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Comparing rates of adverse events and medical errors on inpatient psychiatric units at Veterans Health Administration (VHA) and community-based general hospitals

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Abstract

Objective: There is limited knowledge about how general hospitals and Veterans Health Administration hospitals fare relative to each other on a broad range of inpatient psychiatry-specific patient safety outcomes. This research compares data from two large-scale epidemiological studies of adverse events (AEs) and medical errors (MEs) in inpatient psychiatric units, one in VHA hospitals and the other in community-based general hospitals.

Method: Retrospective medical record reviews assessed the prevalence of AEs and MEs in a sample of 4,371 discharges from 14 community-based general hospitals (derived from 69,081 discharges at 85 hospitals) and a sample of 8,005 discharges from 40 VHA hospitals (derived from 92,103 discharges at 105 medical centers). Rates of AEs and MEs across hospital systems were calculated, controlling for relevant patient and hospital characteristics.

Results: The overall rate of AEs and MEs in inpatient psychiatric units of VHA hospitals was 7.11 and 1.49 per 100 patient discharges; at community-based acute care hospitals, these rates were 13.48 and 3.01 per 100 patient discharges. The adjusted odds ratio of a patient experiencing an AE and a ME at community-based hospitals as compared with VHA hospitals was 2.11 and 2.08, respectively.

Conclusion: Although chart reviews may not document the complete nature and outcomes of care, even after controlling for differences in patient and hospital characteristics, psychiatric inpatients at community-based hospitals were twice as likely to experience AEs or MEs as inpatients at VHA hospitals. While community-based hospitals may lag behind VHA hospitals, both hospital systems should continue to pursue evidence-based improvements in patient safety. Future research aimed at changing hospital practices should draw on established strategies for

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bridging the gap from research to practice in order to improve the quality of care for this vulnerable patient population.

INTRODUCTION

Reducing medical errors and adverse events has been integral to patient safety improvements in medical and surgical care.¹⁻³ These efforts have been informed by epidemiological research examining the frequency with which these events occur, as well as the extent to which they occur due to provider error or result in patient harm.⁴⁻⁶ Patients with psychiatric disorders and hospital-based mental health care were excluded from foundational patient safety research, but have started to receive more recent attention in studies of medical errors (ME) and adverse events (AE).⁷⁻¹¹ Two recent large studies focused on AEs and MEs in inpatient psychiatric units in Veterans Health Administration (VHA) and in community-based acute care general hospitals, providing the first estimates of safety events in these settings.^{12,13} There is a need for quality research in psychiatry, as the gap seems to be widening between the care for mental and physical disorders.¹⁴⁻¹⁶

Every year, there are over one million discharges from psychiatric units of acute care hospitals,^{17,18} approximately half (47.5%) of which are from acute care general hospitals¹⁹ and 10% from VHA medical centers.²⁰ Each of these hospital types represents different patient populations and systems of care. The VHA is the largest integrated health care system in the US with over 90 medical centers that have inpatient psychiatric units. There are more than 1,000 community hospitals with inpatient psychiatric units, which, unlike the VHA, are part of independent hospital systems, each with their own set of policies and practices.²¹ There have been only a few studies comparing these two hospital systems and these have examined only a limited range of patient safety indicators. Findings have been mixed with community hospitals performing better than VHA hospitals on some patient safety indicators measures, most in medicine and a few in behavioral health²² including lower rates of readmission,²³ while VHA hospitals have better continuity of medical care and medication-related quality of care outcomes in general medical²⁴ and mental health care settings.²⁴⁻²⁷ None of these studies have compared the full range of adverse events and medical errors in inpatient psychiatric settings. Thus, we still have only limited knowledge about how general hospitals and VHA hospitals fare relative to each other on a broad range of inpatient psychiatry-specific patient safety outcomes.

This article compares patient safety data from two large-scale epidemiological studies of adverse events and medical errors in inpatient psychiatric units – one in VHA hospitals and the other in community-based general hospitals. An examination is provided of how and to what extent these systems differ in their rates of adverse events and medical errors in inpatient psychiatric care. These findings help shed light on how and where to target future patient safety initiatives.

METHODS

We conducted chart reviews at samples of VHA and community hospitals. As part of these studies, we measured the prevalence of AEs and MEs. Using an established two-tier chart

review process,^{28,29} each study reviewed a random sample of inpatient psychiatric discharges in the respective hospital systems. The study team developed standardized abstraction tools to extract data from the medical records. The first tier of review was conducted by medical record reviewers who received extensive training to detect and ‘flag’ a broad range of potential AEs and MEs. The second-tier of review included a team of board-certified psychiatrists trained to assess whether flagged medical records met study criteria for a safety event.

Medical Errors and Adverse Events

Patient safety events were categorized as medical errors and adverse events. Medical errors (ME) were defined as the omission or commission of clinical care that has potentially negative consequences for a patient that would have been judged wrong by skilled and knowledgeable peers at the time the errors occurred, regardless of whether there were any negative consequences.³⁰ Adverse events (AE) were defined as the negative unintended consequences of clinical care that led to injury, impairment, or other harm.^{31,32} Events could be either or both an AE and a ME. We screened for the following ten events in the medical record: AEs included 1) adverse drug events, 2) self-harm or injury, 3) assault, 4) sexual contact, 5) fall and 6) other non-drug adverse events; MEs included 7) elopement, 8) contraband, and 9) other non-drug medical errors (e.g., wrong test, error in procedure, etc.). The definition and measurement of these events are described in more detail elsewhere.³³ Because of differences in technology at the VHA hospitals, we did not compare medication errors, which are a sub-set of medical errors. The entire VHA uses computerized physician order entry and a barcode-controlled medication delivery system which tracks all medication orders and automatically flags delayed and missed doses. The automated systems may create a bias in the detection of medication errors, particularly when compared with hospitals that do not have this technology.

