

Incidence and Method of Suicide in Hospitals in the United States

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Background: There are no reliable estimates of hospital inpatient suicides in the United States. Understanding the rate and the methods used in suicides is important to guide prevention efforts. This study analyzed two national data sets to establish an evidence-based estimate of hospital inpatient suicides and the methods used.

Methods: The study is designed as a cross-sectional analysis of data from 27 states reporting to the National Violent Death Reporting System (NVDRS) for 2014–2015, and from hospitals reporting to The Joint Commission's Sentinel Event (SE) Database from 2010 to 2017. Categorical variables and qualitative reviews of event narratives were used to identify and code suicide events occurring during hospital inpatient treatment.

Results: Based on the hospital inpatient suicides reported in the NVDRS during 2014–2015, 73.9% of which occurred during psychiatric treatment, it is estimated that between 48.5 and 64.9 hospital inpatient suicides occur per year in the United States. Of these, 31.0 to 51.7 are expected to involve psychiatric inpatients. Hanging was the most common method of inpatient suicide in both the NVDRS and SE databases (71.7% and 70.3%, respectively).

Conclusion: The estimated number of hospital inpatient suicides per year in the United States ranges from 48.5 to 64.9, which is far below the widely cited figure of 1,500 per year. Analysis of inpatient suicide methods suggests that hospital prevention efforts should be primarily focused on mitigating risks associated with hanging, and additional suicide prevention efforts may be best directed toward reducing the risk of suicide immediately following discharge.

Every year in the United States, patients in general and psychiatric hospitals commit suicide. The Joint Commission classifies in-hospital suicide as a sentinel event—a patient safety event (not primarily related to the natural course of the patient's illness or underlying condition) that reaches a patient and results in death, permanent harm, or severe temporary harm.¹ Suicide is also considered a “never event,” which are “adverse events that are unambiguous (clearly identifiable and measurable), serious (resulting in death or significant disability), and usually preventable.”² The US Department of Veterans Affairs (VA) has been able to reduce the number of in-hospital suicides from 4.2 per 100,000 admissions to 0.74 per 100,000 admissions on mental health units, an 82.4% reduction,³ suggesting that well-designed quality improvement initiatives can lead to a reduction in the occurrence of these tragic events.

Despite the seriousness of inpatient suicides, the actual incidence nationally is poorly understood. The Joint Commission collects reports of inpatient suicides and suicides within 72 hours of discharge for all types of accredited health care organizations in its Sentinel Event (SE) Database⁴; there are usually fewer than 100 reports of any type of health care facility-associated suicide each year.⁵ However, because reporting is mostly voluntary, it is unclear whether the SE Database accurately reflects the true num-

ber of suicides in health care settings. In dramatic contrast, many journal articles,^{6–10} literature reviews,^{11,12} and clinical practice guidelines¹³ claim that approximately 1,500 inpatient suicides occur in the United States each year. The primary source for this estimate is a 1984 article by Crammer that begins: “A category of suicide [inpatient suicide] which only accounts for about 5% of the annual suicidal deaths in the country [United Kingdom] may at first seem unimportant.”¹⁴(p. 460) There is no source cited for this estimate, and the statement seems to serve only as a literary device—an effort to call attention to a problem that the author felt deserved closer inspection, despite its relative rarity.

This comment drew little attention until 1993 when Fawcett, Clark, and Busch applied Crammer's “estimate” to the 30,000 annual suicides in the United States to extrapolate: “about 5% of suicides (1,500 per year) are mentally ill inpatients.”¹⁵(p. 245) A version of this estimate appears 10 years later in a 2003 article by Busch, Fawcett, and Jacobs, which states: “there are approximately 30,000 suicides per year in the United States, 5% to 6% of which occur in hospitals.”⁶(p. 14) This article was subsequently cited in the American Psychiatric Association's 2003 clinical practice guideline for the assessment and treatment of patients with suicidal behaviors.¹³ The guideline declares: “In fact, it is estimated that approximately 1,500 inpatient suicides occur in the United States each year, with about a third of these occurring while patients are on one-to-one observation or every-15-minute checks.”¹³(p. 52) Since then, the figure has been widely cited.

