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ORIGINAL ARTICLE

Patterns of Health Care Usage in the Year Before Suicide: A Population-Based Case-Control Study

Megan M. Chock, MD, MPH; Tanner J. Bommersbach, BA; Jennifer L. Geske, MS; and J. Michael Bostwick, MD

Abstract

Objective: To compare the type and frequency of health care visits in the year before suicide between decedents and controls.

Patients and Methods: Cases (n=86) were Olmsted County, Minnesota, residents whose death certificates listed "suicide" as the cause of death from January 1, 2000, through December 31, 2009. Each case had 3 age- and sex-matched controls (n=258). Demographic, diagnostic, and health care usage data were abstracted from medical records. Conditional logistic regression was used to analyze differences in the likelihood of having had psychiatric and nonpsychiatric visits in the year before death, as well as in visit types and frequencies 12 months, 6 months, and 4 weeks before death.

Results: Cases and controls did not significantly differ in having had any health care exposure (P=.18). Suicide decedents, however, had a significantly higher number of total visits in the 12 months, 6 months, and 4 weeks before death (all P<.001), were more likely to have carried psychiatric diagnoses in the previous year (odds ratio [OR], 8.08; 95% CI, 4.31-15.17; P<.001), and were more likely to have had outpatient and inpatient mental health visits (OR, 1.24; 95% CI, 1.05-1.47; P=.01 and OR 6.76; 95% CI, 1.39-32.96; P=.02, respectively). Only cases had had emergency department mental health visits; no control did.

Conclusion: Given that suicide decedents did not differ from controls in having had any health care exposure in the year before death, the fact alone that decedents saw a doctor provides no useful information about risk. Compared with controls, however, decedents had more visits of all types including psychiatric ones. Higher frequencies of health care contacts were associated with elevated suicide risk.

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Suicide is an important public health issue for 2 main reasons: the size of its impact and the potential for its prevention. Suicide is the 10th leading cause of death in America, taking 41,149 lives in 2013 and representing 1.6% of all deaths in the United States.[1] For every one of these suicide deaths, countless others are affected, including the bereaved, community members, and providers.

Suicide prevention has gained national attention starting with the 1999 Surgeon General's Call to Action to Prevent Suicide, which was revised in 2012 to include an emphasis on the role of screening for suicide in primary care and emergency departments.[2] The idea that health care providers play a role in suicide prevention stems from research showing that 75% to 80% of all suicide decedents have contact with the health care system in the year before their death.[3-5]

That the medical literature so often references that those dead by suicide have visited a doctor in proximity to their deaths makes it seem as if this fact alone can aid in predicting suicide. However, these studies almost never contain a nonsuicide comparator group and thus shed no light on whether there are any differences in patterns of health care usage in those committing vs those not committing suicides. A handful of case-control studies comparing patterns of health care utilization between suicide cases and members of the general population have been conducted in Canada,[6,7] Taiwan,[8] the United Kingdom,[9] Iceland,[10] and Denmark,[11] as well as among US military service members[12] and on an

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From Mayo Medical School, Rochester, MN (M.M.C., T.J.B.); Kaiser San Diego, Family Medicine, San Diego, CA (M.M.C.); Department of Biomedical Statistics and Informatics, Mayo Clinic, Rochester, MN (J.L.G.); and Department of Psychiatry and Psychology, Mayo Clinic, Rochester, MN (J.M.B.).

Indian reservation in the Upper Midwest.[13] These studies largely focus on specific types of visits rather than overall patterns of health care use; for example, outpatient visits to general practitioners and/or mental health (MH) providers,[7-9,12] emergency department visits,[10] or inpatient hospitalizations.[11] Only 1 compares patterns of health care utilization in outpatient, inpatient, emergency, and community MH settings among adults in Alberta, Canada.[6]

These studies have yielded mixed results, with most finding an increased amount of health care utilization by suicide cases vs controls.[6,10-12] One study found no difference in the month before death but increased utilization by cases in the 10 previous years,[9] and a single study found a decreased likelihood of accessing health care in the 6 months before suicide.[13] In addition to nonuniform assessments of health care utilization, the generalizability of these studies is limited because of differences between these health care systems and populations and those of the United States.

Without firmly establishing that there are relevant differences in patterns of health care use between those who die by suicide and similar others in the general population who do not, it is unreasonable to expect that providers ought to be able to identify suicide risk merely on the basis of the fact that patients have visited a doctor.

