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ORIGINAL RESEARCH

Emergency Medical Services

Safety of a prehospital emergency medical services protocol for an alternative destination for pediatric behavioral emergencies in Alameda County

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Abstract

Background: Pediatric patients with behavioral health emergencies (BHEs) are often transported to an emergency department (ED) by emergency medical services (EMS), despite having no physical medical complaints, to await psychiatric evaluation and treatment. This process leads to significant delays in their care. We examined the safety of directly transporting pediatric patients with BHEs from the field to an alternative destination of a psychiatric emergency service (PES) facility using an EMS protocol.

Methods: A retrospective review from November 1, 2011, to November 1, 2016, was conducted for pediatric EMS encounters using EMS data from Alameda County, California. Our primary outcome was the safety of a prehospital alternative destination protocol. We identified the proportion of patients who required retransport to an ED within 24 h after arriving at PES (defined as a failed diversion). We also describe the mortality of all patients being transported for a BHE.

Results: There were 38,241 total pediatric encounters, with 20.1% for BHEs. A total of 3122 (41%) BHE encounters met protocol criteria and were transported directly to the PES. Only 16 (0.5%) patients had a secondary transport (failed diversion) to an ED within 24 h of arrival. No patients with a BHE transported to the PES died within 30 days of the EMS encounter.

Conclusion: Death and adverse clinical outcomes are extremely rare in pediatric patients using a prehospital alternative destination protocol. This information could significantly improve the care of children with BHEs.

KEYWORDS

behavioral health emergency, pediatrics, prehospital

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1 | INTRODUCTION

1.1 | Background

Approximately 30% of all pediatric behavioral health emergency (BHE) related emergency department visits in the United States arrive by emergency medical services (EMS) ambulances,¹⁻⁴ indicating the importance of prehospital assessment and management of children with BHEs. The United States is experiencing a marked increase in pediatric behavioral emergencies.^{5,6} The current behavioral health system has limited options for acute crisis assessment and treatment options.⁷⁻⁹ As a result, BHE patients are referred to EDs, which have become the de facto safety net and primary entry point for this patient population.¹⁰⁻¹²

1.2 | Importance

The American Academy of Pediatrics has acknowledged pediatric BHEs as a crisis and identified barriers to the delivery of important services in a majority of EDs, including the absence of mental health clinicians, the lack of in-patient psychiatric beds, and an often inadequate setting for comprehensive mental health evaluations.^{2,12-14} Pediatric BHE visits with a very long length of stay (>12 h) have increased from 5.3% in 2005 to 12.7% in 2015, reflecting long waits for psychiatric inpatient beds.¹⁵ Traditionally, the role of the ED for these patients is to rule out non-psychiatric explanations for the BHE (ie, hypoglycemia, ingestions, trauma, etc). For many BHE patients, an ED visit and routine lab testing are unnecessary because most of these patients do not have a non-psychiatric cause for their symptoms and do not receive any definitive medical or psychiatric treatment in the ED.¹⁶⁻¹⁹

In Alameda County, California, a prehospital alternative destination protocol has been implemented to bypass the ED. Paramedics are trained to use a field-screening protocol ([Appendix, Section A](#)) to identify children presenting with a BHE who can safely be transported directly to a regional pediatric psychiatric emergency services (PESs) facility.²⁰ Although this approach has been demonstrated to be safe in adults,^{21,22} no data are available on the safety of an alternative destination BHE protocol for children.

1.3 | Goals of this investigation

The aims of this study are to describe the characteristics and usage patterns of all pediatric patients serviced by Alameda County EMS, to describe the prevalence of BHE encounters and patients with BHEs, and to assess the safety of an EMS protocol to transport pediatric BHE patients to an alternative destination (the PES).

2 | METHODS

We reviewed all Alameda County, California EMS encounters with all patients <18 years old that occurred from November 1, 2011, to

The Bottom Line

This study of an emergency medical services protocol for alternate transport destinations for pediatric behavioral health emergencies found that the protocol successfully identified pediatric patients who could be safely transported to a mental health facility instead of the emergency department.

November 1, 2016. In order to describe mortality in this population, we identified unique patients and linked these encounters with the Alameda County Public Health Vital Statistics Registry. We describe the data at the patient level and at the encounter level. The study was approved by the University of California, Los Angeles Institutional Review Board with a waiver of informed consent given this was a retrospective record review.

