Emergency Medical Services Use Among Patients Receiving Involuntary Psychiatric Holds and the Safety of an Out-of-Hospital Screening Protocol to "Medically Clear" Psychiatric Emergencies in the Field, 2011 to 2016

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Study objective: Patients with acute psychiatric emergencies who receive an involuntary hold often spend hours in the emergency department (ED) because of a deficit in inpatient psychiatric beds. One solution to address the lack of prompt psychiatric evaluation in the ED has been to establish regional stand-alone psychiatric emergency services. However, patients receiving involuntary holds still need to be screened and evaluated to ensure that their behavior is not caused by an underlying and life-threatening nonpsychiatric illness. Although traditional regional emergency medical services (EMS) systems depend on the medical ED for this function, a field-screening protocol can allow EMS to directly transport a substantial portion of patients to a stand-alone psychiatric emergency service. The purpose of this investigation is to describe overall EMS use for patients receiving involuntary holds, compare patients receiving involuntary holds with all EMS patients, and evaluate the safety of field medical clearance of an established field-screening protocol in Alameda County, CA.

Methods: We obtained data for all EMS encounters between November 1, 2011, and November 1, 2016, using Alameda County's standardized data set. After unique patient identification, we describe the data at the patient level and at the encounter level. At the patient level, we compare "involuntary hold patients" ($\geq$1 involuntary hold during the study period) with those who were "never held." Additionally, we assess the safety of out-of-hospital medical clearance by calculating the rate of failed diversion, defined as retransport of a patient to a medical ED within 12 hours of transport to the psychiatric emergency services by EMS.

Results: Of the 541,731 total EMS encounters in Alameda County during the study period, 10% (N=53,887) were identified as involuntary hold encounters. Of these involuntary hold patient encounters, 41% (N=22,074) resulted in direct transport of the patient to the stand-alone psychiatric emergency service for evaluation; 0.3% (N=60) failed diversion and required retransport within 12 hours. At the patient level, Alameda County EMS encountered 257,625 unique patients, and 10% (N=26,283) had at least one encounter for an involuntary hold during the study period. These "involuntary hold patients" were substantially younger, more likely to be men, and less likely to be insured. Additionally, they had higher overall EMS use: "involuntary hold patients" accounted for 24% of all encounters (N=128,003); 53,887 of these encounters were for involuntary holds, whereas an additional 74,116 were for other reasons. Similarly, 4% of "involuntary hold patients" had 20 or more encounters, whereas only 0.4% of "never held" patients were in this category. Last, the 7% of "involuntary hold patients" (N=1,907) who received greater than or equal to 5 involuntary holds during the study period accounted for 39% of all involuntary holds and 9% of all EMS encounters.

Conclusion: Ten percent of all EMS encounters were for involuntary psychiatric holds. With an EMS-directed screening protocol, 41% of all such patient encounters resulted in direct transport of the patient to the psychiatric emergency service, bypassing medical clearance in the ED. Overall, only 0.3% of these patients required retransport to a medical ED within 12 hours of arrival to psychiatric emergency services. We found that 24% of all EMS encounters in Alameda County were attributable to "involuntary hold patients," reinforcing the importance of the effects of mental illness on EMS use. [Ann Emerg Med. 2019;73:42-51.]

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0196-0644/$-see front matter

https://doi.org/10.1016/j.annemergmed.2018.08.422

INTRODUCTION

An estimated 30% of the 7.4 million annual mental health–related emergency department (ED) visits in the United States are by patients who arrive by ambulance.[1] Although the reasons for this are unknown, a possible explanation is that many of these patients are coercively brought to the ED after receiving an involuntary psychiatric hold. Because of the severe deficit in inpatient

Editor's Capsule Summary

What is already known on this topic

Psychiatric patients are often brought to the emergency department (ED) by ambulance or law enforcement for initial evaluation and medical clearance. These patients often have extended ED stays while awaiting admission to a psychiatric facility.

What question this study addressed

The study examined the characteristics and safety of a program in Alameda County, CA, that allows paramedics to transport selected patients receiving involuntary psychiatric holds directly to the county psychiatric facility.

What this study adds to our knowledge

During a 5-year period, 53,887 of 541,731 encounters (10%) were for patients receiving involuntary holds; 22,074 (41%) of held patients were transported directly to the psychiatric facility. Among them, 60 patients (0.3%) were determined to have failed diversion on the basis of a subsequent need for ED care within 12 hours.

