American Journal of Emergency Medicine 37 (2019) 1829–1835

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Original Contribution

# Factors associated with boarding and length of stay for pediatric mental health emergency visits

Jennifer A. Hoffmann, MD *, Anne M. Stack, MD, Michael C. Monuteaux, ScD, Romy Levin, Lois K. Lee, MD, MPH

*Division of Emergency Medicine, Boston Children's Hospital, 300 Longwood Ave., Boston, MA, United States of America*

ARTICLE INFO

*Article history:*
Received 27 November 2018
Received in revised form 19 December 2018
Accepted 22 December 2018

*Keywords:*
Mental health boarding
Length of stay
Emergency department

ABSTRACT

*Objective:* To determine demographic and clinical risk factors associated with boarding (length of stay ≥24 h) for pediatric mental health emergency department (ED) visits.
*Methods:* This is a retrospective cross-sectional analysis of mental health visits identified by diagnosis codes for children 5–18 years old presenting to a tertiary pediatric ED in 2016. We performed multivariate logistic regression to identify demographic and clinical factors associated with boarding.
*Results:* There were 1746 mental health visits and 386 (22%) visits had length of stay ≥24 h. In the multivariate logistic regression model, factors associated with boarding included: private insurance (OR 1.59, 95% CI 1.15, 2.19) and having both private and public insurance (OR 1.68, 95% CI 1.16, 2.43) relative to public insurance; presentation during a school month (OR 2.17, 95% CI 1.30, 3.63); physical or chemical restraint use (OR 4.80, 95% CI 2.61, 8.84); comorbid autism or developmental delay (OR 1.82, 95% CI 1.35, 2.46); prior psychiatric hospitalization (OR 2.55, 95% CI 1.93, 3.36); and reasons for presentation of agitation, aggression, or homicidal ideation (OR 2.76, 95% CI 1.40, 5.45), depression, self-injury, or suicidal ideation (OR 2.79, 95% CI 1.45, 5.40), and bipolar, mania, or psychosis (OR 5.78, 95% CI 2.36, 14.09) relative to anxiety.
*Conclusions:* Insurance status, presentation month, restraint use, autism or developmental delay comorbidity, prior psychiatric hospitalization, and reason for presentation are associated with pediatric mental health ED boarding. Resources should be directed to improve the mental health care system for children with identified risk factors for boarding.



## 1. Introduction

Mental health disorders among children are common, with at least 1 in 8 children experiencing a mental health condition in a given year [1,2]. Pediatric mental health visits to the emergency department (ED) are rising over time and have a longer length of stay (LOS) than visits for non-mental health conditions [3-5]. When children require intensive psychiatric care, they may board in the ED or on the inpatient pediatric unit for a prolonged time period while awaiting appropriate psychiatric placement [6,7]. Boarding for ED mental health visits has been defined as a LOS ≥ 24 h [8,9]. While boarding, patients typically receive little to no directed acute mental health care, such as counseling or medication management, and overcrowding by boarders may impact the ability to care for other patients [10-13]. From 2001 to 2008, a national sample estimated that 7% of pediatric mental health ED visits exceeded 24 h, with prolonged visits increasing over time [5]. ED boarding demonstrates inadequate capacity in the pediatric mental health system to serve the demand for acute mental health services, and will require system-wide reforms to address [12]. Identification of the particular subgroups at highest risk for ED boarding may reveal focused targets for improvements to the pediatric mental health care system.

Factors that have been previously associated with longer ED length of stay for pediatric mental health visits include female sex, uninsured status, history of autism or developmental delay, history of self-harm, severe suicidal ideation (defined as having both plan and intent), psychosis, and presentation during school months [6,14]. The current prevalence and risk factors for prolonged ED LOS (over 24 h) are less well known, and have likely changed over time with changes in the prevalence of mental health conditions and access to mental health services. The objectives of

* Corresponding author at: Division of Emergency Medicine, Boston Children's Hospital, 300 Longwood Ave., Boston, MA 02115, United States of America.
*E-mail addresses:* Jennifer.Hoffmann@childrens.harvard.edu (J.A. Hoffmann), Anne.Stack@childrens.harvard.edu (A.M. Stack), Michael.Monuteaux@childrens.harvard.edu (M.C. Monuteaux), Lois.Lee@childrens.harvard.edu (L.K. Lee).

https://doi.org/10.1016/j.ajem.2018.12.041
0735-6757/

our study are to determine the current prevalence of psychiatric boarding, defined as ED LOS ≥ 24 h, and to identify demographic and clinical risk factors associated with boarding among children presenting to the ED with mental health emergencies.

## 2. Methods

### 2.1. Study design and setting

We conducted a retrospective cohort analysis of pediatric mental health ED visits at an urban tertiary care children's hospital from January 1, 2016 to December 31, 2016 to determine the prevalence of boarding and the risk factors associated with prolonged ED LOS. The hospital has approximately 400 inpatient medical beds, a 16-bed inpatient pediatric psychiatric unit, and a 12-bed affiliated community-based acute treatment (CBAT) unit on a different campus. Social workers who specialize in mental health care staff the ED 24 h per day. This study was approved by our hospital's institutional review board.

### 2.2. Study population

We identified mental health ED visits by the presence of any International Classification of Diseases, Tenth Edition, Clinical Modification (ICD-10-CM) discharge code for a mental health condition (F20-69, F90-99, R45 except R45.82, R46.81, R46.89, Z91.83), adapted from prior work on pediatric mental health ED visits [4,14-16]. Visits were included for children 5–18 years old, as mental health diagnoses are uncommon in infants and toddlers, and this age range has been used in prior studies of pediatric ED mental health utilization [4,17,18]. Visits were excluded if the primary reason for presentation to the ED was for a physical rather than mental health complaint, based on review of the ED physician electronic medical record (EMR).

