Does Suicidal Ideation as Measured by the PHQ-9 Predict Suicide Among VA Patients?

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Objective: Frequency of suicidal ideation in the past two weeks, assessed by item 9 of the nine-item Patient Health Questionnaire (PHQ-9), has been positively associated with suicide mortality among patients in a setting other than the Veterans Health Administration (VHA). To inform suicide prevention activities at the VHA, it is important to evaluate whether item 9 is associated with suicide risk among patients in the VHA system.

Methods: PHQ-9 assessments (N=447,245) conducted by the VHA between October 1, 2009, and September 30, 2010, were collected. National Death Index data were used to ascertain suicide mortality from the date of PHQ-9 assessment through September 30, 2011. Multivariable proportional hazards regressions were used to evaluate associations between responses to item 9 and suicide mortality.

Results: After the analyses adjusted for covariates, a response of "several days" for item 9 was associated with a 75% increased risk of suicide (hazard ratio [HR]=1.75, 95% confidence interval [CI]=1.24–2.46), a response of "more than half the days" was associated with a 115% increased risk of suicide (HR=2.15, CI=1.32–3.51), and a response of "nearly every day" was associated with a 185% increased risk of suicide (HR=2.85, CI=1.81–4.47), compared with a response of "not at all." However, 71.6% of suicides during the study period occurred among patients who responded "not at all" to item 9 from their most recent PHQ-9.

Conclusions: Higher levels of suicidal ideation, indicated by item 9 of the PHQ-9, were associated with increased risk of suicide among patients in the VHA system.

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Suicide prevention is a priority of the Veterans Health Administration (VHA), which serves a patient population with elevated suicide rates compared with the general adult population of the United States (1–3). A screening tool that is quick to administer and provides valid information could help VHA clinicians to identify patients at greater risk of suicide and direct them toward appropriate treatment. Many suicide assessment measures have been developed, and their reliability and concurrent validity compared with previous suicide attempts or other psychiatric or mood scales have been documented (4). However, the literature lacks prospective evidence regarding whether a screening instrument can predict suicide mortality across a range of settings (5,6).

The nine-item Patient Health Questionnaire (PHQ-9) is a reliable and validated measure of depression severity (7). The final item of the PHQ-9 is commonly used in research studies to indicate the presence of suicidal ideation (8–10). It asks, "Over the past two weeks, how often have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way?" Response options are "not at all," "several days," "more than half the days," and "nearly every day."

Suicidal ideation has been found to be a predictor of both immediate and long-term suicide risk (11,12). Studies have assessed the validity of item 9 of the PHQ-9 by comparing the results with those from a more detailed clinical interview (13–15). However, comparing item 9 to another self-reported assessment has limitations, given that both rely on a respondent's willingness to report suicidal thoughts. To guide clinical care and enhance VHA suicide prevention, it is important to assess how suicidal thoughts expressed through responses to item 9 of the PHQ-9 may relate to risk of suicide mortality.

To our knowledge, only one study, by Simon and colleagues (16), has evaluated whether item 9 of the PHQ-9 is associated with subsequent suicide mortality. The investigators analyzed a cohort of 84,418 outpatients ages 13 and older who were enrolled in an integrated health care system providing primary and mental health care. Providers in the system, with members in two states, had been instructed to conduct PHQ-9 assessments at each depression treatment encounter. The study documented positive associations between item 9 and risk of suicide death (hazard ratio [HR]=1.92, 95% confidence interval [CI]=1.53–2.41).

Replication studies are important in the scientific literature in order to establish an evidence base to guide clinical practice. As the largest integrated health system in the United States, the VHA maintains national data to evaluate and improve patient care. U.S. Department of Veterans Affairs (VA)/Department of Defense (DOD) clinical practice guidelines (CPGs) recommend annual assessment for depression in primary care and use of the PHQ-9 if patients screen positive for possible depression (17). Among PHQ-9 recipients, information from item 9 may help VHA providers to identify those at elevated risk of suicide, enhance care, and prevent suicide deaths.