PATIENTS AND METHODS

The study objective was to compare the frequency and types of health care contact in the year before death between suicide decedents (cases) and age- and sex-matched controls over the same time period. Both Mayo Clinic and Olmsted Medical Center (OMC) institutional review boards approved the study.

Study Population and Setting

The Rochester Epidemiology Project (REP) database, established in 1966, contains the medical records of a population-based cohort in Olmsted County, Minnesota.[14] The 2 major health care providers in Olmsted County are the Mayo Clinic and the OMC, which through multiple branch offices and associated hospitals care for nearly every Olmsted County resident.[14] As of 2010, the REP database contained the records of 502,860 unique residents of Olmsted County who had had at least 1 contact with a health care provider in the Mayo Clinic or the OMC system.[14] The REP database provides a unique opportunity to examine a population not segregated by type of health insurance or specific provider. Researchers have access to electronic medical record and paper charts for detailed review, which provide more information on patient-provider interactions than do billing or diagnosis codes. The data contained in the REP allow the design of retrospective population-based case-control studies.

Study Design

This was a population-based case-control study. The primary research question was whether there were relevant differences in health care utilization between people who would go on to die by suicide and similar others within the population during the 12 months before the death date. In other words, if an eventual suicide decedent and a similar person presented to a health care setting in the same time period, were there any differences in the pattern of health care visits that might indicate a higher likelihood of dying by suicide?

Case Selection

Cases were selected from Olmsted County death certificates from January 1, 2000, to December 31, 2009 (10 years), which were reviewed by a member of the REP study team who was not involved with data collection. All individuals with "suicide" listed as the cause of death were considered potential cases. The resulting 132 records were then assessed by 2 authors (M.M.C. and T.J.B.) to confirm residency status in Olmsted County in the year before death, classified by last recorded address in an Olmsted County zip code. This resulted in 86 confirmed cases of suicide in Olmsted County residents between 2000 and 2009. Each subject kept his or her unique REP ID number as an identifier without any name or demographic data.

Control Selection

The final list of 86 cases was sent to a third author (J.L.G.). For each case, 3 controls were randomly selected from matched Olmsted County residents who had provided research consent for the REP database (258 controls).

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Controls were matched according to date of birth (within 1 year) and sex. All controls were confirmed to be residents of Olmsted County during the study period. The final blinded list of 344 study subjects (86 cases and 258 controls) was sent to 2 authors (M.M.C. and T.J.B.) for data collection. Controls were matched in a 3:1 ratio, consistent with established methods.[15]

Data Collection Methods

Two authors (M.M.C. and T.J.B.) independently reviewed the entire medical record for each subject for the year before death using the REP browser and electronic and paper medical records at each institution (Mayo Clinic, OMC, and Olmsted County Hospital). The following demographic information was collected for each subject:

- Sex
- Birthdate
- Zip code

From within the medical record, the following information was extracted for any face-to-face health care visit that occurred within the 1 year before the death date of the corresponding suicide decedent:

- Type of visit (1 of 6 categories): inpatient MH, inpatient non-MH, outpatient MH, outpatient non-MH, emergency MH, and emergency non-MH.
- For an inpatient admission, total number of days hospitalized (initial admission note to hospital discharge summary).

Only face-to-face health care visits were counted during this study on the basis of the assumption that these represented potential opportunities for providers to address suicide prevention. The Supplemental Appendix (available online at http://www.mayoclinicproceedings.org) contains details on definitions and classification of visits.

Statistical Analyses

Study data were collected and managed using Research Electronic Data Capture electronic data capture tools hosted at Mayo Clinic,[16] cleaned, and transferred to SAS software version 9.3 (Copyright SAS Institute, Inc.) Matched analysis via conditional logistic regression was used to examine differences in frequency and type of visits between suicide decedents and controls and to test for associations between death by suicide and other factors, with $P<.05$ used to denote statistical significance. Cases and controls were compared in the following ways:

- Likelihood of at least 1 face-to-face visit with a health care provider during the previous year (12 months).
- Number of total visits within 12 months, 6 months, and 4 weeks of death date.
- Types of health care contacts within the previous 12 months.
- Presence of an MH diagnosis.

RESULTS

Suicide decedents and control subjects did not differ significantly on any baseline variables except that cases were significantly more likely to have an MH diagnosis in the previous 12 months (OR, 8.08; 95% CI, 4.3-15.2; $P<.001$; see Tables 1 and 2).

