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Patient, Provider, and System Factors Contributing to Patient Safety Events During Medical and Surgical Hospitalizations for Persons With Serious Mental Illness

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Abstract

This study aimed to explore patient-, provider-, and system-level factors that may contribute to elevated risk of patient safety events among persons with serious mental illness (SMI). We conducted a medical record review of medical/surgical admissions in Maryland hospitals from 1994 to 2004 for a community-based sample of adults with SMI ($N = 790$ hospitalizations). We estimated the prevalence of multiple patient, provider, and system factors that could influence patient safety among persons with SMI. We conducted a case crossover analysis to examine the relationship between these factors and adverse patient safety events. Patients' mental status, level of consciousness, disease severity, and providers' lack of patient monitoring, delay/failure to seek consultation, lack of trainee supervision, and delays in care were positively associated with adverse patient safety events ($p < 0.05$). Efforts to reduce SMI-related patient safety risks will need to be multifaceted and address both patient- and provider-level factors.

Keywords

Patient safety; serious mental illness; hospitalization; medical; surgical

In the overall US population, adverse patient safety events—defined as events where medical management, rather than underlying disease, leads to physical harm (Daumit et al., 2006)—could affect as many as 1 in every 10 hospitalized patients (de Vries et al., 2008),

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and studies estimate that such events contribute to 14% to 50% of in-hospital deaths (Dubois and Brook, 1988; Garcia-Martin et al., 1997, 2001). Several studies suggest that persons with serious mental illness (SMI), a group experiencing significant premature mortality compared with the overall US population (Miller et al., 2006; Roshanaei-Moghaddam and Katon, 2009), are at elevated risk of experiencing adverse patient safety events during medical/surgical hospitalizations. Three studies using administrative claims data found higher rates of Patient Safety Indicators, or indicators signaling possible adverse events, among patients with versus without SMI (Daumit et al., 2006; Khaykin et al., 2010; Smith et al., 2012). Most recently, Daumit et al. (2016) explored patient safety in the population with SMI by conducting a medical record review of a community-based cohort of Maryland adults with SMI in their last 5 years of life. Rates of patient safety events, defined as untoward/unexpected occurrences that could indicate human or system error, and related harms during medical/surgical hospitalizations were high among persons with SMI and positively associated with physical harm and 30-day mortality (Daumit et al., 2016). In the cohort with SMI, the researchers observed a rate of 142 physical harms per 100 medical/surgical hospitalizations (Daumit et al., 2016). Although not directly comparable because of use of different measurement tools, estimates of patient safety–related harms in the general US population are much lower: a study of 10 North Carolina hospitals found a rate of 25 harms per 100 admissions (Landrigan et al., 2010) and another study of three large tertiary care centers found a rate of 49 harms per 100 admissions (Classen et al., 2011).

Although these studies have demonstrated high rates of harmful patient safety events during medical/surgical hospitalizations for persons with SMI, little is known about which patient-, provider-, and system-level factors might contribute to elevated risk of adverse patient safety events in this group. Potential factors placing persons with SMI at high risk of experiencing such events include the high prevalence and severity of chronic conditions in this group (Allison et al., 2009; Blank et al., 2014; Daumit et al., 2003; De Hert et al., 2006; Dickerson et al., 2006; McEvoy et al., 2005; Osborn et al., 2007; Rosenberg et al., 2001; Sajatovic and Dawson, 2010); possible interactions between psychotropic medications and commonly used analgesics or anesthetics; overuse of antipsychotics or other medications to address aggressive behavior or other behavioral issues during hospitalization; patient-provider communication challenges related to cognitive impairment, psychotic symptoms, and stigma; and providers' lack of experience caring for this group (Daumit et al., 2006, 2016; Khaykin et al., 2010; Smith et al., 2012). To date, however, no studies have empirically examined whether and how such factors are associated with adverse patient safety events during medical/surgical hospitalizations for persons with SMI.

To begin to address this gap, we conducted an exploratory study examining how multiple patient-, provider-, and system-level factors influence patient safety events shown in previous research to be associated with physical harm and 30-day mortality. The present study uses the same study population and data used in the study by Daumit et al. (2016) described above and builds directly off that previous work. The primary aims of the present study are (1) to examine the prevalence of patient-, provider-, and system-level factors with the potential to contribute to adverse patient safety events in medical/surgical hospitalization for persons with SMI and (2) to assess the relative odds of adverse patient safety events

occurring during medical/surgical hospitalizations for persons with SMI in hospitalizations with versus without specific patient-, provider-, and system-level factors of interest.

METHODS

Design

The parent study on which the current analyses are based used a case-crossover design to assess the relationship between patient safety events and mortality (Daumit et al., 2016). In the original study, a single individual's hospitalization occurring within 30 days of death served as a case and his/her hospitalization(s) not within 30 days of death served as controls. The present study also used a case-crossover design: participants' hospitalizations with a given type of patient safety event served as cases, and the same individuals' hospitalizations without that patient safety event served as controls. The key strength of this design is that it automatically controls for unmeasured within-person characteristics, such as SMI severity and health behaviors.