### 2.3. Measurements

We collected data on patient demographics (sex, age, race/ethnicity, insurance), timing of presentation (time of day, day of week, calendar month), clinical characteristics (reason for presentation, history of autism or developmental delay, presence of a chronic medical condition, current outpatient mental health care, prior psychiatric hospitalization, prior mental health ED visit within 1 year), physical or chemical restraint use, diagnostic testing performed, and disposition from the ED. Study data were collected and managed using REDCap electronic data capture tools hosted at our institution [19].

Age was categorized into 5–8, 9–12, 13–15, and 16–18 years old. Timing of ED presentation was categorized by ED check-in time based on common provider shift times as follows: daytime from 7 AM–2:59 PM, evening from 3 PM–10:59 PM, and overnight from 11 PM–6:59 AM. A visit during a school month was defined as September through June, based on local school calendars [20]. We defined a mental health visit as a repeat visit if the patient had been seen in our ED within 1 year with an ICD-10 mental health discharge diagnosis.

We grouped the primary reason for presentation, as documented in the ED physician EMR, into five clinical diagnosis categories: 1) anxiety; 2) aggression, agitation, or homicidal ideation; 3) depression, self-injury, or suicidal ideation; 4) bipolar, mania, or psychosis; and 5) other mental health conditions (e.g. attention-deficit/hyperactivity disorder, eating disorders, tic disorders, etc.), which were adapted from prior classification schemes [5,16,21]. If more than one reason for presentation was listed, we considered the reason listed first to be the primary reason for presentation. Current outpatient mental health care was defined broadly to include existing care with psychiatrists, psychologists, or other mental health clinicians. Patients whose current outpatient care was not documented were categorized as having no current outpatient care. Patients with no documentation of prior psychiatric hospitalizations were categorized as having no prior psychiatric hospitalization. If a discrepancy existed between the trainee and attending note, the trainee note was considered the definitive data, as these typically had more detail available. When any history elements were absent from physician notes, we reviewed psychiatric social work records as a secondary source of information.

We were unable to clearly distinguish oral chemical restraints from scheduled oral maintenance medications in the medication administration record. Thus chemical restraint use was narrowly defined as intramuscular (IM) or intravenous (IV) administration of diphenhydramine, lorazepam, olanzapine, or haloperidol, which are the medications most commonly used in our ED for this purpose. Use of chemical and physical restraints was combined into a general category of restraint use, given the infrequency of restraint use.

At our hospital, mental health patients awaiting inpatient or CBAT psychiatric bed placement may be admitted to the inpatient medical unit for continued boarding if no appropriate placement is found after 2 searches, which is generally after the patient has been in the ED for over 24 h. Disposition for mental health patients from the ED was categorized into the following categories: 1) inpatient psychiatric admission at our hospital; 2) medical floor admission (for medical reason vs. continued boarding awaiting psychiatric bed placement); 3) transfer to inpatient psychiatric facility; 4) transfer to CBAT; 5) discharge home with follow up at a partial hospital program; 6) discharge to a residential facility; and 7) discharge home with outpatient care.

The primary outcome measure was an ED LOS ≥ 24 h, as measured by the difference between check-in and check-out times.

### 2.4. Data analysis

Descriptive statistics were calculated for demographics, clinical characteristics, diagnostic testing, and restraint use. Median LOS in hours with interquartile ranges (IQR) was calculated for all mental health patients and for each demographic and clinical subgroup. Frequencies of visit characteristics were determined for visits with LOS < 24 h and ≥ 24 h. To identify risk factors associated with boarding, we conducted logistic regression analyses, calculating odds ratios (OR) with 95% confidence intervals (CI). For the multivariate regression model, we selected variables hypothesized to be predictive of ED LOS ≥ 24 h based on clinical plausibility and prior literature. Disposition was included in the univariate, but not the multivariate analysis, as this variable is collinear with LOS. The predictors we examined included: sex, age group (referent 5–8 years), race/ethnicity (referent white/non-Hispanic), insurance type (referent public insurance), time of day (referent daytime), day of week, school month, reason for presentation (referent anxiety, chosen based on having the shortest LOS), IM/IV chemical or physical restraint use, autism or developmental delay, chronic medical condition, current outpatient mental health care, prior psychiatric hospitalization, and prior mental health ED visit within 1 year [5,6,14,22,23]. All analyses were conducted in Stata version 13.0 (StataCorp, College Station, TX).

## 3. Results

There were 1746 mental health ED visits identified for children 5–18 years old in 2016. The age group of 13–15 years old accounted for the largest proportion (35%), and 45% had public insurance (Table 1). Diagnostic evaluation performed during mental health ED visits included urine testing (hCG or urine toxicologic screening) in 73% of visits, serum laboratory testing in 21% of visits, electrocardiogram in 75% of visits, and head imaging (head

