Medication Use and Physical Assaults in the Psychiatric Emergency Department

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ABSTRACT

Objective: To evaluate the relationship between medications used to treat acute agitation (antipsychotics, mood stabilizers, and benzodiazepines) and subsequent assault incidence in the psychiatric emergency department.

Methods: Medication orders and assault incident reports were obtained from electronic health records for 17,056 visits to an urban psychiatric emergency department from 2014 to 2019. Assault risk was modeled longitudinally using Poisson mixed-effects regression.

Results: Assaults were reported during 0.5% of visits. Intramuscular (IM) medications were ordered in 23.3% of visits overall and predominantly were ordered within the first 4 hours of a visit. IM medication orders were correlated with assault (incident rate ratio [IRR] = 24.2; 95% CI, 5.33–110.0), often because IM medications were ordered immediately subsequent to reported assaults. Interacted with time, IM medications were not significantly associated with reduction in subsequent assaults (IRR = 0.700; 95% CI, 0.467–1.04). Neither benzodiazepines nor mood stabilizers were associated with subsequent changes to the risk of reported assault. By contrast, antipsychotic medications were associated with decreased assault risk across time (IRR = 0.583; 95% CI, 0.360–0.942).

Conclusions: Although assault prevention is not the sole reason for ordering IM medications, IM medication order rates are high relative to overall assault incident risk. Of the 3 major categories of medications ordered commonly in the psychiatric emergency setting, only antipsychotic medications were associated with measurable decreases in subsequent assault risk. As antipsychotic medication can have a significant side effect burden, careful weighing of the risks and benefits of medications is encouraged.

J Clin Psychiatry 2022;83(1):21m13970

To cite: Gao YN, Oberhardt M, Vawdrey D, et al. Medication use and physical assaults in the psychiatric emergency department. *J Clin Psychiatry.* 2022;83(1):21m13970.

To share: https://doi.org/10.4088/JCP.21m13970

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Physical assaults are a persistent problem in hospital psychiatry, causing physical injuries, psychological distress, and increased costs.[1–3] Although these events are rare on a per-person basis (1.98 events per 1,000 patient days at one acute psychiatric hospital[4]), larger facilities still have many events. A recent (2018) publication by the Joint Commission[5] highlighted that 75% of 25,000 workplace assaults reported annually to the Occupational Safety and Health Administration occurred in health care and social service settings; workers in health care settings are 4 times more likely to be assaulted than workers in private industry. The publication recommends that "Leadership should establish a goal of zero harm to patients and staff…"[5]; this charge, to make a rare event even rarer, is fraught with challenges.

Previous investigations have made some inroads by clarifying risk factors for in-hospital physical violence, which include younger age,[6,7] male sex,[6,8] lower socioeconomic status,[9] history of violence,[9–11] prior psychiatric hospitalization,[10] involuntary hospitalization,[6,8,9] substance use,[6,8,11–13] personality disorders,[7,11] psychosis,[6–10,12–14] and institutional staffing and the milieu. Alternatively, although medications (especially antipsychotics, benzodiazepines, and mood stabilizers) are a potentially important tool for modifying violence risk, few studies have analyzed the relationship between medication and violence risk.[3,8,12,13,15,16] Studies that did report a relationship offered limited conclusions: nonadherence can be a risk factor for violence,[14,17,18;] clinicians often respond to aggressive or violent behavior by administering medication[10,19,20;] and violent patients may receive more medication during their hospital course, including a higher average daily dose of antipsychotics and benzodiazepines, and multiple antipsychotics.[4,6,7,11] However, these studies did not address the central clinical question of whether a particular medication, given at a particular moment, may be associated with reduced risk of subsequent violence in the milieu. Further, studies do not address emergency department settings where violence is prevalent[21] and pharmacologic interventions are often first-line interventions for highly agitated patients.[1]

The widespread adoption of electronic health records, which capture the sequence of clinical events in granular detail, has created new opportunities to study the relationship between medication administration and subsequent violence risk in emergency settings. We combined electronic health record data with incident reports of violent behaviors (actual or attempted physical assault of another person) to examine

Clinical Points

- Clinicians often manage potentially violent patients in emergency settings, but the evidence for medication treatments is limited.
- Of the 3 major categories of medications ordered in psychiatric emergencies (antipsychotics, benzodiazepines, and mood stabilizers), only antipsychotic medications were associated with measurable decreases in subsequent assault risk.

whether administering a medication was associated with subsequent reductions in violence risk. Specifically, we asked (1) whether there was evidence that ordering an intramuscular (IM) medication would be associated with reduced risk of subsequent assault in the same visit, (2) whether ordering a particular class of medication (antipsychotics, benzodiazepines, or mood stabilizers) would be associated with reduced risk of subsequent assault in the same visit, and (3) whether any observed reductions in assault risk would be short-term or sustained.