How this is relevant to clinical practice

For appropriate patients, diversion by emergency medical services to a dedicated psychiatric facility appears safe and may improve patient experience and reduce burden on EDs.

psychiatric beds, these patients often remain in the ED for hours to days, with 79% of surveyed ED directors reporting that their EDs routinely hold patients in psychiatric crises for hours.[2] Given the nature of the ED, prolonged ED stays for psychiatric patients have been cited by patients and staff as inhumane for patients, exhausting for providers, and inefficient for overall ED operations.[3]

One potential solution for improving emergency psychiatric care and reducing prolonged ED stays for involuntarily held psychiatric patients is the establishment of regional dedicated psychiatric emergency services.[4] Direct ambulance transport from the field to a specialized mental health facility may be a better option for both patients and ED operations. To ensure appropriate triage and safety, many state and local protocols often require that ambulances bring all patients, including those with mental health emergencies, to the ED for "medical clearance." In the case of psychiatric emergencies, the rationale is to ensure that the patient's behavior is not caused by an underlying and life-threatening nonpsychiatric illness. However, miscategorization of patients as having a psychiatric emergency is rare, and some emergency medicine experts have questioned the value of such practices.[5,6] Small-scale studies of paramedic screening protocols have provided some evidence to support the safety of direct transport.[7] As a result, some counties allow police and paramedics to bypass EDs and transport patients directly to a dedicated psychiatric emergency service staffed with mental health professionals if the patient meets certain protocol-based criteria. The Alameda model in Alameda County[4,8] has been described to be an effective strategy to reduce the number of patients with isolated psychiatric complaints in the ED. In fact, several other counties have invested in adopting this model in their own communities.[9,10] However, to our knowledge the safety of this out-of-hospital protocol to divert patients to a psychiatric emergency service has not yet been studied.

Using 5 years of complete data from the emergency medical services (EMS) system in Alameda County, we conducted a study to better understand out-of-hospital management of psychiatric emergencies. We had 2 main objectives. First, we wished to describe basic characteristics and usage patterns of the population of patients transported by ambulance for an involuntary hold and compare them with those of patients transported for other reasons. Second, we aimed to assess the safety of an EMS field protocol to identify patient encounters for involuntary holds that can be diverted from the ED to a dedicated regional psychiatric emergency service.

MATERIALS AND METHODS

Study Design

Using Alameda County EMS data, we conducted a retrospective review of all EMS encounters resulting in contact with a patient that occurred during the study period, from November 1, 2011, to November 1, 2016. The study was approved by the Alameda Health System Institutional Review Board. Informed consent was waived, given that data were kept confidential and participants were not affected because of the retrospective nature of the study.

Setting

Alameda County, CA, has a population of approximately 1.6 million people. The county requires that all patients transported involuntarily have a legal involuntary hold placed in the field, which almost always requires police involvement; involuntary holds are rarely

placed in non–health care settings by mental health workers. In addition, county regulations require that all patients who receive involuntary holds be transported by ambulance, and not by police. As a result, nearly all involuntary holds placed in a non–health care setting in Alameda County are captured within the EMS database. Patients arriving to the ED or psychiatric emergency services on their own or with family were not captured in this database.

The Alameda County EMS Agency developed and approved an EMS protocol that allows the ambulance crew to identify patients with isolated psychiatric complaints who meet protocol criteria and transport them directly to the county's sole psychiatric emergency service. Patients who do not meet protocol criteria or are otherwise judged unstable by the ambulance crew are transported to an ED. The protocol is presented in Appendix E1 (available online at http://www.annemergmed.com).

Data Collection and Processing

For all EMS encounters, EMS workers are required to input data into a standardized out-of-hospital care report, which is uploaded to a centralized EMS database. In this database, data for each patient encounter are available, including patient name and date of birth, Global Positioning System coordinates of pickup, location type (private residence, street/highway, clinic, etc), chief complaint, paramedic impressions, narrative descriptions, vital signs, clinical condition, interventions performed, time of EMS dispatch, time of EMS arrival to scene, time of arrival to destination, time until ambulance was available for the next encounter, destination facility, and whether a critical EMS intervention was required. Critical interventions were defined as the use of airway techniques or devices, respiratory support through oxygen or positive-pressure ventilation, advanced cardiac life support (ACLS) interventions, use of naloxone, use of glucagon, or ST-segment elevation myocardial infarction (STEMI) readout on the field ECG. Additionally, for each transport, EMS workers type out a narrative free-text description of the transport. Missing data were rare, given that the out-of-hospital care report was generated as part of standard EMS documentation practices. EMS dispatches that resulted in no patient contact were excluded.

We used 4 fields from the data set to determine whether a patient was receiving an involuntary hold: the Medical Priority Dispatch System code, primary impression, secondary impression, and medic narrative. The term "5150" refers to section 5150 in the California Welfare code, but is used colloquially in California by medical staff, police, ambulance workers, and lawyers to refer to involuntary holds for adults. We used the following criteria to determine whether the encounter involved an involuntary hold, and the results of the identification process are available in Figure E1 (available online at http://www.annemergmed.com).

The first field, known as the Medical Priority Dispatch System code, directly indicated that an encounter was for an involuntary hold. There were 2 codes that Alameda County EMS uses to designate this: 25A or 5150. This field was not always complete.

If the primary or secondary impression was coded as a "behavioral/psychiatric crisis" or "psych crisis—5150" category and the medic narrative field included the term "on a 5150" (Appendix E2 [available online at http://www.annemergmed.com] for all variations), then the encounter was considered as an involuntary hold.

If the term "not on a 5150" (Appendix E2 [available online at http://www.annemergmed.com] for all variations) was ever present in the medic narrative, the encounter was not considered an involuntary hold, regardless of other coding.

