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Authors

Ford, James S
Rouleau, Sam G
Wagner, Jenny L
et al.

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Assessment of a COVID-19 Vaccination Protocol for Persons Experiencing Homelessness in the Emergency Department

Short Title: COVID-19 Vaccination of Patients Experiencing Homelessness in the Emergency Department

Authors:
James S. Ford, MD[1], Sam G. Rouleau, MD[1], Jenny L. Wagner, MPH[2], Christopher B. Adams, PharmD[1], Larissa S. May, MD, MSPH[1], Aman K. Parikh, MD[1], James F. Holmes, MD, MPH[1]

Affiliations:
1. Department of Emergency Medicine, University of California Davis Health, Sacramento, CA, USA.
2. Department of Public Health Sciences, University of California Davis, Davis, CA, USA.

Corresponding Author
James F. Holmes
4150 V Street
Patient Support Services Building, Suite 2100
Sacramento, CA 95817
Email: jfholmes@ucdavis.edu
Phone: (916) 734-5010

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Author Contributions

JF, AP, LM, CA and JH conceived the study. AP procured the data. JF and JW managed the data. JF analyzed the data. JF, LM and JH interpreted the data. JF and SR drafted the manuscript, and all authors contributed substantially to its revision. JF and JH take responsibility for the paper as a whole.

ABSTRACT

Background: We aimed to evaluate the feasibility of implementing an emergency department (ED)-based Coronavirus Disease of 2019 (COVID-19) vaccination protocol in a population of unhoused patients

Methods: On June 10, 2021, a best practice alert (BPA) was implemented that fired when an ED provider opened the charts of unhoused patients and prompted the provider to order COVID-19 vaccination for eligible patients. We downloaded electronic medical record data of patients who received a COVID-19 vaccine in the ED between June 10, 2021 and August 26, 2021. The outcomes of interest were the number of unhoused, and the total number of patients vaccinated for COVID-19 during the study period. Data were described with simple descriptive statistics.

Results: There were 25,871 patient encounters in 19,992 unique patients (mean 1.3 visits/patient) in the emergency department during the study period. There were 1,474 (6% of total ED population) visits in 1,085 unique patients who were unhoused (mean 1.4 visits/patient). The BPA fired in 1,046 unhoused patient encounters (71% of PEH encounters) and was accepted in 79 (8%). Forty-three unhoused patients were vaccinated as a result of the BPA (4% of BPA fires) and 18 unhoused patients were vaccinated without BPA prompting. An additional 76 domiciled patients were vaccinated in the ED.

Conclusions: Implementing an ED-based COVID-19 vaccination program is feasible, however, only a small number of patients underwent COVID-19 vaccination. Further studies are needed to explore the utility of using the ED as a setting for COVID-19 vaccination.

Key Words: COVID-19, SARS-CoV-2, Vaccination, Public Health, Emergency Department

INTRODUCTION:

Background:

The first documented case of Coronavirus Disease of 2019 (COVID-19) in the United States (U.S.) occurred in January of 2020[1]. As of November 2022, there have been almost one hundred million cases of COVID-19 and over one million deaths in the U.S[2]. Vaccination is the most effective intervention for decreasing transmission of COVID-19 and preventing severe infection and death[3, 4]. The mean reproductive number (R_0) for the COVID-19 delta variant from recently published studies is 5.08, which would require a vaccination proportion of 80.3% to achieve “herd immunity” [5]. As of November 2022, the U.S. vaccination rate remains below this threshold; 68.5% (227,377,753) of the total population have been fully vaccinated and 8.4% (26,290,124) have received a single booster [6].

Higher rates of COVID-19 infection and mortality have been associated with lower socioeconomic status (SES) [7]. Similarly, COVID-19 vaccination rates have also differed substantively among different SES strata by as much as 17% between the highest and lowest SES quartiles[8]. In the U.S., individuals living in homeless shelters experience some of the highest rates of COVID-19 positivity and mortality in the country[9]. While little published data are available on COVID-19 vaccination proportions in unhoused patients, they are presumed to be low, given the high prevalence of vaccine hesitancy that have been documented in survey-based studies of these populations[10, 11]. As many unhoused patients do not access traditional outpatient services, there are few opportunities to discuss and offer COVID-19 vaccinations to this population[12, 13].