This cross-sectional study was conducted to more accurately estimate (1) the rate of inpatient suicides and (2) the method and location of suicides within hospitals in the United States.

METHODS

Data Sources

The primary data source for estimating the rate of inpatient suicides was the Centers for Disease Control and Prevention's (CDC) National Violent Death Reporting System (NVDRS) Restricted Access Database (RAD). The CDC established the NVDRS in 2002 as a population-based surveillance system to analyze death by violence. Forty states, the District of Columbia, and Puerto Rico currently report to the NVDRS, submitting aggregate records collected from death certificates, coroner/medical examiner reports, and associated law enforcement and toxicology reports.¹⁶ Deaths due to violence are coded using the World Health Organization (WHO) definition of violence: "The intentional use of physical force or power against oneself, another person, or against a group or community."¹⁷(p. 4) The case definition includes suicides, homicides, deaths from legal intervention (except death by legal execution), deaths of undetermined intent, and unintentional firearm fatalities.¹⁸ State participation is voluntary; from its inception through 2015, the number of participating states increased from 6 to 27. The CDC provides state health departments with data collection software, coding instructions, and guidelines for data completeness and accuracy.^{19,20} For this study the CDC created a database filter for all suicides that occurred from 2003 to 2015.

The second data set was The Joint Commission's Sentinel Event (SE) Database. Suicide of any patient receiving care, treatment, and services in a staffed around-the-clock care setting or within 72 hours of discharge, including from the hospital's emergency department (ED), is considered a sentinel event. Organizations are sometimes required to report a suicide, but reporting is mostly voluntary. The event circumstances and contributing factors are identified through the organization's root cause analysis and then coded and stored in the database. For this study The Joint Commission created a de-identified data set containing all suicides reported from 2010 through the third quarter of 2017.

Data from the 2016 American Hospital Association (AHA) Annual Hospital Survey²¹ was used to identify the number of hospitals, hospital beds and inpatient admissions in each state. Both AHA data and Joint Commission data were used to calculate the proportion of hospitals accredited by The Joint Commission. Estimates of psychiatric inpatient admissions were determined using estimates provided through the National Association of State Mental Health Program Directors 2017 report on psychiatric inpatient

capacity,²² in conjunction with the AHA hospital survey data.

The study used de-identified data sets containing information about deceased individuals. As such, it does not meet the definition of human subjects research, and it is not subject to Institutional Review Board review.

Identification of Suicides

The study used a combination of existing precoded data and narrative descriptions of events in both data sets to identify all suicides in which the event occurred within a hospital where the victim was being treated as an inpatient. We excluded suicide events that occurred in medical facilities that were not hospitals (for example, nursing care centers, substance use rehabilitation centers, hospice facilities), events that involved nonpatients (for example, suicides that took place on hospital grounds where the victim was not a patient), and events that took place after discharge.

Methods of Suicide

To determine the method of suicide, the study relied on the determinations provided by event reporters. Reports to the SE Database include coded information about the method of suicide (asphyxiation, hanging, gunshot, drug overdose, jumping from a height, jumping in front of a vehicle, laceration, other). Narrative descriptions from the NVDRS were reviewed and classified using the same categories, whenever the method was clearly indicated in the report (for example, "victim found hanging in bathroom"). No category was assigned if narratives did not identify the method, or the method was unclear. When possible, information on service type was captured (for example, general medical/surgical vs. inpatient psychiatric care), as was the location of the event within the hospital (bedroom, bathroom, closet, shower, common area, other). Although "psychiatric treatment" was consistently identified in the NVDRS, it was generally not possible to distinguish between suicides that occurred in psychiatric hospitals vs. those that occurred on psychiatric units of general hospitals. When possible, text descriptions were also used to identify the ligature fixture point in hangings. (See Table 1 for a description of the variables used and the coding from text descriptions.)