Paramedics in Alameda County do not assign unique patient identifiers for EMS encounters, but do collect names and dates of birth, along with other demographic information. Given that some patients had more than one encounter during the study period, we developed a method to uniquely identify patients. All patients who were exact matches on name and date of birth were considered to be unique. To address minor errors in spelling patient names or inputting date of birth, we used a conservative 7-cycle matching strategy (Table E1, available online at http://www.annemergmed.com) using the MATCHIT tool[11,12] in Stata (version 15.0; StataCorp, College Station, TX). A small number of encounters (0.6%) had missing information for name, date of birth, or both. Because we could not assign a unique patient identifier to these encounters, they were excluded from the study (Figure E2, available online at http://www.annemergmed.com).

Outcome Measures

After unique patient identification, we describe the data at the patient level and at the encounter level. At the patient level, we describe and compare basic characteristics and use patterns for "involuntary hold patients" ($\geq$1 involuntary hold during the study period) and those who were "never held." At the encounter level, we describe and compare basic characteristics for 3 groups of encounters: involuntary hold encounters for "involuntary hold patients," non–involuntary hold encounters for "involuntary hold

patients," and all encounters for "never-held patients." We calculated total encounter time, or the total amount of time spent on each EMS encounter from dispatch to availability for another call. Other EMS times that were calculated were time from dispatch to arrival at the scene, time from scene arrival to arrival at the destination, and time from destination arrival to ambulance availability for the next EMS encounter.

Our second objective was to describe the safety of direct transport to a psychiatric facility, bypassing medical clearance in a standard ED. The psychiatric emergency service provides only mental health crisis stabilization services. At all times of the day, the psychiatric emergency service has a psychiatrist, physician-in-triage, and registered nurses who obtain vital signs on patient arrival; however, it has limited capacity to treat, observe, or monitor patients suspected to have an acute medical illness. Patients who need ED-level services such as intravenous fluids or medications, or cardiac or respiratory monitoring, are transferred immediately by ambulance through 911 EMS services. Decisions to transfer patients to the ED are based on judgment of the psychiatric emergency services staff. Thus, we defined a failed diversion as an event in which a patient receiving an involuntary hold was first brought to the psychiatric emergency service and within 12 hours had to be retransported to a medical ED from that psychiatric emergency service. The failed diversion rate was used as a proxy measure for safety of the protocol; the underlying assumption is that a patient who is inappropriately brought to the psychiatric emergency service will "declare himself or herself" within 12 hours, leading the medical staff to call 911 to request emergency transport to a medical ED. Even if a patient died at the psychiatric emergency service, staff would have called 911 for EMS assistance, leading to reliable capture of this outcome. Personal communication with the psychiatric emergency services director confirmed that no patients died at the psychiatric emergency service during the study for whom EMS was not contacted (personal communication, Frederick Tatum, John George Psychiatric Pavilion, February 2018). Additionally, patients are screened at intake and assessed by nursing and physician staff after arrival, so any medical instability that should have been caught by EMS could be recognized by that point. We identified EMS transports from the psychiatric emergency services to the ED in 2 ways. First, we identified all encounters that began between latitude 37.710° to 37.711° and longitude −122.122° to −122.120°, the location of the psychiatric emergency service. Second, because 21% of encounters were missing encounter location Global Positioning System data, we identified any remaining encounters that involved a patient who had been transported to the psychiatric emergency service in the previous 12 hours.

One emergency physician (T.K.T.) manually reviewed the clinical circumstances and paramedic narratives in all potential failed diversion cases and classified the encounter as either a protocol failure or the development of new symptoms after arrival to the psychiatric emergency service. There was 100% agreement during independent review of 10 of 60 selected failed diversion cases by another emergency physician (M.G.); cases were randomly selected but oversampled for protocol failures. Finally, to ensure that no clinically important failed diversion cases were missed because of an incorrectly assigned unique identifier, we conducted a thorough manual chart review on all EMS encounters that originated at the psychiatric emergency services that required a critical intervention. For these encounters, we manually scanned all transports to the psychiatric emergency services in the 12 hours before and ensured that no patients with similar names or birth dates had been brought under a different unique identifier.

Primary Data Analysis

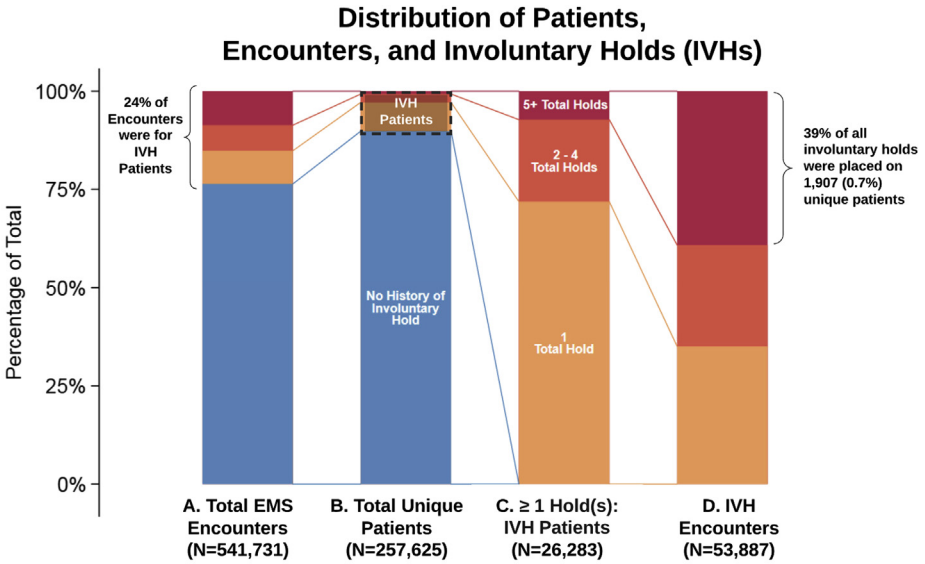
Data management and analysis was conducted with Stata (version 15.0; StataCorp). Comparisons of interest between groups were performed by calculating absolute differences, along with their 95% confidence intervals (CIs).