**Table 1**
Demographic and clinical characteristics of mental health visits, 2016.

| Visit characteristic | Visits (%) N = 1746 | Median length of stay in hours (IQR) |
|---|---|---|
| Sex | | |
| Female | 897 (51%) | 6.8 (4.4, 21.3) |
| Male | 849 (49%) | 7.0 (4.4, 23.3) |
| Age group | | |
| 5–8 | 214 (12%) | 5.6 (3.9, 18.7) |
| 9–12 | 475 (27%) | 6.4 (4.3, 23.3) |
| 13–15 | 607 (35%) | 7.3 (4.7, 23.2) |
| 16–18 | 450 (26%) | 7.5 (4.4, 20.5) |
| Race/ethnicity | | |
| White/non-Hispanic | 881 (50%) | 6.8 (4.5, 22.8) |
| Black/non-Hispanic | 354 (20%) | 6.8 (4.4, 21.8) |
| Hispanic | 210 (12%) | 7.2 (4.3, 24.0) |
| Other | 301 (17%) | 7.0 (4.3, 20.7) |
| Insurance type | | |
| Public | 777 (45%) | 6.4 (4.2, 20.6) |
| Private | 731 (42%) | 6.9 (4.5, 22.0) |
| Both | 236 (14%) | 9.0 (4.8, 27.8) |
| Uninsured | 2 (0.1%) | 5.8 (2.6, 9.1) |
| Time of day | | |
| Day (7 AM–2:59 PM) | 748 (43%) | 6.9 (4.9, 23.6) |
| Evening (3 PM–10:59 PM) | 848 (49%) | 6.7 (4.1, 22.0) |
| Overnight (11 PM–6:59 AM) | 150 (9%) | 7.8 (3.8, 14.9) |
| Day of week | | |
| Weekday | 1474 (84%) | 7.0 (4.4, 22.0) |
| Weekend | 272 (16%) | 6.2 (4.3, 24.0) |
| School month | | |
| Yes | 1574 (90%) | 7.1 (4.5, 23.1) |
| No | 172 (10%) | 5.6 (3.6, 15.8) |
| Reason for presentation | | |
| Anxiety | 143 (8%) | 5.0 (3.5, 7.8) |
| Aggression, agitation, homicidal | 645 (37%) | 7.0 (4.4, 26.1) |
| Depression, self-injury, suicidal | 707 (40%) | 8.3 (5.9, 23.1) |
| Bipolar, mania, psychosis | 46 (3%) | 18.3 (6.8, 31.9) |
| Other mental health condition | 205 (12%) | 5.6 (3.8, 8.5) |
| Chemical IV/IM or physical restraint | | |
| Used | 54 (3%) | 27.4 (14.6, 52.8) |
| Not used | 1692 (97%) | 6.6 (4.4, 21.5) |
| Autism or developmental delay | | |
| Present | 351 (20%) | 8.0 (4.9, 27.5) |
| Not present | 1395 (80%) | 6.6 (4.3, 20.9) |
| Chronic medical condition | | |
| Present | 786 (45%) | 6.6 (4.4, 20.6) |
| Not present | 960 (55%) | 7.0 (4.4, 23.5) |
| Outpatient psychiatric care | | |
| Yes | 1150 (66%) | 8.1 (4.8, 24.5) |
| No | 326 (19%) | 6.0 (4.4, 15.4) |
| Not documented | 270 (15%) | 5.3 (3.3, 8.9) |
| Prior psychiatric hospitalization | | |
| Yes | 649 (37%) | 14.1 (5.3, 29.4) |
| No | 599 (34%) | 6.6 (4.5, 20.1) |
| Not documented | 498 (29%) | 5.3 (3.6, 8.5) |
| Prior psychiatric ED visit within 1 year | | |
| Yes | 481 (28%) | 9.9 (4.8, 26.4) |
| No | 1265 (72%) | 6.4 (4.3, 20.3) |
| Disposition | | |
| Admission to psychiatric unit | 24 (1%) | 22.2 (9.9, 30.8) |
| Admission to pediatrics (medical) | 83 (5%) | 4.7 (3.4, 6.1) |
| Admission to pediatrics (boarding) | 153 (9%) | 41.3 (26.4, 54.2) |
| Transfer to inpatient psychiatric unit | 254 (15%) | 24.1 (14.9, 31.7) |
| Transfer to community-based acute treatment (CBAT) | 157 (9%) | 23.3 (18.8, 38.5) |
| Residential facility | 63 (4%) | 5.0 (3.4, 8.1) |
| Discharge to partial program | 212 (12%) | 5.7 (4.3, 7.9) |
| Discharge home | 800 (46%) | 5.0 (3.6, 7.2) |

computed tomography or brain magnetic resonance imaging) in 1% of visits. Mental health patients cumulatively spent 49,853 h in the ED, and 7949 of those hours were accrued after an initial 24-hour stay. The median ED LOS for mental health visits was 6.9 h (IQR 4.4, 22.3) (Fig. 1A), while the median ED LOS for non-mental health visits was 3.4 h (IQR 2.1, 5.2). The median ED LOS for mental health visits resulting in admission to our hospital's inpatient psychiatric unit was 22.2 h (IQR 9.9, 30.8), and the median ED LOS for transfer to another institution's inpatient psychiatric unit was 24.1 h (IQR 14.9, 31.7). There were 153 visits (9%) resulting in admission to the medical unit at our hospital to continue boarding while awaiting psychiatric bed placement, with a median ED LOS of 41.3 h (IQR 26.4, 54.2). These children experienced a median length of stay in the inpatient medical unit (excluding ED time) of 3.0 days, with a mean of 4.1 days, and a maximum of 45.9 days (Fig. 1B).

There were 1360 visits (78%) with LOS < 24 h and 386 visits (22%) with LOS ≥ 24 h (Table 2). LOS ≥ 48 h accounted for 133 visits (7.6%), including the longest LOS of 185.0 h. Of the 588 ED visits requiring a higher level of psychiatric care (admission or transfer to a psychiatric inpatient unit, transfer to CBAT, or admission to the medical unit for boarding awaiting psychiatric placement), 339 visits (58%) had LOS ≥ 24 h. In the multivariate logistic regression analysis (Table 3), having private insurance alone (OR 1.59, 95% CI 1.15, 2.19) and having both private and public health insurance plans (OR 1.68, 95% CI 1.16, 2.43) relative to public insurance alone was associated with ED LOS ≥ 24 h. Compared to visits for anxiety, there was an increased odds for LOS ≥ 24 h for visits with a reason for presentation of agitation, aggression, or homicidal ideation (OR 2.76, 95% CI 1.40, 5.45); depression, self-injury, or suicidal ideation (OR 2.79, 95% CI 1.45, 5.40); and bipolar, mania, or psychosis (OR