Analysis

To estimate the national inpatient suicide rate, 2014 and 2015 NVDRS data were analyzed because these years had the largest number of states reporting (18 states in 2014, increasing to 27 states in 2015). Participating states in 2014 were Alaska, Colorado, Georgia, Kentucky, Maryland, Massachusetts, Michigan, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Utah, Virginia, and Wisconsin. In 2015 nine additional states were included: Arizona, Connecticut, Hawaii, Kansas, Maine, Minnesota, New Hampshire, New York, and Vermont.

Table 1. Coding Variables Used to Identify Hospital Inpatient Suicide Events	
National Violent Death Reporting System (NVDRS) Restricted Access Database (RAD)	Sentinel Event (SE) Database
Health Care–Associated Suicides: The NVDRS file was restricted to suicides only. Only those suicides associated with the variable InjuryLocationPlace coded as 23 (health-related facility) were selected for the research data file.	Health Care–Associated Suicides: All records in this file were associated with Joint Commission health care–related facilities. Program variable was used to identify hospitals (including psychiatric hospitals) and critical access hospitals. Only suicides were selected for the research data file.
Year: Analyses were conducted on suicides in 2014 and 2015 identified by the variable IncidentDate .	Year: Analyses were conducted on suicides from 2010 through Q32017. Comparisons with the NVDRS focused on events reported in 2014 and 2015 identified by the variable Year .
State: States were identified from the variable InjuryStateName .	State: States were identified from the variable HCOstate .
Location with respect to hospital setting: Text variables LEnarrative and MEenarrative were used to code variable inpat as inpatient or outpatient.	Location with respect to hospital setting: Text variable Synopsis was used to code offsite , whether incident occurred within or outside of the facility; categorical variables Setting and Service were used to code psychiatric inpatient treatment. Events occurring postdischarge were coded as Discharged and were identified through the variables Synopsis and Event_Additional_detail_Other .
Suicide Method: Method was coded from text variables LEnarrative and MEenarrative into the categories of asphyxiation, drug overdose, gunshot, hanging, jumping from height, jumping in front of vehicle, laceration, and other.	Suicide Method: The variable Event_subcategory contained the categories of asphyxiation, drug overdose, gunshot, hanging, jumping from height, jumping in front of vehicle, laceration, and other.
Location: Location of suicide as occurring in bathroom/shower, bedroom, closet, common area, other, not indicated, or missing was coded from the text variables LEnarrative and MEenarrative .	Location: Location of suicide as occurring in bathroom/shower, bedroom, closet, off-site (eloped), other, or not indicated were categories of the variable Event_Additional_detail .
Ligature Fixation Point (hanging victims only): Ligature fixation point was coded from the LEnarrative and MEenarrative variables.	Ligature Fixation Point (hanging victims only): Ligature fixation point was coded from text variable Synopsis .
Observation (hanging victims only): Frequency and type of staff observation of patient who committed suicide were coded from the text variables LEnarrative and MEenarrative .	Observation (hanging victims only): Frequency and type of staff observation of patient who committed suicide were coded from the text variable Synopsis .

To establish the estimate of inpatient suicides across the country, the AHA data set was used to calculate the proportion of all hospital admissions in the United States and inpatient psychiatric admissions that were represented by states reporting to the NVDRS. (Note: Estimates based on proportions of hospital and hospital beds yielded similar results, so results are presented based on hospital admissions.) The average total inpatient suicide counts for 2014 and 2015 in the NVDRS were then divided by the proportion of hospital admissions represented by the reporting states in each year in order to obtain an estimate of the total number of inpatient suicides across hospital admissions in all 50 states. The same approach was used to estimate the number of inpatient psychiatric care suicides nationally. Confidence intervals (CIs) were calculated by considering the estimated rate as the mean of a Poisson distribution, as recommended for counts of uncommon events. Upper and lower CIs were set at 95% using Shoenberg’s (1983) CI factor table.²³

To calculate the average number of suicides reported to the SE Database, all years with complete data were used (2010–2016); data from 2017 were also included in analyses of suicide methods and location. Direct aggregate comparisons between the NVDRS and the SE Database were restricted to the 2014–2015 time period and used SE

Database reports from only the NVDRS–reporting states during each year. To determine if there was a trend in the count of inpatient suicides from 2010 to 2016 in the SE Database a Poisson regression was calculated using SAS 9.4 (SAS Institute Inc., Cary, North Carolina), GENMOD procedure.

