikes. Falls and assault with a sharp object were common in both cohorts. Unhoused patients were admitted more often and stayed longer in the hospital. Understanding the complexities of these patients can guide local and regional prevention and treatment measures. [West J Emerg Med. 2026;27(1)225–232.]

INTRODUCTION

California is in crisis in terms of its homeless population¹ with Santa Clara County alone hosting 10,028 people

experiencing homelessness in 2022.² Unhoused individuals have a high burden of medical comorbidities complicated by under-treated behavioral health disease, substance use

disorders, and high rates of traumatic injury, often due to victimization.³⁻⁵ Previous studies have shown that unhoused individuals have a higher rate of hospital admission following traumatic injury than their housed counterparts with prolonged stays due to the complexity of their injuries and complications with discharge planning.⁴⁻⁹

Preventing and treating physical injury due to victimization among the unhoused is complex. Previous evidence demonstrates unique injury patterns in unhoused populations.⁹ Lack of shelter complicated by the comorbidities associated with homelessness make preventing assault challenging. These same comorbidities add to the complexity of treating injuries and require additional time by social services and case managers to assure that the recovery initiated in the hospital can continue after discharge.⁸ Unhoused survivors of violent injury are at a greater risk for violent re-injury and death than domiciled assault victims.¹⁰ Additionally, they are at increased risk of fatal drug or alcohol overdose following violent injury.¹⁰ It is because of these social and medical complexities that we sought to better understand our unhoused trauma patients.

In this paper we sought to describe the epidemiology, clinical characteristics, mechanisms of injury, and hospital use patterns of unhoused and domiciled patients treated at our Level II trauma center in a Northern California urban center. Understanding that there are regional variations to injury mechanisms and social services, this analysis is intended to inform clinicians and policymakers, facilitating targeted prevention initiatives as well as specific case management and social service strategies.⁸

METHODS

We performed a retrospective analysis of patients evaluated in the emergency department (ED) at a Level II trauma center from January 1, 2019–April 22, 2022, using data from the Trauma Quality Improvement Program Trauma Registry. All patients on whom a trauma activation was initiated by emergency medical services (EMS) personnel based on the county's trauma center criteria were entered into the registry by a trained data abstractor. Patients were also entered into the registry if a trauma consultation was obtained by the attending emergency physician for patients who met trauma center criteria but were transported by non-EMS conveyance or if EMS personnel did not initially perceive injuries as needing trauma activation. In addition to other patient and visit characteristics from the electronic health record, the registry contains patients' housing status based on patient self-report to the medical center's Patient Access Personnel. Unhoused status is defined according to the Substance Abuse and Mental Health Services Administration for patients who lack a permanent living arrangement. It is updated during the hospital course if a patient is unable to answer questions upon arrival to the ED and/or presented initially without identification. Unhoused status was specified by Patient Access Personnel who chose

Population Health Research Capsule

What do we already know about this issue?

California faces a homelessness crisis.

Unhoused patients are frequently victimized, often presenting to the emergency department with trauma.

What was the research question?

Does traumatic injury to unhoused patients differ from injuries to domiciled patients in our trauma center?

What was the major finding of the study?

Unhoused patients were more commonly male, younger, admitted more often and stayed longer despite similar Injury Severity Scores.

How does this improve population health?

Understanding the complexities of trauma care for these populations can guide local and regional prevention and treatment measures.

unhoused from the dropdown menu in the patient management information system.

Data were extracted from the registry for patients presenting to the ED during the study period and de-identified. We included all unhoused patients meeting study criteria as well as an equal number of domiciled patients who were randomly selected using the Google random number generator. Patients and their clinical characteristics were abstracted from the registry by an unblinded author, deidentified, and stored in an Excel spreadsheet (Microsoft Corporation, Redmond, WA). No review of medical records was conducted. This study was granted exempt status and a waiver of informed consent by the Medical Centers Institutional Review Committee for the Protection of Human Subjects.