RESULTS

Characteristics of Study Subjects

Between November 2011 and November 2016, Alameda County EMS encountered 257,625 unique adult EMS patients; 10.2% (n=26,283) had at least one involuntary hold placed during the 5-year period (Figure 1). We refer to them as "involuntary hold patients" and all other patients (N=231,342) as "never held patients." "Involuntary hold patients" were substantially younger, more likely to be men, and less likely to be insured (Table 1).

"Never held patients" had substantially less total EMS use compared with "involuntary hold patients." Whereas 74.0% of "never held patients" had only one EMS transport during the 5-year period, only 47.7% of "involuntary hold patients" were in this category. Similarly, on the other end of the use spectrum, 4.1% (N=1,072) of "involuntary hold patients" had greater than 20 encounters, whereas only 0.4% (N=820) of "never held patients" were in this group (Table 1).



Legend: We recommend reading this figure starting with bar B. This bar represents unique EMS patients during the 5-year study period. The dashed lines at the top of this bar represent the "IVH Patients": unique patients who had at least one involuntary hold (IVH) placed during the study period. Bar A represents the total number of EMS encounters; 10% of "IVH Patients" (top of bar B) accounted for 24% of all EMS encounters (A). Bars C and D provide detailed information about "IVH Patients." Bar C divides "IVH Patients" into groups based on the number of IVHs each had in the database; 74% of Involuntary Patients had only one IVH placed during the study period. Bar D represents the total number of IVHs that the various groups of "IVH Patients" accounted for; for example, "IVH Patients" who had ≥ 5 IVHs accounted for 39% of the total number of encounters for IVHs (top of Bar D).

Figure 1. Distribution of patients, encounters, and involuntary holds.

During the study period, Alameda County EMS had 541,731 patient-contact encounters; 53,887 (10.0%) were for patients receiving an involuntary hold during that transport. Additionally, another 2% of encounters (n=10,247) were coded as being primarily or secondarily for behavioral health.

The 26,283 "involuntary hold patients" had 53,887 encounters (10% of total) while receiving an involuntary hold and 74,116 encounters (14% of total) when not receiving one (Table 2). Thus, "involuntary hold patients" accounted for a total of 128,003 encounters, or 24% of all EMS encounters.

Among the subset of "involuntary hold patients," transports that were for an involuntary hold had a median total encounter time that was 8.9 minutes longer compared with that for encounters that were not for an involuntary hold (95% CI 8.6 to 9.1 minutes). Compared with that for "never held patients," median total encounter times for "involuntary hold patients" were 1.5 minutes shorter (95% CI –1.6 to –1.3). When patients were transported while receiving an involuntary hold, median total encounter times for those taken directly to the psychiatric emergency service were slightly shorter compared with that for patients taken to an ED for medical clearance (80.4 versus 81.5 minutes; absolute difference –1.3 minutes; 95% CI –1.7 to –0.9 minutes).

"Involuntary hold patients" were more frequently transported from a public location instead of a private residence, regardless of their involuntary hold status during the encounter. They were picked up in a public location 55% of the time, whereas the same was true only 29% of the time for "never held patients" (absolute difference 25.5%; 95% CI 25.2% to 25.8%).

Compared with "never held patients," "involuntary hold patients" were more frequently intoxicated (11.2% versus 3.9%; absolute difference 7.3%; 95% CI 7.1% to 7.5%) during an EMS encounter. When receiving an involuntary hold, "involuntary hold patients" were less frequently intoxicated than during their non–involuntary hold encounters (8.0% versus 13.5%; absolute difference –5.5%; 95% CI –5.9% to –5.2%).

Compared with "never held patients," "involuntary hold patients" had a greater proportion of encounters for an overdose, ingestion, or poisoning (3.7% versus 11.8%; absolute difference 8.2%; 95% CI 8.0% to 8.4%) and for non–involuntary hold behavioral complaints (1.1% versus 4.5%; absolute difference 3.6%; 95% CI 3.5% to 3.8%).

Of the 53,887 encounters for involuntary holds, 0.3% (N=163) involved a critical intervention; most (73%; N=119) involved administering naloxone. Other critical interventions included the placement of an advanced airway (N=5), ACLS including cardiopulmonary

Table 1. Characteristics of patients transported by EMS in Alameda County, 2011 to 2016.