Sample and Data Sources—The community hospital sample was drawn from a random selection of hospitals in Pennsylvania using Pennsylvania Health Care Cost Containment Council (PHC4) data and included hospitals with an inpatient psychiatric unit. In 2010, there were 69,081 discharges from 85 hospitals in the state. We selected a stratified random sample of community hospitals stratified by teaching status and hospital location (urban or rural) with probabilities proportional to each hospital’s number of discharges. From these hospitals, a subsample of patient discharges was drawn from each hospital with probabilities inversely proportional to the size of the hospital and weighted to account for nonresponse and to be representative of all discharges for psychiatric units at Pennsylvania general hospitals. The total study sample of community hospitals included 4,371 discharges from 14 hospitals in 2010. For the VHA hospitals, the sample was drawn from the Patient Treatment File of the National Patient Care Database, maintained by the VHA Office of Information. In 2012, the VHA nationally had 92,103 discharges from 105 medical centers with inpatient psychiatric units. For this study, we also selected a random sample of discharges using an implicitly stratified two-stage probability proportional to size design. The total study sample of VHA units included 8,005 discharges from 40 hospitals in 2012. Additional details on the study design are described elsewhere.^{12,13}

At the community-based general hospitals, data were collected from a combination of paper and electronic records, depending on whether the hospital had an electronic medical record or paper chart system. At the VHA, data were collected from the Computerized Patient Record System, the universal electronic medical record used at the VHA. For each selected discharge, data were abstracted from the medical record which contained detailed information about the care received by the patient while on the inpatient psychiatric unit, including admission and discharges notes, clinical notes, nursing notes, progress notes, and physician's orders. The study also included available patient demographic and clinical characteristics, along with hospital attributes. The VHA study was granted approval by the U.S. Department of Veterans Affairs Central Institutional Review Board and the study at the general hospitals was granted approval by the University of Pennsylvania Institutional Review Board.

Patient and hospital characteristics.—For each discharge, patient demographic and clinical factors were examined, along with characteristics of the treating hospital. Patient demographic characteristics included age in years (18–30, 31–42, 43–53, and 54 and older); sex (male, female); and race (white, non-white). Patient clinical factors included: length of stay in days (1–3, 4–6, 7–9, and 10–30; stays of >30 days were excluded from the analysis); admission day (weekday or weekend); principal psychiatric diagnosis (psychosis, mood disorder or other); suicidality (yes, no); and substance use disorders (continuous, unspecified or episodic, no or in remission). Hospital characteristics included teaching status (teaching or non-teaching); urbanicity (urban or rural); and number of psychiatric beds (11–28; 30–44; 46–152). For continuous variables (e.g., length of stay in days and number of admissions), categories were determined based on the median and interquartile range.

Analysis—First we examined differences between community-based and VHA hospitals on key patient and hospital factors, using a Wald chi square and t-test. Second, we calculated the rate per 100 patient discharges of adverse event and medical error overall and for each type of AE and ME. We then calculated unadjusted and adjusted odds ratios using logistic regression to compare the identified rates of AEs and MEs across systems of care. The adjusted model controlled for all of the patient and hospital characteristics noted above. Third, we conducted separate regression models to compare adverse event and medical error rates across systems stratified by the demographic, clinical and hospital characteristics. We present odds ratios (95% Confidence Intervals) for each of these models and also tested an interaction term in the regression. Using an interaction term in the model that included both health systems, we then compared the relative magnitude of each odds ratio across systems. All analyses were conducted in SAS 9.4, using PROC SURVEYFREQ, PROC SURVEYMEANS and PROC SURVEYLOGISTIC to accommodate the two-stage proportional sampling and weighting.

RESULTS

Comparison of patient and hospital characteristics at VHA and general hospitals

Table 1 illustrates that there were significant differences between the community-based general hospitals and the VHA hospitals on many of the patient characteristics. A total of

4,250 discharges were reviewed at the community hospitals while 7,999 discharges were reviewed at the VHA. Patients in the VHA hospitals sample were significantly more likely than patients in the community hospitals to be: 54 years and older (45.9% vs 25.7%, $p < .0001$) and male (90.3% vs 47.6%, $p < .0001$). With regard to clinical characteristics, VHA patients were less likely to have a length of stay (LOS) of 1–3 days, but more likely to be admitted on a weekday, have a principal psychiatric diagnosis other than mood or psychosis, experience suicidality and have continuous drug dependence. There were no significant differences on any of the hospital characteristics (urbanity, teaching status and number of psychiatric beds) between the community-based general hospitals and the VHA hospitals.

Rates of patient safety events by hospital type

The rate of Any Event at community hospitals was 15.26 and 8.00 at VHA hospitals (Table 2). Any Adverse Event rates varied from 13.48 [10.49–16.47] to 7.11 [6.14–8.08] at community and VHA hospitals, respectively. At community hospitals, the rate of Any Medical Error was 3.01 [2.16–3.86] and at the VHA hospitals, it was 1.49 [1.09–1.89]. The most common types of events were adverse drug events and patient falls. There were significant differences in both the unadjusted and adjusted odds ratios of patient safety events in community and VHA hospitals. Community hospitals had approximately two times the rate of VHA hospitals on: Any Event, Any Adverse Events, and Any Medical Errors. Within the specific types of adverse events, patients at community hospitals were more likely to experience an Adverse Drug Event, Sexual Contact, a Fall, and a Non-Drug AE than patients at VHA hospitals. With regard to specific types of medical errors, patients at community hospitals were twice as likely to experience an error involving Contraband or a Non-drug Medical Error than their counterparts at VHA hospitals.

Rate and adjusted odds ratios of any Adverse Event (AE) or Any Medical Error (ME), interaction of hospital system and patient or hospital factors

Tables 3 and 4 illustrate the adjusted odds of a patient experiencing Any AE or Any ME at community versus VHA hospitals, stratified by patient and hospital characteristics. The overall findings were essentially similar across all of the strata, with the adjusted odds ratios of Any AE between the community and VHA hospitals ranging from to 1.503 (number of psychiatric beds) to 3.316 (teaching status) and Any ME ranging from 1.005 (urbanicity) to 4.621 (admission day). When looking at the relationship between hospital system and patient or hospital factors, there were no statistically significant interaction terms.

