Predictors of Adverse Events and Medical Errors Among Adult Inpatients of Psychiatric Units of Acute Care General Hospitals

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Objective: The aim of this study was to identify factors associated with the occurrence of adverse events (AEs) or medical errors (MEs) during inpatient psychiatric hospitalizations.

Methods: A full-probability random sample of 4,371 charts from 14 inpatient psychiatric units at acute care general hospitals in Pennsylvania were reviewed in a two-stage process that comprised screening and flagging by nurses followed by review by psychiatrists. AE and ME rates were calculated overall and then stratified by patient and hospital factors. Unadjusted and adjusted logistic regression models examined predictors of AEs and MEs.

Results: An AE was identified in 14.5% of hospitalizations (95% confidence interval [CI]=11.7–17.9), and an ME was identified in 9.0% (CI=7.5–11.0). In adjusted analyses, patients with a longer length of stay and older patients had higher odds of experiencing an AE or an ME. Patients ages 31–42 (compared with ages 18–30), with commercial insurance (compared with Medicare or Medicaid or uninsured), or treated at high-volume hospitals (compared with low, medium, or very high) had lower odds of an AE. Patients age 54 or older (compared with ages 18–30), admitted during the weekend, admitted to rural hospitals (compared with urban), or treated at very-high-volume hospitals (compared with high) were more likely to experience an ME.

Conclusions: This study provides insight into factors that put patients and hospitals at increased risk of patient safety events. This information can be used to tailor improvement strategies that enhance the safety of patients treated on general hospital psychiatric units.

Psychiatric Services 2018; 69:1087–1094; doi: 10.1176/appi.ps.201800110

More than 17 years have passed since the publication of the groundbreaking patient safety report *To Err Is Human* (1), which called international attention to the issue of adverse events (AEs) and medical errors (MEs) that occur in the care of hospitalized patients. AEs are defined as the negative unintended consequences of clinical care that lead to injury, impairment, or other harm (2,3). MEs are defined as the commission or an omission of clinical care with potentially negative consequences for a patient that would have been judged wrong by skilled and knowledgeable peers at the time it occurred, regardless of whether it caused harm (4). Since that time, patient safety research has guided the development of important interventions to prevent MEs and lower the incidence of AEs in general medical and surgical care (5–14). Knowledge about these critical patient safety events, however, is notably scarce for mental health care because major studies on the topic have systematically excluded patients receiving psychiatric care in acute care general hospitals. This lack of information about inpatient mental health care has hindered the extension and adaptation of patient safety lessons learned in general medicine.

There has been some research on the incidence of specific types of AEs and MEs in mental health care. For example, patient suicide and falls in inpatient psychiatry have been studied (15,16). However, these events are often studied in small samples, without a tested methodology, and in isolation (that is, absent a broader spectrum of inpatient psychiatric patient safety events). One large, national study systematically examined the incidence, nature, and preventability of patient safety events in inpatient psychiatric hospital settings (17). That study of more than 8,000 discharged patients found that one of five patients receiving care on an inpatient psychiatric unit experienced an AE or ME and that 56.6% of all events were characterized as preventable. Although the study provided important data about patient safety rates, generalizability is limited because it was conducted only a Veterans Health Administration (VHA) hospitals, which deliver care to a very specialized segment of the

population, and it did not examine any of the patient and hospital factors associated with a higher risk of patient safety events. Identifying potential risk factors could inform targeted efforts to reduce the incidence of these events.

Community-based acute care general hospitals are the primary service system for inpatient psychiatric care. Each year there are more than one million discharges from inpatient psychiatric units in the United States, and approximately half of these discharges are from acute care nonfederal general hospitals (18). The other half are from state mental hospitals, freestanding psychiatric hospitals, and VHA hospitals—all of which represent different patient populations and systems of care. Given that acute care general hospitals are the most common providers of inpatient psychiatric care, the wide variability in the structural characteristics of general hospital settings, as well as the demographic and clinical characteristics of the patients they care for, studying AEs and MEs in this heterogeneous clinical care environment is integral to understanding the broad context in which they occur. The study reported here examined MEs and AEs in inpatient psychiatric settings at general hospitals in a large, diverse sample of hospitals in Pennsylvania, as well as the patient and hospital factors that influenced their occurrence.