Characteristics	IVH Patients (≥1 IVH) N=26,283 (10%)	Never Held Patients (0 IVHs) N=231,343 (90%)	Absolute Difference for IVH Patients (95% CI)
Age, median (IQR), y	38 (27 to 52)	55 (36 to 73)	14 (14 to 15)
% Men	57.5 (N=15,110)	48.1 (N=111,199)	9.42 (8.79 to 10.05)
% Insured	71.3 (N=18,741)	76 (N=176,563)	−5.02 (−5.56 to −4.44)
Total encounters/patient, No. (%)			
1	12,542 (47.7)	171,093 (74.0)	—*
2	4,282 (16.3)	29,359 (12.7)	—
3 to 5	4,768 (18.1)	21,790 (9.4)	—
6 to 9	2,110 (8.0)	5,708 (2.5)	—
10 to 19	1,509 (5.7)	2,572 (1.1)	—
≥20	1,072 (4.1)	820 (0.4)	—
Total IVHs/patient, No. (%)			
1	18,889 (71.9)	—	—
2 to 4	5,487 (20.9)	—	—
≥5	1,907 (7.3)	—	—
Total encounters (%) (N=541,731)	128,003 (23.6)	413,728 (76.4)	—

IVH, Involuntary hold; *IQR*, interquartile range.
*Dashes indicate that the calculation cannot be performed.

resuscitation (CPR) and medications (N=11), respiratory support with positive-pressure ventilation (N=20), dextrose or glucagon administration for hypoglycemia (N=42), or an ECG with a computer interpretation of STEMI (n=29). Per protocol, all such patients went directly to an ED, and 85% (N=139) had a primary impression unrelated to behavioral health disorders.

"Involuntary hold patients" less frequently received critical EMS interventions compared with "never held patients" (1.0% versus 3.0%; absolute difference –2.3%; 95% CI –2.4% to –2.2%). When "involuntary hold patients" were receiving an involuntary hold, they required a critical intervention less frequently than when they were not receiving one (0.3% versus 1.4%; absolute difference –1.1%; 95% CI –1.2% to –1.0%).

Of 26,283 "involuntary hold patients," 18,889 (76%) received one involuntary hold during the entire study period (Figure 1). A small group consisting of 1,907 patients received involuntary holds more than 5 times during the 5-year period. Although members of this group were only 0.7% of the entire population and 7% of "involuntary hold patients," they accounted for 9% of all EMS encounters and 39% of all involuntary holds.

As allowed by EMS protocol in Alameda County, 22,074 (41%) of the involuntary hold encounters resulted in direct transport to the psychiatric emergency service, bypassing ED medical clearance (Figure 2). Of these encounters, only 0.3% (n=60/22,074) required ambulance transport to an ED within 12 hours of their arrival to the psychiatric emergency service.

Manual chart review revealed that in 54 of the 60 encounters, the patient developed new symptoms after arrival to the psychiatric emergency service; initial EMS documentation did not contain information that supported transporting these patients to a medical ED. Reasons for transporting patients to a medical ED included a new traumatic injury that occurred at the psychiatric emergency service (n=5), previously unrecognized or unreported symptom (n=13), seizure in a previously nonseizing patient with a history of seizure disorder (n=8), excessive administration of sedation at the psychiatric emergency service (n=10), staff request for medical clearance for an asymptomatic patient (n=7), new mental status change not explained by sedative administration (n=6), or patient discharged from the psychiatric emergency service and self-referred to EMS (n=5).

Six patients were transported to the ED because of EMS failure to follow protocol and should have been directly transported to the ED according to their initial presentation. The available clinical information for these patients is listed in Fig 2. Of these 6 patients, 2 had hypoglycemia and 2 had altered mental status. The psychiatric emergency service staff requested medical clearance for the other 2 because of age (>65 years) and pregnancy.

Table 2. Comparisons of encounters for "IVH patients" receiving IVHs,* "IVH patients" not receiving IVHs, and "never held† patients."