Extracted registry data included patient and clinical characteristics such as housing status, sex, age, and ED disposition. Patients were considered admitted if they were classified as an inpatient or placed in observation, whereas they were characterized as discharged if they were discharged from the ED, transferred, or left against medical advice. The unit that a patient was admitted to was at the discretion of the attending trauma surgeon. Additional clinical characteristics in the registry data were admission to the intensive care unit (ICU), length of stay (LOS) in the hospital, results of serum alcohol levels and drug screening, injury mechanism based on the *International Classification of Diseases, 10th Rev, (ICD-10)*, and Injury Severity Score (ISS).

We used descriptive statistics to assess the characteristics of our study sample. Categorical variables were summarized as frequency with percentage, continuous variables as mean with standard deviation or median with interquartile range as appropriate. We compared characteristics of domiciled and unhoused patients using *t*- or Wilcoxon rank-sum tests for normally distributed and skewed continuous variables, respectively, and χ^2 or Fisher exact tests (where expected cell count was < 5) for categorical variables. Statistical significance was assessed at $P < .05$ and tests were two-sided. We performed analyses using R v4.3.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Of the 8,529 patients in the four-year period reviewed in the registry database, we identified 181 (2.1%) unhoused patients for study inclusion. A corresponding 181 domiciled patients were randomly selected for comparison. Unhoused patients were more likely to be male (83% vs 61%, $P < .001$) and younger (48.8 ± 12.3 vs 55.8 ± 23.7 years of age, $P < .001$) than domiciled patients (Table 1).

Although no statistical difference was seen in ISS, unhoused patients had a higher proportion of hospital admissions (76.8% vs 61.9%, $P < .001$) than domiciled patients. There was no significant difference in ICU admissions between unhoused and domiciled patients (29.3% vs 24.3%, respectively, $P = .29$). Unhoused individuals had longer hospital stays than domiciled patients (4.0 [IQR 2.0-9.0] and 3.0 [IQR 1.0-6.0] days, respectively; $P = .02$). Unhoused patients were more likely to receive alcohol (85.6% vs 74.6%, $P = .01$) and drug screening (56.4% vs 30.4%, $P < .001$) than domiciled patients. Of those with screening results for drugs or alcohol, unhoused patients had a higher rate of positive urine drug screens (76.5% vs 50.9%, $P < .001$), but we found no difference in blood alcohol levels (46.5% vs 37.0% for unhoused and domiciled patients, respectively; $P = .11$). Blood alcohol and urine drug screens tended not to be performed or have missing data for domiciled patients.

Assessment of injury mechanisms indicates unhoused patients were more frequently injured due to assault (30.4% vs 8.8%, $P < .001$) or pedestrian strike (21.5% vs 3.3%, $P < .001$), whereas a greater percentage of domiciled patients were injured in falls (46.4% vs 21.5%, $P < .001$) and motor vehicle accidents (29.8% vs 8.3%, $P < .001$) (Table 2). Falls are most common in the oldest age quartile for both unhoused and domiciled patients. The greatest rate of unhoused patients injured by a pedestrian strike were seen in the youngest quartile, < 35 years of age (Table 2). In both unhoused and domiciled patients, a “sharp object” was the most common mechanism of injury during an assault, 40.0% and 37.5%, respectively. Assault by sharp object occurred most frequently in the quartile < 35 years of age (Table 2). Assault by firearm occurred in 14.5% of unhoused and 18.8% of our domiciled patients and was most frequently seen in the unhoused 35-49

years of age quartile where this mechanism of injury occurred in 7 of the 22 (31.8%) assaults (Table 2).

There was no difference in the mortality rate between the two groups (1.7% in unhoused vs 2.8% in domiciled, $P = .70$), which was 2.2% overall (Table 1).

Table 1. Demographic and clinical characteristics of 362 trauma patients by housing status in a 4-year analysis of trauma registry data.

