Predictors of Suicide in Patient Charts Among Patients With Depression in the Veterans Health Administration Health System: Importance of Prescription Drug and Alcohol Abuse

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ABSTRACT

Objective: To identify factors recorded in electronic medical chart progress notes associated with suicide among patients who had received treatment for depression.

Method: The retrospective study sample consisted of 324 randomly selected US Veterans Health Administration (VHA) patients treated for depression who died by suicide from April 1, 1999, to September 30, 2004, stratified by geographic region, gender, and year of depression cohort entry and 312 control patients with depression who were alive on the date of suicide death (index date) and were from the same stratum as the matched suicide patient. In addition to constructing variables from administrative data, variables were abstracted from electronic medical chart notes in the year prior to the index date in 5 categories: clinical symptoms and diagnoses, substance use, life stressors, behavioral/ideation measures (eg, suicide attempts), and treatments received. Logistic regression was used to assess the associations.

Results: Even after we adjusted for administratively available data, suicidal behaviors and substance-related variables were the strongest independent predictors of suicide. Prescription drug misuse had an odds ratio (OR) of 6.8 (95% CI, 2.5–18.5); history of suicide attempts, 6.6 (95% CI, 1.7–26.4); and alcohol abuse/dependence, 3.3 (95% CI, 1.9–5.7). Difficulty with access to health care was a predictor of suicide (OR = 2.9; 95% CI, 1.3–6.3). Receipt of VHA substance abuse treatment was protective (OR = 0.4; 95% CI, 0.1–0.9).

Conclusions: Prescription drug and alcohol misuse assessments should be prioritized in suicide assessments among depressed patients. Additionally, behavioral measures noted in electronic chart records may be useful in health system monitoring and surveillance and can potentially be accessed using word search or natural language processing approaches.

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Suicide is a complex, multidetermined phenomenon.[1] Many individual biological and psychological contributors; social, environmental, and economic contributors; and health system and treatment factors are associated with suicide death.[2–5] Clinicians need to assess important predictors of suicide as they complete suicide assessments, health systems need to assess risk factors as they monitor suicide rates in their facilities, and researchers need to account for known risk factors as they assess the relative importance of new risk factors.[6]

Several variables, such as gender, age, and ethnicity, and mental health diagnoses that have been associated with suicide risk are easily observed or ascertained by clinicians and sometimes easily obtained from health care administrative data.[7,8] Affective states and behaviors such as suicidal attempts also clearly contribute to suicide risk.[9] While the richest data on these risk factors may come from detailed structured interviews with patients or standardized neuropsychological investigations, standard medical documentation in electronic medical records from routine clinical visits may also provide more valuable information concerning suicide risk than is typically appreciated. Such chart data may be useful to clinicians, researchers, and health care systems to complete useful suicide assessments, better adjust for suicide risk in research studies, and identify high-risk individuals within a health system for targeted interventions.

The objective of this study is to assess the association between factors noted in the electronic medical record and suicide mortality, adjusting for variables readily available in health system administrative data. Administrative data typically include information needed for billing and record keeping such as the date, time, and length of the visit and *International Classification of Diseases* (*ICD*) diagnoses. In contrast, the medical record data contain information relevant to clinical care including more detailed information on symptoms and functioning. We abstracted medical record data to construct various measures that might be captured in clinical notes in the medical record but not in administrative data. We hypothesized that behavioral health and symptom variables noted in the medical record that are not necessarily formal diagnoses may be independent factors of increased suicide risk over and above the administrative data variables.

METHOD

Retrospective chart abstraction was conducted for 694 US Veterans Health Administration (VHA) patients from the cohort of veterans with depression diagnoses who received care from April 1, 1999, to September 30, 2004. Entry into the depression cohort was defined by either 2 *ICD* diagnoses of a depressive disorder or a depression diagnosis and an antidepressant prescription fill. Patients were excluded if they received a diagnosis of bipolar I disorder, schizophrenia, or schizoaffective disorder, as these diagnoses substantially change prognosis and treatment approaches.

Clinical Points

- Prescription drug and alcohol misuse assessments should be prioritized in suicide assessments among depressed patients.
- Using word search strategies or natural-language processing assessments of electronic medical records may allow systematic identification of high-risk individuals for suicide prevention efforts.