Population

The study sample, which has been described in detail elsewhere (Daumit et al., 2016), was drawn from a parent cohort (Daumit et al., 2010) of Maryland Medicaid beneficiaries with SMI aged 21 to 64 years in the Baltimore and Eastern Shore regions. Briefly, the study sample was composed of a representative group of adult Medicaid beneficiaries with SMI from the metropolitan Baltimore or rural Eastern Shore regions of Maryland in their last 5 years of life. Persons with SMI who had two or more hospitalizations and died between 1994 and 2004 were eligible for study inclusion. SMI was defined as having any schizophrenia diagnosis, receiving disability benefits with a diagnosis of bipolar disorder or major depression, or being receiving disability benefits with another mental disorder diagnosis and specialty mental health care use.

Data

To identify patient safety events, we conducted a medical record review using an abstraction tool developed by a team of internists, patient safety experts, critical care physicians, nurses, and psychiatrists. A detailed description of the abstraction tool and its development is published elsewhere (Daumit et al., 2016). The abstraction tool required medical record reviewers to record patient safety events in multiple categories, including medical, neurologic/psychiatric, hospital-acquired infection (HAI), medication-related, procedure-related, and care delivery. Patient safety events were defined as situations with an untoward occurrence not related to the primary reason for admission. For example, pneumonia developed during hospitalization was coded as a patient safety event, whereas pneumonia as the reason for admission was not. Like other patient safety measurement tools (Landrigan et al., 2010), the abstraction tool included documentation of patient safety events that were iatrogenic in nature (*e.g.*, HAIs) as well as patient safety events that were unexpected and could signal human or system error but are less clearly iatrogenic. Reviewers also used the tool to document physical harm associated with a given patient safety event and the presence/absence of multiple patient-, provider-, and system-level factors that could contribute to patient safety events during medical/surgical hospitalizations for persons with

SMI, described in detail below. Interrater reliability was assessed to ensure coding consistency across reviewers. Cohen kappa statistics for all event and harm codes met or exceeded accepted standards (Landis and Koch, 1977). We combined data from chart review with Maryland Hospital Administration and Medicaid administrative claims data, which provided facility and patient characteristics.

Measures

For the present study, outcomes of interest included medical patient safety events, neurologic/psychiatric patient safety events, and HAI patient safety events. We focused on these three categories of patient safety events because they have been shown, in our previous study (Daumit et al., 2016), to be positively associated with both physical harm and 30-day mortality. The individual patient safety events included in the “medical events” category were electrolyte/acid/base disturbance, respiratory distress or failure, integument event, dysrhythmia, gastrointestinal bleed or hemorrhage, falls, aspiration, acute renal failure, deep venous thrombosis or pulmonary embolus, and myocardial infarction. The “neurologic/psychiatric” events category included changes in mental status/level of consciousness, psychiatric events such as psychotic episodes, new seizures, and neurologic injury/transient is-chemic attack/stroke. The HAI patient safety event category was composed of events involving hospital/ventilator-acquired pneumonia or central line–associated blood stream infection. The frequency of each of these individual events, as well as their independent associations with physical harm, has been described previously (Daumit et al., 2016).

Independent variables included factors with the potential to contribute to the occurrence of patient safety events during medical/surgical hospitalizations for persons with SMI. The expert team identified these factors based on clinical expertise, previous patient safety literature, and the results of the pilot study that informed overall abstraction tool development (Daumit et al., 2016). As the present study is exploratory rather than confirmatory, we did not test specific hypotheses regarding the association between the factors measured and patient safety events. These factors were coded as present in a hospitalization when reviewers believed they may have contributed to a patient safety event. Patient factors included progression or severity of somatic disease; mental status; difficulty communicating or participating in care; level of consciousness; and line, tube, or drain removed by patient during the hospitalization. Provider factors included incomplete care, defined as care missing one or more components of guideline-concordant care; lack of knowledge, skill, or competence; lack of patient monitoring; lack of trainee supervision; delay in care; lack of appropriate discharge planning; and delay in seeking needed consultation. Although measured independently, patient and provider factors are inherently part of health care systems (Vincent, 2011). We defined system-level factors as missing chart data, evidence that a hospital policy or procedure was not followed, concern with staffing workload, and a reviewer rating of overall care administered below normal standards of care. All system factors were coded based on the impression of the chart reviewers.

In addition to the primary dependent and independent variables described above, we measured facility characteristics (total bed size and number of dedicated inpatient psychiatry beds), hospitalization characteristics (length of stay, admitting service, and admission

source), provider characteristics (primary provider during hospitalization, trainee involvement during hospitalization, and care team experience with patient before hospitalization), and patient characteristics (age, sex, race, mental status assessment at time of hospitalization, medical comorbidity at time of hospitalization, and mental health and medical care history and continuity before hospitalization). Hospital bed size and teaching status were obtained from Maryland Hospital Administration data. Patient age, sex, race, and mental health diagnoses were obtained from Medicaid administrative claims data. All other variables were obtained from the hospital chart data. Chart data on comorbid medical conditions present at the time of hospitalization were used to calculate the Charlson comorbidity index.