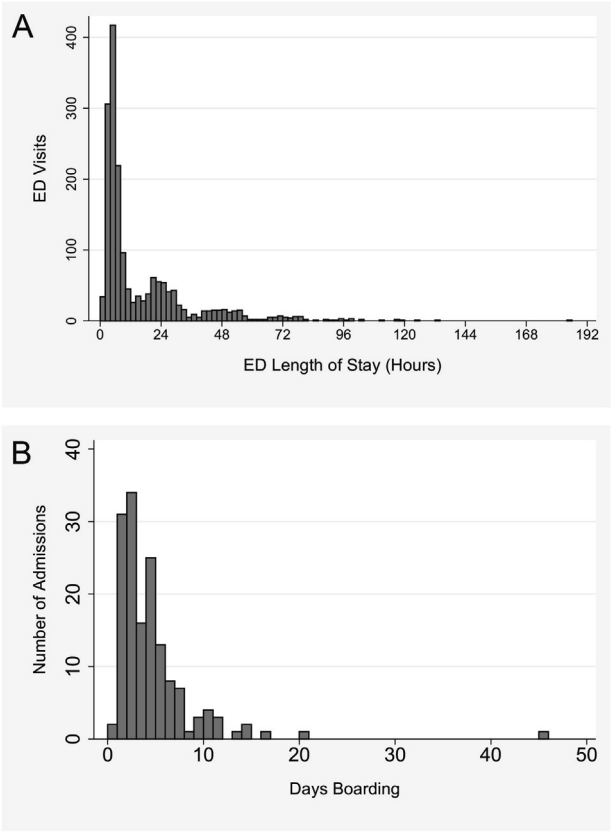


**Fig. 1.** A. Distribution of emergency department length of stay in hours for mental health visits.B. Distribution of hospital length of stay in days for patients admitted to the medical unit for boarding awaiting psychiatric placement.

5.78, 95% CI 2.36, 14.09). There was an increased odds for LOS ≥ 24 h for visits during school months (OR 2.17, 95% CI 1.30, 3.63), with restraint use (OR 4.80, 95% CI 2.61, 8.84), history of autism or developmental delay (OR 1.82, 95% CI 1.35, 2.46), and prior psychiatric hospitalization (OR 2.55, 95% CI 1.93, 3.36).

## 4. Discussion

ED boarding of mental health patients demonstrates that there are insufficient systems-level resources to care for a growing population of children requiring acute mental health services. Our study of pediatric mental health visits to an urban tertiary care children's hospital determined that nearly a quarter (22%) of mental health visits had an ED LOS ≥ 24 h, including 7.6% with LOS ≥ 48 h. Factors associated with ED boarding include patient insurance status, presentation during school months, the specific mental health reason for presentation, chemical or physical restraint use, presence of autism or developmental delay, and prior psychiatric hospitalization. Restraint use and prior psychiatric hospitalization have not been previously described as risk factors for ED boarding of pediatric mental health patients. Understanding the populations at greatest risk for ED boarding is necessary to work towards improving ED care and the broader mental health systems for these patients. While systems solutions are pursued, the individual ED provider can use this information to set family expectations for length of stay, work to create a safe ED environment for children who are expected to board (e.g. employ room safety checklists to remove potentially dangerous medical equipment), and strive to make care for mental health boarders more patient-centered (e.g. setting consistent behavioral expectations and easing transitions at change of shift).

The proportion of pediatric mental health patients who boarded in our ED was substantially larger than the 7% reported in a national sample from 2001 to 2008 [5]. A study of ED boarding in 2007–2008 at our institution (which defined boarding as LOS > 12 h, placement not obtained until the day after psychiatric consult, or medical record designation of boarding) reported 34% of pediatric mental health patients requiring inpatient psychiatric placement boarded in the ED [6]. In our current study, 58% of pediatric mental health visits requiring a higher level of care (inpatient psychiatric hospitalization, CBAT, or admission to the medical unit awaiting psychiatric placement) had an ED LOS ≥ 24 h, demonstrating how boarding has increased over time.

Our findings also highlight the impact of insurance coverage, as individuals with public insurance were at a decreased risk for prolonged LOS. This may be due comprehensive public mental health benefits in Massachusetts that include mobile crisis intervention, in-home therapy, and intensive care coordination [24]. Parents of children in Massachusetts with public insurance have reported shorter wait times (2–6 months) for an outpatient psychiatric appointment compared to parents of children with private insurance coverage (4–9 months) [25]. In contrast, adult mental health patients in Massachusetts with public insurance have an increased likelihood of a prolonged ED LOS ≥ 24 h relative to those with private insurance [8,9]. Efforts to implement mental health parity and improve coverage for mental health conditions across all health plans should continue.

We found that certain mental health reasons for presentation were associated with ED boarding. Prior studies have focused on diagnosis categories rather than reasons for presentation, but similarly found longer ED LOS for pediatric patients with bipolar disorder, psychoses, major depression, and suicidal ideation, relative to anxiety [14,26]. Mental health ED visits have a well described seasonality, and increased boarding during school months may be secondary to greater visit numbers while children are experiencing more life stressors in school [17,27,28]. Use of chemical and physical restraints has been associated with prolonged LOS for mental health patients in general EDs, but has not previously been known as a risk factor for boarding of pediatric mental health patients [23,29,30]. Difficulty in psychiatric bed placement for these individuals may be due to "reverse triage," with psychiatric units selecting less acute patients for admission due to decreased nursing requirements and fewer challenges to the therapeutic milieu [6]. Autism and developmental delay continue to be associated with ED boarding, as there are limited placements available with the specialized expertise and resources required to care for these children [6].