The samples were chosen using a nested case-control design. The *suicide sample* (cases) was randomly selected among individuals who died of suicide, stratified by the cohort entry year, 4 geographic regions of the patient's VHA facility of most use, and gender. The suicide deaths were identified by comprehensive methods including queries to the National Death Index. Details can be found in a prior report based on the same cohort.[10] Females were oversampled within each stratum due to the small number of females in the VHA who died of suicide. The *control sample* was obtained by randomly selecting a patient from the cohort to match with each suicide sample patient from those alive on the date of suicide (ie, index date), within ± 5 years of age, and within the same stratum as the case. This study included only those with at least 1 outpatient visit in the year prior to the index date to allow medical records to be abstracted, giving a total of 636 patients (324 suicide and 312 control patients). Of note, 92.6% of the suicide sample (324 of 350) and 90.7% of the control sample (312 of 344) had at least 1 outpatient visit in the prior year to the index date. The study was conducted with Institutional Review Board approval from the Department of Veterans Affairs Health System.

Administrative Data–Based Variables

Administrative data variables included demographic variables, mental health diagnoses, service connectedness (indicating disability from conditions occurring during or exacerbated by military service), Charlson[11] medical comorbidity index, and numbers of VHA psychiatric hospitalizations, psychiatric inpatient days, and psychotropic medications. All comorbidities were defined based on data during the year prior to the index date. We also defined whether the index date was during a high-risk treatment period based on whether treatment events indicating higher patient risk occurred within either the prior 12 weeks or the prior 12 months of the index date. Treatment events indicating higher risk included discharge from a psychiatric hospitalization, an antidepressant start, or an antidepressant dose change.[12]

Chart Abstraction

Clinical symptoms or diagnosis included presence of the following: anxiety, depression, mania, psychosis (including psychotic symptoms such as auditory or visual hallucinations and delusions), impulsivity (including impulsive symptoms or a formal diagnosis such as intermittent explosive disorder or pyromania), pain, and sleep problems. *Substance use variables* included alcohol problem use/abuse/dependence, illicit drug use/dependence (excluding marijuana use, unless dependence was noted), and tobacco use. Presence of the prescription drug misuse was based on notations that the patient took the prescription drugs recreationally, took prescription medications not prescribed to them, or took more than the prescribed amount. The misused prescription drugs included but were not limited to pain relievers (eg, oxycodone, morphine, acetaminophen and oxycodone, acetaminophen and hydrocodone), sedatives (eg, benzodiazepines), and stimulants (eg, methylphenidate).

Life events or stressors included 12 items and were based on Axis IV of the *Diagnostic and Statistical Manual of Mental Disorders*: suicide of a family member, death of a family member, problems with primary support group (eg, family health problems or discord with siblings), marital problems, social environment problems (eg, loneliness, loss of a friend), difficulty with access to health care services (eg, lack of transportation or inadequate insurance), interaction with legal system/crime, other psychosocial and environmental problems (eg, exposure to war, discord with nonfamily caregivers), chronic illness/pain, educational problems (eg, illiteracy, discord with classmates or teachers), occupational problems (eg, unemployment, job change), and housing problems.

Suicide risk–related behavioral measures included suicidal attempt, suicidal planning, suicidal ideation, suicidal thought, violent ideation, aggression, homicidal thoughts, type and availability of suicidal means, and access to guns.[1,3,5,15] *Mental health or substance use treatments* included participation in a homelessness intervention, VHA substance abuse treatment or Alcoholics Anonymous or self-help substance abuse treatment, and hospitalization considered due to psychological reasons by the provider. All measures were assessed based on all chart notations during the prior year and were dichotomized to "present" if assessed and "not" if assessed and not present or if not mentioned.

Data Analysis

The study sample included 244 pairs of matched patients and 148 patients without a matching set (80 cases and 68 controls). Chart abstraction ceased at the end of study funding, resulting in 148 patients without a matching set. In the interest of increasing the sample size, the primary analysis included all 636 patients without accounting for matching, and a sensitivity analysis was conducted in which only patients with matching sets were included.

