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BRIEF REPORT

Pediatrics

Physical restraint use in children with mental and behavioral health emergencies in the prehospital setting

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Abstract

Objective: Emergency medical services (EMS) transport for mental and behavioral health (MBH) emergencies occurs frequently in children, yet little is understood regarding prehospital physical restraint use despite the potential for serious adverse events. We aim to describe restraint use prevalence and primary impressions among children with MBH emergencies.

Methods: This is a retrospective cross-sectional study of children with MBH emergencies evaluated by Alameda County (ALCO), California EMS from January 1, 2012 to December 31, 2018. Patient demographics and clinical variables were collected from the EMS records including sex, age at time of encounter, year of encounter, transport destination, medication use, and primary impression(s). The primary outcome was the use of physical restraints. Descriptive statistics were used to characterize the primary outcome and associated demographic and diagnostic features, as well as temporal use patterns. Sex and age were compared between restrained and non-restrained youth using chi-square analysis.

Results: Over the 7-year study period, ALCO EMS transported 9775 children with MBH emergencies. Of these transports, 1205 (12.3%) were physically restrained. Most children restrained had the primary impression of "behavioral/psychiatric crisis" (51.1%), "psychiatric crisis" (27.4%), and "behavioral-other" (12.4%) and the remaining children (9.1%) had a non-psychiatric/behavioral health primary impression. Over time, there was no statistically significant change in either number of children with MBH emergencies transported or physical restraint rate.

Conclusions: More than 1 in 8 children with MBH emergencies are being physically restrained during EMS transport. Restraint rate did not substantially change over time.

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Further studies to understand existing restraint rates and EMS resources available to address acute agitation in children are needed to inform quality and care enhancing initiatives.

KEYWORDS

adolescent, child, emergency medical services, mental health services, physical, restraint

1 | INTRODUCTION

1.1 | Background

Pediatric mental and behavioral health (MBH) emergencies in the United States are common and there is an increasing trend of emergency department use for care.¹ Within the prehospital setting, prior literature describes MBH emergencies as the second most common illness using pediatric emergency medical services (EMS) transport²; however, data regarding transport trends over time currently do not exist. During transport or within the hospital setting, children with MBH emergencies may develop acute agitation. In medical settings, physical restraints are recommended only as a last resort, after the failure of deescalation and environmental modification techniques.³ Furthermore, physical restraint has been associated with patient injury, emotional trauma to patient, family, and ED staff, as well as death.^{4,5}

1.2 | Importance

Very few data exist characterizing EMS transport of children with MBH emergencies and frequency of paramedic applied physical restraint use during EMS transport. A previous study of transports of children with MBH emergencies in Florida from 2011 to 2016,⁶ report 4.0% of patients required intervention, with 26.0% of these interventions representing physical restraint. However, to date, no additional data are available regarding restraint use in children during EMS transport.

1.3 | Goals of this investigation

We aim to describe EMS transport frequency and primary impressions among children with MBH emergencies and prehospital physical restraint use. We also explore restraint usage rate over time. Understanding current trends in physical restraint use will help to lay the foundation for quality initiatives focused on prioritizing support, training, and use of non-invasive techniques to manage MBH encounters in children.

2 | METHODS

2.1 | Study design, setting, and data collection and processing

This is a cross-sectional study of children with MBH emergencies who were evaluated during prehospital encounters by Alameda County (ALCO) EMS from January 1, 2012 to December 31, 2018. Alameda County, California, is an exclusive operating area-based EMS system with calls answered by 1 commercial EMS company or a municipal fire EMS team. ALCO receives 125,000 EMS calls resulting in 90,000 patient transports annually.⁷ Alameda County uses a physical restraint protocol (Figure S1). The study was approved by the University of California, San Francisco, Institutional Review Board, along with a designation of minimal risk; therefore, need for informed consent was waived.

To identify MBH emergency encounters for the current study, we employed a previously published strategy that also used the current data set.⁸ First, we excluded encounters for pediatric patients ≥ 18 years of age at time of encounter. Next, we identified encounters as a MBH emergency if the immediate transport destination was the local pediatric psychiatric facility. We then identified encounters containing Medical Priority Dispatch System codes "25A" or "5150" and labeled them as MBH emergencies. The latter were obtained after indexing medic narrative fields and performing text searches for "5150" using Stata. The phrase, "5150," is the beginning section of the California Welfare and Institutions Code granting legal permission to detain/evaluate/treat an individual with mental illness involuntarily; this term is now shorthand for health professionals to refer to psychiatric hold applications, including ALCO EMS. The MDPS code, "25A," was included because it is also consistently used by ALCO EMS to designate a MBH emergency encounter.