Analysis

First, we used descriptive statistics to examine the characteristics of persons with SMI during medical/surgical hospitalizations. Second, we described the hospital, hospitalization, and provider-level characteristics of each hospitalization of interest. Third, we calculated the frequency and prevalence of the patient-, provider-, and system-level factors of interest among hospitalizations with medical, neurologic/psychiatric, and HAI patient safety events. Fourth, to compare the likelihood of a patient safety event occurring in hospitalizations with versus without the patient-, provider-, and system-level factors of interest, we used conditional logistic regression. Separate models were conducted for medical, neurologic/psychiatric, and HAI events. In these analyses, individual participants' hospitalizations with and without a given patient safety event served as cases and controls. The unit of analysis was hospitalization. Models were clustered at the person level. As a result of this clustering, all time-invariant person-level characteristics were automatically controlled. Models also controlled for admission source, admitting service, length of hospital stay, and Charlson comorbidity index. SAS version 9.3 was used for all analyses. The Johns Hopkins School of Medicine Institutional Review Board approved this study.

RESULTS

The study population included 790 medical/surgical hospitalizations among 253 Maryland Medicaid beneficiaries with SMI. Schizophrenia was the most common primary mental health diagnosis (38%), followed by bipolar disorder (19%) and major depression (13%). Sixty-two percent were male, 17% were younger than 40 years, 30% were aged 40 to 54 years, 41% were aged 55 to 64 years, and 12 were 65 years or older (results not shown). Fifty-three percent of study participants were black and 47% were white. Further demographic characteristics of the 253 Maryland Medicaid beneficiaries included in the study sample have been previously reported (Daumit et al., 2016).

The mental status, medical comorbidity, and service engagement before hospitalization among the cohort of persons with SMI varied across hospitalizations. We therefore present these characteristics at the hospitalization level ($N = 790$) in Table 1. At time of admission or any point during the medical/surgical hospital stay, 40% of persons with SMI exhibited abnormal mood; 36% had abnormal speech; 35% presented with impaired orientation; and 23% showed lack of insight into their psychiatric condition. Persons with SMI presented

with comorbid hypertension in 44% of hospitalizations, chronic pulmonary disease in 27% of hospitalizations, myocardial infarction/coronary artery disease in 23% of hospitalizations, and diabetes mellitus in 20% of hospitalizations. Evidence of continuous primary care (19%) and mental health care (7%) before to hospitalization was infrequent. In 47% and 76% of hospitalizations, persons with SMI were taking psychotropic medications or somatic medications, respectively. The primary provider for medical/surgical hospitalizations among persons with SMI was typically an internist/family practitioner (77%) or a surgeon (19%) (Table 2). Trainees were involved in providing care for 64% of hospitalizations, and the primary physician had previous experience with the patient in 37% of hospitalizations.

The frequency with which the patient, provider, and system factors of interest occurred in hospitalizations with medical, neurologic/psychiatric, and HAI patient safety events among persons with SMI is shown in Table 3. The most common patient-level factor was progression or severity of disease (79% overall, 89% of hospitalizations with medical patient safety events, 93% of hospitalizations with neurologic/psychiatric patient safety events, and 97% in hospitalizations with HAI patient safety events), followed by mental status (33% overall, 40% of hospitalizations with medical patient safety events, 64% of hospitalizations with neurologic/psychiatric patient safety events, and 63% of HAI patient safety events). Patients' difficulty communicating or participating in care and level of consciousness were identified in as factors with the potential to contribute to patient safety events in 23% and 21% of hospitalizations overall.

The most frequently identified provider factors with the potential to contribute to patient safety events were incomplete care (79% overall, 80% of hospitalizations with medical patient safety events, 77% of hospitalizations with neurologic/psychiatric patient safety events, 97% of hospitalizations with HAI patient safety events); lack of knowledge, skill, or competence (69% overall, 69% of hospitalizations with medical patient safety events, 76% of hospitalizations with neurologic/psychiatric patient safety events, and 82% of hospitalizations with HAI patient safety events); and lack of patient monitoring (66% overall, 73% of hospitalizations with medical patient safety events, 80% of hospitalizations with neurologic/psychiatric events, 88% of hospitalizations with HAI patient safety events). Lack of trainee supervision and delay in care were identified in 33% and 20%, respectively, of hospitalizations overall. Chart reviewers identified missing chart data in 33% of all hospitalizations; failure to follow hospital procedure or policy, in 26% of hospitalizations; and concerns with staffing workload, in 1% of hospitalizations. On the basis of the evidence available to them in the chart, reviewers classified 12% of hospitalizations as having below-normal standard of care.

Odds of medical (odds ratio [OR], 2.26; 95% confidence interval [CI], 1.58–3.24) and neurologic/psychiatric (OR, 4.91; 95% CI, 2.21–10.88) patient safety events were higher in hospitalizations where patients' progression and severity of disease was identified as an issue that could contribute to a patient safety event (Table 4). Odds of all three categories of patient safety events were elevated in hospitalizations where patients' mental status was identified as an issue. Difficulty communicating or participating in care was associated with elevated odds of HAI patient safety events (OR, 4.86; 95% CI, 1.63–14.1), and patients'

level of consciousness was associated with higher odds of both neurologic/psychiatric (OR, 4.87; 95% CI, 2.28–8.39) and HAI (OR, 4.68, 95% CI, 1.63–14.10) patient safety events.