Distributions of various chart-abstracted variables were compared between suicide and control groups and crude odds ratios (ORs) were calculated. We used logistic regression models to assess the independent association between factors noted in the electronic medical record and suicide mortality, adjusting for administrative data–based variables. We organized the administrative and then the chart-based potential predictors in a hierarchical manner, with the sets of

potential predictors conceptually sequenced to represent unique contributions to suicide risk starting from variables more distal to suicide death (eg, demographics) and progressing from mental health diagnosis and symptoms, life stressors, and behavioral/ideation measures to treatment-related variables. The chart-based variables were added in the following hierarchical sets: (1) clinical symptoms or diagnosis-related variables, (2) substance abuse variables, (3) life events or stressors (4) suicide risk–related behavioral variables, and (5) mental health or substance use treatments received. In each hierarchical modeling step, we locked race, ethnicity, and age and included administrative data–based variables first. We then added each set of predictors sequentially to assess the relationship between the potential predictors in the set, while taking into account the association between the predictors in the previous set. Specifically, at each hierarchical step of the model selection, the variables in the set were selected using both forward and backward stepwise regression in order to ensure stability of the selected predictors, while the variables selected from the previous sets were locked in the model. At each step, we calculated the C statistics[16] as a measure of general importance of the set of covariates in predicting suicides. The C statistic is a measure of classification accuracy (it is the area under a receiver operating characteristic curve and is based on the predicted probability from the logistic regression as the input) in which a value of 0.5 is the lower bound, and values of 0.7 to 0.8 show acceptable discrimination.[17] For the final model, we calculated the C statistic along with its 95% CI based on 100 bootstrap samples[18] to adjust for potential overfitting. Covariate adjusted ORs can be interpreted as risk ratios due to suicide being a rare outcome.[19] The final model was verified using the subset of 244 pairs of matched cases and control patients and based on a conditional logistic regression model. All analyses were done using Stata 11.2 (StataCorp LP, College Station, Texas).

Table 1. From Administrative Data: Demographic Characteristics, Prior Year Health Status Variables, and High-Risk Status Variables by Suicide and Control Patient Group[a]

Patient Characteristics in Administrative Data	Suicide Patients (n = 324)		Control Patients (n = 312)		*P* Value[b]
Demographic					
Age, y					
< 50	94	29.0	92	29.5	
50–59	96	29.6	98	31.4	
60–69	56	17.3	41	13.1	
≥ 70	78	24.1	81	26.0	.53
Gender, male	285	88.0	272	87.2	.77
Race					
White	297	91.6	258	82.7	
Black	13	4.0	39	12.5	
Other or unknown	14	4.3	15	4.8	< .001
Hispanic	11	3.4	18	5.8	.15
Diagnoses and utilization					
Personality disorder	24	7.4	12	3.9	.05
Bipolar II disorder	3	0.9	1	0.3	.33
Other anxiety disorder	74	22.8	42	13.5	.002
Posttraumatic stress disorder	50	15.4	62	19.9	.14
Service-connected status	102	31.5	139	44.6	.001
Charlson comorbidity index, mean (SD)	1.0	1.7	1.0	1.6	.79
Alcohol abuse or dependence	94	29.0	38	12.2	< .001
Illicit drug abuse or dependence	52	16.1	15	4.8	< .001
Suicide attempt (based on *ICD-9* E codes)	9	2.8	0	0.0	.003
Psychiatric hospitalizations, mean (SD)	0.5	1.1	0.05	0.3	< .001
Nonpsychiatric hospitalizations, mean (SD)	0.4	0.9	0.2	0.6	.003
Mental health outpatient visits, mean (SD)	6.2	13.3	4.2	9.0	.03
Non–mental health outpatient visits, mean (SD)	12.1	12.9	13.3	14.7	.28
Psychotropic medications, mean (SD)	2.3	1.7	1.6	1.2	< .001
Years since depression diagnosis, mean (SD)	1.4	1.2	1.5	1.1	.59
Index date is within a high-risk period					
12 weeks of psychiatric hospitalization	30	9.3	5	1.6	< .001
1 year of psychiatric hospitalization	89	27.5	22	7.1	< .001
12 weeks of new antidepressant start	37	11.4	32	10.3	.64
1 year of new antidepressant start	157	48.5	149	47.8	.86
12 weeks of other antidepressant start	30	9.3	12	3.9	.006
1 year of other antidepressant start	116	35.8	76	24.4	.002
12 weeks of antidepressant dose change	30	9.3	19	6.1	.13
1 year of antidepressant dose change	115	35.5	85	27.2	.03
12 weeks of at least 1 high-risk event[c]	92	28.4	64	20.5	.02
1 year of at least 1 high-risk event[c]	261	80.6	232	74.4	.06

[a]Data are given as n (%) unless otherwise noted.
[b]Based on χ^2 test for percentage comparisons and on 2-group *t* test with Satterthwaite degrees of freedom for unequal variance for mean comparisons; for age and race, only 1 *P* value is provided based on χ^2 tests comparing age distribution and comparing race distribution between suicide patients and control patients.
[c]High-risk events include discharge from a psychiatric hospitalization, new antidepressant start, other antidepressant start, or antidepressant dose change.
Abbreviation: *ICD-9* E codes = *International Classification of Diseases*, *Ninth Revision*, external causes of injury.