2.1 | Setting

Alameda County, California is an urban/suburban county in Northern California with 1.6 million residents in a 737-square-mile region. It has the highest reported rate of BHEs among counties in California; per the California Department of Health Services, in fiscal year 2015-2016, the BHE rate was 75.3 per 10,000 children, measured as the overall psychiatric involuntary hold placement.²³

The Alameda County EMS (ALCO EMS) agency manages protocols for paramedics, provides ongoing quality oversight and improvement strategies, and maintains a database of all EMS encounters. The paramedic-staffed ambulances respond to 125,000 EMS calls and transport 90,000 patients each year.

In Alameda County, when the 9-1-1 response system is activated for a BHE, both EMS and police officers arrive at the scene. If the BHE is considered severe, the patient is then transported by EMS to one of the regional EDs.

2.2 | Alternative destination protocol

To reduce unnecessary ED transports for BHEs, the ALCO EMS agency developed and approved an alternative destination (diversion) protocol ([Appendix, Section A](#)) that guides EMS to identify pediatric patients (12 years of age and older) with BHEs who are at low risk for a medical cause of their BHE. Per the EMS policy, pediatric patients who are younger than 12 years or otherwise do not meet protocol criteria are transported directly to an ED. Additionally, the paramedics retain the ability to override the protocol and transport a patient to an ED even if all criteria for diversion are met. Otherwise, if protocol criteria are met, EMS can transport pediatric BHE patients directly to the county's free-standing pediatric PES, the Willow Rock Center. This center consists of

an inpatient unit and a 24-h crisis stabilization unit. Approximately 43% of patients arrive directly by ambulance, 15% self-present, and 42% are transported from an ED after medical clearance (Jessie Eschmann and John Adam, Willow Rock leadership, personal communication, June 3, 2019).

2.3 | Data collection

ALCO EMS staff record data into a computerized patient care report, which is then uploaded to a centralized EMS database provided by Zoll Data Systems (Broomfield, Colorado). Within this database, information for each patient encounter is available including patient name, date of birth, global positioning system (GPS) coordinates, location type (school, home, etc), paramedic clinical impressions, vital signs, clinical condition, Medical Priority Dispatch System (MPDS) codes, transport destination, and whether a critical EMS intervention was required. In addition, EMS workers include a free text narrative description of the encounter. EMS dispatches that resulted in no patient contact were excluded from the data set.

2.4 | Unique patient identification

ALCO EMS data are encounter based and do not include a variable to uniquely identify patients. Names and dates of birth can be subject to misspelling and mis-entry during input by EMS clinicians.²⁴ In order to describe the data at the patient level, we assigned each encounter to a unique patient identifier resulting in a longitudinal data set, using a previously described probability-based matching strategy (see, [Appendix, Section B and C](#)).²¹ To address minor errors in spelling patient names or inputting dates of birth, we used a conservative 7-cycle matching strategy ([Appendix, Section B and C](#)) using the MATCHIT tool²⁵ in Stata (version 15.0; StataCorp, College Station, Texas, USA). A small number of encounters had missing information for name, date of birth, or both ($N = 4795/591,931$, 0.8%), and because we could not assign a unique patient identifier to these encounters, they were excluded from the study. After unique patient identification, we created a pediatric data set, restricting it to encounters with patients who were under the age of 18 at the time of the encounter.

2.5 | Defining BHE visits

We used 3 fields from the data set to determine whether a patient was experiencing a BHE: the destination facility, the MPDS code, and the medic narrative; the exact details of this method can be found in the [Appendix, Section D and Figure D1](#). A brief discussion of the method follows. First, all encounters that were transported directly to the PES were classified as BHEs. Second, we used both the MPDS codes and medic narratives to identify BHEs. There were 2 MPDS codes that Alameda County EMS used to designate BHE: 25A or 5150. This field was not always complete ($N = 4204/38,241$, 11.0%). Additionally, if the

medic narrative field included the term “on a 5150” ([Appendix, Section D](#)) the encounter was also classified as a BHE. The term “5150” was important in identifying BHEs because involuntary psychiatric holds are described under section 5585 of the California Welfare Code, and the term “5150” is used colloquially in California by medical staff, police, ambulance workers, and lawyers to refer to all behavioral holds.