At the provider level, lack of patient monitoring was associated with increased odds of medical (OR, 1.36; 95% CI, 1.04–1.79), neurologic (OR, 2.03; 95% CI, 1.23–3.35), and HAI (OR, 3.87; 95% CI, 1.20–12.55) patient safety events. Lack of trainee supervision was positively associated with HAI patient safety events (OR, 3.02; 95% CI, 1.07–8.52), and delays in care were associated with elevated likelihood of medical (OR, 1.63; 95% CI, 1.23–2.15) and HAI (OR, 2.87; 95% CI, 1.22–6.74) patient safety events. Provider delay in seeking needed consultation was positively associated with neurologic/psychiatric patient safety events (OR, 2.74; 95% CI, 1.16–6.50). At the system level, failure to follow a hospital policy or procedure was associated with heightened odds of neurologic/psychiatric events (OR, 1.73; 95% CI, 1.02–2.91) and chart reviewers' determination that the overall care administered during a given hospitalization was below normal standards of care was associated with increased odds of medical (OR, 1.57; 95% CI, 1.11–2.22) and neurologic/psychiatric (OR, 1.81; 95% CI, 1.05–3.14) patient safety events.

DISCUSSION

The complex mental and physical health conditions experienced by persons with SMI, who often present at medical/surgical hospitalization with both mental illness–related impairment and significant medical comorbidity, seem to play an important role in risk of adverse patient safety events. At the provider level, insufficient patient monitoring, lack of trainee supervision, delays in care, and delay or failure to seek needed consultation were all associated with elevated likelihood of at least one category of adverse patient safety event. Mental status was associated with elevated odds of all three categories of patient safety events, suggesting that the psychiatric symptoms of SMI may confer uniquely high risk of experiencing adverse events. The other factors found to be associated with elevated risk of patient safety events in the study population with SMI have also been shown to increase the likelihood of patient safety events in the population without SMI (Christian et al., 2006; Karsh et al., 2006; Nolan, 2000; Rothschild et al., 2005). For example, a study of critical care patients found a positive association between delays in care and lack of patient monitoring and adverse safety events (Rothschild et al., 2005). Several factors identified suggest promising pathways for future intervention. At the patient level, mental status and level of consciousness can potentially be improved through better use of psychiatric consultations and identification and management of delirium (Hsieh et al., 2015). Patient communication could be improved with support from onsite consumer advocates or other social support interventions. At the provider level, our results suggest that increased patient monitoring, trainee supervision, and team-based care that facilitates consultation across provider specialties may improve safety for persons with SMI. Mental status, level of consciousness, and lack of patient monitoring were associated with elevated likelihood of all three types (medical, neurologic/psychiatric, and HAI) of patient safety events, suggesting that these factors should be priorities for intervention. Importantly, not all factors identified as increasing risk of adverse patient safety events, such as patients' progression and severity of disease, are clearly modifiable.

Although we assessed the relationship between individual patient-, provider-, and system-level factors and adverse patient safety events, these factors are not independent. For example, although delayed or incomplete care could signal a failure to follow hospital policy or procedure, these issues could also be related to a patient's difficulty communicating or participating in his/her care. At the patient level, mental status and level of consciousness influence a patient's ability to communicate or participate in care. At the provider level, lack of knowledge about and/or experience with SMI may contribute to incomplete care, insufficient monitoring, and delayed or absent consultation with mental health specialists. Although our measure of delay in seeking/failure to seek consultation applied to all types of consultation, the finding that this provider-level factor was associated with elevated likelihood of neurologic/psychiatric, but not medical or HAI, patient safety events suggests that improving consultation and collaboration among medical/surgical and mental health specialty providers during medical/surgical hospitalization may benefit persons with SMI.

Our exploratory study assessed multiple factors that could increase risk of adverse patient safety events during medical/surgical hospitalizations for persons with SMI, but the list of factors examined was not comprehensive. For example, while we measured patients' ability to communicate, we were unable to assess two-way patient-provider communication using medical record data. Patient-provider communication challenges have been shown to be associated with suboptimal care in other vulnerable populations (Cooper et al., 2003; Haywood et al., 2014; Lattimer et al., 2010; Laws et al., 2014) and may also contribute to harmful patient safety events in the population with SMI. Stigma among general medical providers may also play a role. Although previous research has shown higher levels of stigma toward persons with SMI among general internists than psychiatrists (Mittal et al., 2014), the influence of stigma on quality of care for persons with SMI is unknown. In addition, the present study did not examine risk management and treatment factors, such as use of restraints or pain management, which could influence the occurrence of adverse patient safety events among persons with SMI.

Study results should be interpreted in the context of several limitations. The generalizability of results is limited because of selection into the study sample by mortality, and our study results are specific to a subset of Maryland Medicaid beneficiaries with SMI in their last 5 years of life. Because of lack of a non-SMI comparison group, we were unable to assess which patient, provider, and system factors were uniquely associated with elevated risk of patient safety events among those with SMI. Despite these limitations, the case-crossover design used provided the critically important benefit of automatically controlling for unmeasured person-level risk factors (*e.g.*, tobacco smoking, family/social support) that may influence patient safety, making this an optimal design to accurately assess factors influencing the likelihood that persons with SMI experience patient safety events during medical/surgical hospitalizations. Although we controlled for key time-varying characteristics across hospitalizations in statistical models, our analysis may have inadequately accounted for other time-variant factors. The patient safety measurement tool used in this study is newly developed and has not been validated in other populations, although it has several important benefits over prior tools (Daumit et al., 2016; Pronovost and Wachterl, 2013). The medical record review methodology used allowed for collection of detailed information about the hospitalizations of interest, but the accuracy of the abstracted