RESULTS

Bivariate Analyses

Table 1 shows the administrative data variables and their unadjusted associations with suicide death. Patients who died of suicide were less likely to be black than control group patients. Various mental health diagnoses and severity measures (past psychiatric hospitalization) were also significant predictors of suicide death.

Table 2 shows the unadjusted associations between variables based on medical record notations and suicide death. Symptoms or diagnoses of depression, psychosis, and impulsivity were highly associated with suicide. Current alcohol abuse/problem use/dependence and prescription drug misuse were highly associated with suicide death, but past history of substance abuse (without current use) was not associated with suicide death (data not presented). The total number of stressful events was also higher in the suicide than the control group. Of the stressful life events, economic or financial, occupational, and housing problems were most significantly associated with suicide. Suicide attempt, suicidal ideation (not including attempt), suicidal plan, access to suicidal means, and noted access to a gun were also highly associated with suicide death. Lastly, all variables related to

Table 2. From Chart Notations: Mental Health–Related Symptoms, Substance Use, Stressful Life Events, Suicidality, and Other Characteristics During the 12 Months Prior to the Index Date[a] in Patients With at Least 1 Visit in Prior Year (N = 636)

	Suicide Patients		Control Patients			Odds	
Patient Characteristics in Chart Notations	n	%	n	%	*P* Value	Ratio	95% CI
Mental health-related symptoms or a formal diagnosis							
Anxiety or posttraumatic stress disorder	220	67.9	180	57.7	.008	1.6	1.1–2.1
Depression	302	93.2	266	85.3	.001	2.4	1.4–4.0
Mania or manic behavior	22	6.8	9	2.9	.02	2.5	1.1–5.4
Psychotic symptoms or diagnosis	48	14.8	13	4.2	< .001	4.0	2.1–7.5
Impulsivity	33	10.2	8	2.6	< .001	4.3	2.0–9.5
Chronic or acute pain	242	74.7	246	78.9	.22	0.8	0.5–1.1
Various sleep problems	227	70.1	198	63.5	.08	1.3	1.0–1.9
Aggression/aggressive actions	18	5.6	12	3.9	.31	1.5	0.7–3.1
Substance abuse							
Alcohol abuse/problem use/dependence	118	36.4	47	15.1	< .001	3.2	2.2–4.7
Other drug use/dependence	33	10.2	17	5.5	.03	2.0	1.1–3.6
Prescription drug misuse	59	18.2	6	1.9	< .001	11.4	4.8–26.7
Stressful life events[b]							
General family member problems	67	20.7	57	18.3	.44	1.2	0.8–1.7
Suicide of family member	4	1.2	5	1.6	.69	0.8	0.2–2.9
Death of family member	22	6.8	12	3.9	.10	1.8	0.9–3.7
Marital/intimate problems	82	25.3	53	17.0	.01	1.7	1.1–2.4
Social environment problems	75	23.2	52	16.7	.04	1.5	1.0–2.2
Difficulty with access to health care	26	8.0	12	3.9	.03	2.2	1.1–4.4
Legal system/crime problems	48	14.8	24	7.7	.005	2.1	1.2–3.5
Other psychosocial/environment problems	7	2.2	7	2.2	.94	1.0	0.3–2.8
Chronic illness or pain	263	81.2	272	87.2	.04	0.6	0.4–1.0
Economic/financial problems	109	33.6	67	21.5	.001	1.9	1.3–2.6
Educational problems	3	0.9	0	0.0	.09	3.7[c]	0.4, + inf
Occupational problems	136	42.0	91	29.2	.001	1.8	1.3–2.4
Housing problems	71	21.9	25	8.0	< .001	3.2	2.0–5.2
Suicidality or violence							
Suicide attempt	48	14.8	3	1.0	< .001	17.9	5.5–58.2
Suicidal ideation, not including attempt	94	29.0	34	10.9	< .001	3.3	2.2–5.1
Suicidal plan	74	22.8	11	3.5	< .001	8.1	4.2–15.6
Access to suicidal means	59	18.2	7	2.2	< .001	9.7	4.4–21.6
Access to guns	31	9.6	11	3.5	.002	2.9	1.4–5.9
Violent intent	35	10.8	19	6.1	.03	1.9	1.0–3.3
Homicidal thoughts	33	10.2	19	6.1	.06	1.7	1.0–3.1
Mental health treatments received or considered							
Hospitalization considered for psychological symptoms	95	29.3	15	4.8	< .001	8.2	4.6–14.5
Attended AA or self-help program[d]	35	10.8	11	3.5	< .001	3.3	1.7–6.6
Homelessness intervention	32	9.9	11	3.5	.001	3.0	1.5–6.1
VA substance abuse treatment[d]	65	20.1	23	7.4	< .001	3.2	1.9–5.2