METHODS

We extracted patient and medication data from psychiatry emergency department records, merged these with assault incident reports, and modeled assault risk over time using Poisson mixed-effects regression.

Setting

Data were collected from a psychiatric emergency department at a large, urban hospital system. The psychiatric emergency department is a locked 24-bed unit staffed with psychiatrists, nurses, nurse practitioners, social workers, and recreation therapists, located adjacent to the medical emergency department. Regulations allow patients to be held on an involuntary basis for up to 24 hours, or up to 72 hours in an extended observation room.

Data Sources

Data from the electronic health record were obtained for patients evaluated in the psychiatric emergency department from January 2014 through December 2019. Data included all medication orders written during each patient's visit as well as demographic variables such as the patient's age, sex, and history of assault.

Assault incident reports were collected by the clinical team as part of the organization's routine monitoring and quality improvement procedure. Hospital staff were required to complete an online incident report for all assaults that occurred, which included a free-text description of what happened, when and where it happened, and who was involved. Incident reports from January 2014 through December 2019 were identified for inclusion by review of both the incident reports and the medical records. Incident reports included many varieties of assaultive behaviors (eg, punching, spitting, projectiles).[22] Because "assault" language can imply intentionality, unidirectionality, and even moral assessment, we opted to use the more neutral term *incidents* when describing the results.

Dataset Construction

A dataset was constructed describing each visit from the time of presentation, hour by hour, until the point of discharge or missing orders. Medication orders included medication name, route of delivery, and time of order. Medication class was assigned as outlined in the footnotes to Table 1. Several patients appeared to have stays inconsistent with provider accounts or the usual timeframe for a psychiatry emergency department visit, likely owing to anomalies in documentation. Panels were thus truncated at the 95th percentile of events to minimize inclusion of spurious data.

The dependent variable was the count of incidents reported for each visit in each hour post-presentation. Independent variables included medication event indicators marked from the hour after the medication was ordered, log(time) with time in hours from presentation, and 3-level age group (as described in the footnotes to Table 2). The rarity of incidents and number of missing values limited the inclusion of other demographic controls.

Analyses

Data were modeled using Poisson mixed-effects regression,[23] which allowed risk of rare events to be compared across a wide variety of visit types. The count of incidents per hour per visit was then regressed on log(time), a medication event indicator, an interaction term between medication event and log(time), and age group controls, with visit-level random effects.

To distinguish short-run from sustained reductions in incident risk, we conducted an event study.[24] Several windows of time (4–8 hours before the medication was ordered, 1–2 hours before the order, the hour of the order, 1–2 hours after the order, 4–8 hours after the order, 8–16 hours after the order, and greater than 16 hours after the order) were identified. These windows were of varying size because, in practice, medication orders were clustered in time, particularly around the time of an incident. The regression results of incident counts on lagged indicators are reported in the Results section (see Figure 2).

The study was approved by the Columbia University Institutional Review Board. Analyses were conducted in STATA 16.1 (StataCorp).

RESULTS

Study Sample

The matched sample included 1,302,140 hours over 17,056 visits for 9,870 unique patients. The median length of stay for a visit was 40.5 hours. Assault incident reports were relatively rare. From 2014 to 2019, 86 incident reports were matched; 1 remained unmatched. Incidents occurred during 0.5% of visits overall and during only 1.7% of visits in which the patient had a history of assault (the strongest a priori

Table 1. Visit-Level Variables For Visits With and Without Reported Assault Incidents[a,b]