measurements was dependent on information being documented in the charts. Content and format of medical records may vary across providers and hospitals. The patient safety events measured occurred in 1994–2004, before widespread use of electronic medical records (EMRs), which may facilitate communication among providers (McGuire et al., 2013) but also may pose their own burdens such as a shift away from time spent with patients to time spent entering data into the EMR (Cellucci et al., 2015; Miller and Sim, 2004). Future research should assess whether and how risk of adverse patient safety events in the population with SMI has changed in the EMR era. Furthermore, clinical events occurred before widespread availability of hospitalists and thus may not reflect health system improvements in areas including delirium prevention, falls prevention, and others.

CONCLUSIONS

Persons with SMI are at high risk of adverse patient safety events during medical/surgical hospitalizations. Impaired mental status and severity of medical comorbidities make this group particularly vulnerable to patient safety–related harm. Modifiable provider and system factors, such as patient monitoring, consultative care, and hospital policies and procedures, may play an important role in the patient safety of persons with SMI during medical/surgical hospitalizations. Study findings suggest that efforts to reduce the unique patient safety risks associated with SMI will need to be multifaceted and address system-, provider-, and patient-level factors.

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References

- Allison DB, Newcomer JW, Dunn AL, Blumenthal JA, Fabricatore AN, Daumit GL, Cope MB, Riley WT, Vreeland B, Hibbeln JR, Alpert JE. Obesity among those with mental disorders: A National Institute of Mental Health meeting report. *Am J Prev Med.* 2009; 2009:341–350.
- Blank MB, Himelhoch SS, Balaji AB, Metzger DS, Dixon LB, Rose CE, Oraka E, Davis-Vogel A, Thompson WW, Heffelfinger JD. A multisite study of the prevalence of HIV with rapid testing in mental health settings. *Am J Public Health.* 2014; 104:2377–2384. [PubMed: 24524493]
- Cellucci LW, Cellucci T, Stanton M, Kerrigan D, Madrake M. Current status and future directions of EMR use in psychology clinics. *Health Policy Technol.* 2015; 4:91–99.
- Christian CK, Gustafson ML, Roth EM, Sheridan TB, Gandhi TK, Dwyer K, Zinner MJ, Dierks MM. A prospective study of patient safety in the operating room. *Surgery.* 2006; 139:159–173. [PubMed: 16455323]
- Classen DC, Resar R, Griffin F, Federico F, Frankel T, Kimmel N, Whittington JC, Frankel A, Seger A, James BC. ‘Global trigger tool’ shows that adverse events in hospitals may be ten times greater than previously measured. *Health Aff (Millwood).* 2011; 30:581–589. [PubMed: 21471476]
- Cooper LA, Roter DL, Johnson RL, Ford DE, Steinwachs DM, Powe NR. Patient-centered communication, ratings of care, and concordance of patient and physician race. *Ann Intern Med.* 2003; 139:907–915. [PubMed: 14644893]
- Daumit G, Anthony C, Ford DE, Fahey M, Skinner EA, Lehman A, Hwang W, Steinwachs D. Pattern of mortality in a sample of Maryland residents with severe mental illness. *Psychiatry Res.* 2010; 176:242–245. [PubMed: 20207013]