The objective of this study was to evaluate whether the suicide mortality analyses reported by Simon and colleagues (16) extend to patients in the VHA health system. We hypothesized that after control for other risk factors, higher scores for item 9 of the PHQ-9 would be associated with higher suicide mortality risk.

METHODS

The VA's Corporate Data Warehouse (CDW) was used to identify unique PHQ-9 assessments in fiscal year (FY) 2010 (October 1, 2009–September 30, 2010). Descriptive analyses were conducted at the patient level, and cohort construction and survival analyses were conducted at the assessment level. Assessment records were excluded if they were missing PHQ-9 score information or had improperly computed scores (N=2,609); were for patients whose records indicated age less than 18 years (N=864); had an assessment date after the patient's date of death (N=7); were administered in the Philippines, American Samoa, or Guam (N=220) (the National Death Index [NDI] does not include deaths from these areas); or were administered to individuals who did not have recorded VHA outpatient or inpatient encounters in FY 2010 (N=79). Together, these exclusions resulted in removal of 3,779 (.8%) of the unique PHQ-9 assessments identified in FY 2010, with 447,245 assessments remaining for 391,492 individual patients. Patients excluded did not differ significantly from those who were retained with regard to suicide mortality. This study was conducted as part of ongoing VHA program evaluation and did not require informed consent and institutional review board review.

Suicide mortality was assessed from the time of each PHQ-9 assessment through September 30, 2011. Using previously reported procedures (2), we identified vital status and cause of death data by NDI search records. Suicide death was defined by *ICD-10* codes X60–X84 and Y87.0 (18).

Covariates were extracted from the CDW and VA national encounter data sets. At the patient level, risk factors collected were age, sex, and psychiatric diagnoses. Data on race-ethnicity were not collected because this information was not consistently available. Age was measured at the initial PHQ assessment date in FY 2010. The presence of psychiatric diagnoses within 365 days prior to this index assessment was assessed.

At the assessment level, six indicator variables were created to indicate the type of encounter for each PHQ-9 assessment: standard primary care (PC) encounters; PC–mental health integration (PC-MHI) encounters; specialty, non–PC-MHI mental health outpatient encounters; other outpatient encounters; mental health inpatient encounters; and other inpatient encounters not associated with mental health.

The sum of scores from the first eight items of the PHQ-9 was categorized into groups, consistent with procedures of Simon and colleagues (16). Sums ranging from 0 to 4 were categorized as minimal depression; 5 to 9, mild depression; 10 to 14, moderate depression; and ≥15, severe depression. These groupings are similar to those used in other studies (7).

Analyses were conducted by using SAS 9.3 and SAS Enterprise Guide 6.1. For descriptive analyses, frequencies were calculated for all variables at the patient level (N=391,492), overall and by suicide status. Chi square tests were used to test for differences in proportions of patients with various characteristics by suicide status. Suicide rates were calculated at the patient level by dividing the number of suicides by risk time, assessed as days from the initial assessment date until the end of the observation period or death (whichever came first for each individual), and dividing the quotient by 365. The result was multiplied by 100,000 to express rates per 100,000 person-years.

In proportional-hazards regression analyses, each individual PHQ-9 assessment was used as the unit of analysis. Risk time started on the day of the PHQ-9 assessment and ended at death or the end of the observation period (September 30, 2011), whichever came first. Consistent with methods of Simon and colleagues (16), we used partly conditional proportional-hazards regression models (19), controlling for nonsuicide mortality as a competing risk. By treating each assessment as the unit of analysis, the models were conditioned on the baseline covariates (age, sex, and psychiatric diagnoses) but not on the time-varying covariates (PHQ-9 score and type of encounter). Mirroring the models used in the analyses by Simon and colleagues (16), the first four models assessed the association between item 9 of the PHQ-9 and suicide mortality while controlling for several covariates (age, sex, psychiatric diagnoses, and items 1–8 from the PHQ-9). A fifth model also adjusted for inpatient and outpatient encounters on each assessment date.