[a]Date of suicide death.
[b]Total stressors (mean ± SD) in suicide patients = 2.8 ± 1.8 and in control patients = 2.2 ± 1.5 ($P < .001$).
[c]Based on exact logistic regression.
[d]Does not include tobacco-cessation program.
Abbreviations: AA = Alcoholics Anonymous, inf = infinity, PTSD = posttraumatic stress disorder, VA = Veterans Affairs.

treatments received or considered were highly associated with increased suicide death risk.

Multivariate Analyses

Correlation was generally low across the variables within each hierarchical set of potential predictors (highest variance inflation factor (VIF) was 1.5 where VIF > 10 is generally considered to indicate multicollinearity[20]), except for suicide risk–related behavioral measures where the mean VIF was 10.4. Of the behavioral measures, violent intent and homicidal thoughts showed the highest VIF, and after excluding either of the 2, the mean VIF was reduced to 4.9. The model was carefully fit when the behavioral measures were added in light of these correlations.

Table 3 shows the significant adjusted OR of each sequentially fit model. With only administrative data–based variables in the model, prior year psychiatric hospitalization had the largest effect size. When the chart data–based mental health–related symptoms or diagnoses were added to the administrative diagnoses, only psychotic symptoms or diagnosis noted was associated with increased risk of suicide death. Of substance abuse–related variables, alcohol abuse and prescription drug misuse were highly associated with suicide mortality. When suicide risk–related behavioral variables and variables representing mental health treatments received or considered were included, prior year hospitalization was no longer predictive of suicide death, because prior year hospitalization was highly associated with suicide risk–related behavioral variables and consideration for hospitalization. In terms of the importance of each set of variables, the model based only on administrative data–based variables gave a C statistic of 0.74. Although adding the mental

Table 3. Crude and Adjusted Odds Ratios From Logistic Regression Models of Suicide Death in Which Hierarchical Sets of Variables Are Sequentially Added in Blocks (N = 636)[a]

Suicide Death	Crude OR	Model (AOR) 1	2	3	4	5	6
Administrative data variables							
Demographic variables							
Black (ref: white/other/unknown)	0.29†	0.36*	0.36*	0.35*	0.34*	0.33*	0.34*
Hispanic	0.57	0.72	0.75	0.65	0.70	0.76	0.82
Age ≥ 60 y	1.10	1.33	1.37	1.60*	1.74*	1.78*	1.80*
Diagnosis and utilization							
Other anxiety disorder	1.90	1.39	1.52	1.34	1.38	1.45	1.51
Posttraumatic stress disorder	0.74	0.53*	0.52*	0.52*	0.49*	0.51*	0.49*
Service-connected	0.57*	0.68*	0.71	0.76	0.78	0.82	0.79
Alcohol abuse or dependence	2.95†	1.80*	1.78*	0.92	0.89	0.99	1.14
Had ≥ 1 psychiatric hospitalizations	7.79†	5.13†	4.38†	3.68*	3.75*	2.28	1.28
Had ≥ 1 nonpsychiatric hospitalizations	2.04*	1.60	1.73	1.67	1.67	1.51	1.64
Non–mental health visits, no.	0.99	0.98*	0.98*	0.98*	0.98*	0.98	0.98
Psychotropic medications, no.	1.39†	1.37†	1.35†	1.34†	1.34†	1.28*	1.26*
Chart-noted variables							
Mental health–related symptoms or diagnoses							
Psychotic symptoms or diagnosis	4.00†		2.62*	2.62*	2.85*	3.03*	2.91*
Chronic or acute pain	0.79		0.68	0.61*	0.56*	0.52*	0.51*
Substance abuse-related variables							
Alcohol abuse	3.23†			2.55*	2.56*	2.50*	2.83*
Prescription drug misuse	11.35†			7.67†	7.51†	6.00*	6.75†
Stressful life events							
General family member problems	1.17				0.70	0.59*	0.59
Death of family member	1.82				1.83	1.74	1.77
Difficulty with access to health care	2.18*				2.76*	2.74*	2.71*
Occupational problems	1.76*				1.39	1.15	1.19
Suicidality-related variables							
Suicide attempt	17.91†					7.08*	5.82†
Suicidal ideation without an attempt	3.34†					3.22†	3.07†
Homicidal thoughts	1.75					0.56	0.60
Mental health treatments received or considered							
Hospitalization considered	8.21†						2.69
VA substance abuse treatment	3.15†						0.30*
Attended AA or self-help program	3.31*						2.06
Area under the ROC curve		0.74	0.75	0.78	0.79	0.81	0.81