METHODS

Study Sample

This study included medical records of patients discharged from psychiatric inpatient units at 14 acute care general hospitals in Pennsylvania during 2010. The Pennsylvania Health Care Cost Containment Council (PHC4) provided a data set from which a stratified random sample of inpatients from psychiatric units in general hospital settings was drawn. The PHC4 data included detailed information about patient demographic and clinical characteristics (for example, diagnosis and procedure codes, length of stay, and hospital information) for all hospital discharges in the state. From these data, a random sample of 19 general hospitals was selected, stratified by teaching status and hospital location (urban or rural), with probabilities proportional to each hospital's number of discharges. Next, a subsample of approximately 300 patient discharges was drawn from each selected hospital, with probabilities inversely proportional to the size of the hospital. Long-term admissions with a length of stay of more than 90 days were excluded from the sample. Because five hospitals declined to participate, our total sample included 14 inpatient psychiatric units, representing a 74% recruitment rate. There were no significant differences between the included and excluded hospitals in teaching status, urban or rural location, or size. Discharges from the responding hospitals were weighted to account for nonresponse and to be representative of all discharges from psychiatric units at Pennsylvania acute care general hospitals.

Design and Procedure

We conducted a retrospective cross-sectional chart review with two stages: nurses trained as medical record administrators (MRAs) screened and flagged the random sample of medical records within each hospital for potential patient safety events, and trained physician reviewers then evaluated flagged charts for harm, error, and preventability. We developed training manuals and instrumentation to implement both tiers of the study on the basis of the methodology used in the landmark patient safety studies (2,19). We then recruited 11 MRAs across the state to review medical records from each study hospital and flag them as described above. After extensive training, the teams of MRAs reviewed 4,371 of the 4,401 medical records (99.3%); several charts were unavailable or unable to be located. Each medical record was carefully evaluated by using information in admission and discharge notes, clinical notes, nursing notes, progress notes, physician orders, and medication administration records. We recruited and implemented our rigorous training process with 12 physicians across the state. Throughout the study, reviewers examined an overlap of 10% of the sampled charts, and these were used as training files during weekly calls to maintain reliability. Our study team of reviewers abstracted data from the medical records of all hospitals in the sample, with the exception of one hospital that stipulated that only its employees could have access to the data. For that hospital, we trained a separate team of nurse and physician reviewers in the study methods. None of the reviewers had treated the patients whose records they reviewed.

Outcome Measures

Patient safety events were categorized as dichotomous outcomes for the occurrence of AEs or MEs. The following events were categorized as AEs: adverse drug event, self-harm or injury, assault, sexual contact, patient fall, and other. MEs included any mention in the chart of medication errors, elopement, possession of contraband, and other nonmedication errors. [Detailed definitions of these events are included in an online supplement to this article, and the events have been described elsewhere (17)].

Predictors

For each discharge, we examined patient demographic and clinical factors, as well as characteristics of the hospital from which the patient was discharged. We investigated data on gender, age (18–30, 31–42, 43–53, and ≥54) and race (white or nonwhite). Clinical factors included admission day (weekday versus weekend), length of stay (one to three, four to six, seven to nine, and 10 or more days), insurance status (uninsured, commercial, or Medicaid or Medicare).

The *ICD-9* coding system was used to categorize principal diagnosis, which included psychosis (codes 295, 297, and 298), mood disorders (code 296), and other diagnoses (all other codes). Suicidal ideation (V62.84) or suicide attempts (E950–E959) were identified by using all available diagnosis codes on the discharge claim. Drug use was categorized as continuous (codes 303.01, 303.91 304.21–304.91, and 305.01), unspecified or episodic (303.00, 303.90, 304.20–304.90, and 305.20 or 303.02, 303.92, 304.22–304.92, and 305.02), or none or in remission (303.03, 303.93, 304.23–304.93, and 305.03). Hospital-level factors included teaching status (teaching or nonteaching); urbanity (urban or rural); and low, medium, high, or very high hospital volume based on annual admissions (0–800, 801–1,060, 1,061–1,280, and ≥1,281, respectively). Stratification of the continuous variables (age, length of stay in days, and number of admissions per year) was based on the median and interquartile range.