Our encounter selection approach leverages commonly agreed upon alpha/numeric syntax used among ALCO EMS clinicians, while eliminating the potential for push-button data entry errors when selecting primary impressions. A prior pediatric prehospital study by Fische et al.⁶ used primary impression to identify MBH emergencies. However, subsequent validation studies attempting to illustrate consistent diagnostic coding patterns across EMS systems are lacking.⁹ The current study's MBH emergency identification strategy offers a

possible alternative with an individualized system approach with the potential for replication.

2.2 | Methods of measurements

We collected patient demographics and clinical variables from ALCO EMS records including sex, age at time of encounter, year of encounter, transport destination, medication use (for sedation), and primary impression(s). In lieu of listing individual transport destinations, we identified destinations as either an ED, psychiatric hospital, jail, or no location listed. Age was divided into 3 categories to represent pre-teen (<13 years old), early teenage (13–15 years old), and late teen (16–17 years old) groups. ALCO EMS uses intramuscular midazolam for sedation, exclusively. Midazolam use is captured by ALCO EMS via a “Yes/No” checkbox within the documentation template. All primary impressions for restrained patients were collected and reported.

2.3 | Outcome measures

The primary outcome for this study was physical restraint usage during a MBH encounter. Unlike previously conducted ED studies involving restraint use,^{10,11} there was no “restraint order” variable available in the data set. To identify restrained patients, the medic narratives of MBH encounters were indexed and searched for the terms “restrain” using Stata (Version 17.0 Stata Corp, College Station, TX). An initial emergency physician reviewer (T.T.) manually read all medic narratives that contained the term “restrain” in them ($N = 1587$). In these manually reviewed encounters, the term “restrain” was used in a positive sense (“the patient was restrained,” $N = 1205$) and in a negative sense (“the patient was not restrained,” $N = 392$). Encounters with narratives that did not contain the term “restrain” ($N = 8188$) were not manually reviewed during this phase; these encounters were automatically coded as negative for physical restraint use.

2.4 | Interrater reliability

Interrater reliability was assessed for the coding of restraint use by EMS using Cohen’s Kappa coefficient. To validate the coding scheme and algorithm developed by the initial reviewer (T.T.), 2 additional raters (a pediatric emergency physician, S.L., and a pediatric psychologist, M.R.) were trained on using the simple coding scheme (“0” for no EMS restraint application and “1” for EMS restraint application) during a bimonthly research group meeting. The 2 additional reviewers (S.L. and M.R.) independently evaluated a 20.0% sample ($N = 1879$) of all MBH encounters ($N = 9775$) and coded for the presence or absence of physical restraint use. Additional reviewer responses were compared to the initial reviewer responses. There was very high overall level of agreement, and the Kappa for the 3 unique raters was 0.960. Reviewers unanimously agreed on 516/535 of positively coded and 1332/1344 negatively coded encounters in the 20% sample.

The Bottom Line

Little is known regarding the use of prehospital physical restraint of mental and behavioral health emergencies in children. In this series of 9775 children in Alameda County, California with mental and behavioral health emergencies, 1205 (12.3%) underwent prehospital physical restraint. These results highlight the need to better understand the etiology and care of acute agitation in children.

2.5 | Statistical analysis

In keeping with our objectives, this study uses descriptive statistics to summarize the primary outcome, associated demographics, and diagnostic characteristics. Using Pearson’s chi-square test, we assessed for significant difference between years for restrained and non-restrained populations. We also compared sex and age (groups) between restrained and non-restrained youth using chi-square/bivariate analysis. Statistical analysis was performed using Stata.

3 | RESULTS

3.1 | Characteristics of study subjects

Among the 66,893 children transported by EMS, 9775 were transported with a MBH emergency.

3.2 | Main results

Of these transports, 1205 (12.3%) were physically restrained. Restraint was more common in children aged 13–15 years (49.3%) and male sex (56.7%) (Table 1). The 2 most common transport destinations were the ED (72.9%) and a psychiatric facility (26.7%). Most children that were physically restrained had a primary impression of behavioral/psychiatric crisis (51.1%), psychiatric crisis (27.4%), and behavioral–other (12.4%) (Table 2). The remaining children who were physically restrained (9.1%) had a non-mental/behavioral health primary impression. Over the study period, there was no significant change in physical restraint rate by year (Pearson $\chi^2 = 9.46, p = 0.149$) (Table 3).