	IVH Patients (≥1 IVH During Study) (N=26,283)				Never Held Patients (N=231,343)	
	IVH Encounters (N=53,887), %	Non-IVH Encounters (N=74,116), %	Absolute % Risk Difference (95% CI)	All Encounters for IVH Patients (N=128,003), %	Encounters for Never Held Patients (N=413,728), %	Absolute % Risk Difference for IVH Patients (95% CI)
Location of EMS pickup						
Home	36.2 (N=19,526)	38.2 (N=28,315)	−1.97 (−2.50 to −1.43)	37.4 (N=47,841)	60.3 (N=249,601)	−22.95 (−23.26 to −22.65)
Public place	55.5 (N=29,891)	54.0 (N=40,051)	1.03 (0.88 to 1.98)	54.6 (N=69,942)	29.1 (N=120,547)	25.50 (25.20 to 25.81)
Other	8.3 (N=4,470)	7.8 (N=5,750)	0.54 (0.23 to 0.84)	8.0 (N=10,220)	10.5 (N=43,581)	−2.55 (−2.73 to −2.37)
Encounter clinical attributes						
% intoxicated with alcohol	8.0 (N=4,306)	13.5 (N=9,992)	−5.49 (−5.85 to −5.15)	11.2 (N=14,298)	3.9 (N=16,157)	7.26 (7.08 to 7.45)
Overdose/poisoning related	9.4 (N=5,061)	13.6 (N=10,089)	−4.22 (−4.57 to −3.87)	11.8 (N=15,150)	3.7 (N=15,108)	8.18 (8.00 to 8.37)
Behavioral transport (no hold)	–	8 (N=6,097)	–	4.5 (N=6,097)	1.1 (N=4,640)	3.64 (3.52 to 3.76)
Critical intervention performed	0.3 (N=163)	1.4 (N=1,051)	−1.11 (−1.21 to −1.02)	1.0 (N=1,214)	3.3 (N=13,499)	−2.31 (−2.39 to −2.24)
EMS times, min‡	**Median (IQR)**	**Median (IQR)**	**Median difference§**	**Median (IQR)**	**Median (IQR)**	**Median difference§**
1. Dispatch to arrival	9.3 (6.4 to 13.2)	6.2 (4.5 to 8.3)	3.0 (3.0 to 3.1)	7.2 (5.0 to 8.6)	6.3 (4.6 to 8.6)	0.9 (0.8 to 0.9)
2. Arrival to destination	15.5 (11.0 to 21.8)	13.1 (8.8 to 18.6)	2.5 (2.5 to 2.6)	14.1 (9.7 to 19.9)	16.5 (12.0 to 21.8)	−2.1 (−2.2 to −2.1)
3. Destination to available	54.1 (41.8 to 67.3)	52.3 (40.0 to 65.5)	1.9 (1.7 to 2.1)	53.0 (40.8 to 66.3)	55.3 (43.0 to 68.6)	−2.2 (−2.3 to −2.1)
Dispatch to destination$^{(1+2)}$	26.3 (20.8 to 33.1)	20.1 (15.2 to 26.0)	6.2 (6.1 to 6.3)	22.7 (17.2 to 29.3)	23.7 (18.8 to 29.4)	−0.9 (−1.0 to −0.9)
Overall encounter time$^{(1+2+3)}$	81.1 (66.3 to 97.6)	72.8 (57.5 to 88.6)	8.9 (8.6 to 9.1)	76.3 (61.0 to 92.4)	78.3 (62.6 to 94.1)	−1.5 (−1.6 to −1.3)

*IVH patients are defined as those receiving one or more IVHs.
†Never held patients had no history of an IVH.
‡Of EMS encounters, 5.4% did not result in transport.
§All median differences were statistically significant ($P<.001$) by Wilcoxon rank sum test.

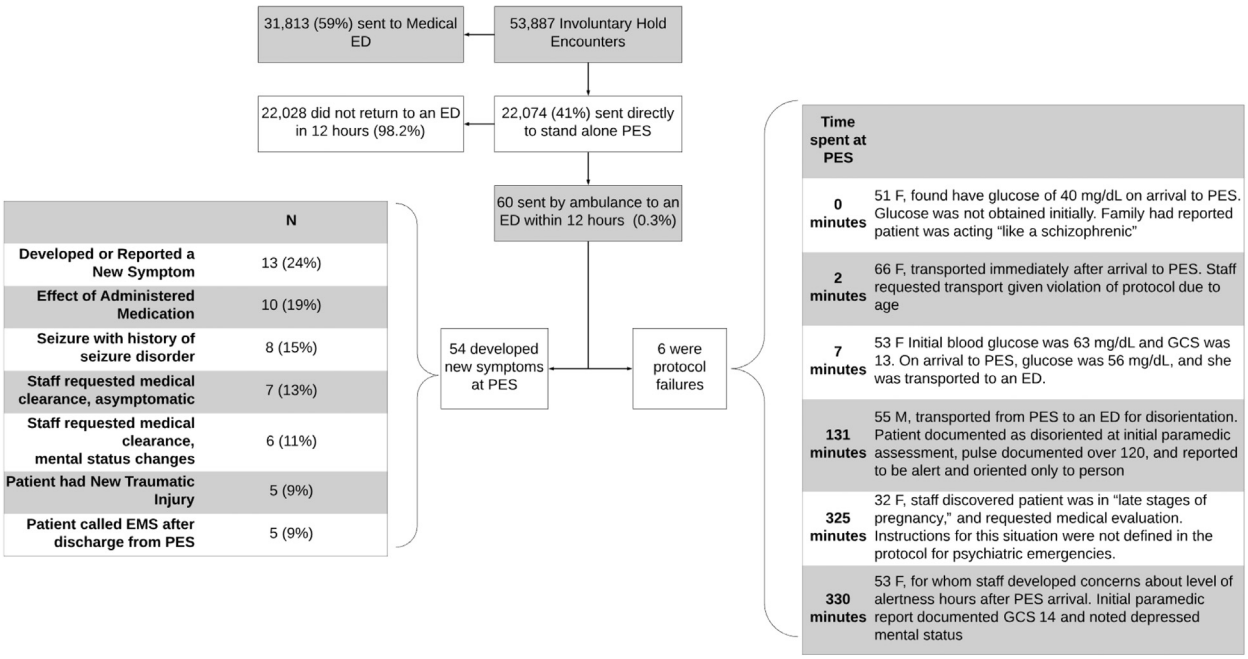


Figure 2. Encounters diverted to the psychiatric emergency services. *PES*, Psychiatric emergency services.