TABLE 1. Characteristics of 4,371 hospitalizations in inpatient psychiatric units at acute care general hospitals, by presence or absence of an adverse event or medical error[a]

Variable	Adverse event (%)			Medical error (%)		
	Absent (N=3,752)	Present (N=619)	p	Absent (N=3,981)	Present (N=390)	p
Patient level						
Gender			.108			.077
Female	52.0	56.2		52.0	58.7	
Male	48.0	43.8		48.0	41.3	
Race			.300			.187
White	76.3	79.3		76.3	81.5	
Nonwhite	23.7	20.7		23.7	18.5	
Age			.001			<.001
18–30	26.6	20.3		26.3	19.4	
31–42	24.7	15.5		24.1	16.0	
43–53	25.3	20.9		24.9	22.6	
≥54	23.4	43.3		24.8	42.0	
Length of stay (days)			<.001			<.001
1–3	28.0	6.3		26.2	11.4	
4–6	34.2	16.4		32.7	20.0	
7–9	17.7	20.7		18.2	17.3	
≥10	20.1	56.6		22.8	51.3	
Admission day			.086			.238
Weekday	78.4	81.2		79.0	76.7	
Weekend	21.6	18.8		21.0	23.3	
Principal diagnosis[b]			.068			.122
Mood	58.3	58.2		58.6	55.3	
Psychosis	22.2	26.7		22.3	28.3	
Other	19.5	15.1		19.1	16.5	
Suicidality[c]			.001			.036
Yes	15.5	9.9		84.9	89.6	
No	84.5	90.1		15.1	10.4	
Drug dependence[d]			.001			.002
Continuous	8.6	4.9		8.4	4.1	
Unspecified or episodic	23.3	15.6		22.6	17.2	
No or in remission	68.2	79.5		68.9	78.7	
Insurance status			.008			.010
Uninsured	8.2	5.6		8.2	4.5	
Commercial	40.5	31.3		39.9	32.3	
Medicaid or Medicare	51.2	63.1		51.9	63.2	
Hospital level						
Teaching status			.064			.599
Yes	54.2	45.0		53.1	50.4	
No	45.8	55.0		46.9	49.6	
Urbanity			.729			.478
Rural	18.1	17.2		17.8	19.2	
Urban	81.9	82.8		82.2	80.8	
Admissions per year			.058			.087
Low (0–800)	29.6	32.2		29.6	33.4	
Medium (801–1,060)	29.7	37.6		31.0	29.8	
High (1,061–1,280)	22.3	14.9		21.9	13.8	
Very high (≥1,281)	18.4	15.3		17.5	22.9	

[a] All analyses were performed with complex samples analysis, and thus the results are presented as percentages.
[b] *ICD–9* codes: mood, 296; psychosis, 295, 297, and 298; other, all other codes
[c] *ICD–9* codes: suicidal ideation, V62.84; attempt, E950–E959
[d] *ICD–9* codes for drug use: continuous, 303.01, 303.91, 304.21–304.91, and 305.01; unspecified or episodic, 303.00, 303.90, 304.20–304.90, and 305.20 or 303.02, 303.92, 304.22–304.92, and 305.02; in remission, 303.03 303.93, 304.23–304.93, and 305.03

Analysis

First, we used chi-square tests to compare demographic, clinical, and hospital factors between patients with and without an AE or ME. Second, we calculated the proportion of hospitalizations with an AE or ME, both overall and separately by each type of event. We then conducted unadjusted and adjusted logistic regression analyses to assess the strength of the relationship between the patient and hospital factors and the AE or ME. Odds ratios were adjusted for all demographic, clinical, and hospital factors, and we considered predictors in the adjusted analyses statistically significant at a significance level of <.05 (two-tailed). Finally, we present box-and-whisker plots to describe the distribution of unadjusted hospital AE and ME rates calculated by using Stata, version 14.0. Analyses were performed by using complex samples analysis in SPSS, version 24, which accommodated the study design's two-stage proportional sampling and its weighting.