Covariance sandwich estimators were used to adjust for the nested nature of the data. The proportional-hazards assumption was evaluated by examining the significance of interaction terms between risk time and all covariates in regression models.

Two sensitivity analyses were conducted. First, we restricted the analyses to patients' initial PHQ-9 in FY 2010 to examine whether eliminating repeated assessments would alter the observed associations between item 9 of the PHQ-9 and suicide mortality. Also, because we had assessed mental health diagnoses at an index date, and not the date of each

TABLE 1. Characteristics of 391,492 VHA users with a documented PHQ-9 assessment in FY 2010, by suicide mortality status[a]

| | Total | | Suicide | | | | | Suicide mortality per 100,000 person-years |
| | | | No | | Yes | | | |
Characteristic	N	%	N	%	N	%	p	
Total	391,492	100.0	391,182	100.0	310	100.0		53.9
Age							<.001	
18–29	24,920	6.4	24,889	6.4	31	10.0		83.5
30–39	26,045	6.7	26,024	6.7	21	6.8		54.1
40–49	43,165	11.0	43,113	11.0	52	16.8		80.3
50–59	78,289	20.0	78,215	20.0	74	23.9		63.3
60–69	117,885	30.1	117,823	30.1	62	20.0		35.7
70–79	58,054	14.8	58,017	14.8	37	11.9		43.9
≥80	43,134	11.0	43,101	11.0	33	10.7		55.3
Sex							.020	
Male	362,875	92.7	362,577	92.7	298	96.1		56.0
Female	28,617	7.3	28,605	7.3	12	3.9		28.0
Psychiatric diagnosis								
Serious mental illness	18,382	4.7	18,360	4.7	22	7.1	.046	80.4
Anxiety	30,226	7.7	30,182	7.7	44	14.2	<.001	97.1
PTSD	51,860	13.3	51,817	13.3	43	13.9	.746	55.1
Substance use disorder	37,478	9.6	37,418	9.6	60	19.4	<.001	107.3
Depression	60,788	15.5	60,700	15.5	88	28.4	<.001	95.5
Other	46,051	11.8	45,994	11.8	57	18.4	<.001	83.2
Depression severity[b,c]							<.001	
Minimal	219,552	56.1	219,450	56.1	102	32.9		31.7
Mild	56,204	14.4	56,145	14.4	59	19.0		71.5
Moderate	48,544	12.4	48,482	12.4	62	20.0		86.7
Severe	67,192	17.2	67,105	17.2	87	28.1		87.6
PHQ–9 item 9 response[c]							<.001	
Not at all	342,964	87.6	342,742	87.6	222	71.6		44.1
Several days	30,834	7.9	30,788	7.9	46	14.8		100.8
More than half the days	8,798	2.3	8,779	2.2	19	6.1		146.5
Nearly every day	8,896	2.3	8,873	2.3	23	7.4		175.5
Type of encounter on assessment date[c]								
Primary care–mental health integration (PC-MHI)	26,917	6.9	26,885	6.9	32	10.3	.016	79.8
Standard primary care	285,803	73.0	285,627	73.0	176	56.8	<.001	41.9
Non–PC-MHI outpatient mental health	73,633	18.8	73,530	18.8	103	33.2	<.001	94.5
Other outpatient	191,532	48.9	191,376	48.9	156	50.3	.622	55.7
Inpatient mental health	3,668	.9	3,659	.9	9	2.9	<.001	163.2
Other inpatient	5,281	1.4	5,273	1.4	8	2.6	.060	106.6

[a] VHA, Veterans Health Administration; PHQ-9, nine-item Patient Health Questionnaire
[b] From scores on items 1–8 of the PHQ-9
[c] From each patient's first PHQ-9 assessment in FY 2010

assessment, we wanted to assess whether results differed when restricted to initial assessments. Second, replicating Simon and others (16), to eliminate overlapping risk time for VHA users with more than one assessment, we ran all models with risk time censored at each user's subsequent PHQ-9 assessment. These models produced results similar to those reported for the main analysis.

To assess potential differences in suicide risk in the study population, supplemental analyses compared suicide rates among FY 2010 VHA users who did or did not have a PHQ-9 assessment in that year.