- Daumit GL, Clark JM, Steinwachs DM, Graham CM, Lehman A, Ford DE. Prevalence and correlates of obesity in a community sample of individuals with severe and persistent mental illness. *J Nerv Ment Dis.* 2003; 191:799–805. [PubMed: 14671456]
- Daumit GL, McGinty EE, Pronovost P, Dixon LB, Guallar E, Ford DE, Cahoon EK, Boonyasai R, Thompson D. Patient safety events and harms during medical and surgical hospitalizations for persons with serious mental illness. *Psychiatr Serv.* 2016; 67:1068–1075. [PubMed: 27181736]
- Daumit GL, Pronovost PJ, Anthony CB, Guallar E, Steinwachs DM, Ford DE. Adverse events during medical and surgical hospitalizations for persons with schizophrenia. *Arch Gen Psychiatry.* 2006; 63:267–272. [PubMed: 16520431]
- De Hert M, van Winkel R, Van Eyck D, Hanssens L, Wampers M, Scheen A, Peuskens J. Prevalence of diabetes, metabolic syndrome and metabolic abnormalities in schizophrenia over the course of the illness: A cross-sectional study. *Clin Pract Epidemiol Ment Health.* 2006; 2:14. [PubMed: 16803620]
- de Vries EN, Ramrattan MA, Smorenburg SM, Gouma DJ, Boermeester MA. The incidence and nature of in-hospital adverse events: A systematic review. *Qual Saf Health Care.* 2008; 17:216–223. [PubMed: 18519629]
- Dickerson FB, Brown CH, Kreyenbuhl JA, Fang L, Goldberg RW, Wohheiter K, Dixon LB. Obesity among individuals with serious mental illness. *Acta Psychiatr Scand.* 2006; 113:306–313. [PubMed: 16638075]
- Dubois RW, Brook RH. Preventable deaths: Who, how often, and why? *Ann Intern Med.* 1988; 109:582–589. [PubMed: 3421565]
- Garcia-Martin M, Lardelli-Claret P, Bueno-Cavanillas A, Luna-del-Castillo JD, Espigares-Garcia M, Galvez-Vargas R. Proportion of hospital deaths associated with adverse events. *J Clin Epidemiol.* 1997; 50:1319–1326. [PubMed: 9449935]
- Garcia-Martin M, Lardelli-Claret P, Jimenez-Moleon JJ, Bueno-Cavanillas A, Luna-del-Castillo JD, Galvez-Vargas R. Proportion of hospital deaths potentially attributable to nosocomial infection. *Infect Control Hosp Epidemiol.* 2001; 22:708–714. [PubMed: 11842992]
- Haywood C Jr, Bediako S, Lanzkron S, Diener-West M, Strouse J, Haythornthwaite J, Onojobi G, Beach MC. An unequal burden: Poor patient-provider communication and sickle cell disease. *Patient Educ Couns.* 2014; 96:159–164. [PubMed: 24935607]
- Hsieh TT, Yue J, Oh E, Puelle M, Dowal S, Trivison T, Inouye SK. Effectiveness of multicomponent nonpharmacological delirium interventions: A meta-analysis. *JAMA Intern Med.* 2015; 175:512–520. [PubMed: 25643002]
- Karsh B, Holden RJ, Alper SJ, Or CK. A human factors engineering paradigm for patient safety: Designing to support the performance of the healthcare professional. *Qual Saf Health Care.* 2006; 15:i59–i65. [PubMed: 17142611]
- Khaykin E, Ford DE, Pronovost PJ, Dixon L, Daumit GL. National estimates of adverse events during nonpsychiatric hospitalizations for persons with schizophrenia. *Gen Hosp Psychiatry.* 2010; 32:419–425. [PubMed: 20633747]
- Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics.* 1977; 33:159–174. [PubMed: 843571]
- Landrigan CP, Parry GJ, Bones CB, Hackbarth AD, Goldmann DA, Sharek PJ. Temporal trends in rates of patient harm resulting from medical care. *N Engl J Med.* 2010; 363:2124–2134. [PubMed: 21105794]
- Lattimer L, Haywood C Jr, Lanzkron S, Ratanawongsa N, Bediako SM, Beach MC. Problematic hospital experiences among adult patients with sickle cell disease. *J Health Care Poor Underserved.* 2010; 21:1114–1123. [PubMed: 21099065]
- Laws MB, Lee Y, Rogers WH, Beach MC, Saha S, Korthuis PT, Sharp V, Cohn J, Moore R, Wilson IB. Provider-patient communication about adherence to anti-retroviral regimens differs by patient race and ethnicity. *AIDS Behav.* 2014; 18: 1279–1287. [PubMed: 24464408]
- McEvoy JP, Meyer JM, Goff DC, Nasrallah HA, Davis SM, Sullivan L, Meltzer HY, Hsiao J, Scott Stroup T, Lieberman JA. Prevalence of the metabolic syndrome in patients with schizophrenia: Baseline results from the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE)

- schizophrenia trial and comparison with national estimates from NHANES III. *Schizophr Res.* 2005; 80:19–32. [PubMed: 16137860]
- McGuire MJ, Noronha G, Samal L, Yeh HC, Crocetti S, Kravet S. Patient safety perceptions of primary care providers after implementation of an electronic medical record system. *J Gen Intern Med.* 2013; 28:184–192. [PubMed: 22887020]
- Miller BJ, Paschall CB 3rd, Svendsen DP. Mortality and medical comorbidity among patients with serious mental illness. *Psychiatr Serv.* 2006; 57:1482–1487. [PubMed: 17035569]
- Miller RH, Sim I. Physicians' use of electronic medical records: Barriers and solutions. *Health Aff (Millwood).* 2004; 23:116–126. [PubMed: 15046136]
- Mittal D, Corrigan P, Sherman MD, Chekuri L, Han X, Reaves C, Mukherjee S, Morris S, Sullivan G. Healthcare providers' attitudes toward persons with schizophrenia. *Psychiatr Rehabil J.* 2014; 37:297–303. [PubMed: 25313529]
- Nolan TW. System changes to improve patient safety. *Br Med J.* 2000; 320:771. [PubMed: 10720364]
- Osborn DP, Levy G, Nazareth I, Petersen I, Islam A, King MB. Relative risk of cardiovascular and cancer mortality in people with severe mental illness from the United Kingdom's General Practice Research Database. *Arch Gen Psychiatry.* 2007; 64: 242–249. [PubMed: 17283292]
- Pronovost PJ, Wachter RM. Progress in patient safety: A glass fuller than it seems. *Am J Med Qual.* 2013; 29:165–169. [PubMed: 23939487]
- Rosenberg SD, Goodman LA, Osher FC, Swartz MS, Essock SM, Butterfield MI, Constantine NT, Wolford GL, Salyers MP. Prevalence of HIV, hepatitis B, and hepatitis C in people with severe mental illness. *Am J Public Health.* 2001; 2001:31–37.
- Roshanaei-Moghaddam BMD, Katon WMD. Premature mortality from general medical illnesses among persons with bipolar disorder: A review. *Psychiatr Serv.* 2009; 60:147–156. [PubMed: 19176408]
- Rothschild JM, Landrigan CP, Cronin JW, Kaushal R, Lockley SW, Burdick E, Stone PH, Lilly CM, Katz JT, Czeisler CA, Bates DW. The Critical Care Safety Study: The incidence and nature of adverse events and serious medical errors in intensive care. *Crit Care Med.* 2005; 33:1694–1700. [PubMed: 16096443]
- Sajatovic M, Dawson NV. The emerging problem of diabetes in the seriously mentally ill. *Psychiatr Danub.* 2010; 22(Suppl 1):S4–S5.
- Smith EG, Zhao S, Rosen AK. Using the Patient Safety Indicators to detect potential safety events among US veterans with psychotic disorders: Clinical and research implications. *Int J Qual Health Care.* 2012; 24:321–329. [PubMed: 22718516]
- Vincent, C. Patient safety. Hoboken, NJ: John Wiley & Sons; 2011.