Importance and Goals of This Investigation

In recent years, the Emergency Department (ED) has become a nexus for public health delivery among populations without access to traditional outpatient services, particularly with regards to infectious diseases screening and vaccination[14-19]. During the early COVID-19 pandemic, clinics struggled to keep pace with demand for outpatient visits, forcing many patients to visit the ED for routine care[20]. In uninsured and unhoused populations, the ED remained one of the only sources of healthcare services available to them during the COVID-19 pandemic. While unhoused individuals make up just 0.2% (580,000 in 2020) of the U.S. population (329.5 million in 2020), they account for as many as 0.65% of all ED visits, indicating patterns of high ED utilization[21, 22]. A recent survey-based study of 15 U.S. EDs reported that in patients who use the ED as their usual source of care, 95% would accept the COVID-19 vaccine as part of their ED visit[23]. To our knowledge, no previous studies have reported the use of an ED-based COVID-19 vaccination protocol. This indicates that the ED represents an innovative and underutilized setting to administer COVID-19 vaccinations, particularly to populations without access to other forms of healthcare. The aim of this study was to evaluate the feasibility of implementing an ED-based COVID-19 vaccination protocol in a population of unhoused patients.

METHODS

Design and Setting:

We performed an analysis of electronic medical record (EMR) data of patients who received a COVID-19 vaccine in the ED of the study institution between June 10, 2021, and August 26,

2021. The study ED was a level-1 adult and pediatric trauma center that cares for a mixed urban and rural population, and services more than 75,000 patient visits annually. This study was approved by the study site's institutional review board.

Selection of Participants:

All ED patients who were seen by an ED provider during the study period were included in the study. A sub-group comprised of patients who were identified as unhoused was taken from the whole study population.

Intervention:

An ED-based COVID-19 vaccination protocol was designed as a way of reducing vaccine waste by redirecting vaccines near expiration for use in the ED. Given the relative scarcity of vaccines in the ED at the time of the study, this protocol was designed to target people experiencing homelessness, a high-risk population that does not frequently access other sources of healthcare. Given that there may be other more efficient settings for delivering vaccinations to this population, this protocol was originally designed as a temporary intervention.

A best practice advisory (BPA) was implemented, which was designed to "fire" when an ED provider opened the chart of a patient who had been identified as unhoused in the EMR (EPIC) (**Figure 1**). If a patient was experiencing homelessness that was documented in the EMR during any of their ED visits during the study period, they were considered unhoused for the sake of the study. The BPA would fire as long as other inclusion/exclusion criteria were met. The only inclusion criterion was age greater than or equal to 18 years, as only the Janssen (Johnson &

Johnson) vaccine was consistently available in the ED. Use of the Janssen vaccine had the additional benefit of being a single-dose intervention that would not require ED follow-up. Exclusion criteria included an inpatient bed request order, placement of admission orders, admission to the ED Observation unit, temperature greater than 100.3 Fahrenheit during the ED encounter, history of COVID vaccination, placement of an order for COVID vaccination during the same encounter, and placement of a behavioral health hold. Most exclusion criteria were specifically designed to limit the risk of prolonged hospital stays due to vaccine side effects during a time of severe ED boarding and over-crowding. These exclusion criteria were designed after significant discussions with inpatient physician services, inpatient nursing leadership, and inpatient psychiatric facilities. A program for COVID vaccination on discharge for patients admitted to the hospital was also initiated at the same institution. When providers were presented with the BPA, the provider was not forced to place the order for vaccination and had multiple options to defer for 5-30 minutes or lockout the BPA. If accepted, the BPA triggered an ED Pharmacy consult order, which sent an automatic page to the ED Pharmacy service pager and generated a consult request in the ED Pharmacist in-basket work queue in the EMR.