While our study did not delineate the time spent for medical clearance before psychiatric evaluation, prior work has found that medical clearance accounts for only a small proportion (10.5%) of total ED LOS. In particular, for patients who are admitted or transferred, the majority of the visit time is spent between the disposition decision and discharge, indicating that placement issues are the major contributor to ED LOS [8,29]. While patients are boarding in the ED, typically little to no acute mental health care is provided. In a survey of emergency physicians, 62% indicated no psychiatric services are delivered for ED psychiatric boarders [11]. A study of 2 pediatric EDs demonstrated <15% of mental health visits provided crisis intervention or pharmacological care [10]. Boarding can also lead to ED overcrowding, reducing the capacity to care for medical patients [13,31]. When considering the total ED patient-hours for mental health patients in 2016, we estimated that if all mental health visits could have been reduced to 24 h or less, 2338 additional medical visits per year (6.4 visits per day), could have been seen (using a median LOS for medical visits of 3.4 h, the median in our ED). Overall, boarding requires prolonged use of ED resources, while yielding relatively little value in terms of the mental health care provided.

In our study, patients admitted to the medical unit for boarding awaiting psychiatric placement had a median stay of 4.1 days. Inpatient boarders are also less likely to receive counseling or psychiatric medications than patients admitted to inpatient psychiatric hospitals [32]. The delivery of supportive and cognitive behavioral therapy, psychotropic medications, and behavioral plans has resulted in modest clinical improvement for boarders on the pediatric unit of our hospital [33]. Expansion of such services to patients with long LOS may represent an opportunity for improved care.

There are several potential strategies to reduce psychiatric ED boarding, such as implementing novel ED staffing models and diverting referrals to alternative settings that provide acute mental health care. Interventions that add mental health staff, such as child psychiatrists, mental health social workers, or dedicated mental health nurses to pediatric EDs have been shown to reduce LOS, decrease admissions without changes to return visit rates, and decrease restraint use among mental health patients [34,35]. Opening a regional dedicated emergency psychiatric facility, functioning as a stand-alone ED that can provide up to 24 h of intensive treatment, has been found to decrease boarding times in surrounding community EDs [36]. Population health management approaches, rather than fee-for-service models, may provide increased financial incentives for prevention and coordination of chronic mental illness that would prevent costly, low-value ED stays [37]. Improved access to outpatient services, particularly for at-risk populations, may decrease mental health crises that would otherwise require ED evaluation and inpatient admission. Potential avenues for advocacy and legislation include increased funding for school- and community-based services, inpatient mental health services, and need-based coverage rather than fixed limits [38]. Future research should aim to correlate ED mental health LOS with availability of regional psychiatric services.

Our study has several limitations. As the study was performed at a single academic center, ED LOS may be affected by local availability of outpatient and inpatient pediatric mental health

**Table 2**
Univariate analysis of factors associated with length of stay (LOS) ≥ 24 hours for mental health visits.

| Visit characteristic | Visits with LOS < 24 h (%) N = 1360 | Visits with LOS ≥ 24 h (%) N = 386 | Odds ratio for LOS ≥ 24 h (95% CI) |
|---|---|---|---|
| Sex | | | |
| Female | 712 (79%) | 185 (21%) | Reference |
| Male | 648 (76%) | 201 (24%) | 1.19 (0.95–1.50) |
| Age group | | | |
| 5–8 | 171 (80%) | 43 (20%) | Reference |
| 9–12 | 363 (76%) | 112 (24%) | 1.23 (0.83–1.82) |
| 13–15 | 468 (77%) | 139 (23%) | 1.18 (0.80–1.73) |
| 16–18 | 358 (80%) | 92 (20%) | 1.02 (0.68–1.53) |
| Race/ethnicity | | | |
| White/non-Hispanic | 683 (78%) | 198 (22%) | Reference |
| Black/non-Hispanic | 276 (78%) | 78 (22%) | 0.97 (0.72–1.31) |
| Hispanic | 157 (75%) | 53 (25%) | 1.16 (0.82–1.65) |
| Other | 244 (81%) | 57 (19%) | 0.81 (0.58–1.12) |
| Insurance type | | | |
| Public | 620 (80%) | 157 (20%) | Reference |
| Private | 573 (78%) | 158 (22%) | 1.09 (0.85–1.40) |
| Both | 165 (70%) | 71 (30%) | 1.70 (1.22–2.36)* |
| Uninsured | 2 (100%) | 0 (0%) | – |
| Time of day | | | |
| Day (7 AM–2:59 PM) | 566 (76%) | 182 (24%) | Reference |
| Evening (3 PM–10:59 PM) | 664 (78%) | 184 (22%) | 0.86 (0.68–1.09) |
| Overnight (11 PM–6:59 AM) | 130 (87%) | 20 (13%) | 0.32 (0.27–0.38)* |
| Day of week | | | |
| Weekday | 1156 (78%) | 318 (22%) | Reference |
| Weekend | 204 (75%) | 68 (25%) | 1.21 (0.90–1.64) |
| School month | | | |
| Yes | 1208 (77%) | 366 (23%) | 2.30 (1.42–3.72)* |
| No | 152 (88%) | 20 (11%) | Reference |
| Reason for presentation | | | |
| Anxiety | 132 (92%) | 11 (8%) | Reference |
| Aggression, agitation, homicidal | 466 (72%) | 179 (28%) | 4.61 (2.43–8.73)* |
| Depression, self-injury, suicidal | 546 (77%) | 161 (23%) | 3.54 (1.87–6.71)* |
| Bipolar, mania, psychosis | 28 (61%) | 18 (39%) | 7.71 (3.28–18.12)* |
| Other mental health condition | 188 (92%) | 17 (8%) | 1.09 (0.49–2.40) |
| Chemical IV/IM or physical restraint | | | |
| Used | 21 (39%) | 33 (61%) | 5.96 (3.41–10.43)* |
| Not used | 1339 (79%) | 353 (21%) | Reference |
| Autism or developmental delay | | | |
| Present | 237 (68%) | 114 (32%) | 1.99 (1.53–2.57)* |
| Not present | 1123 (81%) | 272 (19%) | Reference |
| Chronic medical condition | | | |
| Present | 629 (80%) | 157 (20%) | 0.80 (0.63–1.00) |
| Not present | 731 (76%) | 229 (24%) | Reference |
| Outpatient mental health care | | | |
| Yes | 852 (74%) | 298 (26%) | 1.76 (1.28–2.43)* |
| No | 272 (83%) | 54 (17%) | Reference |
| Not documented | 236 (87%) | 34 (13%) | 0.73 (0.46–1.15) |
| Prior psychiatric hospitalization | | | |
| Yes | 427 (66%) | 222 (34%) | 2.29 (1.76–2.97)* |
| No | 488 (81%) | 111 (19%) | Reference |
| Not documented | 445 (89%) | 53 (11%) | 0.52 (0.37–0.74)* |
| Prior mental health ED visit within 1 year | | | |
| Yes | 336 (70%) | 145 (30%) | 1.83 (1.44–2.33)* |
| No | 1024 (81%) | 241 (19%) | Reference |
| Disposition | | | |
| Admission to psychiatric unit | 14 (58%) | 10 (42%) | Reference |
| Admission to pediatrics (medical) | 80 (96%) | 3 (4%) | 0.05 (0.01–0.21)* |
| Admission to pediatrics (boarding) | 26 (17%) | 127 (83%) | 6.84 (2.74–17.07)* |
| Transfer to inpatient psychiatric unit | 123 (48%) | 131 (51%) | 1.49 (0.64–3.48) |
| Transfer to community-based acute treatment (CBAT) | 86 (55%) | 71 (45%) | 1.16 (0.48–2.76) |
| Residential facility | 57 (90%) | 6 (10%) | 0.15 (0.05–0.47)* |
| Discharge to partial program | 201 (95%) | 11 (5%) | 0.08 (0.03–0.21)* |
| Discharge home | 773 (97%) | 27 (3%) | 0.05 (0.02–0.12)* |