TABLE 2. Rates of adverse events and medical errors during 4,371 hospitalizations in inpatient psychiatric units at acute care general hospitals

Event	Hospitalization N	Hospitalization %	95% CI
Any adverse event	619	14.5	11.7–17.9
Any adverse drug event	398	9.3	7.1–12.2
Any patient fall	160	3.9	3.2–4.8
Any other adverse event	65	1.5	.9–2.4
Any patient assault	56	1.2	.91–.6
Any patient sexual contact	42	.9	.7–1.2
Any patient self-harm or injury	27	.6	.3–1.1
Any medical error	390	9.0	7.5–11.0
Any medication error	249	5.7	4.3–7.5
Any nondrug errors	120	2.8	2.2–3.6
Any contraband[a]	64	1.5	1.1–2.0
Any elopement[a]	7	.2	.1–.4

[a] Elopement and contraband are errors by proxy.

RESULTS

Of the 4,371 discharges reviewed, 48% were of males and 52% were of females (Table 1). The mean±SD age of the discharged patients was 43.5±16.9. The mean length of stay was 8.3±8.5 days. We found no significant differences between the included and excluded hospitals in the hospital-level variables. Discharged patients with an AE were more likely than those without an AE to be older and to have a longer stay, but they were less likely to have suicidality or drug dependence and less likely to be uninsured. We found similar associations for patients who had an ME while hospitalized.

Overall, AEs occurred during 14.5% of all hospitalizations (Table 2). In 35% of all hospitalizations with an AE, a ME was also identified. The most commonly identified AEs were adverse drug events (9.3% of all hospitalizations) and falls (3.9%). An ME was identified during 9.0% of all hospitalizations, and medication errors were the most common type (5.7%). In 57% of the hospitalizations with a ME, an AE also occurred.

Table 3 presents the adjusted and unadjusted logistic regression results for patient and hospital factors as predictors of an AE. In the unadjusted model, several variables were significantly associated with a patient's increased odds of experiencing an AE: older age (≥54); longer stay (four or more days); psychosis as a principal diagnosis (compared with other); absence of suicidality or drug dependence (compared with unspecified or episodic use or continuous use); insurance with Medicare or Medicaid (compared with commercial insurance or uninsured); and low- or medium-volume hospitals (compared with high). After adjustment for all other variables, the variables of age (p=.031), length of stay (p<.001), insurance status (p=.029), and hospital volume (p<.001) were significantly associated with a patient's odds of experiencing an AE. Specifically, a hospitalization of four or more days was associated with increased odds of an AE (highest odds for 10 or more days; adjusted odds ratio [AOR]=11.87), and patients ages 31–42 had lower odds of an AE during hospitalization (AOR=.71) compared with the youngest age group (18–30). Patients seen in low-, medium-, or very-high-volume hospitals were more likely to have an AE than those seen in high-volume hospitals. Compared with patients with Medicaid or Medicare, those with commercial insurance had lower odds of an AE (AOR=.78). When MEs were included in the adjusted model for AEs, the association was highly significant (AOR=9.07, 95% confidence interval=6.14–13.38).

Table 4 presents potential predictors of MEs in the adjusted and unadjusted logistic regression models. In the unadjusted model, older age (≥54), longer stay (more than six days), insurance with Medicaid or Medicare (compared with commercial insurance or uninsured), and an absence of drug dependence or suicidality were significantly associated with increased odds of an ME. In the adjusted model, age (p=.006), length of stay (p<.001), admission day of the week (p=.030), urbanity (p<.001), and hospital volume (p=.005) showed significant associations with MEs. Older age (≥54), longer stay (more than six days), and admission during the weekend were associated with increased odds of an ME. In addition, the odds of an ME during hospitalization were higher for patients seen in rural hospitals (AOR=1.45) or in very-high-volume hospitals (AOR=2.23) (compared with high-volume hospitals).