RESULTS

Estimated Incidence Based on NVDRS Data

Hospitals from the 18 states reporting to the NVDRS in 2014 represented approximately 31.1% of all hospitals in the United States, 32.0% of hospital beds, 33.0% of hospital admissions, and 35.5% of psychiatric inpatient admissions (Table 2). During 2015, hospitals within the 27 states reporting to the NVDRS represented approximately 43.7% of all hospitals in the United States, 46.0% of hospital beds, 46.2% of hospital admissions, and 44.5% of psychiatric inpatient admissions. These proportions were similar when the analysis included only Joint Commission–accredited hospitals. The vast majority of general and psychiatric hospitals were Joint Commission accredited.

Table 3 shows suicide events reported to the NVDRS in 2014–2015. From the states reporting to the NVDRS in

	Hospitals	Total Hospital Beds	Total Number of Hospital Admissions	Total Number of Psychiatric Hospitals	Total Number of Psychiatric Hospital Beds	Total Number of Psychiatric Hospital Admissions	Estimate of All Psychiatric Inpatient Admissions [†]
All Hospitals							
2014 NVDRS States,* N (% of total)	1,986 (31.1)	297,305 (32.0)	11,875,998 (33.0)	167 (31.2)	24,396 (32.8)	374,461 (35.5)	579,661.0 (35.5)
2015 NVDRS States,* N (% of total)	2,792 (43.7)	428,000 (46.0)	16,654,392 (46.2)	235 (43.8)	35,470 (47.7)	619,485 (58.7)	726,308.1 (44.5)
Total (All US States) [‡]	6,388	929,674	36,009,816	536	74,343	1,054,698	1,632,659.4
Joint Commission–Accredited Hospitals							
2014 NVDRS States,* N (% of total)	1,473 (34.4)	252,935 (32.9)	10,526,344 (33.4)	137 (32.2)	22,274 (34.4)	318,641 (38.2)	493,252.3 (38.2)
2015 NVDRS States,* N (% of total)	1,945 (45.4)	356,570 (46.4)	14,598,235 (46.4)	197 (46.2)	32,724 (50.6)	393,064 (47.1)	608,458.2 (47.1)
Total Joint Commission Accredited	4,281	767,691	31,476,917	426	64,704	835,187	1,292,859.1
% of Total (All US States) [‡]	67.0	82.6	87.4	79.5	87.0	79.2	79.2

* 2014: AK, CO, GA, KY, MD, MA, MI, NJ, NM, NC, OH, OK, OR, RI, SC, UT, VA, WI (n = 18); 2015: AK, AZ, CO, CT, GA, HI, KS, KY, ME, MD, MA, MI, MN, NH, NJ, NM, NY, NC, OH, OK, OR, RI, SC, UT, VT, VA, WI (n = 27).

[†] Data from National Association of State Mental Health Program Directors (NASMHPD). Trend in Psychiatric Inpatient Capacity, United States and Each State, 1970 to 2014. Assessment #10. Aug 2017. Accessed Aug 9, 2018. <https://www.nri-inc.org/media/1319/tac-paper-10-psychiatric-inpatient-capacity-final-09-05-2017.pdf>. The assessment observed that state and private psychiatric hospital inpatients represented 64.6% of all psychiatric inpatients at the end of 2014. The remaining 35.4% of psychiatric inpatients were treated in general hospitals with separate psychiatric units and in US Department of Veterans Affairs Medical Centers. Estimates in this column, are based on a calculation using the Total Number of Psychiatric Hospital Admissions (from the American Hospital Association) divided by 0.646 (the proportion of psychiatric hospital inpatients relative to all psychiatric inpatients observed in the NASMHPD assessment).