Paramedic-coded primary impressions were available but were not used for classification. We compared the strategies and found that this method allowed for more accurate classification of BHE encounters, especially in cases that the patient had an associated physical complaint (ie, overdose, trauma, pain). We include the primary impressions for all encounters and provide the proportion of each impression category that we classified as a BHE in the supplement ([Appendix, Section D](#)).

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 “behavioral patients” (patients who had at least 1 BHE during the study period) and “non-behavioral patients” (those who never had a BHE). At the encounter level, we describe and compare basic characteristics for BHE encounters versus non-BHE encounters.

2.6 | Primary outcome: Failed diversion

Our primary objective was to describe the safety of direct transport to the regional PES, bypassing medical clearance in an ED. The PES provides psychiatric stabilization services as opposed to ED services such as intravenous fluids/medications or cardiac/respiratory monitoring. Decisions to triage patients to an ED are based on judgment of the PES staff who call 9-1-1 if they have a patient they believe requires ED services. Thus, we defined a failed diversion as a patient transported directly to PES and who was retransported to a medical ED within 24 h. The failed diversion proportion was used as a proxy measure for safety of the protocol; the underlying assumption is that a patient who is inappropriately brought to the PES will “declare themselves” within 24 h, leading the staff to call 911 and request emergency transport to an ED.

We identified EMS failed diversions for BHEs in 2 ways. First, we used the unique identifier we developed to identify all patients who had 2 or more transports in a 24-h time period. For these patients, we classified the first encounter as a failed diversion if the following criteria were met: (1) the first transport was for a BHE, (2) the patient was transported to the PES on the first encounter, and (3) the patient was subsequently transported to an ED on the second encounter.

Second, to ensure that no clinically important failed diversions were missed because of an incorrectly assigned unique identifier, we conducted a thorough manual review of all EMS encounters that originated at the PES. This was done by creating a bounding box around Willow Rock Center using GPS coordinates to identify all EMS encounters that originated at this site ([Appendix, Section E](#)). For these encounters ($n = 69$) identified geographically, 2 authors (N.G., T.T.) manually read through the names, dates of birth, and narratives of all transports with a PES destination in the preceding 24 h. We found that only

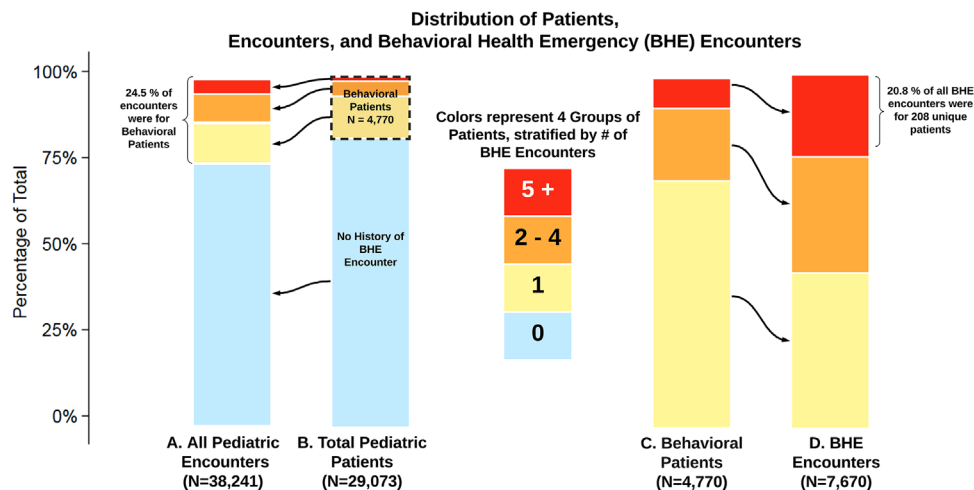


FIGURE 1 Distribution of patients, encounters, and BHE encounters. Abbreviation: BHE, behavioral health emergency.

2 patients with a similar name or birth date had been transported under a different unique identifier, which provided credence to the unique identification process.

Two emergency physicians (T.T., N.G.) manually reviewed each of the paramedic narratives for the encounters labeled as failed diversions. We generally classified the explanation for the retransport (new symptom, previously missed medical indication, etc.) after reading through the paramedic narratives for both the initial transport and the retransport.