DISCUSSION

Even after controlling for differences in patient and hospital characteristics, patients treated at community-based hospitals were approximately twice as likely as patients at VHA hospitals to experience adverse events or medical errors. As compared to their counterparts at VHA facilities, psychiatric inpatients at community-based hospitals were more likely to experience a wide range of such events including adverse drug events, sexual assault, non-medication related adverse events, falls, and non-drug medical errors. Study findings suggest that safety oriented patient care processes at VHA facilities may serve as a model for safety improvement at community-based hospitals.

The lower overall rates of safety events in the VHA system may be attributable to the VHA's considerable investment in quality improvement and care coordination, including the standardization of safety efforts across hospitals. An evaluation of all medical care at the VHA found that their system-wide quality-improvement initiatives have been effective, resulting in significant improvements over prior years and over non-VHA systems of care.³⁴ The VHA's use of a universal electronic medical record across all areas of medicine and standardized database of reported safety events¹¹⁻¹³ contribute to their systematic continuity of care and facilitates root cause analyses (RCA) of adverse events to identify where processes fail and how to improve them.³⁵ These improvements may have had a positive impact on inpatient psychiatry as well. The VHA provides online toolkits available to improve the quality of care around specific medical conditions (e.g., PTSD)³⁶ or clinical processes that include assessment tools, treatment resources, organizational and process change tools, patient registries, and patient education materials.³⁷ Making these and other standardized protocols and evidence-based clinical practices available to all hospitals with inpatient psychiatric units, both in the VHA and in community hospitals, paired with RCAs to understand the local or specific hospital conditions affecting patient safety, could have contributed to the comparatively lower rate of safety events at VHA hospitals.

It is difficult to compare our findings with prior research which has mostly focused on different quality of care measures for mental health patients. The few studies examining psychiatric patient outcomes between hospital systems have found no significant differences between the VHA and non-VHA hospital systems on clinical status, provider satisfaction, community adjustment,²⁷ and quality measures of pharmacotherapy for patients with schizophrenia,²⁶ but slightly better performance by the VHA in treating patients with major depression.²⁵ Still, the existing research supports the supposition that both systems of care have room for further safety improvements and look to evidence-based treatment practices.²⁶

In our study, the fact that the magnitude of differences in patient safety rates held up across almost all patient and hospital demographic groups suggest that broad system of care factors contribute to the group differences in error rates. Even at their best, both community and VHA hospitals have plenty of room for improvement as patient safety event rates ranging from 8–15% are still unacceptably high. A recent qualitative inquiry of inpatient psychiatric physician and nursing staff at the VHA found a need for additional training, both for frontline staff on the assessment and early detection of warning signs, as well as for non-psychiatric staff who regularly interact with psychiatric inpatients (e.g., lab technicians, food service providers).¹¹ Another recent study at the VHA suggested needed improvements in the policies and processes governing existing reporting practices, along with strategies that promote an active culture of safety in inpatient psychiatry.³⁸ Thus, inpatient psychiatry could also benefit from examining relevant evidence-based safety strategies that have fostered a culture of safety and improved safety outcomes in medicine and surgery. For instance, efforts could draw on promising multi-component interventions in medicine that promote a culture of safety,³⁹ such as Structured Inter-Disciplinary Rounds (SIRs; which promote daily interdisciplinary communication),⁴⁰ Situation, Background, Assessment and Recommendation (SBAR; a communication strategy that includes automated alerts and reminders), and Comprehensive Unit-based Safety Programs (CUSPs; which evaluates

culture of safety, prioritizes targets and implements tailored interventions),⁴¹ since these strategies have been associated with improvements in safety climate^{42,43} and adverse event rates,⁴⁴ including falls, unexpected death and ICU admissions.⁴⁵ In practice, this could include incorporating: daily joint rounds and closed-loop communication among all hospital staff on the unit (i.e., nurses, physicians, pharmacists, social workers and case managers); structured tools to assess patient plan of care, discharge and safety; and establishing universal screening criteria for flagging potential adverse events.⁴⁰ Finally, to target the most prevalent events in our study, hospitals should consider tailoring established prevention strategies that have been effective in other areas of hospital care, such as adverse drug event and fall prevention that try to reduce known risk factors (e.g., nurse staffing and skills).⁴⁵ Yet some events, such as self-harm and violence, may be uncommon outside of inpatient psychiatry and particularly difficult to predict or prevent. There are, however, initiatives specifically in psychiatry that successfully target such events, which could be adopted in both VHA and community-based units. For instance, Safewards is a strategy that has identified staff actions influencing the likelihood of patient conflict and has developed 10 specific interventions in response, ranging from de-escalation techniques, positive patient comments during shift handovers, regular patient meetings, and distraction and sensory modulation tools for use with agitated patients.⁴⁶

Limitations.

First, while chart reviews are limited in that they may not document the complete nature and outcomes of care, they are comparable to prospective data collection,⁴⁷ as well as more effective at identifying events than voluntary reporting, incident reports,⁴⁸ patient safety indicators or provider-report.⁴⁹ Second, data were derived from two different studies and although they used the same protocol, they were operationalized in slightly different ways. The community hospital sample of 14 units each had their own medical record system and method of documentation while the VHA included 40 hospital units which shared the same standardized electronic medical record system. The staffing of the two studies also differed in that the review of the community-based hospital records was conducted by professional nurses trained in chart review while the review of VHA records was completed by trained non-clinical research staff, thus the enhanced clinical expertise may have led to the nurse reviewers doing a better job of detecting patient safety events. However, both teams of reviewers underwent the same rigorous training using standardized manuals and safety definitions, underwent the same testing and completion of mock reviews with fidelity and continuous follow-up throughout the study. In addition, both studies used standardized abstraction forms to systematize the process. Third, study findings may not be applicable to psychiatric hospitals or longer-term units. Fourth, the community-based hospital sample included only hospitals from one state which likely limits generalizability to other states given variations in state licensure and regulatory policies. Finally, the patients seen in the community hospitals likely differ from patients seen at the VHA in numerous ways and although we included a substantial number of covariates, it is still possible that other relevant patient characteristics (i.e., socioeconomic status⁵⁰) may confound the observed group differences in event risk.