[‡] All 50 US states and the District of Columbia.

NVDRS Year	Total Suicides Reported to the NVDRS	Suicides Occurring in a Hospital or Other Medical Facility [†]	Hospital Inpatients [‡]			Suicides Occurring Within an Emergency Department [§]
			Hospital	Psychiatric	Total	
2014	14,721	55	5	11	16	4
2015	20,361	84	7	23	30	3
Total	35,082	139	12	34	46	7

* NVDRS—reporting states: 2014: AK, CO, GA, KY, MD, MA, MI, NJ, NM, NC, OH, OK, OR, RI, SC, UT, VA, WI (n = 18); 2015: AK, AZ, CO, CT, GA, HI, KS, KY, ME, MD, MA, MI, MN, NH, NJ, NM, NY, NC, OH, OK, OR, RI, SC, UT, VT, VA, WI (n = 27)

[†] Other medical facilities included hospitals, nursing homes, hospice organizations, clinics, rehabilitation facilities, emergency departments, and grounds adjacent to a health care facility (for example, parking lot).

[‡] Hospital inpatients were identified through recoding of the narrative text descriptions, which were originally coded as taking place within a “hospital or other medical facility.” Suicide events were excluded from the hospital inpatient count if they occurred in a non-hospital setting, or if it was clear from the description that the victim was not a patient of the health care facility. Hospital inpatients were further categorized as psychiatric inpatients if (1) the hospital location was described as a psychiatric hospital, (2) the victim was identified in the narrative as a psychiatric or mental health patient, or (3) the victim was receiving psychiatric care, behavioral health care, or similar references to psychiatric treatment.

[§] Suicides were counted as occurring within an emergency department if the narrative description of the event identified the victim as a patient being treated in an emergency department or emergency room, and the patient had not been admitted to the hospital as an inpatient.

Table 4. Suicides Reported as Sentinel Events (SEs) from 2010 to 2016* for All States† and for National Violent Death Reporting System (NVDRS)–Reporting States‡

	All Suicide Deaths Reported to SE Database	All Hospital-Associated Suicides§	Hospital Inpatients			Suicides Occurring Within an Emergency Department#
			Hospital	Psychiatric	Total	
All States†						
2010	65	59	5	21	26	2
2011	125	107	7	34	41	4
2012	83	69	6	13	19	1
2013	90	64	8	9	17	2
2014	80	65	6	8	14	2
2015	93	73	8	22	30	3
2016	85	68	10	17	27	4
Total	621	505	50	124	174	18
Average	88.7	72.1	7.1	17.7	24.9	2.6
NVDRS–Reporting States‡						
2014	26	20	0	5	5	0
2015	41	32	3	10	13	2
Total	67	52	3	15	18	2
Average	33.5	26	1.5	7.5	9	1

* Sentinel event data from 2017 are not shown because reporting was not complete for the entire year.

† All 50 US states and the District of Columbia.

‡ 2014: AK, CO, GA, KY, MD, MA, MI, NJ, NM, NC, OH, OK, OR, RI, SC, UT, VA, WI ($n = 18$); 2015: AK, AZ, CO, CT, GA, HI, KS, KY, ME, MD, MA, MI, MN, NH, NJ, NM, NY, NC, OH, OK, OR, RI, SC, UT, VT, VA, WI ($n = 27$).

§ All reported suicide deaths associated with a hospital, psychiatric hospital, critical access hospital, or hospital emergency department. Counts in this column include suicides reported as occurring postdischarge, and events in which the victim may not have been directly receiving treatment at the hospital.

|| Hospital inpatients were identified through the use of categorical codes in the SE Database and additional review of the narrative description. They include events in which the victim was being treated as an inpatient within the facility. Events that occurred postdischarge were excluded. Hospital inpatients were further categorized as psychiatric inpatients if the categorical variable "Service" was identified as "mental health."