Characteristic	Housing status		P-value
	Unhoused (n = 181)	Domiciled (n = 181)	
Age at ED visit, years, mean (SD)	48.8 (12.3)	55.8 (23.7)	$< .001$
Age group at ED visit			$< .001$
< 35 years	29 (16.0)	45 (24.9)	
35-49	53 (29.3)	33 (18.2)	
50-64	87 (48.1)	30 (16.6)	
≥ 65 years of age	12 (6.6)	73 (40.3)	
Female sex	32 (17.7)	73 (40.3)	$< .001$
ED visit year			.10
2019	38 (21.0)	55 (30.4)	
2020	50 (27.6)	45 (24.9)	
2021	67 (37.0)	50 (27.6)	
2022	26 (14.4)	31 (17.1)	
Any admission	139 (76.8)	112 (61.9)	$< .001$
Admission to ICU	53 (29.3)	44 (24.3)	.29
Hospital length of stay, days, median (IQR)	4.0 (2.0, 9.0)	3.0 (1.0, 6.0)	.02
Injury Severity Score			.30
Mild (≤ 8)	90 (52.0)	106 (62.4)	
Moderate (9-15)	64 (37.0)	48 (28.2)	
Severe (16-24)	9 (5.2)	9 (5.3)	
Extremely severe (≥ 25)	10 (5.8)	7 (4.1)	
Missing	8	11	
Blood alcohol screen			.01
Positive	72 (39.8)	50 (27.6)	
Negative	83 (45.9)	85 (47.0)	
Not performed/missing	26 (14.4)	46 (25.4)	
Drug screen			$< .001$
Positive	78 (43.3)	28 (15.5)	
Negative	24 (13.3)	27 (14.9)	
Not performed/missing	79 (43.6)	126 (69.6)	
Died	3 (1.7)	5 (2.8)	.70

*Data are n (%) unless otherwise noted.

ED, emergency department; ICU, intensive care unit.

DISCUSSION

More than 2% of patients in this four-year analysis of trauma registry data were experiencing homelessness. This is higher than the 0.7% homeless rate reported in a similar analysis of the national Trauma Quality Improvement Program

Trauma Registry data in the US and Canada.⁹ Our unhoused cohort was younger, predominantly male, more likely to be injured due to assault or being struck as a pedestrian, with a higher percentage of admissions to the hospital and a longer LOS than domiciled trauma patients randomly

Table 2. Mechanism of injury for 362 trauma patients by housing status and age group* in a 4-year analysis of trauma registry data.

Mechanism of Injury	Age < 35 years		Age 35-49 years		Age 50-64 years		Age ≥ 65 years		All Ages	
	Unhoused (n = 29)	Domiciled (n = 45)	Unhoused (n = 53)	Domiciled (n = 33)	Unhoused (n = 87)	Domiciled (n = 30)	Unhoused (n = 29)	Domiciled (n = 45)	Unhoused (n = 29)	Domiciled (n = 45)
Pedestrian injured in transport accident	10 (34.5)	1 (2.2)	9 (17.3)	2 (6.1)	19 (22.1)	2 (6.7)	1 (8.3)	1 (1.4)	39 (21.8)	6 (3.3)
Pedal cycle rider injured in transport accident	1 (3.4)	3 (6.7)	9 (17.3)	1 (3.0)	5 (5.8)	4 (13.3)	0 (0.0)	1 (1.4)	15 (8.4)	9 (5.0)
Motor vehicle accident	5 (17.2)	25 (55.6)	2 (3.8)	12 (36.4)	4 (4.6)	10 (33.3)	4 (33.3)	7 (9.6)	15 (8.3)	54 (29.8)
Motorcycle rider injured in transport accident	0 (0.0)	4 (8.9)	0 (0.0)	5 (15.2)	0 (0.0)	3 (10.0)	0 (0.0)	0 (0.0)	0 (0.0)	12 (6.6)
Car occupant injured in transport accident	4 (13.8)	19 (42.2)	2 (3.8)	7 (21.2)	3 (3.5)	4 (13.3)	3 (25.0)	5 (6.8)	12 (6.7)	35 (19.3)
Occupant of pick-up truck or van injured in transport accident	1 (3.4)	2 (4.4)	0 (0.0)	0 (0.0)	1 (1.2)	3 (10.0)	1 (8.3)	2 (2.7)	3 (1.7)	7 (3.9)
Other land-transport accidents	0 (0.0)	1 (2.2)	0 (0.0)	1 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.1)
Slipping, tripping, stumbling, and falls	1 (3.4)	4 (8.9)	4 (7.7)	9 (27.3)	29 (33.7)	9 (30.0)	5 (41.7)	62 (84.9)	39 (21.8)	84 (46.4)
Exposure to inanimate mechanical forces	0 (0.0)	1 (2.2)	1 (1.9)	1 (3.0)	1 (1.2)	1 (3.3)	0 (0.0)	0 (0.0)	2 (1.1)	3 (1.7)
Exposure to animate mechanical forces	0 (0.0)	0 (0.0)	1 (1.9)	0 (0.0)	1 (1.2)	0 (0.0)	1 (8.3)	0 (0.0)	3 (1.7)	0 (0.0)
Accidental exposure to other specified factors	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.4)	0 (0.0)	1 (0.6)