CONCLUSION

This study presents population adjusted rates of AEs and MEs in inpatient psychiatric units of acute care hospitals, stratified by key demographic, clinical and hospital characteristics for community-based general acute care hospitals and VHA hospitals. While community-based hospitals may lag behind VHA hospitals in patient safety, both hospital systems should strive to continue making improvements in inpatient psychiatric care. Implementing patient safety improvement initiatives require input and knowledge of direct care providers paired with support and buy-in from organizational leadership.¹¹ Future research aimed at changing hospital practices should draw on established interventions combined with strategies for bridging the gap from research to practice⁵¹ in order to improve the quality of care for this vulnerable patient population.

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REFERENCES

1. Kohn LT, Corrigan JM, Donaldson MS. To Err Is Human: Building a Safer Health System. Washington, DC: National Academies Press; 2000.
2. Harrison MI, Henriksen K, Hughes RG. Improving the health care work environment: a sociotechnical systems approach. *Jt Comm J Qual Patient Saf* 2007; 33(suppl):3–6. [PubMed: 18173161]
3. Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: National Academies Press; 2001.
4. Leape LL, Brennan TA, Laird N, et al. The nature of adverse events in hospitalized patients: Results of the Harvard Medical Practice Study II. *N Eng J Med* 1991;324:377–384.
5. Brennan TA, Leape LL, Laird NM, et al. Incidence of adverse events and negligence in hospitalized patients: Results of the Harvard Medical Practice Study I. *N Eng J Med* 1991; 324:370–376.
6. Landrigan CP, Parry GJ, Bones CB, et al. Temporal trends in rates of patient harm resulting from medical care. *N Eng J Med* 2010;363:2124–2134.
7. 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]
8. Nath SB, Marcus SC: Medical errors in psychiatry. *Harv Rev Psychiatry* 2006;14: 204–211. [PubMed: 16912006]
9. Cullen SW, Nath SB, Marcus SC: Toward understanding errors in inpatient psychiatry: A qualitative analysis. *Psychiatric Quarterly* 81: 197–205, 2010. [PubMed: 20204514]
10. Hanrahan NP, Kumar A, Aiken LH: Adverse events associated with organizational factors of general hospital inpatient psychiatric care environments. *Psychiatric Services* 61:569–574, 2010 [PubMed: 20513679]
11. True G, Frasso R, Cullen S, Hermann RC, Marcus S. Adverse events in Veterans Affairs inpatient psychiatric units: Staff perspectives on contributing and protective factors. *Gen Hosp Psychiatry* 48: 65–71, 2017. [PubMed: 28843113]
12. Marcus SC, Hermann RC, Frankel MR, Cullen SW. Safety of Psychiatric Inpatients at the Veterans Health Administration. *Psychiatric Services*, 69, 204–210, 2018 [PubMed: 29032707]
13. Vermeulen JM, Doedens P, Cullen SW, van Tricht MJ, Hermann R, Frankel M, de Haan L, Marcus SC: Predictors of adverse events and medical errors among adult inpatients of psychiatric units of acute care general hospitals. *Psych Serv* 2018; 69:1087–1094.