The ED Pharmacy service was responsible for confirming the patient's interest in receiving the vaccine, assessing their ability to provide consent and verifying the patient's eligibility for vaccination. This included confirming whether or not the patient had been previously vaccinated for COVID-19, assessing for contraindications to vaccinations, and providing additional patient education. Once deemed eligible, the ED Pharmacist placed a vaccination order in the EMR, and a dose was prepared using a vaccine supply stock maintained in the ED. The ED Pharmacy was set up as an electronic remote stock location and the medication refrigerator temperature was

monitored remotely to document a chain of custody and vaccine integrity. Once prepared, the vaccine was delivered to bedside with the Janssen COVID-19 Emergency Use Authorization Fact Sheet, Centers for Disease Control (CDC) COVID-19 Vaccination Record Card, and the California Immunization Registry (CAIR) disclosure.

While the protocol was designed for unhoused patients, the vaccination order was not restricted to unhoused patients and could be ordered for any patient by ED providers.

Measurements:

Data were downloaded directly from the EMR using computer-generated reports. Personnel responsible for procuring these reports were blinded to the hypothesis of the study. Data elements abstracted included age, sex, housing status, BPA fire status (Yes/No), reason for BPA rejection, race, ethnicity (Hispanic/Non-Hispanic), date and time of ED visit, total number of ED visits during study period, date of COVID-19 vaccination and type of COVID-19 vaccination (Janssen, Moderna, Pfizer).

Outcomes:

The outcomes of interest were the number of unhoused patients and the number of total patients who received a COVID-19 vaccine.

Analysis:

Data were described with simple descriptive statistics. Categorical data were presented as raw numbers and proportions. Continuous data were presented as mean ± one standard deviation.

Ninety-five percent confidence intervals (95% CI) were presented, where appropriate. Data analysis was conducted using Stata 15 (StataCorp. 2017, College Station, TX).

RESULTS

Characteristics of Study Subjects

There were 25,871 patient encounters in 19,992 unique patients (mean 1.3 visits/patient) in the ED during the study period. The mean age was 40 ± 24 years. Most patients were female (n=10,127, 51%). The most common race was White (n=7,789; 39%) and most patients were Non-Hispanic (n=14,179; 71%).

There were 1,474 (5.7%, 95% CI 5.4, 6.0) visits in 1,085 unique unhoused patients (mean 1.4 visits/patient). The mean age of unhoused patients was 45 ± 14 years. Most unhoused patients were male (n=724, 67%). The most common race was white (n=448, 41%) and most patients were Non-Hispanic (n=843, 78%). Compared to the whole ED population, unhoused patients were older and more likely to be male.

Full patient characteristics for all ED patients, as well as important sub-groups, are available in **Table 1**.

BPA Results

COVID-19 vaccination BPAs fired in 1,046 patient encounters (71% of encounters with unhoused patients). The BPA was accepted in 79 (8%) ED encounters for which the BPA fired, and vaccination was completed in 43 of these patients. The BPA was rejected in 967 (92%)

encounters. The reason for BPA rejection was unknown in 253 (26%) encounters for which it fired. In 190 (20%) encounters for which the BPA fired, the patient had been previously vaccinated for COVID-19. The BPA was rejected or deferred without further action by ED providers in 368 (38%) encounters. Vaccination was declined by patients in 156 (16%) encounters. Full BPA results are available in **Table 2**.

Vaccination Results

Forty-three unhoused patients were vaccinated as a result of the BPA (4% of BPA fires). Eighteen (4%) unhoused patients were vaccinated for COVID-19 during encounters for which the BPA never fired. A total of 61 unhoused patients (6% of unhoused ED census during the study period) were vaccinated during the study period.

In addition to the COVID-19 vaccinations in unhoused patients, an additional 76 housed patients were vaccinated during the study period. Patient characteristics were similar between vaccinated patients who were unhoused and those who were housed (**Table 1**).