In univariate analysis by case and control status, the number of total visits in the 12 months (9.1±12.2 vs 4.5±6.9; OR, 1.06; 95% CI, 1.03-1.09; $P<.001$), 6 months (5.0±8.3 vs 2.3±3.9; OR, 1.10; 95% CI, 1.04-1.16; $P<.001$), and 4 weeks (1.1±2.2 vs 0.4±1.0; OR, 1.38; 95% CI, 1.15-1.67; $P<.001$) before the death date were all significantly higher in cases than in controls. The total days of inpatient treatment were also significantly higher in cases than in controls (3.8±10.5 vs 0.3±2.0; OR, 1.19; 95% CI, 1.08-1.32; $P<.001$), driven by differences in inpatient MH stays (3.2±10.3 vs 0.1±0.9; OR, 1.30; 95% CI, 1.05-1.61; $P=.02$). There was no statistically significant difference in days of non-MH inpatient treatment between cases and controls (0.6±2.5 vs 0.3±1.5; OR, 1.10; 95% CI, 0.97-1.25; $P=.14$). Cases were also significantly more likely to have visited the emergency department for a non-MH reason in the past 12 months (OR, 1.51; 95% CI, 1.04-2.20; $P=.03$). However, the likelihood of having had any health care contact in the past 12 months was not significantly different; 78% of controls and 85% of cases had at least 1 health care visit in the past 12 months (OR, 1.56; 95% CI, 0.82-2.99; $P=.18$; see Table 2).

When adjusting for the presence of MH diagnosis, new differences emerged. Cases

TABLE 1. Demographic Characteristics

Characteristic	All (N=344)	Controls (N=258)	Cases (N=86)
Age (y) (at case's time of death)	45.7±18.9	45.6±18.7	45.7±19.0
Sex: male, n (%)	288 (83.7)	216 (83.7)	72 (83.7)

were more likely than controls to have had non-MH inpatient admissions (OR, 1.86; 95% CI, 1.02-3.41; *P*=.05; see Table 3). Cases were not significantly more likely to have had an emergency department visit for a non-MH reason (OR, 1.47; 95% CI, 0.97-2.23; *P*=.07). The finding that cases were significantly more likely to have had visits for MH reasons in inpatient, outpatient, and emergency department settings was unchanged. Cases were also significantly more likely to have had a health care visit in the previous 12 months (OR, 1.04; 95% CI, 1.00-1.07; *P*=.04) and 4 weeks before death when compared with controls during the same time period (OR, 1.26; 95% CI, 1.01-1.60; *P*=.04).

DISCUSSION

This study is unique in several ways. Unlike previous studies conducted in the United States, it is population-based and does not rely on study subjects having a health plan membership or health insurance during the study period.[3] In this way, the results are more useful for health care providers, who realistically only see patients who actually come to their office. Given the paucity of studies comparing health care contact by suicide decedents to matched controls in the general US population, the REP provides a generally homogenous population and potentially more generalizable results.[14] Most of the suicide cases confirmed by death certificate data were men (72 of 86 cases [83.7%]), consistent with others' findings.[17,18]

Interestingly, our results were similar to those of other population-based case-control studies in markedly different health care systems. Recent studies in Canada,[6] Taiwan,[8] and Denmark[11] also found an increased likelihood of health care utilization in suicide cases than in controls. These countries have universal health insurance, unlike the United States. These studies, combined with our results, seem to indicate that increased health care utilization among suicide decedents is a consistent pattern across different cultures and health systems.

A significant strength is that this study focused on provider documentation rather

TABLE 2. Health Care Utilization by Case/Control Status[a,b]