14. Pincus HA, Page AE, Druss B, Appelbaum PS, et al. Can psychiatry cross the quality chasm? Improving the quality of health care for mental and substance use conditions. *Am J Psych* 2007; 164:712–719.
15. Institute of Medicine Committee on Crossing the Quality Chasm: Adaptation to Mental Health and Addictive Disorders Improving the Quality of Health Care for Mental and Substance-Use Conditions: Quality Chasm Series. 2006: National Academies Collection Accessed online 1/30/19 <https://www.ncbi.nlm.nih.gov/books/NBK19830/>
16. Kilbourne AM, Beck K, Spaeth-Rublee B, Ramanuj P, et al. Measuring and improving the quality of mental health care: A global perspective. *World Psychiatry* 2018; 17:30–38. [PubMed: 29352529]
17. Heslin KC, Elixhauser A, Steiner CA: Hospitalizations Involving Mental and Substance Use Disorders Among Adults, 2012 Healthcare Cost and Utilization Project Statistical Brief 191. Rockville, MD, Agency for Healthcare Research and Quality, 2015.
18. Heslin KC, Weiss AJ: Hospital Readmissions Involving Psychiatric Disorders, 2012 Healthcare Cost and Utilization Project Statistical Brief 189. Rockville, MD, Agency for Healthcare Research and Quality, 2015.
19. Mark TL, Stranges E, Levit KR. Using Healthcare Cost and Utilization Project State Inpatient Database and Medicare Cost Reports Data to Determine the Number of Psychiatric Discharges From Psychiatric Units of Community Hospitals. Rockville, MD, Agency for Healthcare Research and Quality, 2010.
20. VHA Facility Quality and Safety Report, Fiscal Year 2012 Data. Washington, DC, US Department of Veterans Affairs, 2013 https://www.va.gov/HEALTH/docs/VHA_Quality_and_Safety_Report_2013.pdf. Accessed Jan 13, 2017
21. Lutterman T, Shaw R, Fisher W, Manderscheid R: Trend in psychiatric inpatient capacity, United States and Each State, 1970–2014. Alexandria, VA: National Association of State Mental Health Program Directors 8 2017 www.nasmhpd.org%2Fsites%2Fdefault%2Ffiles%2FTACPaper.2.Psychiatric-Inpatient-Capacity_508C.pdf&usg=AOvVaw1W8DK8-h3QsD_tJquz7fB-
22. Blay E Jr., DeLancey JO, Hewitt DB. Initial public reporting of quality at Veterans Affairs vs Non-Veterans Affairs Hospitals. *JAMA Internal Medicine*, 177, 882–885, 2017. [PubMed: 28418527]
23. Leslie DL, Rosenheck RA. Comparing quality of mental health care for public sector and privately insured populations. *Psychiatr Serv*, 51, 650–5, 2000. [PubMed: 10783185]
24. Barnett MJ, et al., Comparison of rates of potentially inappropriate medication use according to the Zhan criteria for VA versus private sector Medicare HMOs. *J Manag Care Pharm*, 12, 362–70, 2006. [PubMed: 16792442]
25. Busch SH, Leslie DL, Rosenheck RA, Comparing the quality of antidepressant pharmacotherapy in the Department of Veterans Affairs and the private sector. *Psychiatr Serv*, 55, 1386–91, 2004. [PubMed: 15572566]
26. Leslie DL, Rosenheck RA. Benchmarking the quality of schizophrenia pharmacotherapy: a comparison of the Department of Veterans Affairs and the private sector. *J Ment Health Policy Econ*, 6, 113–21, 2003. [PubMed: 14646004]
27. Rosenheck RA, et al., Benchmarking treatment of schizophrenia: a comparison of service delivery by the national government and by state and local providers. *J Nerv Ment Dis*, 188, 209–16, 2000. [PubMed: 10789997]
28. Hiatt HH, Barnes BA, Brennan TA, et al.: A study of medical injury and medical malpractice. *New England Journal of Medicine* 321: 480–484, 1989 [PubMed: 2761585]
29. Thomas EJ, Studdert DM, Burstin HR, et al.: Incidence and types of adverse events and negligent care in Utah and Colorado. *Medical Care* 38:261–271, 2000 [PubMed: 10718351]
30. Wu AW, Cavanaugh TA, McPhee SJ, et al.: To tell the truth: ethical and practical issues in disclosing medical mistakes to patients. *Journal of General Internal Medicine* 12:770–775, 1997 [PubMed: 9436897]
31. Griffin FA, Resar RK: IHI Global Trigger Tool for Measuring Adverse Events, 2nd ed. IHI Innovation Series white paper. Cambridge, MA, Institute for Healthcare Improvement, 2009.
32. Kizer KW, Stegun MB: Serious Reportable Adverse Events in Health Care Advances in Patient Safety. vol. 4 Rockville, MD, Agency for Healthcare Research and Quality, 2005.

33. Marcus SC, Hermann RC, Cullen SW. Defining patient safety events in inpatient psychiatry. *J Patient Safety* 2018; 7 17: Epub ahead of print.
34. Jha AK, Perlin JB, Kizer KW, Dudley RA. Effects of the transformation of the Veterans Affairs health care system on the quality of care. *N Eng J Med* 2003; 348: 2218–2227.
35. Lee A, Mills PD, Neily J, Hemphill RR. Root cause analysis of serious adverse events among older patients in the Veterans Health Administration. *Jt Comm J Qual Patient Saf* 40: 253–62, 2014. [PubMed: 25016673]
36. https://www.ptsd.va.gov/about/mission/education/online_education_research.asp
37. York L, Bruce B, Luck J, Bowman C, Midboe AM, Smith N, Elenes M, Girard J, Griffith D, et al.: Online toolkits for metric-driven quality improvement: The Veterans Health Administration managed grassroots approach. *Joint Commission J on Qual Pat Saf* 39: 561–569, 2013.
38. Reilly CA, Cullen SW, Watts BV, Mills PD, Paull DE, Marcus SC. How well do incident reporting systems work on inpatient psychiatric units? *Jt Comm J Qual Pat Saf* 2019; 45:63–69.
39. Weaver SJ, Dy S, Lubomski LH, et al. Promoting a culture of safety; in making health care safer II: an updated critical analysis of the evidence for patient safety practices. Rockville, MD: Agency for Health Care Research and Quality; 2013.
40. O’Leary KJ, Buck R, Fligel HM, et al. Structured interdisciplinary rounds in a medical teaching unit: improving patient safety. *Arch Intern Med* 2011;171:678–84. [PubMed: 21482844]
41. Pronovost P, Weast B, Rosenstein B, et al. Implementing and validating a comprehensive unit-based safety program. *J Patient Saf* 2005;1:33–40.
42. Sexton JB, Berenholtz SM, Goeschel CA, et al. Assessing and improving safety climate in a large cohort of intensive care units. *Crit Care Med* 2011;39:934–9. [PubMed: 21297460]
43. Timmel J, Kent PS, Holzmueller CG, et al. Impact of the comprehensive unit-based safety program (CUSP) on safety culture in a surgical inpatient unit. *Jt Comm J Qual Patient Saf* 2010;36:252–60. [PubMed: 20564886]
44. O’Leary KJ, Haviley C, Slade ME, et al. Improving teamwork: impact of structured interdisciplinary rounds on a hospitalist unit. *J Hosp Med* 2011;6:88–93. [PubMed: 20629015]
45. Muller M, Jurgens J, Redaelli M, Klingberg K, Hautz WE, Stock S: Impact of the communication and patient hand-off tool SBAR on patient safety: A systematic review. *BMJ Open*, 8: e022202, 2018.
46. Bowers L, James K, Quirk A, Simpson A, et al. Reducing conflict and containment rates on acute psychiatric wards: The Safewards cluster randomised controlled trial. *Int J Nurs Stud* 2015; 52:1412–22. [PubMed: 26166187]
47. Haley RW, Schaberg DR, McClish DK, et al. The accuracy of retrospective chart review in measuring nosocomial infection rates: results of validation studies in pilot hospitals. *American Journal of Epidemiology* 1980; 111:516–533. [PubMed: 7377196]
48. Murff HJ, Patel VL, Hripcsak G, et al. Detecting adverse events for patient safety research: a review of current methodologies. *Journal of Biomedical Informatics* 2003;36:131–143. [PubMed: 14552854]
49. Classen DC, Resar R, Griffin F, et al.: “Global trigger tool” shows that adverse events in hospitals may be ten times greater than previously measured. *Health Affairs* 2011; 30:581–589. [PubMed: 21471476]
50. Figueroa JF, Wang DE, Jha AK. Characteristics of hospitals receiving the largest penalties by US pay-for-performance programmes. *BMJ Qual Saf* 2016;25:898–900.
51. Hirschhorn LR, Ramaswamy R, Devnani M, Wandersman A, Simpson LA, Garcia-Elorrio E. Research versus practice in quality improvement? Understanding how we can bridge the gap. *Int J Qual Health Care* 2018; 30(Suppl 1): 24–28. [PubMed: 29447351]