*Data are n (%).

Table 2. Continued.

Mechanism of Injury	Age < 35 years		Age 35-49 years		Age 50-64 years		Age ≥ 65 years		All Ages	
	Unhoused (n = 29)	Domiciled (n = 45)	Unhoused (n = 53)	Domiciled (n = 33)	Unhoused (n = 87)	Domiciled (n = 30)	Unhoused (n = 29)	Domiciled (n = 45)	Unhoused (n = 29)	Domiciled (n = 45)
Intentional self-harm	0 (0.0)	1 (2.2)	0 (0.0)	0 (0.0)	2 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.1)	1 (0.6)
Assault	11 (37.9)	6 (13.3)	22 (41.5)	6 (18.2)	21 (24.1)	4 (13.3)	1 (8.3)	0 (0.0)	55 (30.4)	16 (8.8)
Assault by rifle, shotgun, and larger firearm discharge	0 (0.0)	0 (0.0)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	0 (0.0)
Assault by other and unspecified firearm and gun discharge	1 (3.4)	0 (0.0)	6 (11.5)	1 (3.0)	0 (0.0)	2 (6.7)	0 (0.0)	0 (0.0)	7 (3.9)	3 (1.7)
Assault by sharp object	6 (20.7)	3 (6.7)	6 (11.5)	2 (6.1)	10 (11.6)	1 (3.3)	0 (0.0)	0 (0.0)	22 (12.3)	6 (3.3)
Assault by blunt object	3 (10.3)	0 (0.0)	2 (3.8)	0 (0.0)	2 (2.3)	1 (3.3)	0 (0.0)	0 (0.0)	7 (3.9)	1 (0.6)
Assault by bodily force	1 (3.4)	2 (4.4)	6 (11.5)	3 (9.1)	7 (8.1)	0 (0.0)	1 (8.3)	0 (0.0)	15 (8.4)	5 (2.8)
Assault by other specified means	0 (0.0)	1 (2.2)	1 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	1 (0.6)
Assault by unspecified means	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.1)	0 (0.0)
Event of undetermined intent	0 (0.0)	2 (4.4)	4 (7.7)	0 (0.0)	3 (3.5)	0 (0.0)	0 (0.0)	1 (1.4)	7 (3.9)	3 (1.7)
Legal Intervention	1 (3.4)	1 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	1 (0.6)
Toxic effects of substances, chiefly nonmedicinal as to source	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)
Unreported/missing	0 (0.0)	0 (0.0)	1 (1.9)	0 (0.0)	2 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	3 (1.7)	0 (0.0)

*Data are n (%).

selected from the same registry during the study period. The unhoused patients were more likely to have laboratory alcohol and drug screening and had a higher proportion of positive urine drug screens. Previous studies have found comparable characteristics of unhoused patients seen in the emergency department (ED) setting, including those presenting with traumatic injuries.^{4,8,9} Despite these differences in demographic, utilization, and injury characteristics, the

proportion of deaths in the two groups was similar.