* Denotes statistical significance (P < 0.05).

**Table 3**
Multivariate regression analysis for factors associated with length of stay (LOS) ≥ 24 h for mental health visits.

| Visit characteristic | Visits with LOS < 24 h (%) N = 1358 | Visits with LOS ≥ 24 h (%) N = 386 | OR for LOS ≥ 24 h (95% CI) |
|---|---|---|---|
| Sex | | | |
| Female | 711 (79%) | 185 (21%) | Reference |
| Male | 647 (76%) | 201 (24%) | 1.02 (0.78, 1.35) |
| Age group | | | |
| 5–8 | 170 (80%) | 43 (20%) | Reference |
| 9–12 | 363 (76%) | 112 (24%) | 1.15 (0.74, 1.80) |
| 13–15 | 468 (77%) | 139 (23%) | 1.12 (0.71, 1.76) |
| 16–18 | 357 (80%) | 92 (20%) | 1.06 (0.65, 1.73) |
| Race/ethnicity | | | |
| White/non-Hispanic | 683 (78%) | 198 (22%) | Reference |
| Black/non-Hispanic | 275 (78%) | 78 (22%) | 0.99 (0.70, 1.41) |
| Hispanic | 157 (75%) | 53 (25%) | 1.41 (0.93, 2.13) |
| Other | 243 (81%) | 57 (19%) | 0.84 (0.58, 1.22) |
| Insurance type[+] | | | |
| Public | 620 (80%) | 157 (20%) | Reference |
| Private | 573 (78%) | 158 (22%) | 1.59 (1.15, 2.19)[*] |
| Both | 165 (70%) | 71 (30%) | 1.68 (1.16, 2.43)[*] |
| Overnight | | | |
| Yes (11 PM–6:59 AM) | 129 (87%) | 20 (13%) | 0.62 (0.37, 1.04) |
| No (7 AM–10:59 PM) | 1229 (77%) | 366 (23%) | Reference |
| School month | | | |
| Yes | 1206 (77%) | 366 (23%) | 2.17 (1.30, 3.63)[*] |
| No | 152 (88%) | 20 (12%) | Reference |
| Reason for presentation | | | |
| Anxiety | 131 (92%) | 11 (8%) | Reference |
| Aggression, agitation, homicidal | 466 (72%) | 179 (28%) | 2.76 (1.40, 5.45)[*] |
| Depression, self-injury, suicidal | 545 (77%) | 161 (23%) | 2.79 (1.45, 5.40)[*] |
| Bipolar, mania, psychosis | 28 (61%) | 18 (39%) | 5.78 (2.36, 14.09)[*] |
| Other mental health condition | 188 (92%) | 17 (8%) | 0.84 (0.37, 1.90) |
| Chemical IV/IM or physical restraint | | | |
| Used | 21 (39%) | 33 (61%) | 4.80 (2.61, 8.84)[*] |
| Not used | 1337 (79%) | 353 (21%) | Reference |
| Autism or developmental delay | | | |
| Present | 237 (68%) | 114 (32%) | 1.82 (1.35, 2.46)[*] |
| Not present | 1121 (80%) | 272 (20%) | Reference |
| Chronic medical condition | | | |
| Present | 628 (80%) | 157 (20%) | 0.83 (0.65, 1.07) |
| Not Present | 730 (76%) | 229 (24%) | Reference |
| Outpatient mental health care | | | |
| Yes | 851 (74%) | 298 (26%) | 1.30 (0.97, 1.75) |
| No/not documented | 507 (85%) | 88 (15%) | Reference |
| Prior psychiatric hospitalization | | | |
| Yes | 426 (66%) | 222 (34%) | 2.55 (1.93, 3.36)[*] |
| No/not documented | 932 (85%) | 164 (15%) | Reference |
| Prior mental health ED visit within 1 year | | | |
| Yes | 336 (70%) | 145 (30%) | 1.31 (0.99, 1.74) |
| No | 1002 (81%) | 241 (19%) | Reference |