Figure 1 shows the distribution of facility rates of any AE or ME per 100 admissions for all included acute care general hospitals. The mean hospital rate of AEs per 100 admissions for study hospitals was 14.15 (range 8.12–24.52), and the mean hospital rate of MEs per 100 admissions for study hospitals was 8.94 (range 3.57–15.48).

DISCUSSION

By identifying patient- and hospital-level factors that were significantly associated with the odds of an AE or an ME, this study has laid a foundation for further understanding and preventing safety events for patients receiving care in psychiatric units at acute care general hospitals. The findings also help identify hospital system vulnerabilities that can be targeted for patient safety improvements.

Patient-level factors, including longer length of stay, older patient age, admission during the weekend, and Medicaid or Medicare insurance compared with commercial insurance status were associated with higher risk of AEs or MEs. These findings align with prior research in general hospital units, which has also found that longer length of stay, older patient age, and weekend admission are significantly associated with increased odds of experiencing an AE or ME (20,21). Length of stay likely increases odds of AE and ME because of a patient's longer exposure to inpatient care (21). However, it is also possible that a longer stay is a proxy for greater severity of illness, because sicker patients often require more intensive and, consequently, lengthy treatment. Thus identifying patients who may experience longer stays (for

example, those who have prior involuntary commitments) and implementing additional safety protocols for these high-risk patients, such as more intensive monitoring and continual assessment, could reduce their likelihood of experiencing an AE or ME. Suicidal patients had shorter stays, and after the analysis controlled for amount of time spent in the hospital, suicidality was no longer associated with likelihood of experiencing an AE or ME.

Even though patient age is not modifiable, it is useful to know that elderly patients may be at especially high risk of iatrogenic exposure on the psychiatric unit. This finding may prompt exploration of targeted strategies that enhance safety for these high-risk patient populations. Finally, the "weekend effect" has been identified in other hospital settings to be associated with adverse patient outcomes (22) and is not unique to psychiatric units. One common intervention used in other specialties—and readily adaptable to psychiatry—is to provide seven-day hospital services with experienced staff and access to specialized diagnostics and therapeutics (22). These findings should be used to parallel the processes used in general medical and surgical care to develop interventions for reducing AEs and MEs and for improving the quality of care for psychiatric patients (5–14).

Our study found that patients seen at hospitals with low, medium, or very high patient volume (compared with high volume) and rural hospitals (compared with urban) were more likely to

TABLE 3. Association between patient- and hospital-level factors and any adverse event during 4,371 hospitalizations in inpatient psychiatric units at acute care general hospitals