Suicides were counted as occurring within an emergency department if the narrative description of the event identified the victim as a patient being treated in an emergency department or emergency room, and the patient had not been admitted to the hospital as an inpatient.

2014, there were 16 hospital inpatient suicides. In 2015 there were 30 inpatient suicides reported. Eleven of the 2014 inpatient suicides (68.8%) and 23 (76.7%) of the inpatient suicides in 2015 were associated with psychiatric hospitalization. Data from the NVDRS reporting states were used to extrapolate national estimates based on the proportion of hospital admissions in the NVDRS–reporting states for each year. Using data from the 18 states reporting in 2014, representing 33.0% of hospital admissions, it is estimated that 48.5 (95% CI = 27.7–78.6) hospital inpatient suicides occurred in the United States. Based on the larger set of data available from 27 states in 2015, representing 46.2% of all hospital admissions, it is estimated that 64.9 (95% CI = 43.8–92.8) hospital inpatient suicides occurred in the United States. If we restrict the analysis to suicides during inpatient psychiatric treatment and extrapolate using the proportion of inpatient psychiatric admissions in the NVDRS states, the 2014 and 2015 estimates range from 31.0 (95% CI = 15.5–55.5) to 51.7 (95% CI = 32.8–77.6) psychiatric inpatient suicides, respectively.

To facilitate comparisons with rates frequently found in the literature, these count-based estimates were converted into rates/100,000 admissions (based on the hospital admissions data in Table 2) using the results from the larger and more representative data set (2015 data from 27 states). Because 51.7 of the 64.9 total annual inpatient suicides occur among psychiatric inpatients, approximately 13.2 inpatient suicides can be attributed to nonpsychiatric admissions. The estimated inpatient suicide rate among nonpsychiatric inpatients, therefore, is 0.03 (95% CI = 0.02–0.05) per 100,000 nonpsychiatric admissions. Among inpatient psychiatric inpatients, the estimated rate is 3.2 (95% CI = 1.7–4.7) per 100,000 psychiatric inpatient admissions.

Rate of Suicides Reported to the SE Database

Of the 505 hospital-associated suicide events reported to the SE Database from 2010 to 2016, 174 (34.5%) took place during inpatient treatment in a hospital (Table 4). The average number of hospital inpatient suicides reported per year during this period was 24.9 (95% CI = 16.1–36.9);

Table 5. Suicide Method During Hospital Inpatient Treatment for Cases Reported to the National Violent Death Reporting System (NVDRS)* and the Joint Commission Sentinel Event (SE) Database

Method	NVDRS* 2014–2015		SE Database: NVDRS States* 2014–2015		SE Database: All States† 2014–2015		SE Database: All States† 2010–2017	
	Count	%	Count	%	Count	%	Count	%
Asphyxiation (not hanging)	2	4.3	1	5.0	3	7.0	25	12.8
Drug Overdose	5	10.9	1	5.0	1	2.3	4	2.1
Gunshot	1	2.2	2	10.0	3	7.0	8	4.1
Hanging	33	71.7	13	65.0	29	67.4	137	70.3
Jumping from height	3	6.5	2	10.0	4	9.3	13	6.7
Laceration	1	2.2	0	0	1	2.3	2	1.0
Other	1	2.2	1	5.0	2	4.7	6	3.1
Total	46	100	20	100	43	100	195	100

* NVDRS—reporting states: 2014: AK, CO, GA, KY, MD, MA, MI, NJ, NM, NC, OH, OK, OR, RI, SC, UT, VA, WI (n = 18); 2015: AK, AZ, CO, CT, GA, HI, KS, KY, ME, MD, MA, MI, MN, NH, NJ, NM, NY, NC, OH, OK, OR, RI, SC, UT, VT, VA, WI (n = 27)

† All 50 US states and the District of Columbia.

the average number occurring among psychiatric inpatients (psychiatric hospitals and psychiatric units in general hospitals) was 17.9 (95% CI = 10.6–28.3). Longitudinally, there was no significant change in the number of suicides reported between 2010 and 2016 ($\beta = -0.03/\text{year}$; $p = 0.36$).