An analysis of our results with regard to the mechanism of injury was performed with the intent of advancing our care and guiding injury prevention of our trauma patients, particularly in the unhoused. As with previously published work, we found falls to be a significant mechanism of injury in traumatic injuries for all trauma patients with the occurrence increasing with age and more common in the domiciled.⁹ Our unhoused

cohort had a high rate of injury due to assault and pedestrian strikes (Table 2). Unhoused individuals injured as a pedestrian accounted for 21.8% of injuries in our unhoused cohort vs 3.3% of the domiciled. These injuries were most prevalent in our youngest unhoused age quartile, < 35 years of age, and is a phenomenon again seen on a national level, deserving of further investigation to develop preventive strategies.^{3,4,9}

Both cohorts were frequently assaulted by sharp object(s), referred to here as “stabbing.” Stabbing accounted for 40% of assaults experienced by the unhoused and 37.5% of assaults in the domiciled group. Previously published literature has found stab wounds are experienced at a significantly greater rate in the unhoused population and consistently more often the mechanism of injury than injury from a firearm.^{9,10} It has been hypothesized that there is a “hidden epidemic” of stabbing violence fueled by the sequelae of drug addiction.¹¹ Accessibility of knives or other sharp instruments that can be weaponized makes it uniquely difficult to design preventative interventions. Meanwhile, violence intervention programs have focused on gun violence with less emphasis given to stabbing.¹¹ Our analysis, showing a high rate of stabbing injury, suggests prevention efforts focused on this mechanism of injury could impact both unhoused and domiciled individuals in our region.

When assaulted, the rate of firearm injury in our population was 14.5% and 18.8% in the unhoused and domiciled, respectively. While injury including death due to firearms is prevalent among unhoused individuals, the data are nuanced. In the national Trauma Quality Improvement Program Trauma data analysis, firearm injuries were significantly more common in the unhoused vs domiciled, 5.2% and 4.1%, respectively.⁹ Additionally, non-fatal firearm injury has been seen more frequently in the unhoused population.¹² Furthermore, death due to firearms has been found to be a leading cause of mortality in the unhoused.^{3,13} Other investigators found that overall homelessness was not associated with increased firearm homicide rates except in chronically unhoused individuals.¹⁴ Courtepatte found that stab wounds were more prevalent than gunshot wounds particularly in older, White, unhoused patients with pre-existing mental health and substance use disorders.¹⁰ It has been proposed that trauma centers continually review the populations they are serving to identify additional resources required to optimize care and adjust prevention efforts, as traumatic injuries are influenced by local factors.^{8,9}

American College of Surgeons (ACS) guidelines have traditionally encouraged trauma centers to perform laboratory screening for the presence of alcohol when treating victims of physical trauma. Updated guidelines from the ACS now recommend adding a urine drug screen (UDS) as part of trauma care.¹⁵ We appropriately evaluated 80% of our trauma patients for alcohol use including equal numbers of housed and unhoused being tested. Only 57% of our trauma patients had UDS performed, with significantly more unhoused being

tested and found to have positive screens at 43.3% (Table 1). Other investigators have found a similar phenomenon.^{8,9,10} The UDS has been considered of limited clinical value in the treatment of trauma patients given clinical ability to identify relevant toxidromes, while delays in obtaining test results add to the cost of care but minimally impact management.¹⁶ Criteria driving the decision to order a UDS based on age of the victim, mechanism, time of day, and day of the week has been demonstrated to reduce the number of negative studies ordered and the associated costs.¹⁶ The updated guidelines for urine drug screening are recommended for all trauma patients with the intent that individuals with positive screenings can undergo a “brief intervention” by trained coordinators and be referred for treatment.¹⁵