Variable	Assault Incident Reported (86 visits) Mean	Assault Incident Reported (86 visits) SD	No Assault Incident Reported (16,970 visits) Mean	No Assault Incident Reported (16,970 visits) SD	Overall Median	Overall Mean	*t* Test *P*
Female	0.313	0.0503	0.380	0.00373	0	0.380	.207
Age, y	33.0	1.33	40.4	0.105	39	40.4	< .001
Length of stay, h	251.2	66.5	294.9	22.8	40.5	294.6	.892
Received IM medication during visit	0.813	0.0422	0.229	0.00323	0	0.233	< .001
Received antipsychotic during visit[c]	0.977	0.0163	0.673	0.00360	1	0.675	< .001
Received benzodiazepine during visit[d]	0.849	0.0388	0.751	0.00332	1	0.751	.036
Received mood stabilizer during visit[e]	0.126	0.00255	0.267	0.0480	0	0.127	< .001
Diagnosis							
Any psychiatric diagnosis	0.523	0.0542	0.262	0.00338	0	0.264	< .001
Primary psychotic	0.256	0.0473	0.108	0.00239	0	0.109	< .001
Depression	0.0814	0.0297	0.0852	0.00214	0	0.0851	.901
Bipolar disorder	0.244	0.0466	0.0856	0.00215	0	0.0865	< 0.001
Substance use disorder	0.244	0.0466	0.122	0.00251	0	0.123	< .001
Lack of/inadequate housing	0.0813	0.0297	0.0464	0.00162	0	0.0467	.126
History of violence[f]	0.977	0.0163	0.284	0.00346	0	0.288	< .001
Brought in by EMS	0.349	0.0517	0.342	0.00364	0	0.342	.896
Admitted to inpatient psychiatry service	0.686	0.0503	0.651	0.00366	1	0.651	.494
Ever received IM medication in psych ED[g]	0.860	0.0376	0.356	0.00368	0	0.359	< .001

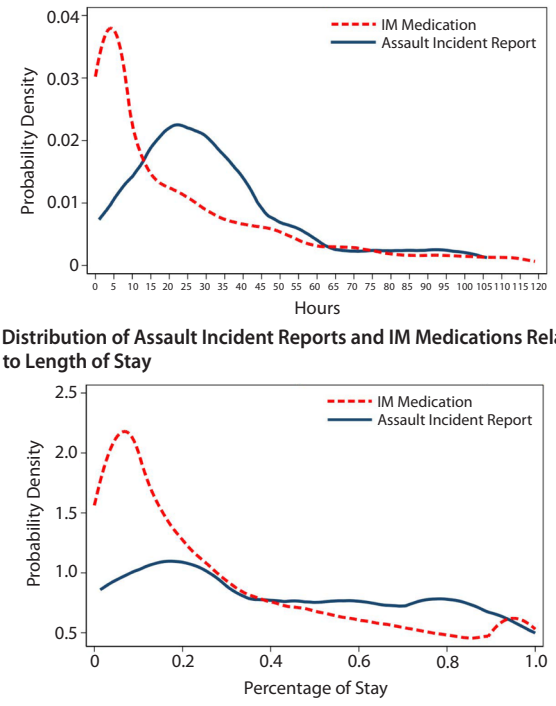
[a]Variable summaries at the visit-level. In total, there were 17,056 visits for 9,870 patients with matched data.
[b]Mean values for binary visits represent fraction of visits with that characteristic; for example, 38% of observed visits were for female patients.
[c]Antipsychotics analyzed in this study were chlorpromazine, fluphenazine, haloperidol, lurasidone, olanzapine, quetiapine, and risperidone.
[d]Benzodiazepines analyzed were alprazolam, chlordiazepoxide, clonazepam, lorazepam, and midazolam.
[e]Mood stabilizers were valproic acid, lithium, and oxcarbazepine.
[f]History of violence was a provider-filled checkbox field pulled from the electronic medical record.
[g]A binary variable equal to 1 if the patient was observed to have received an intramuscular medication in dataset.
Abbreviations: ED = emergency department, EMS = Emergency Medical Services, IM = intramuscular, psych = psychiatric.