	Hospitalization with adverse event		Unadjusted analysis		Adjusted analysis[a]	
Variable	%	95% CI	OR	95% CI	OR	95% CI
Patient-level factor						
Gender						
Female	15.5	12.2–19.6	1.19	.96–1.47	.99	.81–1.20
Male (reference)	13.4	10.8–16.6				
Race						
White	14.9	11.8–18.7	1.19	.84–1.69	1.01	.74–1.38
Nonwhite (reference)	12.8	9.6–17.0				
Age						
18–30 (reference)	11.5	9.3–14.1				
31–42	9.6	8.0–11.6	.82	.66–1.02	.71	.54–.93
43–53	12.3	9.5–15.8	1.08	.82–1.43	.82	.60–1.13
≥54	23.9	16.6–33.2	2.42	1.44–4.07	1.21	.79–1.88
Length of stay (days)						
1–3 (reference)	3.7	2.3–5.7				
4–6	7.5	5.4–10.5	2.14	1.24–3.72	2.12	1.11–4.04
7–9	16.6	13.2–20.6	5.22	3.38–8.09	5.07	3.05–8.42
≥10	32.4	25.5–40.1	12.58	8.38–18.89	11.87	7.33–19.21
Admission day						
Weekday (reference)	14.7	11.5–18.5				
Weekend	12.7	9.4–16.9	.84	.69–1.03	.95	.79–1.14
Principal diagnosis[b]						
Mood	14.5	12.1–17.3	1.29	.87–1.90	1.24	.91–1.67
Psychosis	17.0	12.5–22.6	1.55	1.13–2.13	.99	.72–1.37
Other (reference)	11.7	7.8–17.2				
Suicidality[c]						
Yes	9.8	8.3–11.5	.60	.46–.78	.84	.57–1.25
No (reference)	14.5	12.1–19.3				
Drug dependence[d]						
Continuous	8.9	6.4–12.2	.49	.36–.67	.94	.64–1.36
Unspecified or episodic	10.2	8.0–13.0	.58	.39–.85	.75	.58–.98
No or in remission (reference)	16.5	12.8–21.2				
Insurance status						
Uninsured	10.2	7.2–14.1	.55	.34–.89	.79	.59–1.06
Commercial	11.4	10.2–12.7	.63	.44–.89	.78	.61–.99
Medicaid or Medicare (reference)	17.0	12.0–23.6				
Hospital-level factor						
Teaching status						
Yes	12.4	10.2–14.9	.69	.46–1.03	.96	.64–1.45
No (reference)	17.0	12.8–22.2				
Urbanity						
Rural	13.9	11.3–17.0	.94	.64–1.37	1.06	.73–1.54
Urban (reference)	14.7	11.3–18.8				
Admissions per year						
Low (0–800)	15.6	13.2–18.3	1.63	1.05–2.53	1.90	1.47–2.45
Medium (801–1,060)	17.7	12.0–25.3	1.90	1.04–3.46	2.10	1.48–2.99
High (1,061–1,280) (reference)	10.2	7.1–14.4				
Very high (≥1,281)	12.4	11.4–13.4	1.25	.83–1.87	1.36	1.01–1.84

[a] Adjusted for all patient-level and hospital-level factors
[b] *ICD–9* codes: mood, 296; psychosis, 295, 297, and 298; other, all other codes
[c] *ICD–9* codes: suicidal ideation, V62.84; attempt, E950–E959
[d] *ICD–9* codes for drug use: continuous, 303.01, 303.91, 304.21–304.91, and 305.01; unspecified or episodic, 303.00, 303.90, 304.20–304.90, and 305.20, or 303.02, 303.92, 304.22–304.92, and 305.02; in remission, 303.03 303.93, 304.23–304.93, and 305.03

TABLE 4. Association between patient- and hospital-level factors and any medical error during 4,371 hospitalizations in inpatient psychiatric units at acute care general hospitals

	Hospitalization with medical error		Unadjusted analysis		Adjusted analysis[a]	
Variable	%	95% CI	OR	95% CI	OR	95% CI
Patient-level factor						
Gender						
Female	10.0	8.2–12.2	1.32	.97–1.79	1.29	.89–1.87
Male (reference)	7.8	5.8–10.5				
Race						
White	9.5	7.6–11.7	1.37	.84–2.23	1.46	.91–2.34
Nonwhite (reference)	7.1	4.8–10.4				
Age						
18–30 (reference)	6.8	5.5–8.4				
31–42	6.2	4.4–8.6	.90	.65–1.25	.74	.52–1.07
43–53	8.2	6.3–10.6	1.23	.89–1.70	1.02	.71–1.47
≥54	14.4	10.8–18.9	2.30	1.69–3.12	1.32	1.04–1.67
Length of stay (days)						
1–3 (reference)	4.1	2.8–6.0				
4–6	5.7	4.4–7.4	1.41	.96–2.06	1.39	.89–2.15
7–9	8.6	6.0–12.0	2.19	1.19–4.03	2.41	1.35–4.32
≥10	18.2	13.5–24.0	5.17	3.57–7.49	4.78	3.35–6.81
Admission day						
Weekday (reference)	8.5	6.9–10.5				
Weekend	9.7	6.9–13.3	1.15	.90–1.46	1.29	1.00–1.67
Principal diagnosis[b]						
Mood	8.5	7.0–10.4	1.09	.70–1.71	1.11	.72–1.72
Psychosis	11.1	8.0–15.3	1.46	.90–2.36	1.21	.70–2.10
Other (reference)	7.9	5.2–11.7				
Suicidality[c]						
Yes	6.4	4.8–8.5	.65	.44–.97	1.03	.60–1.77
No (reference)	9.4	7.8–11.7				
Drug dependence[d]						
Continuous	4.6	3.0–7.1	.43	.29–.64	.80	.50–1.28
Unspecified or episodic	7.0	5.1–9.5	.66	.47–.95	.91	.66–1.25
No or in remission (reference)	10.1	8.2–12.5				
Insurance status						
Uninsured	5.1	2.6–10.0	.46	.23–.93	.51	.17–1.51
Commercial	7.3	5.8–9.1	.67	.48–.93	.78	.59–1.03
Medicaid or Medicare (reference)	10.5	7.7–14.2				
Hospital-level factor						
Teaching status						
Yes	8.6	6.0–12.1	.90	.58–1.39	1.14	.84–1.57
No (reference)	9.5	7.8–11.4				
Urbanity						
Rural	9.6	9.4–9.9	1.10	.83–1.45	1.45	1.19–1.75
Urban (reference)	8.9	6.9–11.3				
Admissions per year						
Low (0–800)	10.0	9.4–10.7	1.79	.99–3.24	1.60	.96–2.67
Medium (801–1,060)	8.7	6.4–11.6	1.53	.78–3.00	1.51	.93–2.48
High (1,061–1,280) (reference)	5.9	3.3–10.1				
Very high (≥1,281)	11.5	7.7–16.7	2.08	.99–4.34	2.23	1.19–4.19