Type of health care utilization	All (N=344)	Controls (N=258)	Cases (N=86)	OR (95% CI)	*P* value[c]
Any visit in the past 12 mo, n (%)	274 (79.7)	201 (77.9)	73 (84.9)	1.56 (0.82-3.0)	.18
MH diagnosis in the past 12 mo, n (%)	74 (21.5)	30 (11.6)	44 (51.2)	8.08 (4.3-15.2)	<.001[d]
Total visits (all types)					
Previous 12 mo	5.6±8.8	4.5±6.9	9.1±12.2	1.06 (1.03-1.09)	<.001[d]
Previous 6 mo	2.9±5.5	2.3±3.9	5.0±8.3	1.10 (1.04-1.16)	<.001[d]
Previous 4 wk	0.6±1.4	0.4±1.0	1.1±2.2	1.38 (1.15-1.67)	<.001[d]
Days inpatient (all types)	1.2±5.7	0.3±2.0	3.8±10.5	1.19 (1.08-1.32)	<.001[d]
Days inpatient MH	0.8±5.4	0.1±0.9	3.2±10.3	1.30 (1.05-1.61)	.02[d]
Days inpatient non-MH	0.4±1.8	0.3±1.5	0.6±2.5	1.10 (0.97-1.25)	.14
MH ED visits	0.1±0.5	0.0±0.0	0.4±1.0	-	-[d]
MH outpatient visits	1.0±0.5	0.2±1.1	3.1±8.3	1.55 (1.27-1.89)	<.001[d]
MH inpatient admissions	0.1±4.4	0.0±0.1	0.3±0.9	15.70 (3.59-68.59)	<.001[d]
Non-MH ED visits	0.3±0.6	0.2±0.5	0.4±0.8	1.51 (1.04-2.20)	.03[d]
Non-MH outpatient visits	4.1±6.4	3.9±6.3	4.7±6.6	1.02 (0.98-1.06)	.34
Non-MH inpatient admissions	0.1±0.4	0.1±0.4	0.2±0.5	1.51 (0.88-2.59)	.14

[a]ED = emergency department; MH = mental health; OR = odds ratio.
[b]Mean ± SD are presented to give readers a context in addition to the OR. Values represent mean ± SD except otherwise indicated.
[c]All *P* values are from conditional logistic regression models.
[d]Statistically significant, *P*<.05.

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than *International Classification of Diseases* and billing codes. It was assumed that the provider would document issues of concern addressed during that face-to-face interaction, which was of particular importance in considering whether an active MH issue was present. Reviewing the medical record in a retrospective fashion simulated the plausible clinical scenario of a provider reviewing a patient's chart before or during a face-to-face visit. Put differently, clinicians would have had access to the same information that we did when conducting this study and similarly would have been able to recognize different types and frequency of health care usage. A potential limitation of relying on retrospective documentation is that providers may not have accurately recorded all clinical problems addressed or may have omitted or incorrectly documented parts of the interaction.

TABLE 3. Health Care Utilization by Case/Control Status Adjusted for MH Diagnosis[a]

Type of health care utilization	OR (95% CI)	*P* value
Any visit	1.17 (0.57-2.40)	.66
Total visits		
Previous 12 mo	1.04 (1.002-1.07)	.04[b]
Previous 6 mo	1.05 (0.99-1.12)	.10
Previous 4wk	1.26 (1.01-1.58)	.04[b]
Days inpatient	1.13 (1.02-1.25)	.02[b]
Days inpatient MH	1.161 (0.98-1.38)	.08
Days inpatient non-MH	1.092 (0.95-1.25)	.21
MH ED visits	-	-[b]
MH outpatient visits	1.24 (1.05-1.47)	.01[b]
MH inpatient admissions	6.76 (1.39-32.96)	.02[b]
Non-MH ED visits	1.47 (0.97-2.23)	.07
Non-MH outpatient visits	1.01 (0.96-1.05)	.82
Non-MH inpatient admissions	1.86 (1.02-3.41)	.05

[a]ED = emergency department; MH = mental health; OR = odds ratio.
[b]Statistically significant, *P*<.05.

Our results yielded several notable findings. Suicide decedents were significantly more likely to have had an MH diagnosis (*P*<.001) and not surprisingly were significantly more likely to have had more MH-related visits in the outpatient, inpatient, and emergency department settings (all *P*<.05). However, there was no significant difference in the odds of having had any contact with the health care system in the year before death (OR 1.56, 95% CI, 0.82-3.0, *P*=.18). In other words, merely stating that suicide decedents have had contact with the health care system in the past year is not in and of itself a distinguishing factor of health care use. Suicide decedents were not more likely than controls to have outpatient visits for nonpsychiatric reasons.