Our unhoused and domiciled cohorts had similar ISS; however, unhoused patients had a higher rate of inpatient admissions and LOS (Table 1). There was no difference in the rate of admission to the ICU between the two cohorts. Increased admission rates reflect the complexity of caring for these patients who in addition to their acute traumatic injuries often present with recent ingestion of drugs and alcohol confounding disposition decisions.^{7,8} Prolonged LOS is described for unhoused patients as there are numerous barriers impacting the decision to discharge, be it from the ED or an inpatient unit.⁸ Clinicians may perceive significant risk in discharging an unhoused trauma patient back to the street, a setting where the patient was initially injured.⁹ Discharging unhoused individuals from an inpatient unit after a trauma admission often requires extensive discharge planning and must consider post-discharge therapies and convalescence for care of acute injuries, in addition to undertreated co-morbidities including substance use disorder and behavioral health factors raising the concern that patients will be “lost to follow-up.”^{7,8}

Results of our analysis demonstrate an unhoused population presenting with physical trauma that has a high rate of injury due to assault with concurrent substance use. This provides local experience that can guide injury treatment and targeted prevention efforts. The linkage between homelessness, substance use, behavioral health co-morbidities, and injury is prevalent throughout the literature.^{4,5,7,9,17} The prevalence of traumatic injuries among a growing number of unhoused nationally should stimulate further multidisciplinary, prospective investigations to determine effective injury prevention strategies. Work in this area has demonstrated how progressive case management in addition to intensive social services support are needed to secure post-acute care options such as respite care and referral to temporary housing, as well as concurrent behavioral health and addiction treatment.¹⁰ Further development of centralized homeless healthcare clinical services in a specialized setting, offering access to follow-up, primary care, addiction services, and behavioral and social services following trauma hospitalization has been demonstrated to reduce LOS, unplanned returns due to complications of injuries, and prevention of readmission from

future injuries.^{18–20}

LIMITATIONS

Results from this single-center analysis may not be generalizable; however, demographic characteristics of our unhoused cohort are comparable to those described in other studies, suggesting our results may inform other centers.^{4,5,7,8,9} Additionally, we assume that accurate coding and complete data entry occurred for the registry used in the study. In particular, the number of unhoused patients in our analysis may be underestimated despite percentages described in similar studies using national trauma data, as patients who self-report housing status may be reluctant to disclose housing insecurity.^{9,18,21} The reality of individuals' housing status is also likely much more complex and nuanced than we describe. For example, some unhoused persons may spend time split between shelters, hotels, and/or friends and family; conversely, authors have described the concept of "marginally housed."²⁴ Further, we do not have information about the onset or duration of homelessness.

Admission decisions, including ICU utilization and hospital discharge, were made at the discretion of the attending trauma surgeon. Some patients admitted to the ICU may have had medical indication for that level of care; however, that does not impact our chosen outcomes. Bias in this decision-making could impact some of the characteristics we report, including admission vs discharge from the ED, ICU utilization, and LOS. We were unable to obtain and compare hospital charges for our cohorts. We hypothesize that given the increased rate of admission and the longer LOS observed in the unhoused cohort we might have found our unhoused cohort care more expensive. Lastly, we chose to randomly select a subset of domiciled patients to compare with our unhoused cohort based on the resources available to conduct this study. Employing a different study design—eg, homeless and domiciled individuals matched by mechanism of injury, and/or substance use—would reduce the potential confounding effect of these important factors and allow for better elucidation of the association of homelessness with outcomes.