[a]Cell values are crude or adjusted odds ratios.
*$P < .05$; †$P < .001$.
Abbreviations: AA = Alcoholics Anonymous, AOR = adjusted odds ratio, OR = odds ratio, ROC = receiver operating characteristic, VA = Veterans Affairs.

Table 4. Adjusted Odds Ratios From the Final Logistic Regression Model of Suicide Death (N = 636; bootstrapped area under the receiver operating characteristic curve = 0.80 [bias-corrected 95% CI = 0.75, 0.82])

Suicide Death	Final Model AOR	95% CI	P Value
Administrative data variables			
Black (ref: white/other/unknown)	0.28	0.12–0.65	.003
Hispanic	0.75	0.30–1.87	.54
Age ≥ 60 y	1.79	1.19–2.70	.005
Posttraumatic stress disorder	0.44	0.25–0.77	.004
Psychotropic medications, no.	1.26	1.08–1.46	.003
Chart-noted variables			
Psychosis	2.69	1.22–5.93	.01
Chronic or nonchronic pain	0.50	0.32–0.77	.002
Alcohol abuse	3.29	1.90–5.69	< .001
Prescription drug misuse	6.76	2.47–18.50	< .001
General family member problems	0.58	0.34–0.98	.04
Difficulty with access to health care	2.86	1.30–6.32	.009
Suicide attempt	6.64	1.67–26.42	.007
Suicidal ideation without an attempt	3.22	1.91–5.43	< .001
Hospitalization considered	2.93	1.29–6.67	.01
VA substance abuse treatment	0.35	0.14–0.89	.03
Attended AA or self-help group	2.05	0.76–5.57	.16

Abbreviations: AA = Alcoholics Anonymous, AOR = adjusted odds ratio, ref = reference, VA = Veterans Affairs.

health–related symptoms or diagnosis variables from charts to this model improved predictability minimally (C statistic = 0.75), further adding substance use measures from the chart improved the predictability substantially (C statistic = 0.78). Finally, adding stressful life events gave a C statistic of 0.79, and adding suicide risk–related behavioral measures further improved the predictability with a C statistic of 0.81.

Table 4 shows the final model, which includes variables either marginally significant ($P < .10$) or has the OR estimates with magnitudes greater than 2.0 or less than 0.5. Of particular note, compared with patients without an attempt or ideation, those with a suicide attempt in the prior year were 6.6 times more likely to die of suicide, and patients with suicide ideation without an attempt were also 3.2 times more likely to die of suicide. Additionally, patients with prescription drug misuse and those with alcohol abuse were 6.8 times and 3.3 times, respectively, more likely to die of suicide than those without. Patients for whom providers considered a hospitalization for psychological issues had a 2.9 times higher risk of suicide death than those for whom hospitalization was not considered. Lastly, in the adjusted analyses, patients who received VHA substance abuse treatment had 0.35 times the risk of suicide death than those who did not, a marked change from the unadjusted OR of 3.2 for patients receiving this treatment. Lastly, a conditional logistic regression model using only the 244 matched patient pairs gave OR estimates that were identical in the direction of the association and similar in magnitude to the OR estimates from the final logistic regression analysis based on 634 patients.