Method of Suicide

The methods used in the inpatient setting to commit suicide were similar in the two databases (Table 5). Hanging was by far the most common method of inpatient suicide in the NVDRS and SE databases (33 of 46 [71.7%] and 137 of 195 [70.3%], respectively). The location and ligature fixation point for hangings were consistently coded in the SE Database but not in the NVDRS. A total of 99 of 195 (50.8%) sentinel event suicides occurred in the bathroom, 66 (33.8%) in the bedroom, 8 (4.1%) in the closet, 7 (3.6%) in the shower, and 15 (7.7%) in another location. Within the SE Database, of the 137 inpatient hanging events, a ligature fixture point was identified in 106 cases—a door, door handle, or door hinge was the most commonly used fixture point (53.8%). In both data sets, the method for monitoring patients to ensure their safety prior to the suicide was poorly documented and could not be reliably determined.

DISCUSSION

There were 16 and 30 hospital inpatient suicides identified in the NVDRS during 2014 and 2015, respectively; 34 of the 46 total events (73.9%) occurred during psychiatric treatment. Extrapolating these data, it is estimated that between 48.5 and 64.9 hospital inpatient suicides occur per year in the United States, with 31.0 to 51.7 of these events occurring during psychiatric hospitalization. Hang-

ing was the most common method of inpatient suicide in the NVDRS and SE databases, accounting for 70.5% of all inpatient suicide events. Of the inpatient hanging events, a door, door handle, or door hinge was the most commonly used fixture point (53.8%). Not surprisingly, more than 90% of suicides took place in private spaces such as the bathroom, bedroom, closet, and shower. These findings support the recommendations from a recent Joint Commission Technical Expert Panel that psychiatric hospitals and inpatient psychiatric units in general medical/surgical hospitals should be made “ligature-resistant” environments to decrease the risk of suicide by hanging.²⁴

This study provides the first data-driven estimate of the number of inpatient suicides per year in hospitals in the United States. The estimated range of 48.5 to 64.9 inpatient suicides per year is vastly lower than the most widely quoted figure of 1,500 per year, which appears to have been based on speculation.^{6,13} The high level of concordance between the number of suicides found in the NVDRS and the number reported to the SE Database in NVDRS-reporting states (after accounting for the proportion of hospitals in these states accredited by The Joint Commission) supports the validity of our estimate from the NVDRS data and makes substantial underestimation by the NVDRS unlikely. In addition, our estimated rate of 3.2 per 100,000 admissions for patients with primary psychiatric diagnoses is similar to the rate reported in VA mental health units (4.2 per 100,000 admissions) prior to their interventions to address this problem.³

It is important to note that inpatient suicide remains an important safety issue with an annual rate similar to the number of deaths due to transfusions reported to the US Food and Drug Administration annually from 2013 to 2016.²⁵ This new, lower estimate of the rate of suicides in

hospitals has important implications for the allocation of resources to address suicide prevention within health care and the broader population. The Joint Commission established suicide prevention as a National Patient Safety goal in 2007 and has released three *Sentinel Event Alerts* to provide hospitals and other health care organizations with guidance on how they can prevent suicides.²⁶ These and other prevention recommendations have focused on conducting risk assessments, improving the safety of the environment (for example, removing ligature points), and implementing risk mitigation strategies (for example, protective observation policies and procedures).^{12,26,27} Despite these efforts, we found no downward trend in the number of inpatient suicides reported to The Joint Commission's SE Database.