CONCLUSION

In this analysis of the Trauma Quality Improvement Program Trauma Registry from our trauma center, unhoused individuals were predominantly younger males, having a higher rate of substance use and a greater likelihood of admission and longer length of stay despite similar Injury Severity Scale scores when compared to the domiciled cohort. The unhoused cohort had a greater likelihood of injuries resulting from assault and pedestrian strike than domiciled individuals. Falls were the predominant mechanism of injury in the domiciled cohort and were most common in the oldest age quartile of both cohorts. Assaults due to stabbing were prevalent in both cohorts, while injury due to firearms was less frequent but with a noteworthy spike in the unhoused 35–49

years of age quartile. Understanding the complexities of these patient populations can guide local and regional prevention and treatment measures. Prospective multidisciplinary investigations are needed to determine best practices for injury treatment, prevention, and discharge resources.

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Retention Challenges in Opioid Use Disorder Treatment: The Role of Comorbid Psychological Conditions

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To the Editor:

We read with interest the recent paper by Dr. Seaberg and colleagues, in which they linked higher income and lower post-traumatic stress disorder scores with higher retention rates in an emergency department (ED)-based medication for opioid use disorder (MOUD) program.¹ They also reported a decrease in the number of patients entering the MOUD program compared to previous years.¹ We propose several suggestions to improve patient retention in MOUD programs.

Of the patients who participated in the study, 21%, 23%, 30%, and 30% indicated that they or their family members had been unable to pay for telephone service, healthcare, food, or clothing, respectively, when needed.¹ Perhaps their “distrust” [with the system] may have contributed to a participant’s decision to quit the treatment program. especially in the cohort that experienced abstinence and relapse, Research conducted by Stone et al (2018) found that the overall relapse rate in patients who suffered from opioid use disorder was as high as 57%,² while Yangchen and colleagues in 2024 found that among 1,745 patients presenting to the ED for opioid use disorder, 20% experienced a recurrent overdose.³ Difficulty during abstinence may also determine the retention rate. In those patients who experienced any recurrent overdose, the median time to first recurrent overdose was 88 days.³ If individuals with opioid use disorder encounter more difficulty in achieving successful abstinence, it may make them less likely to trust the MOUD program.

If we were to divide the participants into three groups—the people who initiated abstinence for the first time; those who experienced relapse, and those experiencing opioid overdose—we suggest that there would be large differences in their retention rates. Therefore, different treatment programs could be tailored to different groups. For example, research has shown that participants who had experienced a fentanyl-related overdose were more likely to keep naloxone nearby when using drugs compared with those who had never experienced an overdose.⁴ “Take-home naloxone,” thus, may

not be suitable to the latter group.

Seaberg et al¹ underscored that ability to regulate emotions may be a significant factor to consider in MOUD treatment and that bolstering emotion regulation skills may be an important focus of treatment. However, we believe that emotional dysregulation is not the cardinal symptom of all participants. For instance, opioid overdose may generate detrimental effects on breathing, including fatal respiratory depression.⁵ Personalized treatment programs such as trauma counseling and breathing improvement protocols, along with emotion regulation therapies, could be designed for each participant based on their primary symptoms. More personalized treatment measures could help to retain patients in MOUD programs.

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Retention Challenges in Opioid Use Disorder Treatment: The Role of Comorbid Psychological Conditions

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Dear Editor:

We would like to thank Dr. Shu Yuan and colleagues for their insightful letter. The treatment of patients with opioid use disorder (OUD) presents a myriad of complicating factors, making both successful treatment and retention particularly challenging. They note that patients may be more likely to remain in treatment if they enter a program de novo, rather than following relapse or overdose. While our study did not specifically evaluate this factor, it is a reasonable assumption that warrants further exploration.

Over the five-year period of our investigation, we observed a decline in enrollment for medication for opioid use disorder (MOUD) treatment.¹ This trend may reflect a growing “distrust” in the treatment system among patients or, as we hypothesize, may indicate that MOUD alone is not universally effective for all individuals. Importantly, our study highlighted the role of psychosocial factors in risk stratification of MOUD patients, suggesting that these factors may be critical for predicting treatment adherence and outcomes.

We hope that future research will focus on integrating psychosocial determinants into OUD care strategies, thereby improving retention and treatment success for this complex

and vulnerable patient population.

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