Table 1.

Patient demographic/clinical and hospital characteristics

<i>Patient characteristics</i>	Community-based general acute care hospitals (n=4250)	VHA acute care hospitals (n=7999)	Comparing general to VHA hospitals (p-value)
Age in years ¹			<.0001
18-30	26.1	13.6	
31-42	23.6	15.3	
43-53	24.6	25.1	
54 and older	25.7	45.9	
Gender ²			<.0001
Male	47.6	90.3	
Female	52.4	9.7	
Race ³			0.1041
White	76.7	63.6	
Non-white	20.2	30.5	
Length of stay in days			0.0014
1-3	25.6	18.4	
4-6	32.5	33.8	
7-9	18.6	22.7	
10 or more	23.3	25.1	
Admission day ⁴			0.0032
Weekday	69.9	83.4	
Weekend	18.9	16.6	
Principal psychiatric diagnosis			<.0001
Psychosis	25.0	21.6	
Mood disorder	69.3	60.5	
Other	5.7	17.9	
Suicidality			<.0001
Yes	15.2	36.6	
No	84.8	63.4	
Substance use disorders			<.0001
Continuous	10.0	24.1	
Unspecified or episodic	26.4	31.4	
No or in remission	63.6	44.5	
<i>Hospital characteristics</i>			
Urbanity			0.7763
Urban	81.7	85.1	
Rural	18.3	14.9	

<i>Patient characteristics</i>	Community-based general acute care hospitals (n=4250)	VHA acute care hospitals (n=7999)	Comparing general to VHA hospitals (p-value)
Teaching status			0.1431
Teaching	52.8	77.6	
Non-teaching	47.2	22.4	
Number of psychiatric beds			0.3433
11-28	44.0	30.0	
30-44	37.5	32.4	
46-152	18.4	37.6	

¹VHA_{miss}=5

²VHA_{miss}=4

³VHA_{miss}=465, COM_{miss}=134

⁴COM_{miss}=317

^aAll analyses were performed using complex samples analyses, therefore results are presented as percentages.

^bICD-9 Psychosis: 295, 297, 298, 290.20, 290.41, 290.42, 291.0, 291.1, 291.3, 291.5, 292.11, 292.12, 292.81, 293.0, 293.81; Mood: 296, 311, 290.21, 290.43, 292.84, 293.0, 293.83, 300.4, 301.13, 309.0, 309.28; Other: all other mental health codes

^cICD-9 Suicidal ideation V62.84 or attempt E950-E959

⁴ICD-9 Drug use: Continuous 303.01, 303.91, 304.01, 304.21, 304.31, 304.41, 304.51, 304.61, 304.71, 304.81, 304.91, 305.01, 305.21, 305.31, 305.41, 305.51, 305.61, 305.71, 305.81, 305.91; Unspecified or episodic 303.00, 303.02, 303.90, 303.92, 304.00, 304.02, 304.10, 304.12, 304.20, 304.22, 304.30, 304.32, 304.40, 304.42, 304.50, 304.52, 304.60, 304.62, 304.70, 304.72, 304.80, 304.82, 304.90, 304.92, 305.00, 305.20, 305.22, 305.30, 305.40, 305.42, 305.50, 305.52, 305.60, 305.62, 305.70, 305.72, 305.90; In remission: 303.03, 303.93, 304.03, 304.13, 304.23, 304.33, 304.43, 304.53, 304.63, 304.73, 304.83, 304.93, 305.03, 305.23, 305.33, 305.43, 305.53, 305.63, 305.73, 305.93

Table 2.

Prevalence and rates per 100 patient discharges of patient safety events by hospital type

	Community-based general acute care hospitals (n=4371)	VHA acute care hospitals (n=8005)	(ref=VHA)	(ref=VHA)
	Rate, 95% CIs	Rate, 95% CIs	Unadjusted Odds Ratio	Adjusted Odds Ratio [†]
Any Event	15.26[11.88-18.65]	8.00[6.95- 9.05]	2.07 [1.57-2.73]	2.10 [1.71-2.59]
Adverse Events (AE) All	13.48 [10.49-16.47]	7.11 [6.14-8.08]	2.03 [1.55-2.67]	2.11[1.72-2.59]
Adverse drug event (ADE)	8.60 [6.17-11.03]	3.74 [3.05-4.43]	2.42 [1.73-3.40]	2.20 [1.67-2.90]
Patient self-harm or injury	0.60 [0.22-0.99]	0.44 [0.29-0.59]	1.39 [0.71-2.71]	1.57 [0.73-3.39]
Patient assault	1.05 [0.75-1.35]	0.94 [0.61-1.26]	1.12 [0.72-1.73]	1.60 [0.85-3.04]
Patient sexual contact	0.80 [0.61-0.99]	0.11 [0.04-0.19]	7.19 [3.54-14.61]	8.36 [3.53-19.8]
Patient fall	3.55 [2.73-4.37]	2.44 [1.95-2.92]	1.47 [1.10-1.98]	1.75 [1.23-2.49]
Other non-drug AEs	1.40 [0.71-2.09]	0.25 [0.11-0.38]	5.67 [2.82-11.41]	5.38 [2.42-11.99]
Medical Errors All	3.01 [2.16-3.86]	1.49 [1.09-1.89]	2.06 [1.41-3.00]	2.08 [1.43-3.02]
Elopement	0.18 [0.02-0.34]	0.21 [0.05-0.38]	0.87 [0.29-2.64]	0.75 [0.21-2.70]
Contraband	1.47 [1.08-1.87]	0.65 [0.41-0.89]	2.29 [1.48-3.54]	2.31 [1.35-3.96]
Non-drug medical errors	1.63 [1.02-2.24]	0.80 [0.55-1.05]	2.06 [1.29-3.27]	2.19 [1.41-3.40]

[†]Controlling for all characteristics in Table 1.