DISCUSSION

Suicide is a complex and multiply determined phenomenon.[21] To reduce suicide-related mortality, it is important to improve suicide assessments and surveillance in high-risk populations, such as patients in depression treatment. We found that more than 90% of the suicide sample patients saw a VHA provider at least once within a year prior to their

suicide death, highlighting the importance of identifying factors that may make clinical suicide assessments more complete. Although chart-noted mental disorder diagnoses did not add to suicide prediction after adjusting for administrative data variables, we found numerous other factors recorded in the charts to be associated with suicide death and to improve suicide prediction among patients receiving depression treatment.

In addition to our finding of increased risk of suicide death among patients with chart notations of suicide ideation and attempts (risk factors that have been previously noted),[22–24] key findings regarding substance abuse were most notable. First, patients with chart notations of prescription drug misuse were 6.8 times more likely to die of suicide than those without, and such notation was a significant predictor of suicide death even after controlling for suicide attempt, a very strong predictor of suicide death.[1] We note that medications that are frequently misused included medications of varying lethality (pain medications, methylphenidate, and benzodiazepines), and the chart notation of abuse of any prescription drug was associated with much higher risk of suicide. Although studies have shown associations between prescription drug misuse and suicide attempts or suicidal behaviors,[24–26] to our knowledge, our study is the first study to show an independent association between chart notation of prescription drug misuse and suicide death. This association could partly be due to increased risk of unintentional overdoses misclassified as suicide, but it is likely that this misclassification neither fully explains the strength nor diminishes the importance of recognizing its association.

Secondly, patients with alcohol abuse noted were 3.3 times more likely to die of suicide than those without. Adjusted models showed that chart-noted alcohol abuse had an even stronger association with suicide death than the administrative data–based alcohol abuse diagnoses. Lastly, receipt of VHA substance abuse treatment showed a protective association with suicide after adjusting for other variables. These findings are consistent with the associations between substance abuse and suicidal behaviors or attempts in prior research[21,25,26] and further highlight the significance of addressing the substance abuse issues in patients in depression treatment.

Another key finding was the association between stressful life events and suicide death. Consistent with what has been reported in the literature,[27] stressful life events related to economic conditions were significant risk factors. However, after adjusting for covariates, only difficulty with accessing health care remained a significant risk factor. This stressor includes the presence of inadequate health care services, lack of transportation to health care facilities, or inadequate health insurance. Although care within the VHA includes many standardized elements, even among the VHA users, variation exists in access to health care, and our study emphasizes that this difficulty with health care access is a significant risk factor. Coupled with our finding of the protective effect of the receipt of VHA substance abuse treatment, future studies should assess whether access to care, particularly to substance abuse treatment care, is associated with suicide death.

Limitations

Our study is based on VHA users, primarily male, and an older patient population. Any gender differences in health behaviors and how they relate to suicide mortality risks need be evaluated in additional populations. All measures were dichotomized to "present" if a potential risk factor was assessed and "not" if it was assessed and not present or if not mentioned. We believe that not mentioning a behavioral factor is informative, indicating that clinician concern or the perceived likelihood of this risk factor is low. Potentially, if a specific behavioral factor is seldom assessed, this could bias study estimates. However, if the direction of the association between the behavioral factor and suicide is the same in the nonassessed and the assessed patients, the association will very likely be underestimated rather than overestimated by assuming "not present" when it is not mentioned.

Although the predictive power of suicide risk assessment is not likely to be substantial,[28,29] providers encountering patients in depression care should be provided with an adequate list of risk factors and risk-assessment skills. The risk factors identified here will need to be further validated, but many are consistent with previous study findings and have implications for intervention strategies (eg, the protective effect of substance use treatment).[25–27] Health systems attempting to systematically identify high-risk individuals for suicide prevention efforts could potentially obtain data on several key risk factors from electronic progress notes using word search strategies or natural language processing. Implementation of suicide surveillance or prevention strategies that include all available information in the prior year in both administrative and chart data may improve assessment. In particular, prescription drug misuse, alcohol abuse, and difficulty with access to health care should be considered carefully in suicide risk assessment and in interventions to address these issues.

Drug names: acetaminophen and hydrocodone (Vicodin, Zydone, and others), acetaminophen and oxycodone (Roxicet, Percocet, and others), methylphenidate (Focalin, Ritalin, and others), morphine (Kadian, Avinza, and others).

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