A total of 137 total patients were vaccinated during the study period. Almost all patients (n=134, 98%) received the Janssen vaccine. Two patients received the Moderna vaccine, and one patient received the Pfizer vaccine. Most patients were vaccinated during their first ED visit (74%, 100/137) or second ED visit (15%, 21/137), during the study period. In ED patients with high utilization behavior (≥ 1 visit/month), the number of visits before vaccination ranged between 3 and 25 visits.

DISCUSSION

In order to meet the population-level vaccination goals required for herd immunity, innovative strategies will be needed to engage individuals with vaccine hesitancy and to provide education and reassurance about the efficacy and safety of vaccine administration. Each time an individual interacts with the healthcare system, this interaction represents a new opportunity to accomplish this aim. In individuals without access to primary care services, their visits to the ED are often the only opportunities in which to deliver important public health services, such as vaccinations. One recently published, large, ED-based survey study indicated that many individuals who routinely receive their care in the ED would be receptive to receiving COVID-19 vaccination as part of their ED visit[23]. In this study, we sought to evaluate the feasibility of introducing an ED-based COVID-19 vaccination protocol in an unhoused population.

In our study, unhoused patients accounted for approximately 6% of all ED encounters, which is as much as 12-fold higher than the U.S. national average (0.5-0.65%), indicating that the study institution provides a high-level of indigent care[22]. The proportions of unhoused patients who received vaccinations were similar between those for whom vaccination was prompted by the BPA and for those for whom it was not (4% for both). Thus, it appears the BPA had little effect on whether a clinician ordered COVID-19 vaccination. Overall, only a small number of BPA fires led to the vaccination of unhoused patients. There are many potential reasons for this low yield. Once the BPA fired, this required the ED provider to have a conversation about the vaccine with the patient to gauge initial interest. If the patient was interested, the ED provider would then have to return to the EMR to enter the ED Pharmacist order and in many cases,

discuss the case with the ED pharmacist. The ED-pharmacist would then have a second discussion with the patient to provide education, confirm patient willingness and eligibility, and ultimately administer the vaccination. This process may have been too cumbersome and may have had low provider compliance, leading to a low BPA yield. This seems likely, given that 38% of BPA fires were ultimately not accepted because of the clinician's decision. The BPA was initially deferred in 11% of BPA fires that were not accepted; it is possible that the provider meant to return to the bedside to inquire about patient interest in vaccination but was otherwise interrupted or distracted and did not do so before the patient disposition was determined. Future quality improvement processes will plan to introduce a screening question to the triage process in order to gauge a patient's interest in the vaccine, which will help streamline the vaccination protocol. BPA yield may also have been low due to low patient receptivity.

In a survey of 1,000 Americans conducted by a health communications company, 74% of individuals had a vaccine manufacturer preference, with most preferring Pfizer (36%), followed by Moderna (19%) and Janssen (17%)[24]. During the study period, only the Janssen vaccine was widely available, which may have affected patients' willingness to accept vaccination. While previous survey-based studies have explored theoretical reasons as to why patients might refuse testing, there remains a stark leap between taking a survey about willingness to vaccinate, and actually choosing to become vaccinated in a real clinical setting[23]. Further studies will focus on surveying unhoused patients on their reasons for vaccine refusal when they are offered vaccination in a real-world clinical setting.

Most patients (89%) who were ultimately vaccinated for COVID-19, received vaccination during their first or second ED visit during the study period. However, 11% of patients received their vaccination during their third or later ED visit, and one patient did not receive vaccination until their 25th ED visit during the study period. These data suggest that persistent engagement, education and discussion with individuals may lead to vaccination, even in those who are initially resistant to vaccination.

The BPA did not fire for almost one-third of unhoused patient encounters. In some of these cases, the BPA may not have fired if the patient met the exclusion criteria above. Alternatively, it is possible that the BPA did not fire if a patient was not identified as homeless until they were seen by a registration assistant once they were roomed. In these cases, the BPA may not have fired before the clinician saw and dispositioned the patient. Nonetheless, a very small number of unhoused patients were vaccinated by ED providers without prompting from the BPA. Interestingly, an additional 76 patients without documented homelessness were also vaccinated during the study period. One possible explanation is that these patients were not documented as experiencing homelessness during triage, but after discussions with ED providers, were found to be experiencing homelessness and thus eligible for vaccination. Alternatively, it is possible that ED providers were offering vaccinations to individuals who may not have been experiencing homelessness but were perhaps deemed high-risk.