3.3 | Limitations

Our study’s limitations include the potential for undercounting restraint use frequency due to the reliance on EMS worker documentation in the medical narrative as a method for identifying episodes

TABLE 1 Demographic characteristics of study population.

	Children with mental and behavioral health emergencies, N (%), n = 9775	Children with mental and behavioral health emergencies with physical restraint, N (%), n = 1205	Children with mental and behavioral health emergencies without physical restraint, N (%), n = 8570	P value
Age (years)				<0.001
<13	1942 (19.9)	202 (16.8)	1740 (20.3)	
13–15	5003 (51.2)	594 (49.3)	4409 (51.4)	
16–17	2830 (29.0)	409 (33.9)	2421 (28.2)	
Sex				<0.001
Male	4307 (44.1)	683 (56.7)	3624 (42.3)	
Female	5463 (55.9)	521 (43.2)	4942 (57.7)	
Unknown	5 (0.1)	1 (0.1)		
Intramuscular versed administered	97 (1.0)	85 (7.1)	12 (0.1)	<0.001
Transport destination				<0.001
ED	5790 (59.2)	879 (72.9)	4911 (57.3)	
Psychiatric facility	3878 (39.7)	322 (26.7)	3556 (41.5)	
Jail	1 (0.0)	0 (0.0)	1 (0.0)	
Not listed	106 (1.1)	4 (0.3)	102 (1.2)	
Not transported	0 (0.0)	0 (0.0)	0 (0.0)	
Primary impression MBH related? (Yes/No)				0.002
Yes		1120 (92.9)	7955 (92.8)	
No		85 (7.1)	591 (6.9)	
Missing primary impression	24 (0.2)	–	24 (0.3)	

Abbreviations: ED, emergency department; MBH, mental and behavioral health.

of restraint. Incomplete EMS documentation is a national issue, and restraint status could very well have been omitted from the EMS narratives, resulting in an undercount of cases. Our method of keyword searching followed by manual review may have introduced some error because we did not review every chart to verify the absence or presence of restraint; however, the interrater agreement on a 20% sample suggests this was not a major issue. Additionally, our technique for identifying children with MBH emergencies may have missed some within the larger EMS cohort, therefore representing a potential for undercounting.

4 | DISCUSSION

In this cross-sectional study of EMS transports of children with MBH, we found that 1 in 8 children were physically restrained in Alameda County. Over the study period, there were no significant changes in either the number of children transported with a MBH emergency or the percentage of children who were physically restrained. Although most primary impressions documented represented psychiatric or behavioral etiology, nearly 10% of children were restrained with a non-psychiatric/behavioral health primary impression.

Our data reveal a significant number of children in the prehospital setting are experiencing physical restraint. Prior literature reports a substantially lower prehospital restraint use (1.1%) in children with MBH emergencies.⁶ These data may reflect regional variability of practice. Alternatively, this may be due to differing inclusion definitions of MBH emergency used for our study. Concerningly, it is currently unknown whether restraint in the prehospital setting affects subsequent restraint use once the patients are at their destination (psychiatric facility, ED, jail). This may significantly affect the child's care trajectory and ultimate disposition, as restraint in the ED is associated with prolonged ED length of stay.¹²

When comparing our data to rates of restraint in children with MBH emergencies in the ED (2.4%–10.0%),^{11,13,14} the rate of physical restraint in the prehospital setting is higher. Differences in physical resources among the 2 environments may account for this difference. However, a prior qualitative study reveals prehospital personnel do not feel adequately trained in the management of patients experiencing a MBH crisis.¹⁵ Additionally, there is a gap in knowledge regarding both the use prevalence and use of non-invasive deescalation strategies to manage acute agitation in the prehospital setting. There is a need for future work aimed at understanding existing resources, potential facilitators, and barriers to non-invasive deescalation techniques specific to EMS transport. A recently implemented strategy that

TABLE 2 Primary impression for children with mental and behavioral health emergencies.