2.7 | Secondary outcome: Mortality

To describe mortality in this cohort, we linked data from Alameda County Public Health Vital Statistics Registry. We obtained mortality data for all deaths in the county between November 1, 2011 and November 1, 2017 inclusive. An additional year of data (2016–2017) was obtained to allow for calculation of a minimum of 365-day period of follow-up for mortality after the final EMS encounter in the data set. Again, because there was no common identifier to link the two databases, we developed a strategy to link patients based on similarity of names and dates of birth ([Appendix, Section F](#)).

3 | RESULTS

During the study period, EMS treated 29,073 unique pediatric patients, and 16.4% ($N = 4770$) were behavioral patients and had at least 1 encounter for a BHE. Of the behavioral patients, a total of 208 (4.4%) had 5 or more BHEs encounters; this subset of patients accounted for 20.8% ($N = 1594$) of all BHE encounters (Table 1 and Figure 1).

At the encounter level, there were a total of 38,241 pediatric EMS encounters, and 20.1% ($N = 7670$) were for BHEs; BHEs were the second most common reason for ambulance transport of children, after trauma. Of interest, 89.3% ($N = 6846/7670$) of these BHE encoun-

TABLE 1 Patient characteristics ($N = 29,073$ unique patients).

Patient characteristics	Behavioral patients (≥ 1 BHE Encounters) $N = 4770$	Non-behavioral patients (0 BHE Encounters) $N = 24,303$
% Male	45.1%	53.0%
Total encounters per patient, No. (%)		
1	2945 (61.7%)	21,419 (88.1%)
2	930 (19.5%)	2035 (8.4%)
3–5	662 (13.9%)	747 (3.1%)
≥ 6	233 (4.9%)	102 (0.4%)
Total BHE encounters per patient, No. (%)		
1	3515 (73.7%)	–
2–4	1047 (21.9%)	–
≥ 5	208 (4.4%)	–
Total encounters (%) ($N = 38,241$)	9369 (24.5%)	28,872 (75.5%)
Overall mortality at end of study period	17 (0.4%)	153 (0.6%)
Days since any encounter		
< 30	1	101
Within 30–365	3	30
After 365	13	22
Days since final BHE encounter		
< 30	0	–
Within 30–365	3	–
After 365	14	–

Abbreviation: BHE, behavioral health emergency.

TABLE 2 Encounter characteristics (N = 38,241 encounters).

	BHE encounters N = 7670	All other pediatric encounters N = 30,571
Age, IQR	15.1 (13.6–16.6)	10.1 (2.9–15.4)
Location of EMS pick-up		
School	1806 (23.5%)	2928 (9.6%)
Home	3371 (43.9%)	14,983 (49.0%)
Other	2493 (32.5%)	12,660 (41.4%)
Clinical information ^a		
Trauma	489 (6.4%)	9506 (31.1%)
Seizure	88 (1.2%)	5404 (17.7%)
Overdose/poisoning	469 (6.1%)	1213 (4.0%)

Abbreviations: BHE, behavioral health emergency; EMS, emergency medical services; IQR, interquartile range.

^aThese impressions were recorded by paramedics in either the primary or secondary impression.

ters were for patients who met age criteria for diversion to the PES (pediatric encounters with age ≥ 12 , N = 20,273).

Comparing BHE encounters to non-BHE encounters, BHE encounters occurred more often in older children (median age 15.1, interquartile range [IQR]: 13.1–16.6 vs. 10.1, IQR: 2.9–15.4). BHE encounters more frequently occurred at school (23.5%) when compared to non-BHE encounters (9.6%) (Table 2). The most frequent additional paramedic clinical impressions in BHEs include trauma (6.4%), seizure (1.2%), and overdose/poisoning (6.1%) (Table 2).

A total of 3122 (41%) BHE encounters met all diversion protocol criteria and were transported directly to PES. There were 27 unique patients who had a second transport within 24 h after being transported for a BHE. Manual review demonstrated that a total of 16 patients (0.5%) failed diversion; these 16 patients were first taken to the PES and then were retransported to an ED within 24 h of arrival to the PES (Figure 2). The other 11 patients were taken to an ED first, deemed safe for evaluation at the PES, and then were retransported back to an ED within 24 h. None of the patients required any critical EMS intervention. Of the 16 patients with failed diversion, 5 were retransported for symptoms that developed or were reported after arrival at the PES (eg, chest pain, headache). Four of the retransports were for either staff-suspected or patient-reported ingestion that had not been previously identified by EMS. In addition, 2 patients were retransported because of an unsupervised departure (elopement) from the facility, 2 patients were retransported for agitation, and 2 patients were retransported because of a non-specific staff request. The median time before retransport at the PES was 2.5 h, ranging from 1.4 h to 6.0 h.