Table 2. Poisson Regressions Expressing the Relationship of Medication Administration to Incident Risk[a]

Variable	1. Incident Counts Associated With Timing of IM Medication Orders (any medication class)	2. Incident Counts Associated With Antipsychotic Orders	3. Incident Counts Associated With Oral Antipsychotic Orders	4. Addition of Benzodiazepine, Controlling for Antipsychotic Order	5. Incident Counts Associated With Mood Stabilizer Orders
Log(time)	0.425* (0.311 to 0.580)	0.483* (0.320 to 0.732)	0.426* (0.314 to 0.580)	0.41* (0.260 to 0.646)	0.402* (0.326 to 0.495)
After IM medication[b]	24.2* (5.33 to 110.0)				
(After IM medication) ×log(time)	0.700 (0.467 to 1.04)				
After antipsychotic[c]		14.7* (3.30 to 65.4)		26.8* (4.78 to 150.4)	
(After antipsychotic) ×log(time)		0.583* (0.360 to 0.942)		0.489* (0.291 to 0.822)	
After oral antipsychotic[d]			10.9* (2.22 to 53.6)		
(After oral antipsychotic) ×log(time)			0.597* (0.376 to 0.949)		
After benzodiazepine[e]				0.342 (0.060 to 1.95)	
(After benzodiazepine) ×log(time)				1.49 (0.868 to 2.57)	
After mood stabilizer[f]					10.4 (0.967 to 112.8)
(After mood stabilizer) ×log(time)					0.635 (0.350 to 1.15)

[a]The table describes the IRR (95% CI) from 5 Poisson mixed-effects regressions at the visit-level, with each column representing the coefficient values estimated for an individual regression. Row values give the variables contained in each regression. The outcome of every regression is incidents by visit by hour. The number of observations was 1,302,140 with a total of 17,052 visits. All regressions include age-group controls for ages 30–49, 50–69, and > 70 years with age < 30 years as the reference category and visit-level random effects. No other demographic controls were included due to the number of missing values.
[b]After IM medication is a binary variable equal to 1 if the patient had an intramuscular medication ordered earlier during the current visit.
[c]After antipsychotic is a binary variable equal to 1 if the patient had an antipsychotic medication of any route of administration ordered earlier during the current visit. For a list of included medications, see Table 1 footnote c.
[d]After oral antipsychotic is a binary variable equal to 1 if the patient had an oral antipsychotic medication ordered earlier during the current visit. For a list of included medications, see Table 1 footnote c.
[e]After benzodiazepine is a binary variable equal to 1 if the patient had a benzodiazepine of any route of administration ordered earlier during the current visit. For a list of included medications, see Table 1 footnote d.
[f]After mood stabilizer is a binary variable equal to 1 if the patient had a mood stabilizer of any route of administration ordered earlier during the current visit. For a list of included medications, see Table 1 footnote e.
*Wald statistic significant at the .05 level.

Figure 1. Distribution of Assault Incident Reports and IM Medications From the Psychiatric Emergency Department[a]



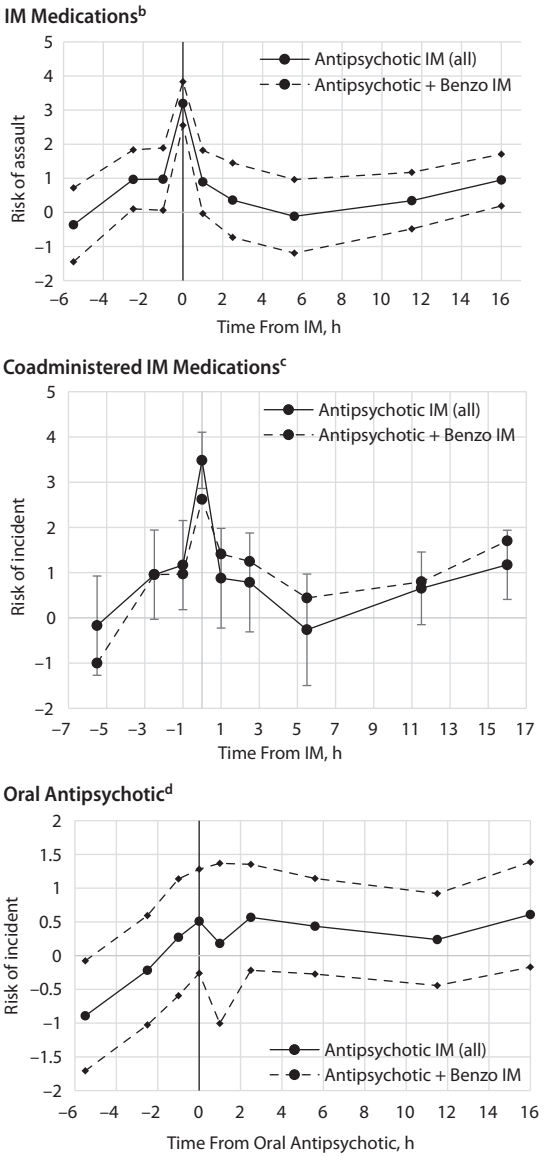
[a]The distribution of aggregated assault incident reports and intramuscular (IM) medications across all visits are shown (A) with respect to the first 120 hours in the emergency department and (B) with respect to length of stay for the visits, respectively.