[a] Adjusted for all patient-level and hospital-level factors
[b] *ICD–9* codes: mood, 296; psychosis, 295, 297, and 298; other, all other codes
[c] *ICD–9* codes: suicidal ideation, V62.84; attempt, E950–E959
[d] *ICD–9* codes for drug use: continuous, 303.01, 303.91, 304.21–304.91, and 305.01; unspecified or episodic, 303.00, 303.90, 304.20–304.90, and 305.20 or 303.02, 303.92, 304.22–304.92, and 305.02; in remission, 303.03 303.93, 304.23–304.93, and 305.03

experience an AE or ME. Operating at overcapacity and with understaffing and higher patient-to-nurse ratios are factors known to be associated with an increase in rates of patient safety events (23). On the other hand, smaller hospitals may be underresourced, leading to an increased risk of AEs. The optimal equilibrium of staffing and resources to provide safe care may be present in high-volume hospitals. Such equilibrium may be lacking in very-high-volume hospitals, where the most ill patients likely present for treatment. Similarly, the findings regarding rural hospitals may point to the need for improvements in the areas of staffing, staff training, and process management. Improving systems of care and structural issues that put patients at risk of experiencing a patient safety event can be instrumental in developing interventions.

It is not surprising that organizational factors play a key role in maintaining a safe and therapeutic environment, given our understanding of the nature of the hospital milieu and prior research on safety in hospital-based mental health settings (24). A potential intervention, Safewards, is an example of a major innovation that addresses several organizational factors in order to improve the safety of patients on psychiatric wards. Safewards consists of strategies that address six key domains: the staff team, the physical environment, events and relationships outside the hospital grounds, the patient community, patient characteristics, and the regulatory framework (25). In a clustered randomized

controlled trial, Safewards was effective in reducing harmful situations (for example, assaults and self-harm) (26), suggesting that certain aspects of patient safety in inpatient psychiatry can be improved by implementing systems or organizational interventions.