None of the patients died, required CPR, or required an advanced airway during their second transport. Three patients had critical interventions during the second transport: one patient received glucagon for hypoglycemia, another received naloxone for depressed mental status, and one had a nasopharyngeal airway for hypoventilation placed during transport.

LIMITATIONS

There are several limitations that must be addressed, given the nature of this observational study. First, the data used in this study are from a single county in California that has a single county-operated psychiatric emergency service. Although accurate data are not available, we suspect that police and provider thresholds for involuntary hold placement vary significantly from county to county. The California Department of Health Care Services publishes an annual report that includes counts of involuntary holds per 10,000 people. Alameda County reported a rate of 195.7 per 10,000 in 2015, 4 times the state average of 46.5, but data are unreliable because of incomplete or no reporting from most counties.[13] In counties that have higher thresholds for involuntarily transport, a diversion protocol may not be necessary if the pretest probability of having a severe concurrent medical illness is higher. Also, the diversion protocol has been in place in Alameda County for years, and the same rates of failed diversion may not be present during initial implementation phases. Second, our data did not contain a variable that indicated the EMS crew's decision to divert a patient to the psychiatric emergency service; thus, we assumed that only the patients who arrived at the psychiatric emergency service were diverted. Theoretically, patients receiving involuntary holds who initially met criteria for diversion to the psychiatric emergency service may have developed symptoms or signs during transportation, requiring their transport to a medical ED; these cases would not be classified as having failed diversion. Such "en route" diversions are a standard part of EMS care, just as an occasional patient heading to a regular ED may be diverted to an STEMI or stroke specialty center. Third, unique identifiers were not recorded at the transport, so we used a probabilistic matching algorithm to identify unique patients. This introduces some error and may lead to an underestimate of number of failed diversions. For example, a failed diversion would be missed if 2 encounters were not attributed to the same patient and 1 of the 2 encounters was a transport from the psychiatric emergency service to an ED. To ensure we did not miss any clinically important failed diversion cases, we conducted a thorough manual review of the 14 EMS transports that originated at the psychiatric emergency service and required a critical intervention. As reported above, our chart review confirmed that only 3 of these patients had arrived to the psychiatric emergency service by ambulance in the previous 12 hours. We found no evidence of problems with our unique identification

algorithm, indicating a low error rate. This is consistent with previous work using names and dates of birth to match patients; market analysis studies demonstrate that 92% of unique patients in a national US database of 300 million records can be identified by name and date of birth alone[14]; our matching protocol was more sophisticated, was locally based, and used other identifiers, including Global Positioning System coordinates.

DISCUSSION

We found that 10% of all ambulance encounters in Alameda County were for an involuntarily psychiatric hold. Although "involuntary hold patients" (those who had received at least one involuntary hold during the 5-year study) represented only 10% of unique patients, they accounted for nearly 1 in 4 ambulance encounters. "Involuntary hold patients" also disproportionately used EMS services compared with "never held patients"; they were also more likely to use EMS for behavioral health reasons, to be intoxicated, and to be picked up in a public location. Our work demonstrates the safety of a paramedic-administered screening protocol; during the study period, EMS diverted 41% of the 53,887 involuntary hold encounters directly to the psychiatric emergency service. Only 0.3% of these diverted patient encounters (n=60) needed to be transported within 12 hours of arrival to the psychiatric emergency service.

To our knowledge, this is the first and only large study to describe ED and EMS use patterns of patients receiving involuntary holds. Our work confirms results of previous studies that have shown that patients with mental illness use EMS disproportionately.[1,15] We noted that only 8% of EMS encounters for "involuntary hold patients" were for behavioral health reasons when patients were not receiving an involuntary hold, indicating that 92% of their encounters were for other reasons. Overdoses and poisoning accounted for some of these encounters, and "involuntary hold patients" far more frequently used EMS services for this reason compared with "never held patients" (11.7% versus 3.7%). Furthermore, compared with "never held patients," "involuntary hold patients" were substantially more likely to be picked up from the street or in another public location (54.6% versus 29.1%). We suspect this was due to either their propensity for homelessness or that public locations have more bystanders who may call police or EMS because of noticed erratic behavior. Unfortunately, variables for who initiated the call or homelessness were not reliably available in the database.

A previous study evaluating the out-of-hospital diversion of patients in psychiatric crisis to a psychiatric emergency service in New Mexico immediately after the implementation of a protocol found a 5.2% failed diversion rate.[7] In contrast, our study found a rate of 0.3% among 22,074 patient encounters, but the assessment was carried out years after implementation.