[+] Only two patients were uninsured, and these were excluded from the analysis.
[*] Denotes statistical significance (P < 0.05).

services and local mental health initiatives, which may limit generalizability. However, the variables studied are not available in national datasets of pediatric ED visits, limiting the ability to perform a similar analysis on a national scale. As the rate of unmet pediatric mental health care needs is lower in Massachusetts relative to other states, with comprehensive public mental health benefits, we would expect even greater ED mental health utilization and a higher prevalence of ED boarding in states without such services available [24, 39]. The use of ICD codes to identify mental health visits may result in misclassification, as some mental health visits may not have been captured by our ICD scheme. We were not able to accurately determine which oral medications were given for chemical restraint; therefore, our analysis of restraint use was limited to IV/IM and physical restraints. With a retrospective design, not all variables were reported for all patients, particularly for documentation of current outpatient mental health care and prior hospitalizations; however, we addressed missing data with a uniform approach. As the exact time of medical clearance was not documented, we were unable to determine the proportion of the visits spent on medical clearance.

## 5. Conclusions

Nearly one quarter of children presenting to the ED with a mental health emergency boarded in the ED with a LOS ≥ 24 h. Risk factors associated with boarding include patient insurance status, visit timing during school months, the reason for presentation, ED restraint use, presence of autism or developmental delay, and prior psychiatric hospitalization. Future study should include intervention-based trials that aim to reduce mental health board-

ing among these populations and facilitate access to definitive mental health care. The findings from this study may inform targeted improvements in the pediatric mental health system.

## Funding sources

This work was supported by the Michael Shannon Grant from the Division of Emergency Medicine at Boston Children's Hospital and the House Officer Development Award from the Medical Staff Organization of Boston Children's Hospital. The sponsors did not have any role in the study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the article for publication.

## Declarations of interest

None.