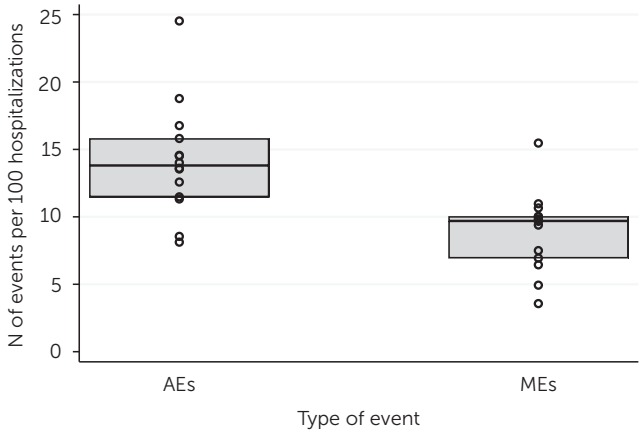
Limitations

As with every study, this study had limitations. First, chart review studies may not document the full nature and outcomes of care. However, existing research shows that systematic methods of detecting AEs are 10 times more effective than other detection methods, such as voluntary reporting (27). Second, the use of administrative data to test patient and hospital predictors may have been influenced by the presence of measurement error for clinical characteristics (for example, diagnosis) that are not collected by validated instruments. Third, we did not have access to data about important covariates, such as comorbid medical issues that may complicate risk of AEs and MEs and socioeconomic status. Fourth, because only one hospital included in this study was a for-profit hospital, we were unable to examine the potential role of ownership in the occurrence of AEs and MEs. Fifth, the presence and extent of patient psychological harm were difficult to ascertain in a chart review; a trauma-informed lens that takes these factors into consideration should be employed when designing future research and safety interventions in inpatient psychiatry. Sixth, this study of inpatient psychiatric hospitalizations was conducted at general acute care hospitals and may not be applicable to psychiatric hospitals or longer-term units. For example, patients admitted to general hospitals are likely to have a shorter stay compared with patients admitted to stand-alone psychiatric hospitals. Finally, these findings may not be generalizable to other states given the role of varying state regulations (licensure, policies, insurance mandates, and so forth).

Implications

Essential to patient safety is understanding the underlying patterns of patient and provider factors that are associated with AEs and MEs. Ours is the first large-scale study that used an established methodology (17) to examine predictors of AEs and MEs in inpatient psychiatric units, providing new information about the patient and hospital factors associated with patient safety events among psychiatric inpatients of acute general care hospitals. Extensive interhospital variability exists in rates of AEs and MEs in medical-surgical hospitalizations (20,28), which suggests that "poor-performing" hospitals could learn from "high performers" by comparing hospitals systems, identifying gaps, and improving care. In general medicine, research has established a framework to lower rates of preventable harm (14) in five steps: measurement, evidence-based care practices, investment in implementation sciences, local ownership and peer learning, and aligning and synergizing efforts around common goals and measures. The field of mental health care would do well to adopt a similar framework in which this and other studies measuring AEs and MEs can serve as a first step. From our findings, we can then move to the next step and develop evidence-based practices that address the specific vulnerabilities to patient safety in inpatient psychiatry, by using high-quality interventions focused on improving care paths, such as "plan-do-study-act" cycles (29). These interventions should be targeted to patient groups with the highest risk of experiencing a patient safety event. The effectiveness of improvement interventions could be evaluated by using the recently published road map from an international consensus group in the field of psychiatry (30). Future studies should continue the steps along the framework in order to develop comprehensive safety improvements for this vulnerable patient population.

FIGURE 1. Adverse events (AEs) and medical errors (MEs) during 4,371 hospitalizations in inpatient psychiatric units at 14 acute care general hospitals in 2010[a]



[a] The dark line represents the median. The bottom of the box indicates the 25th percentile, and the top of the box represents the 75th percentile.

CONCLUSIONS

This study examined risk factors for a broad array of safety events in inpatient psychiatric care at acute care general hospitals. The patient and hospital factors that we identified as predicting patient safety events suggest that policies and practices should be targeted at the unit and hospital level to ensure an adequate and safe level of care during all shifts and at all hospitals regardless of location. By targeting opportunities and strategies to prevent AEs and MEs in inpatient psychiatry, the field moves one step closer to the end goal of ensuring that psychiatric inpatients receive care in a safe environment.

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This research was supported by grant MH086722 from the National Institute of Mental Health and by the National Patient Safety Foundation.

Dr. Marcus reports receipt of consulting fees from Allergan, Alkermes, Johnson & Johnson, Sage, and Sunovion. The other authors report no financial relationships with commercial interests.

Received March 7, 2018; revision received May 31, 2018; accepted June 22, 2018; published online August 3, 2018.

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