With respect to the frequency of health care utilization, suicide decedents had a significantly higher number of visits of any sort in the year before death, 6 months before death, and 4 weeks before death than did control subjects in the same time periods (*P*<.001 for all). Suicide decedents spent significantly more days in the hospital than did controls (3.8±10.5 vs 0.3±2.0; OR, 1.19; 95% CI, 1.08-1.32; *P*<.001), which was driven almost entirely by increased inpatient days for a psychiatric reason. Interestingly, after controlling for MH diagnosis, suicide decedents had a higher number of days spent in the inpatient setting for nonpsychiatric reasons, suggesting that they may have been sicker overall. These findings are consistent with those of other studies that have found an association with suicide and physical comorbidities[11] in addition to psychiatric disorders.[18,19]

One type of health care utilization, emergency department visits for an MH reason, was a distinguishing factor between cases and controls. No control presented in the emergency department for an MH reason throughout the study period. In contrast, 14 of the 86 suicide decedents (16%) had at least 1 emergency department visit for an MH reason in the year before death. This finding suggests that record of presentation in the emergency department for an MH issue should alert clinicians that the patient carries a significantly higher likelihood of death by suicide (*P*=undefined, OR infinite). Although cases were also more likely than controls to have visited the emergency department for non-MH reasons in the past year, when controlling for MH diagnosis, no significant difference between cases and controls was found (*P*=.07). One interpretation of this finding is that MH diagnosis is associated with a higher number of emergency department visits, which others have similarly described.[6,10,20] A recent case-control study nested in the cohort of patients presenting to the emergency department in Reykjavik, Iceland, found that suicide risk increased with the number of emergency department visits in a dose-response manner even after controlling for age, sex, and psychiatric diagnoses.[10]

An inherent limitation to the REP is that health care visits only to licensed providers in Mayo Clinic and OMC systems are included in the database; the records from community MH providers (eg, psychologists, therapists, and social workers) are not available.[14] Thus, this study may underestimate the number of outpatient MH visits for all subjects. Another inherent limitation is that study subjects are limited to Olmsted County residents. As others have noted, death certificate data may underrepresent suicide mortality by as much as 24%.[18] Therefore, it is possible that the cases identified in this study may not represent all the suicide decedents in Olmsted County.

The REP database does not contain information on health insurance status, education, and neighborhood income, which can affect health care utilization.[21,22] Although this is a limitation, our study focused on identifying particular patterns of health care usage that, in addition to known risk factors, may be used to inform suicide prevention. This study was designed to answer whether health care providers might be able to use a patient's pattern of recent health care use to identify increased suicide risk, not to explain the reason for differential utilization. The overall aim is to improve suicide prevention for providers. Two necessary conditions for this are (1) provider recognition of warning signs for suicide[23] and (2) the opportunity to interact with a patient, which this study defined as a face-to-face visit. Factors such as socioeconomic status or MH history are risk factors for suicide, but they are largely nonmodifiable from a provider's perspective.[23] In contrast, providers have more opportunities to address modifiable warning signs in patients who interact more frequently with the health care system. The challenge is to recognize these opportunities.

Further studies that build upon this study's findings to more clearly identify predictors of suicide are necessary to inform prevention. For example, a similarly designed REP study comparing suicide cases with psychiatric diagnoses to nonsuicidal controls with psychiatric diagnoses could identify different clinical presentations before death date. This study was not designed to focus on differences between suicide decedents that may have contributed to differential health care utilization. Future studies comparing suicide method, specific MH diagnosis, and non-MH conditions may help further understanding of the drivers of increased health care utilization among suicide decedents.

CONCLUSION

It appears that the distinguishing factors for a group at a higher risk of suicide are those with MH histories, any health care visit for an MH reason, and hospitalizations for any reason. Only suicide decedents had record of an emergency department visit for any MH reason in the time period analyzed, indicating that a clinician must be aware of the increased likelihood of suicide in any individual with this type of visit. Suicide decedents are more likely than age- and sex-matched controls to interact with the health care system in the outpatient, inpatient, and emergency department settings in the month and year before death. In addition to awareness about other suicide risk factors, clinicians and health systems should recognize that patients exhibiting increased health care usage, particularly for MH reasons, might be at a higher suicide risk.

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SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at http://www.mayoclinicproceedings.org. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

Abbreviations and Acronyms: **MH** = mental health; **OMC** = Olmsted Medical Center; **OR** = odds ratio; **REP** = Rochester Epidemiology Project

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Correspondence: Address to J. Michael Bostwick, MD, Department of Psychiatry and Psychology, Mayo Clinic, 200 1st St SW, Rochester, MN 55905 (bostwick.john@mayo.edu).

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