Notably, none of the behavioral patients (whether taken directly to an ED or to the PES) died within 30 days of their final BHE encounter. Of all behavioral patients transported during the study period, 17/4770 (0.4%) died by November 1, 2017 (Table 1). Of these 17 behavioral patients who expired, 3 died between 30 and 365 days after their final BHE encounter, and 14 died more than 365 days after

their final BHE encounter. Comparatively, of the 153 non-behavioral patients who expired, 101 died within 30 days of their final EMS encounter, 30 died within 30–365 days, and 22 died after 365 days.

In assessing EMS usage patterns for the behavioral patients who died, we noted that 8/17 were transported by EMS only once during the study period, 4/17 were transported twice, and 5/17 were transported 3 or more times.

4 | LIMITATIONS

There are some limitations to the generalizability of the results from this study. Our data included pediatric patient encounters with EMS in a single county in northern California with an established field medical clearance protocol. There may be regional differences in the severity and types of pediatric BHEs, which could influence the safety of field medical clearance.

Second, there may be some underreporting in the identification of failed diversions and retransports. Because EMS staff do not assign unique identifiers and sometimes inaccurately record patient information (names and dates of birth), this study relied on a probabilistic data matching algorithm to identify unique patients. If the algorithm inaccurately assigned the same patient a different unique identifier on the second, there was a possibility of missing a retransport. In order to minimize this error, we employed a secondary strategy of using a GPS bounding box to identify transports originating at the PES, and scrutinized all visits to the PES in the preceding 24 h. Only 2 additional patients with duplicate unique identifiers were discovered using this secondary strategy, and only 1 had met criteria for the primary outcome of retransport; this suggests that this limitation is unlikely to affect the validity of the study. Furthermore, we found minimal evidence of problems with our unique identification strategy, 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,²⁶ our matching protocol was more sophisticated, was locally based, and used other identifiers, including GPS coordinates.

Though we include data on all patients < 18 years of age, the EMS protocol did not allow transport directly to the PES for children under 12 years of age. 89.3% of BHE encounters were ≥ 12 , making 10.7% of all pediatric patients with BHEs ineligible for diversion to the pediatric PES. These patients were all transported to an ED; 89% of children < 12 were taken to the county's Pediatric Level One Trauma Center (Benioff Children's Hospital, Oakland ED). We do not suspect there would be a significant difference in failed diversion proportion in this population but further studies on children < 12 years old with a BHE are warranted. Additionally, we were not able to identify the reasons why patients were taken to the ED despite meeting protocol criteria, as the protocol allows for the paramedic's subjective impression when deciding in favor of ED transport. A prospective study could capture the decision making around whether or not the diversion protocol was implemented.