## References

[1] Perou R, Bitsko RH, Blumberg SJ, et al. Mental health surveillance among children–United States, 2005–2011. Morb Mortal Wkly Rep Surveill Summ 2013;62(2):1–35 [doi:su6202a1] [pii].
[2] Merikangas KR, He JP, Brody D, Fisher PW, Bourdon K, Koretz DS. Prevalence and treatment of mental disorders among US children in the 2001–2004 NHANES. Pediatrics 2010;125(1):75–81. https://doi.org/10.1542/peds.2008-2598.
[3] Rogers SC, Mulvey CH, Divietro S, Sturm J. Escalating mental health care in pediatric emergency departments. Clin Pediatr (Phila) 2017;56(5):488–91. https://doi.org/10.1177/0009922816684609.
[4] Mahajan P, Alpern ER, Grupp-Phelan J, et al. Epidemiology of psychiatric-related visits to emergency departments in a multicenter collaborative research pediatric network. Pediatr Emerg Care 2009;25(11):715–20. https://doi.org/10.1097/PEC.0b013e3181bec82f.
[5] Case SD, Case BG, Olfson M, Linakis JG, Laska EM. Length of stay of pediatric mental health emergency department visits in the United States. J Am Acad Child Adolesc Psychiatry 2011;50(11):1110–9. https://doi.org/10.1016/j.jaac.2011.08.011.
[6] Wharff EA, Ginnis KB, Ross AM, Blood EA. Predictors of psychiatric boarding in the pediatric emergency department: Implications for emergency care. Pediatr Emerg Care 2011;27(6):483–9. https://doi.org/10.1097/PEC.0b013e31821d8571.
[7] Mansbach JM, Wharff E, Austin SB, Ginnis K, Woods ER. Which psychiatric patients board on the medical service? Pediatrics 2003;111(6):e693–8. , http://www.ncbi.nlm.nih.gov/pubmed/12777587.
[8] Pearlmutter MD, Dwyer KH, Burke LG, Rathlev N, Maranda L, Volturo G. Analysis of emergency department length of stay for mental health patients at ten massachusetts emergency departments. Ann Emerg Med 2017;70(2):193–202.e16. https://doi.org/10.1016/j.annemergmed.2016.10.005.
[9] Chang G, Weiss A, Kosowsky JM, Orav EJ, Smallwood JA, Rauch SL. Characteristics of adult psychiatric patients with stays of 24 hours or more in the emergency department. Psychiatr Serv 2012;63(3):283–6. https://doi.org/10.1176/appi.ps.201000563.
[10] Newton AS, Ali S, Hamm MP, et al. Exploring differences in the clinical management of pediatric mental health in the emergency department. Pediatr Emerg Care 2011;27(4):275–83. https://doi.org/10.1097/PEC.0b013e31821314ca.
[11] ACEP. Psychiatric and substance abuse survey, https://www.acep.org/uploadedFiles/ACEP/Advocacy/federal_issues/PsychiatricBoardingSummary.pdf, ; 2008.
[12] Alakeson V, Pande N, Ludwig M. A plan to reduce emergency room "boarding" of psychiatric patients. Health Aff (Millwood) 2010;29(9):1637–42. https://doi.org/10.1377/hlthaff.2009.0336.
[13] American Academy of Pediatrics Committee on Pediatric Emergency Medicine. Overcrowding crisis in our nation's emergency departments: is our safety net unraveling? Pediatrics 2004;114(3):878–88. https://doi.org/10.1542/peds.2004-1287.
[14] Chakravarthy B, Yang A, Ogbu U, et al. Determinants of pediatric psychiatry length of stay in 2 urban emergency departments. Pediatr Emerg Care 2017;33(9):613–9. https://doi.org/10.1097/PEC.0000000000000509.
[15] Pittsenbarger ZE, Mannix R. Trends in pediatric visits to the emergency department for psychiatric illnesses. Acad Emerg Med 2014;21(1):25–30. https://doi.org/10.1111/acem.12282.
[16] Zima BT, Rodean J, Hall M, Bardach NS, Coker TR, Berry JG. Psychiatric disorders and trends in resource use in pediatric hospitals. Pediatrics 2016;138(5). https://doi.org/10.1542/peds.2016-0909.
[17] Ali S, Rosychuk RJ, Dong KA, McGrath PJ, Newton AS. Temporal trends in pediatric mental health visits. Pediatr Emerg Care 2012;28(7):620–5. https://doi.org/10.1097/PEC.0b013e31825cf93b.
[18] Holder SM, Rogers K, Peterson E, Shoenleben R, Blackhurst D. The impact of mental health services in a pediatric emergency department. Pediatr Emerg Care 2017;33(5):311–4. https://doi.org/10.1097/PEC.0000000000000836.
[19] Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap) – a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009;42(2):377–81.
[20] Boston Public Schools Communications Office. Boston public schools 2015–2016 district calendar, https://www.bostonpublicschools.org/cms/lib/MA01906464/Centricity/Domain/238/BPSCalSY16final3-26.pdf, ; 2015.
[21] Santiago LI, Tunik MG, Foltin GL, Mojica MA. Children requiring psychiatric consultation in the pediatric emergency department: epidemiology, resource utilization, and complications. Pediatr Emerg Care 2006;22(2):85–9. https://doi.org/10.1097/01.pec.0000199568.94758.6e.
[22] Simpson S, Joesch J, West I, Pasic J. Who's boarding in the psychiatric emergency service? West J Emerg Med 2014;15(6):669–74. https://doi.org/10.5811/westjem.2014.5.20894.
[23] Warren MB, Campbell RL, Nestler DM, et al. Prolonged length of stay in ED psychiatric patients: A multivariable predictive model. Am J Emerg Med 2016;34(2). https://doi.org/10.1016/j.ajem.2015.09.044.
[24] Commonwealth of Massachusetts. MassHealth children's behavioral health initiative (CBHI), https://www.mass.gov/service-details/learn-about-cbhi.
[25] Sirkin JT, Olsho L, Sheedy K, McClelland S, Walsh K. Access to outpatient mental health services in Massachusetts: A summary of findings, https://bluecrossmafoundation.org/sites/default/files/download/publication/Outpatient_MH_Access_SUMMARY_v05_final.pdf, ; 2017.
[26] Waseem M, Prasankumar R, Pagan K, Leber M. A retrospective look at length of stay for pediatric psychiatric patients in an urban emergency department. Pediatr Emerg Care 2011;27(3):170–3. https://doi.org/10.1097/PEC.0b013e31820d644b.
[27] Goldstein AB, Silverman MAC, Phillips S, Lichenstein R. Mental health visits in a pediatric emergency department and their relationship to the school calendar. Pediatr Emerg Care 2005;21(10):653–7.
[28] Lueck C, Kearl L, Lam CN, Claudius I. Do emergency pediatric psychiatric visits for danger to self or others correspond to times of school attendance? Am J Emerg Med 2015;33(5). https://doi.org/10.1016/j.ajem.2015.02.055.
[29] Weiss AP, Chang G, Rauch SL, et al. Patient- and practice-related determinants of emergency department length of stay for patients with psychiatric illness. Ann Emerg Med 2012;60(2):162–171.e5. https://doi.org/10.1016/j.annemergmed.2012.01.037.
[30] Wilson MP, Brennan JJ, Modesti L, et al. Lengths of stay for involuntarily held psychiatric patients in the ED are affected by both patient characteristics and medication use. Am J Emerg Med 2015;33(4):527–30. https://doi.org/10.1016/j.ajem.2015.01.017.
[31] Bernstein SL, Aronsky D, Duseja R, et al. The effect of emergency department crowding on clinically oriented outcomes. Acad Emerg Med 2009;16(1):1–10. https://doi.org/10.1111/j.1553-2712.2008.00295.x.
[32] Claudius I, Donofrio JJ, Lam CN, Santillanes G. Impact of boarding pediatric psychiatric patients on a medical ward. Hosp Pediatr 2014;4(3):125–32. https://doi.org/10.1542/hpeds.2013-0079.
[33] Gallagher KAS, Bujoreanu IS, Cheung P, et al. Psychiatric boarding in the pediatric inpatient medical setting: a retrospective analysis. Hosp Pediatr 2017;7(8):444–50. https://doi.org/10.1542/hpeds.2017-0005.
[34] Sheridan DC, Sheridan J, Johnson KP, et al. The effect of a dedicated psychiatric team to pediatric emergency mental health care. J Emerg Med 2016;50(3). https://doi.org/10.1016/j.jemermed.2015.10.034.
[35] Uspal NG, Rutman LE, Kodish I, Moore A, Migita RT. Use of a dedicated, non-physician-led mental health team to reduce pediatric emergency department lengths of stay. Acad Emerg Med 2016;23(4):440–7. https://doi.org/10.1111/acem.12908.
[36] 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):1–6. https://doi.org/10.5811/westjem.2013.6.17848.
[37] Jellinek M. A path beyond advocacy to improve mental health services for children and families. JAMA Pediatr 2017;171(7):615. https://doi.org/10.1001/jamapediatrics.2017.0216.
[38] Dolan MA, Fein JA, Committee on Pediatric Emergency Medicine. Pediatric and adolescent mental health emergencies in the emergency medical services system. Pediatrics 2011;127(5):e1356–66. https://doi.org/10.1542/peds.2011-0522.
[39] Sturm R, Ringel JS, Andreyeva T. Geographic disparities in children's mental health care. Pediatrics 2003;112(4):. https://doi.org/10.1542/PEDS.112.4.E308e308.