risk factor available from the literature[8,25]). By contrast, IM medications were ordered at least once during 23.3% of visits, and for patients who had a history of assault in any setting, 29.4% received at least 1 IM medication order during subsequent visits. Though at least 1 diagnosis was encoded for each visit, psychiatric diagnoses were poorly coded: only 26.4% of all patients had any recorded *ICD-9* or *ICD-10* psychiatric diagnosis. Patients with an *ICD* psychiatric diagnosis had higher rates of IM medication orders (33.5%) and incidents (1.0%).

Figure 1 summarizes the time course of aggregated IM medication orders and incidents. IM medications were most commonly ordered very early during a patient's evaluation; 25% of all IM medication orders occurred within the first 4 hours of a patient's stay. Incidents peaked much later, approximately 20–30 hours from the time of presentation. Subsequently, the risk of an incident and the risk of IM medication both declined dramatically with the exception of a small, but observable increase in IM medication order close to the time of departure from the psychiatric emergency department.

Table 2 displays the results from 5 Poisson mixed-effects regressions. Column 1 pertains to medication route (IM vs oral). Risk of an incident decreased with time spent in the psychiatry emergency department (IRR = 0.425; 95% CI, 0.311 to 0.580).

Figure 2. Event Study of Assault Risk Relative to Timing of Medication Orders[a]



[a]The figure plots the estimated Poisson coefficients for risk of assault incident report for lagged dependent indicator variables labeled with respect to the hour of medication administration. Coded periods are from 4 to 8 hours before the medication order is written, from 1 to 2 hours before the medication order is written, the hour of the medication order, from 1 to 2 hours after the order, from 4 to 8 hours after the order, from 8 to 16 hours after the order and, finally, greater than 16 hours after the order. All regressions include age group and history of IM medication in the Psychiatric Emergency Department and log(time) controls.

[b]Panel A shows event study for all IM medications, regardless of medication time, and illustrate the extent to which IM medications are administered within the same hour as an assault incident report (elevated risk at time = 0), with patients returning to baseline level of risk 4–6 hours after administration. Dashed lines give the 95% CI on estimates. Panels B and C attempt to disaggregate this effect.

[c]Panel B displays two curves. The bold curve gives the aggregated trendline for all IM antipsychotics, which closely resembles panel A. Error bars give the 95% CI on estimates for IM antipsychotics. The dotted line in panel B gives the trend for only IM antipsychotics coadministered with a benzodiazepine.

[d]Panel C displays the results for oral antipsychotics alone, which is modestly downward sloping after time > 0. Dashed lines in panel C give the 95% CI on estimates.

Abbreviations: benzo = benzodiazepine, IM = intramuscular.

Medication Route

The first clinical question we examined was whether ordering an IM medication was associated with reduced risk of subsequent assault in the same visit. Overall, 41% of incidents occurred within an hour of IM medication order, with incidents more commonly preceding IM medication orders than vice versa (data not shown). This finding suggested that IM medications were often ordered in response to an incident. Orders for IM medications were associated with higher overall levels of incident risk (Table 2, IRR = 24.2; 95% CI, 5.33 to 110.0); however, when followed longitudinally (IM medication interacted with time), IM medications were not associated with falling incidents rates over time (IRR = 0.700; 95% CI, 0.467 to 1.04).