TABLE 1

Medical and Surgical Hospitalizations for Adults With SMI: Patient Characteristics During Hospital Stay ($N=790$ Hospitalizations)

Patient Characteristics During Hospital Stay	Hospitalizations ($N = 790$)
Mental status assessment, ^a n (%)	
Abnormal motor state	73 (9)
Abnormal mood	318 (40)
Abnormal thought content ^b	59 (7)
Abnormal thought processes ^c	72 (9)
Hallucinations	26 (3)
Abnormal speech	286 (36)
Lack of insight into psychiatric condition	85 (11)
Lack of insight into medical condition(s)	185 (23)
Impaired orientation	280 (35)
Cognitive impairment	229 (29)
Delirium	54 (7)
Medical comorbidity, ^a n (%)	
Hypertension	350 (44)
Chronic pulmonary disease	215 (27)
Myocardial infarction/coronary artery disease	179 (23)
Diabetes mellitus	154 (20)
Renal disease	132 (17)
HIV	118 (15)
Liver disease	103 (13)
Moderate or severe liver disease	41 (5)
Mild liver disease	82 (10)
Cerebrovascular disease	105 (13)
Substance use disorder	104 (13)
Peripheral vascular disease	75 (10)
Malignancy	78 (10)
Metastatic solid tumor	56 (7)
Number of medical comorbidities present, mean (SD)	4 (11)
Service engagement prior to hospitalization, ^d n (%)	
Any mental health treatment	355 (50)
Outpatient mental health treatment	90 (13)
Evidence of continuous outpatient mental health treatment	52 (7)
Psychotropic medication(s)	337 (47)
Evidence of continuous psychotropic medication treatment	147 (19)
Any primary medical care	662 (84)
Outpatient primary care treatment	401 (51)
Evidence of continuous outpatient primary care treatment	154 (19)

Patient Characteristics During Hospital Stay	Hospitalizations (<i>N</i> = 790)
Medication to treat somatic conditions	599 (76)
Evidence of continuous medication to treatment somatic conditions	246 (31)
Any specialty medical/surgery care	279 (35)
Any substance use disorder treatment	36 (5)

^aIncludes factors documented as present at admission and/or developed during the hospital stay.

^bDelusions, homicidal ideation, suicidal ideation, paranoia, obsessive thoughts.

^cConfabulation, perseveration, blocking, illogical, tangential, and disorganized thought processes.

^dAny evidence of service engagement, at any time point, prior to hospitalization.

TABLE 2

Medical and Surgical Hospitalizations Among Adults With SMI: Facility, Hospitalization, and Provider Characteristics (*N* = 790 Hospitalizations)

Hospitalizations (<i>N</i> = 790)	
Facility characteristics	
Total bed size, <i>n</i> (%)	
0–250	223 (28)
251–400	302 (38)
>400	247 (31)
Psychiatry beds, <i>n</i> (%)	
0	226 (29)
1–50	455 (58)
51–100	65 (8)
>100	44 (6)
Teaching hospital, <i>n</i> (%)	494 (63)
Hospitalization characteristics	
Length of stay, mean (SD), days	10 (1)
Admitting service, <i>n</i> (%)	
Medical	732 (93)
Surgical	58 (7)
Admission source, <i>n</i> (%)	
Emergency department	625 (79)
Direct inpatient admission	165 (21)
Provider characteristics	
Primary provider during hospitalization, <i>n</i> (%)	
Internist/family practice	609 (77)
Surgeon	147 (19)
Obstetrician/gynecologist	1 (<1)
Unknown	33 (4)
Any trainee involvement during hospitalization, <i>n</i> (%)	508 (64)
Intern involvement	491 (62)
Medical student involvement	73 (9)
Fellow involvement	22 (3)
Nursing student involvement	11 (1)
Care team experience with patient prior to hospitalization, <i>n</i> (%)	
Primary physician experience with patient	291 (37)
Social work team experience with patient	48 (6)
Emergency department team experience with patient	21 (3)
Nursing team experience with patient	24 (3)
Psychiatry team experience with patient	16 (2)

TABLE 3

Frequency and Prevalence of Patient and Provider Factors Contributing to Patient Safety Events in Medical and Surgical Hospitalizations for Patients With SMI (*N* = 790 Hospitalizations)