Because the vast majority of suicides continue to be by hanging, with the most common ligature fixation points being a door, door handle, or door hinge, hospitals should conduct careful environmental assessments to ensure that door handles and door hinges are "ligature resistant." Additional data are needed, however, to assess the risks and benefits of prevention efforts. For example, the study was unable to determine how many suicides were committed by patients fixing a knot in a sheet at the top of a closed door and using that to hang themselves. Although over-door alarm devices may prevent this type of hanging attempt, a recent Joint Commission Technical Expert Panel recommended that these devices not be required until we know how often patients attempt suicide in this manner and whether alarms are effective in aborting attempts.²⁴

A number of studies suggest that the risk for suicide may be significantly higher following discharge from inpatient mental health treatment than during the hospital stay.^{28,29} Between 2002 and 2015, the VA identified 141 reports of suicide within 7 days of discharge from a mental health unit²⁸ compared to 29 inpatient suicides between 2000 and 2015.³ Looking even more broadly, of the 35,082 suicides included in the NVDRS for 2014–2015, only 139 (0.4%) occurred in a hospital or other medical facility, and only 46 (0.1%) actually occurred during an inpatient hospital stay (Table 3). Although there is still much to be done to prevent inpatient hospital suicides, this is a small part of a much larger societal problem.

Limitations

This study has several important limitations. First, the national estimates are extrapolated from NVDRS data reported by 18–27 states. Although the states that voluntarily participate in the NVDRS are required to report on all qualifying deaths, and the CDC has guidelines to evaluate and ensure the data quality of surveillance reporting, this study made no attempt to verify the accuracy and completeness of NVDRS data in each state. Furthermore, the proportions of hospitals in reporting and nonreporting states appear to be representative, but it is possible that the hospitals and/or hospital patients treated in the states reporting

to the NVDRS are different from those hospitals and patients in nonreporting states. The unknown degree to which hospitals in reporting states reasonably represent those in nonreporting states, as well as the accuracy and completeness of NVDRS data, could have caused us to overestimate or underestimate the national rate. That concern may be somewhat mitigated by the relatively similar distribution of suicides reported to the SE Database across the NVDRS and non-NVDRS states (Table 4). In 2014–2015, the 18 events reported to the SE Database from NVDRS–reporting states represented 40.9% of inpatient suicides reported to the SE Database nationally ($n = 44$) during the same time period. This is roughly what would be expected, given that 34.4%–45.4% of accredited hospitals were in the 2014–2015 NVDRS–reporting states (Table 2). There are also limits that should be acknowledged around the suicide methods reported in the SE Database. Although the SE Database reports are national, reporting is voluntary and therefore cannot be assumed to be nationally representative. In contrast, the NVDRS data provide a more complete picture of events within reporting states, but they cannot be assumed to represent all states. It is encouraging, however, that the methods identified in these databases were similar to one another and similar to previous publications when the population studied was limited to hospital inpatients (that is, within-facility events).^{7,10,12} Finally, there were also challenges coding inpatient suicide events because of a lack of specific detail in the narratives, particularly those in the NVDRS, which were not collected through a root cause analysis. These events often lacked the detail needed to identify contextual factors, such as the ligature and ligature fixture point, or the observation status of a patient at the time of the event. NVDRS codes indicating that a suicide occurred in a hospital or medical facility also needed to be carefully reviewed, as a surprising number of suicides that the NVDRS coded as taking place at a hospital turned out to involve someone who was not a patient (for example, suicide in the hospital parking lot or at the front entrance of a hospital or in an ED bathroom).

CONCLUSION

The results from this study provide a more reliable benchmark of the national inpatient suicide rate for policy makers, regulators, accrediting organizations, health care providers, and researchers to use when making decisions regarding allocation of resources and implementation of specific requirements to prevent inpatient suicides. Going forward, we need better information on methods used in suicide attempts to guide the development of a rational approach to policy and mitigation strategies. Data collection efforts should include information on staff training and other human factors that are equally, if not more, essential to inform improvement efforts intended to reduce the number of inpatient suicides. To aid in that effort, The

Joint Commission plans to enhance its approach to collecting sentinel event data on suicides to help inform national improvement efforts on this ongoing safety issue.

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