Figure 2 elaborates on the results shown in Table 2 by plotting the estimated Poisson coefficients (ie, incident risk level) for incidents relative to the timing of medication. Figure 2A describes the time course for IM medications and shows that, on average, the incident risk increased starting 1 hour before the hour of IM medication order and peaked during the hour of IM medication order (point estimate, 3.19; 95% CI, 2.56 to 3.83). Subsequent to IM medication, incident risk decreased abruptly, reaching a trough in the 4–7 hours following IM medication order (−0.116; 95% CI, −1.19 to 0.962). This trough was not statistically distinguishable from estimated risk at time of presentation for the visit. Controlling for time spent in the emergency department, IM medications did not appear to be associated with sustained reductions in incident risk.

Medication Class

The second clinical question was whether ordering a particular class of medication (antipsychotic, benzodiazepine, or mood stabilizer) was associated with reduced risk of subsequent assault in the same visit. Because antipsychotic medications were the most commonly ordered IM medications in this sample, it was not surprising that antipsychotic medications (Table 2, column 2) were also associated with elevated assault risk after the time of initiation (IRR = 14.7; 95% CI, 3.30 to 65.4). Importantly, interacted with time, antipsychotics were associated with decreased assault risk across time (IRR = 0.583; 95% CI, 0.360 to 0.942).

Given that IM medications were not associated with subsequent incident risk reduction, the effect of antipsychotics should derive partially from orally administered medications. The data shown in column 3 of Table 2 confirm this by isolating oral antipsychotics. Interacted with time, oral antipsychotic orders were associated with incident risk reduction (IRR = 0.597; 95% CI, 0.376 to 0.949).

Neither benzodiazepines nor mood stabilizers were associated with sustained changes in incident risk over time. While it has been suggested that, in the short-run, the addition of benzodiazepines to an antipsychotic could accelerate risk reduction, we did not observe additional shorter-run risk reduction associated with adjunct benzodiazepines (Figure 2B).

DISCUSSION

In this study, we used a large single-site electronic health record database harmonized with assault incident reports to address whether IM medications, antipsychotics, benzodiazepines, or mood stabilizers, ordered in the psychiatry emergency department setting, were associated with a subsequent reduction in the risk of physical assault during that emergency department encounter. We found that IM medication orders were common (23.3% of visits) while assault incident reports were rare (0.5% of all visits). Our findings raise the question of whether existing research on risk factors for assault, combined with a regulatory emphasis on violence prevention and "zero harm," have had an unintended consequence of lowering the threshold for ordering IM medications. While IM medications are an important tool, they come with a complex set of risks, benefits, and implications. Administration of IM medications can increase scene safety in some respects, but—particularly when IM medications are given involuntarily—patients may experience a loss of autonomy, they may experience the intervention as unnecessarily invasive, and the experience may disrupt their relationships with health care providers.[26,27] Administration of IM medications may also temporarily escalate the situation and place the patient and staff members at increased risk of injury.

Furthermore, our data did not show a clear association between IM medication orders and reduced risk of a subsequent assault incident report. Figure 1 shows that a large proportion of total IM medications are ordered within a few hours of presentation, while incident reports peak many hours later, likely reflecting both compositional factors (agitated patients staying longer) and frustration over longer stays.

Our clinical interpretation of the lack of interaction between IM medication and log(time) is that IM medications were not associated with sustained drops in incident risk across time. We find that risk declines from peak rapidly after IM medication and remains close to baseline risk for approximately 7 hours subsequent to IM medication before rising again. Our interpretation of this pattern is that the effect of IM medications on incident risk appears to be primarily short-term and is likely mediated by sedation. Even in the setting of sedation after IM medication, however, risk never falls significantly below baseline risk. From this exploratory analysis, we cannot state conclusively whether increasing the preemptive use of IM medications would lead to any further reduction in assault incident reports.

In contrast to results for IM medications, the interaction between antipsychotic medication and log(time) was significant and negative. Thus, our results suggest that antipsychotic medications are associated with a decreased risk of subsequent assault. This finding suggests scheduled antipsychotic medications may play a role in incident prevention. Antipsychotic medications are not benign; side effects can include orthostasis, dystonia, parkinsonism, metabolic derangements, seizure, and neuroleptic malignant

syndrome. The decision of whether to order an antipsychotic is complicated in the acute setting when there is diagnostic uncertainty. That said, if a patient at high risk of assault has a diagnosis for which antipsychotics are indicated, these results suggest that antipsychotics may also be helpful in preventing assault.