	Total (<i>N</i> = 790)	Type of Patient Safety Event		
		Medical (<i>n</i> = 443)	Neurologic/ Psychiatric (<i>n</i> = 182)	HAI (<i>n</i> = 76)
Patient factors				
Progression or severity of disease	615 (78)	396 (89)	170 (93)	74 (97)
Mental status	259 (33)	178 (40)	116 (64)	48 (63)
Level of consciousness	163 (21)	127 (29)	102 (56)	44 (58)
Difficulty communicating or participating in care	180 (23)	126 (28)	69 (38)	39 (51)
Line, tube, or drain removed by patient	60 (8)	51 (12)	31 (17)	18 (24)
Provider factors				
Incomplete care	628 (79)	355 (80)	140 (77)	63 (83)
Lack of knowledge, skill, or competence	546 (69)	305 (69)	182 (76)	62 (82)
Lack of patient monitoring	522 (66)	323 (73)	145 (80)	67 (88)
Lack of trainee supervision	260 (33)	153 (35)	78 (43)	39 (51)
Delay in care	160 (20)	130 (29)	67 (37)	42 (55)
Lack of appropriate discharge planning ^a	222 (35)	101 (34)	29 (27)	12 (32)
Appropriate referrals and appointments not arranged ^a	187 (29)	86 (29)	23 (21)	10 (27)
Delay in seeking/failure to seek needed consultation	42 (5)	30 (7)	22 (12)	7 (9)
System factors				
Missing chart data	258 (33)	163 (37)	73 (40)	31 (41)
Hospital policy or procedure not followed	183 (26)	109 (27)	59 (35)	26 (39)
Concerns with staffing workload	9 (1)	7 (2)	6 (3)	1 (1)
Overall care administered below normal standards of care	91 (12)	16 (91)	37 (20)	20 (26)

Note: Data are presented as *n* (%).

^a Among subset of 636 hospitalizations where patient did not die in the hospital.

TABLE 4

Relative Odds of Patient Safety Events in Hospitalizations With Versus Without Specific Patient, Provider, and System-Level Factors ($N = 790$ Hospitalizations)

	Type of Patient Safety Event					
	Medical			Neurologic/Psychiatric		
	OR ^a (95% CI)	<i>p</i>		OR ^a (95% CI)	<i>p</i>	HAI
						OR ^a (95% CI)
Patient factors						
Progression of or severity of disease	2.26 (1.58–3.24)	<0.001	4.91 (2.21–10.88)	<0.001	1.97 (0.67–5.76)	0.215
Mental status	1.42 (1.10–1.85)	0.008	3.03 (1.86–1.49)	<0.001	2.52 (1.09–5.82)	0.031
Level of consciousness	1.71 (1.27–2.29)	<0.001	4.87 (2.82–8.39)	<0.001	4.68 (1.63–14.1)	0.004
Difficulty communicating or participating in care	1.29 (0.96–1.75)	0.094	1.60 (0.98–2.63)	0.063	4.86 (1.86–12.73)	0.001
Line, tube, or drain removed by patient	1.28 (0.97–1.56)	0.095	1.11 (0.78–1.59)	0.566	1.06 (0.59–1.89)	0.845
Provider factors						
Incomplete care	0.92 (0.73–1.16)	0.449	1.05 (0.60–1.85)	0.864	0.91 (0.52–1.60)	0.740
Lack of knowledge, skill, or competence	0.95 (0.75–1.22)	0.709	1.35 (0.71–2.58)	0.708	1.51 (0.62–3.64)	0.363
Lack of patient monitoring	1.36 (1.04–1.79)	0.028	2.03 (1.23–3.35)	0.006	3.87 (1.20–12.55)	3.87
Lack of trainee supervision	1.13 (0.92–1.55)	0.449	1.10 (0.66–1.82)	0.719	3.02 (1.07–8.52)	0.037
Delay in care	1.63 (1.23–2.15)	<0.001	1.42 (0.89–2.26)	0.144	2.87 (1.22–6.74)	0.015
Lack of appropriate discharge planning ^b	0.84 (0.60–1.18)	0.316	0.37 (0.10–1.11)	0.073	1.59 (0.44–5.72)	0.477
Delay in seeking/failure to seek needed consultation	1.25 (0.76–2.05)	0.778	2.74 (1.16–6.50)	0.022	0.76 (0.19–3.13)	0.706
System factors						
Missing chart data	1.21 (0.93–1.57)	0.159	1.38 (0.89–2.15)	0.145	1.31 (0.56–3.09)	0.531
Hospital policy or procedure not followed	1.12 (0.81–1.53)	0.459	1.73 (1.02–2.91)	0.041	1.36 (0.52–3.54)	0.536
Concerns with staffing workload	1.51 (0.59–3.90)	0.393	2.06 (0.63–6.69)	0.232	1.97 (0.11–34.98)	0.644
Overall care administered below normal standards of care	1.57 (1.11–2.22)	0.010	1.81 (1.05–3.14)	0.034	2.17 (0.88–5.38)	0.094

^aRelative odds were estimated using conditional logistic regression models clustered at the person level. Models controlled for admission source, admitting service, length of stay, and Charlson comorbidity index.

^bAmong a subset of 636 hospitalizations where the patient did not die in the hospital.