This work highlights how patients with severe mental illness affect the capacity of the EMS system and demonstrates that a small number of patients disproportionately receive involuntary holds. 7% of "involuntary hold patients," or 1,907 patients, received 5 or more involuntary holds during the study period (>1 involuntary hold/year), but accounted for 39% of all transports for involuntary holds. These patients represent the ideal target population for crisis intervention programs and intense wraparound services.

Our findings raise questions in regard to the need for critical care ambulances for patients receiving involuntary holds. Only 0.3% of patients receiving involuntary holds needed any critical interventions. Ambulance transports can be very expensive, and financial barriers may act as deterrents for families who need help for their loved ones. Additionally, the use of a regular ambulance may cause further agitation in a patient in psychiatric crisis. Simultaneously, paramedic expertise in the field allowed 41% of patients receiving involuntary holds to be safely diverted from medical EDs to the psychiatric emergency service. This significantly unburdens medical EDs and undoubtedly increases ED capacity for other patients. Counties should consider increasing funding for mobile crisis teams staffed by professionals who can direct patients to medical EDs or psychiatric emergency service units, depending on their evaluation.

Further research is needed to better understand the optimal strategy for the out-of-hospital management of psychiatric emergencies.

Supervising editor: Theodore R. Delbridge, MD, MPH

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Author contributions: TKT conceived the study. MG, GH, and KAS helped in design and data collection. DLS provided statistical

advice on study design and helped to analyze the data. TKT drafted the article, and all authors contributed substantially to its revision. TKT takes responsibility for the paper as a whole.

All authors attest to meeting the four ICMJE.org authorship criteria: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND (2) Drafting the work or revising it critically for important intellectual content; AND (3) Final approval of the version to be published; AND (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Funding and support: By *Annals* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see www.icmje.org). Dr. Trivedi was supported by the UCLA National Clinician Scholars Program at the David Geffen School of Medicine at UCLA, the VA Office of Academic Affiliations through the VA/National Clinician Scholars Program, and the David Geffen School of Medicine at UCLA. The contents do not represent the views of the U.S. Department of Veterans Affairs or the United States Government.

Publication dates: Received for publication March 10, 2018. Revisions received June 8, 2018, and July 30, 2018. Accepted for publication August 13, 2018. Available online September 28, 2018.

REFERENCES

1. Larkin GL, Claassen CA, Pelletier AJ, et al. National study of ambulance transports to United States emergency departments: importance of mental health problems. *Prehosp Disaster Med*. 2006;21:82-90.
2. American College of Emergency Physicians. Psychiatric and substance abuse survey. Available at: http://www.acep.org/uploadedFiles/ACEP/newsroom/NewsMediaResources/StatisticsData/Psychiatric Boarding Summary.pdf.
3. Stefan S. *Emergency Department Treatment of the Psychiatric Patient*. Oxford, United Kingdom: Oxford University Press; 2006.
4. Zeller S, Calma N, Stone A. Effects of a dedicated regional psychiatric emergency service on boarding of psychiatric patients in area emergency departments. *West J Emerg Med*. 2014;15:1-6.
5. Santillanes G, Donofrio JJ, Lam CN, et al. Is medical clearance necessary for pediatric psychiatric patients? *J Emerg Med*. 2014;46:800-807.
6. Korn CS, Currier GW, Henderson SO. "Medical clearance" of psychiatric patients without medical complaints in the emergency department. *J Emerg Med*. 2000;18:173-176.
7. Cheney P, Haddock T, Sanchez L, et al. Safety and compliance with an emergency medical service direct psychiatric center transport protocol. *Am J Emerg Med*. 2008;26:750-756.
8. Moulin A, Jones K. The Alameda model: an effort worth emulating. *West J Emerg Med*. 2014;15:7-8.
9. Bernstein M. Psychiatric ER proposed for Portland would provide new link in mental health crisis treatment. Available at: https://www.oregonlive.com/portland/index.ssf/2014/12/psychiatric_er_proposed_for_po.html. Accessed September 18, 2018.
10. Graham J. County to get first emergency centers for psych patients, unburdening hospitals. Available at: https://www.ocregister.com/2016/08/24/county-to-get-first-emergency-centers-for-psych-patients-unburdening-hospitals. Accessed September 18, 2018.
11. Raffo J. MATCHIT: Stata module to match two datasets based on similar text patterns. Available at: https://ideas.repec.org/c/boc/bocode/s457992.html. Accessed December 7, 2017.
12. Grannis S, Overhage J, McDonald C. Real world performance of approximate string comparators for use in patient matching. *Stud Health Technol Inform*. 2004;107:43-47.
13. Department of Health Care, Services. California Involuntary Detentions Data Report Fiscal Year 2015-2016. Available at: https://www.dhcs.ca.gov/services/MH/Documents/FMORB/FY15-16_Involuntary_Detentions_Report.pdf. Accessed September 18, 2018.
14. Barr JR, Coggeshall S, Zhao W. The trouble with names/dates of birth combinations as identifiers. Available at: http://www.idanalytics.com/media/The_Trouble_With-Names_White_Paper_FINAL.pdf. Accessed December 14, 2017.
15. Durant E, Fahimi J. Factors associated with ambulance use among patients with low-acuity conditions. *Prehosp Emerg Care*. 2012;16:329-337.