Table 3.

Rates per 100 patient days and adjusted odds ratio of Any Adverse Event by hospital type, stratified by patient and hospital factors

Any Adverse Event						
	Event rate at community-based general acute care hospitals Rate, 95% CIs (n=4250)	Event rate at VHA acute care hospitals Rate, 95% CIs (n=7999)	Unadjusted p-value	Adjusted Odds Ratio, 95% CIs [†]	Adjusted p-value	Overall p-value for interaction
Overall	13.48 [10.78-16.18]	7.11 [6.15-8.07]	<.0001	2.111 [1.718-2.593]	<.0001	
<i>Patient characteristics</i>						
Age in years						0.1444
18-30	10.75 [8.75-12.76]	4.96 [3.58-6.35]	<.0001	2.898 [2.119-3.964]	<.0001	
31-42	9.00 [7.29-10.71]	5.22 [4.07-6.38]	0.0002	1.715 [1.269-2.317]	0.0004	
43-53	11.17 [8.69-13.66]	6.07 [4.73-7.41]	<.0001	1.677 [1.093-2.571]	0.0179	
54 and older	22.57 [15.28-29.86]	8.95 [7.58-10.33]	<.0001	2.162 [1.638-2.854]	<.0001	
Gender						0.1566
Male	12.66 [9.99-15.33]	6.98 [5.99-7.97]	<.0001	2.248 [1.722-2.934]	<.0001	
Female	14.23 [11.14-17.31]	8.35 [6.11-10.60]	0.0019	1.761 [1.261-2.459]	0.0009	
Race						0.9328
White	14.03 [11.13-16.93]	7.42 [6.31-8.53]	<.0001	2.142 [1.717-2.672]	<.0001	
Non-white	11.55 [8.00-15.09]	6.47 [5.29-7.65]	0.0014	1.792 [1.271-2.529]	0.0009	
Length of stay in days						0.5766
1-3	3.67 [2.19-5.15]	2.11 [1.33-2.89]	0.0438	1.637 [0.882-3.038]	0.1181	
4-6	7.55 [5.29-9.80]	3.59 [2.77-4.41]	<.0001	1.878 [1.286-2.741]	0.0011	
7-9	16.59 [13.24-19.93]	7.91 [6.25-9.57]	<.0001	1.901 [1.341-2.695]	0.0003	
10 or more	30.01 [23.12-36.90]	14.79 [12.24-17.34]	<.0001	2.362 [1.746-3.196]	<.0001	
Admission day						0.4088
Weekday	13.57 [10.62-16.53]	7.24 [6.26-8.23]	<.0001	2.140 [1.770-2.586]	<.0001	
Weekend	11.45 [8.12-14.78]	6.46 [4.86-8.06]	0.0029	2.051 [1.336-3.149]	0.0010	
Principal psychiatric diagnosis						0.1168

Any Adverse Event						
	Event rate at community-based general acute care hospitals Rate, 95% CIs (n=4250)	Event rate at VHA acute care hospitals Rate, 95% CIs (n=7999)	Unadjusted p-value	Adjusted Odds Ratio, 95% CIs †	Adjusted p-value	Overall p-value for interaction
Mood disorder	12.84 [10.64-15.05]	6.76 [5.77-7.75]	<.0001	2.235 [1.828-2.734]	<.0001	
Psychosis	15.19 [10.68-19.72]	9.54 [7.76-11.31]	0.0090	1.880 [1.352-2.616]	0.0002	
Other	13.71 [7.89-19.53]	5.38 [4.30-6.47]	0.0001	2.314 [1.112-4.814]	0.0248	
Suicidality						0.7596
Yes	9.62 [8.10-11.14]	6.56 [5.21-7.92]	0.0030	2.120 [1.473-3.052]	<.0001	
No	14.17 [11.07-17.27]	7.43 [6.43-8.43]	<.0001	2.089 [1.678-2.601]	<.0001	
Substance use disorders						0.6487
Continuous	10.05 [8.48-11.62]	5.97 [4.44-7.50]	0.0005	2.107 [1.529-2.905]	<.0001	
Unspecified or episodic	10.14 [7.89-12.39]	6.20 [5.15-7.26]	0.0005	2.049 [1.556-2.699]	<.0001	
No or in remission	15.41 [11.55-19.26]	8.38 [7.03-9.72]	<.0001	2.041 [1.561-2.669]	<.0001	
<i>Hospital characteristics</i>						
Urbanity						0.3149
Urban	13.56 [10.29-16.83]	7.05 [6.02-8.09]	<.0001	2.004 [1.590-2.525]	<.0001	
Rural	13.13 [10.23- 16.04]	7.45 [4.32-10.59]	0.0054	2.152 [1.174-3.943]	0.0131	
Teaching status						0.0718
Teaching	11.40 [9.52-13.29]	7.30 [6.18-8.42]	<.0001	1.853 [1.524-2.253]	<.0001	
Non-teaching	15.81 [11.06- 20.55]	6.47 [4.41-8.53]	<.0001	3.134 [1.693-5.801]	0.0003	
Psychiatric beds						0.1252
11-28	13.98 [11.63-16.34]	7.17 [5.14-9.20]	<.0001	2.247 [1.548-3.262]	<.0001	
30-44	14.59 [8.26-20.92]	7.33 [5.67-8.98]	0.0039	2.215 [1.515-3.238]	<.0001	
46-152	10.01 [7.23-12.80]	6.88 [5.21- 8.56]	0.0328	1.578 [1.037-2.402]	0.0332	

† Controlling for all characteristics in Table 1.