Primary impression	Children with mental and behavioral emergencies with physical restraint, <i>n</i> (%), <i>N</i> = 1205	Children with mental and behavioral emergencies without physical restraint <i>n</i> (%), <i>N</i> = 8570
Behavioral/psychiatric crisis	616 (51.1)	4420 (51.6)
Psychiatric crisis-5150	330 (27.4)	2328 (27.2)
Behavioral-other	150 (12.4)	888 (10.4)
Overdose/poisoning/ingestion	23 (1.9)	314 (3.7)
Trauma non-activation	20 (1.7)	168 (2.0)
No medical complaint	19 (1.6)	162 (1.9)
Acute loss of consciousness (no hypoglycemia/no seizure)	16 (1.3)	33 (0.4)
Headache-non-traumatic	6 (0.5)	44 (0.5)
General weakness	3 (0.2)	19 (0.2)
Non-traumatic body pain	3 (0.2)	26 (0.3)
Abdominal pain/problems	2 (0.2)	33 (0.4)
Respiratory distress/other	2 (0.2)	10 (0.1)
Traumatic injury-activation	2 (0.2)	8 (0.1)
Other ^{a,b}	13 (1.1)	89 (1.0)
Alcohol intoxication		4 (0.0)
Missing primary impression		24 (0.3)

^aOther: agitated delirium, allergic reaction, anaphylaxis, apneic episode, burn, cardiac dysrhythmia, cold/flu symptoms, dizziness/vertigo, hyperglycemia, other, pain/swelling extremity-non traumatic, respiratory distress/bronchospasm, seizure.

^bOther: allergic reaction, apneic episode, burn, chest pain-non cardiac, cold/flu/symptom, dizziness/vertigo, dystonic reaction, epistaxis, hyperglycemia, hypertension, hypoglycemia, inhalation, nausea/vomiting, inhalation injury, newborn, other, pain/swelling-non traumatic, respiratory arrest/respiratory failure, respiratory distress/other, seizure, seizure-active, seizure post.

TABLE 3 Number of prehospital transports of children with mental and behavioral health emergencies and physical restraint rate, by study year.

Year	Children with mental and behavioral health emergencies (<i>n</i> = 9775)	Children with mental and behavioral health emergencies with physical restraint (%)
2012	1341	160 (11.9)
2013	1427	166 (11.6)
2014	1447	184 (12.7)
2015	1427	168 (11.8)
2016	1324	183 (13.8)
2017	1380	189 (13.7)
2018	1429	155 (10.8)

increases mental health-trained personnel evaluation in the prehospital setting and early initiation of deescalation techniques is the addition of MBH mobile crises teams. Mobile crises teams can provide MBH evaluation and initial stabilization and care and have been shown to facilitate connecting patients to outpatient resources, decrease ED use, and reduce the need for psychiatric hospitalization.^{16,17}

We found that although most of the children that were restrained had a primary impression representing a psychiatric or behavioral

health symptom, nearly 10% of children had a non-mental/behavioral health primary impression. Consensus ED guidelines regarding management of pediatric agitation emphasize the importance of determining etiology when managing the underlying cause of distress in the child.³ Currently, little is understood about the most common etiologies of agitation in children in the prehospital setting or the ED setting. Our findings highlight that physical restraint may be used in non-mental or behavioral-related agitation, which may require alternative deescalation approaches. Alternatively, a non-mental/behavioral health primary impression may have represented a concomitant physical symptom in the setting of a MBH emergency (eg, headache, laceration). Evidence regarding frequent causes of agitation in children and further characterization of the events leading to physical restraint use during EMS transport will help to prioritize targeted training to ensure safe and effective care.

In summary, we describe rates of physical restraint use in children with MBH emergencies in the prehospital setting. We find a high number of children are physically restrained and this number has not significantly changed over the course of the study period. Physical restraint represents a dangerous event for the patient and staff involved. Further study investigating prehospital practice variability, particularly among racially/ethnically marginalized populations, is needed. Finally, evaluations of prehospital resources needed to discern agitation etiology and initiate appropriate management will assist in developing quality initiatives aimed to reduce physical restraint in children.

AUTHOR CONTRIBUTIONS

Drs Foster and Watkins attest to equal participation and therefore are joint first authors. Drs Foster, Watkins, Trivedi, and Glomb conceptualized and designed the study, drafted the initial manuscript, coordinated and supervised data collection, and reviewed and revised the manuscript. Drs Trivedi, Watkins, Leibovich, and Romero collected data, carried out the initial data analysis, and reviewed and revised the manuscript. Drs Daftary, Kornblith, Grupp-Phelan, Sporer, and Colleen Kellison interpreted the data and critically reviewed and revised the manuscript. All authors have approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest relevant to this article to disclose.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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