The ED Pharmacist played an integral role in facilitating the COVID-19 vaccine protocol. However, in settings without access to this resource, another clinician would be capable of filling this role.

Respecting the autonomy of vulnerable populations is paramount to the practice of medicine. This study was not a randomized control trial of vaccine efficacy and instead was a retrospective review of an implemented policy, thus patients were not consented for research. Patients were provided with a preventative intervention (COVID-19 vaccination, which at the time was standard of care for all patients), not a new, previously unstudied intervention. California has specific homeless discharge requirements, which include a provision to provide vaccinations as appropriate (SB 1152)[25]. Thus, patients were consented for all medical treatment as per normal standards, and in compliance with state health policy. Patients who did not want the vaccine were not pressured or coerced in any way to receive the vaccine.

This was a single center study, so its results may not be generalizable to all settings. This study was retrospective, thus it is limited by the data available in the EMR and subject to the specific limitations of this design. The BPA did not fire for all encounters in which the patient was identified as experiencing homelessness, which may have been due to the patient meeting one of the exclusion criteria or may have been due to technical issues. The specific reason for why an ED provider chose to defer or reject the BPA was not known in most cases. Likewise, the reason for why a patient chose not to be vaccinated was not captured in our data. Further studies on provider practice behavior are necessary to understand why providers may not be accepting BPAs.

In summary, implementing an emergency department based COVID-19 vaccine for unhoused patients is feasible, however, use of a BPA had minimal impact on whether a clinician ordered

COVID-19 vaccination. As COVID-19 vaccines become more available, the study institution plans to expand vaccination eligibility to all ED patients. Further studies are needed to explore the utility of the ED as a setting for COVID-19 vaccination.

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Table 1. Characteristics of ED patients stratified by unhoused status and ED COVID-19 vaccination administration status

Characteristic	All ED Patients (n=19,992)	Unhoused (n=1,085)	Unhoused Vaccinated (n=61)	Housed Vaccinated (n=76)
Age (years)	40 ± 24	45 ± 14	48 ± 13	44 ± 16
Sex				
Male	9,853 (49%)	724 (67%)	42 (69%)	49 (64%)
Female	10,127 (51%)	361 (33%)	19 (21%)	27 (36%)
Unknown	12 (<1%)	-	-	-
Race				
White	7,789 (39%)	448 (41%)	26 (43%)	24 (32%)
Black	3,538 (18%)	288 (27%)	13 (21%)	20 (26%)
Asian	1,463 (7%)	27 (2%)	3 (5%)	6 (8%)
Mixed/Other	6,733 (34%)	305 (28%)	19 (31%)	25 (33%)
Unknown	459 (2%)	17 (2%)	-	1 (1%)
Ethnicity				
Hispanic	5,045 (25%)	189 (17%)	10	18
Non-Hispanic	14,179 (71%)	843 (78%)	50	55
Unknown	768 (4%)	53 (5%)	1	3

PEH, people experiencing homelessness.

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Table 2. Best practice alert results

BPA Result[1] (n=1,046)	N (%)
Accepted (n=79, 8% of total)	
Completed vaccination	43 (54%)
Did not complete vaccination	36 (46%)
Rejected (n=967, 92% of total)	
Previously vaccinated	190 (20%)
Patient declined	156 (16%)
Provider deferred, no further action	118 (12%)
Provider rejected, reason unknown	141 (15%)
Provider rejected, “Not appropriate for patient”	109 (11%)
Unknown/No data	253 (26%)

BPA, best practice alert. The BPA fired only in people experiencing homelessness and who met specific inclusion and exclusion criteria.

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Figure Legends

Figure 1. Screenshot of COVID-19 vaccination best practice alert for patients experiencing homelessness