Table 4.

Rates per 100 patient days and adjusted odds ratio of Any Medical Error by hospital type, stratified by patient and hospital factors

Any Medical Error						
	Event rate at community-based general acute care hospitals (n=4250)	Event rate at VHA acute care hospitals (n=7999)	Unadjusted p-value	Adjusted Odds Ratio, 95% CIs [†]	Adjusted p-value	Overall p-value for interaction
Overall	3.01 [2.24-3.78]	1.49 [1.09-1.88]	0.0001	2.077 [1.429-3.021]	0.0001	
<i>Patient characteristics</i>						
Age in years						0.3910
18-30	2.95 [2.09-3.81]	1.65 [0.75-2.56]	0.0611	2.090 [1.028-4.247]	0.0417	
31-42	2.32 [1.55-3.10]	1.06 [0.46-1.66]	0.0161	2.538 [1.204-5.347]	0.0143	
43-53	3.03 [1.76-4.31]	1.04 [0.59-1.50]	0.0004	2.161 [1.065-4.384]	0.0328	
54 and older	3.68 [2.52-4.85]	1.82 [1.33-2.32]	0.0007	1.952 [1.177-3.236]	0.0095	
Gender						0.0687
Male	3.08 [2.18-3.98]	1.58 [1.16-1.99]	0.0007	1.967 [1.328-2.913]	0.0007	
Female	2.95 [2.14-3.76]	0.64 [0.11-1.18]	0.0004	4.557 [1.899-10.931]	0.0007	
Race						0.8602
White	3.29 [2.49-4.08]	1.79 [1.25-2.32]	0.0014	2.169 [1.461-3.221]	0.0001	
Non-white	2.03 [0.71-3.34]	0.94 [0.53-1.36]	0.0507	1.997 [0.878-4.543]	0.6682	
Length of stay in days						0.4535
1-3	1.89 [1.15-2.64]	0.54 [0.10-0.99]	0.0054	5.366 [1.750-16.456]	0.0033	
4-6	2.44 [1.76-3.11]	1.07 [0.70-1.44]	0.0002	1.981 [1.176-3.339]	0.0102	
7-9	2.68 [1.96-3.40]	1.65 [1.02-2.28]	0.0368	1.261 [0.782-2.033]	0.3424	
10 or more	5.30 [3.25-7.35]	2.59 [1.71-3.47]	0.0054	2.178 [1.300-3.651]	0.0031	
Admission day						0.0349
Weekday	2.72 [1.88-3.55]	1.63 [1.20-2.07]	0.0119	1.824 [1.202-2.768]	0.0047	
Weekend	3.56 [2.33-4.79]	0.75 [0.07-1.43]	0.0012	4.705 [2.012-11.003]	0.0004	
Principal psychiatric diagnosis						0.0595
Mood disorder	2.61 [1.90-3.32]	1.55 [1.10-2.00]	0.0090	1.629 [1.122-2.366]	0.0103	

Any Medical Error						
	Event rate at community-based general acute care hospitals (n=4250)	Event rate at VHA acute care hospitals (n=7999)	Unadjusted p-value	Adjusted Odds Ratio, 95% CIs [†]	Adjusted p-value	Overall p-value for interaction
Psychosis	4.17 [2.01-6.32]	1.39 [0.84-1.93]	0.0008	2.801 [1.446-5.427]	0.0023	
Other	2.85 [0.95-4.75]	1.40 [0.75-2.05]	0.0794	3.217 [1.277-8.106]	0.0132	
Suicidality						0.2522
Yes	2.69 [2.06-3.31]	1.64 [1.11-2.18]	0.0132	1.544 [0.932-2.558]	0.0916	
No	3.07 [2.18-3.96]	1.40 [0.97-1.83]	0.0002	2.457 [1.530-3.944]	0.0002	
Substance use disorders						0.0333
Continuous	3.49 [2.25-4.73]	1.19 [0.74-1.64]	<.0001	2.820 [1.419-5.605]	0.0031	
Unspecified or episodic	2.76 [1.87-3.65]	1.31 [0.78-1.85]	0.0040	2.079 [1.219-3.548]	0.0072	
No or in remission	3.04 [2.06-4.02]	1.77 [1.12-2.42]	0.0261	1.719 [1.059-2.790]	0.0284	
<i>Hospital characteristics</i>						
Urbanity						0.3667
Urban	3.11 [2.19-4.04]	1.37 [0.97-1.77]	<.0001	2.217 [1.439-3.415]	0.003	
Rural	2.55 [2.25-2.86]	2.18 [0.69-3.67]	0.5972	1.079 [0.581-2.007]	0.8092	
Teaching status						0.0632
Teaching	2.47 [1.60-3.34]	1.56 [1.08-2.04]	0.0474	1.688 [1.083-2.632]	0.0208	
Non-teaching	3.62 [2.49-4.74]	1.23 [0.52-1.93]	0.0004	2.893 [1.249-6.698]	0.0132	
Psychiatric beds						0.0881
11-28	3.03 [2.45-3.61]	1.54 [0.74-2.35]	0.0101	1.878 [1.022-3.450]	0.0423	
30-44	3.69 [2.37-5.02]	1.08 [0.29-1.87]	0.0014	3.044 [1.407-6.588]	0.0047	
46-152	1.59 [0.00-3.44]	1.80 [1.22-2.37]	0.8300	1.423 [0.678-2.988]	0.3507	

[†]Controlling for all characteristics in Table 1.