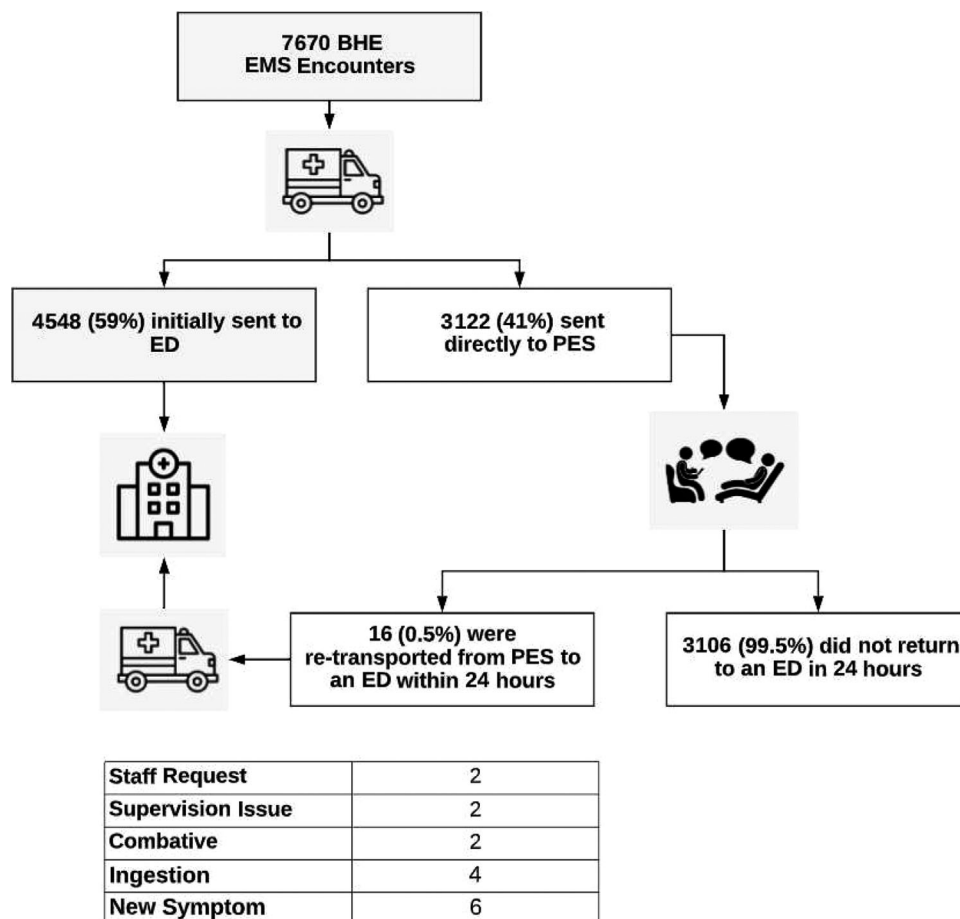


FIGURE 2 Summary of pediatric BHE transports and safety of prehospital medical clearance allowing direct transport to a psychiatric emergency services center. Abbreviations: BHE, behavioral health emergency; ED, emergency department; EMS, emergency medical services; PES, psychiatric emergency services.

Finally, mortality records were limited to those deaths occurring in Alameda County. If a patient died outside of the county, it is possible that the death may have been missed.

5 | DISCUSSION

The EMS alternative destination protocol was safe as measured by the rates of failed diversion and mortality. Using the protocol established by Alameda County EMS, 41% of pediatric patients with BHEs were directly transported to the regional pediatric PES, bypassing medical clearance in the ED. Our findings are consistent with other previously published studies involving adults²⁰⁻²² that demonstrate the potential of alternative destinations to decrease the burden on local EDs and, more important, allow for more timely evaluation and treatment for patients with a BHE. Failed diversion, as measured by EMS retransport to the ED within 24 h was extremely rare, occurring in 16 out of the 3122 (0.5%) encounters taken directly to the PES. These data support the potential safety of EMS alternative destination protocols for BHEs in a pediatric population. Furthermore, death is rare in pediatric patients after EMS diversion for a BHE. Using this prehospital pro-

ocol, pediatric patients with BHEs in Alameda County can be safely transported from the field directly to a pediatric PES.

Our study demonstrates an example of how a regional prehospital program can coordinate care with pediatric EDs and PES centers. Potential challenges in replicating this in different settings include variations in EMS protocols, data systems, and BHE resources. Most important, the availability of an alternative destination like the PES center in Alameda County does not widely exist.⁷⁻⁹ Furthermore, there is limited data on the prehospital pediatric BHE environment and the availability of PES centers across the country, warranting further investigation.

There is no evidence supporting the need for transport of all children experiencing a BHE to an ED. Traditional arguments for this practice come from the belief that an ED visit is required to evaluate patients to identify physiologic emergencies that are masquerading as BHEs. However, evidence indicates that most laboratory tests in patients with BHE are unnecessary.¹⁶ Expanding on this, our study demonstrates that patients can be safely triaged in the prehospital setting. Universal ED transport for BHE patients likely stems from the lack of alternative destinations where these patients can be managed safely. It is well documented that the ED is not an ideal environment for this

purpose and prolonged time in this location can often be detrimental to the mental health of children already in crisis. Future policy should focus on developing a more patient-centered system for the evaluation and treatment of children experiencing BHEs.

AUTHOR CONTRIBUTIONS

All authors meet the International Committee of Medical Journal Editors. Drs. Nicolaus Glomb, Tarak Trivedi, Jacqueline Grupp-Phelan, and Karl Sporer conceived and designed the study and supervised the conduct of the data collection. Dr. David Schriger provided statistical support on study design and data analysis. No one other than the listed authors had control over the data, over how the data were analyzed or interpreted, or over the wording or conclusions used by the authors in the manuscript. All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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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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