The findings are limited for benzodiazepines and mood stabilizers. Neither benzodiazepine nor mood stabilizer orders were associated with a subsequent reduction in incident risk in our data; however, this lack of association may have more to do with the way in which they are used in our sample. Within our sample, benzodiazepines were seldom used alone for the management of agitation, but more commonly coadministered with an antipsychotic. When coadministered, benzodiazepines did not appear to be associated in any additional reductions in incident risk. These findings appear compatible with consensus guidelines. Hankin et al[28] stated that the goal of agitation management is "to rapidly calm the agitated patient without overly sedating him or her"(p175) and subsequently suggested that benzodiazepines should not be used alone because they sedate without treating the underlying condition.

Mood stabilizers were similarly not found to be associated with reduced incident risk, although their relatively infrequent use limited the analysis. In contrast to antipsychotics, which are administered in 97.7% of visits with incidents, mood stabilizers are prescribed in only 12.6% of such visits. As a result, this analysis may be underpowered to describe a reduction in observed incidents for mood stabilizers. Another explanation may be that mood stabilizers require a longer time to work; clinical trials for valproate and lithium, two common mood stabilizers, have illustrated a 20% reduction in mania scores by 5 days.[16,29] By comparison, the median length of stay in the psychiatric emergency department for visits during which an incident is reported is 71.2 hours. Median lengths of stay overall are shorter still, at 40.5 hours.

This study was several limitations. First, as with most observational studies, it is necessary to construct a comparable counterfactual group representing what might have happened if circumstances or interventions had been different. We attempted to address cross-sectional differences between patients by constructing our study longitudinally and using random effects to correct for inherent differences between patients; however, the single largest omitted variable is the level of subjective risk as assessed by psychiatric providers. Previous literature has demonstrated that acute symptoms are a good predictor of seclusion or restraint,[30] although verbal assault, disruptive behaviors, and other acute predictors of risk are poorly captured by incident reports. Incident reports differentially reflect the most severe incidents and will systematically underreport incidents resolved successfully by clinical interventions (eg, relocating a patient, verbal de-escalation).[31] Additionally, using incident reports as the outcome reduces complex interpersonal events into a binary (present/absent), which does not account for qualitative differences between the incidents and the parties involved.

Another limitation is study size. Because subgroup analysis of only patients with assault history risked exclusion of already rare events, we included the sample as a whole, compromising granularity of findings to specific patient groups or diagnostic categories. Subgroup analysis by medication was similarly limited. For example, antipsychotic IM medications were relatively rarely ordered alone and disproportionately ordered for elderly patients. Thus, there was insufficient common support to examine effects for antipsychotic IM medications given alone. Future studies would benefit from larger and more inclusive databases, which would permit stratification by patient diagnosis, measures of intoxication/withdrawal or violence risk (eg, Brøset checklist), and medication refusal, as well as by distinguishing between medications within class.[32,33]

The study setting may differ from other psychiatric emergency departments. Lengths of stay were longer,[34,35] and staffing resembles that for inpatient services. These results might therefore be better interpreted as describing a mixture of emergency department and inpatient services.

Safety is a priority in emergency psychiatry settings. Violence prevention and creation of an environment with "zero harm" are worthwhile goals to pursue. However, the challenge to reduce the prevalence of already rare assaults is complicated. Thoughtful weighing of the risk of in-hospital assault versus the risk of antipsychotic medication exposure is therefore warranted.

Submitted: March 3, 2021; accepted July 8, 2021.

Published online: December 14, 2021.

Potential conflicts of interest: **Dr Gao** is supported in part a Moynihan Clinical Research Fellowship from the Leon Levy Foundation and by the National Institute of Mental Health grant R25 MH086466. **Dr Luo** is partially supported by National Institute of Health grants K23DA04213 and UG1DA013035. **Drs Oberhardt**, **Vawdrey**, **Lawrence**, and **Dixon** have no conflicts to disclose.

Funding/support: No funders provided direct support in the design, writing, or publication of this study.

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