RESULTS

Most patients were male (92.7%) and age 50 or older (75.9%) (Table 1). Sixteen percent had a diagnosis of depression

within 365 days prior to their first PHQ-9 assessment, and 29.6% had moderate or severe depressive symptoms on the basis of items 1–8 from their first PHQ-9 assessment. On the date of their first PHQ-9 assessment, most patients (73.0%) had a standard primary care encounter, and 19.7% had a non-PC-MHI outpatient mental health or inpatient mental health encounter. A majority (87.6%) responded "not at all" to item 9 from their first PHQ-9 assessment.

Most patients (90.8%) had only a single documented PHQ-9 assessment in FY 2010. The maximum number of recorded assessments by a VHA user was 30. The number of risk days ranged from 1 to 730 (mean±SD=530.9±118.9). Among the 391,492 unique VHA users in the study, there were 310 suicide deaths, with a crude suicide mortality rate of 53.9 per 100,000 person-years (Table 1). According to patients' first PHQ-9 assessments, 7.4% of individuals who

TABLE 2. Timing of suicide deaths relative to the most recently completed PHQ-9 assessment among 391,492 VHA users, by response to item 9[a]

| | Total users (N=391,492) | | Suicide deaths (N=310) | | Timing of suicide deaths (N=310) | | | | | | | | | | | | | |
| | | | | | Same day | | ≤7 days | | ≤30 days | | ≤60 days | | ≤90 days | | ≤180 days | | ≤1 year | |
Response	N	%	N	%	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %
Not at all	343,635	87.8	222	71.6	0	—	3	1.4	19	8.6	33	14.9	51	23.0	92	41.4	160	72.1
Several days	30,570	7.8	49	15.8	0	—	1	2.0	6	12.2	9	18.4	11	22.4	18	36.7	40	81.6
More than half the days	8,698	2.2	17	5.5	0	—	2	11.8	2	11.8	7	41.2	8	47.1	10	58.8	14	82.4
Nearly every day	8,589	2.2	22	7.1	0	—	0	.0	4	18.2	4	18.2	5	22.7	13	59.1	17	77.3
Total					0	—	6	1.9	31	10.0	53	17.1	75	24.2	133	42.9	231	74.5

[a] PHQ-9, nine-item Patient Health Questionnaire; VHA, Veterans Health Administration

died by suicide in the follow-up period had reported that they were bothered nearly every day by thoughts that they would be better off dead or thoughts of hurting themselves (item 9), compared with 2.3% of patients who did not die by suicide (p<.001).

A total of 31 individuals died by suicide within 30 days of a PHQ-9 assessment (Table 2); 18.2% of patients who responded "nearly every day" to item 9 from their most recent PHQ-9 assessment died by suicide within 30 days of the assessment, compared with 8.6% who responded "not at all." In total, 71.6% of all suicide decedents responded "not at all" to item 9 from their most recent PHQ-9 assessment.

Without considering other covariates, analyses based only on item 9 of the PHQ-9 found that the relative hazard of suicide mortality increased with increased frequency of suicidal thoughts (Table 3, model 1). A post hoc test for trend revealed a 64% increased risk of suicide for every unit increase in response to item 9 (HR=1.64, CI=1.47–1.82). [A figure showing the unadjusted suicide-specific cumulative incidence function by item-9 response is available as an online supplement to this article.]

Although HRs were attenuated, a similar trend persisted after the analyses controlled for demographic characteristics, previous psychiatric diagnoses, and scores on PHQ-9 items 1–8 (HR=1.47, CI=1.29–1.68). Results were similar after the analyses also controlled for presence of inpatient and outpatient encounters on each assessment date.

Supplemental analyses indicated that the suicide rate for all FY 2010 VHA users was 53.3 per 100,000 person-years for users who completed PHQ-9 assessments, compared with 37.0 per 100,000 person-years for users who did not complete PHQ-9 assessments.

DISCUSSION

Among VHA users who received PHQ-9 assessments in FY 2010, higher scores on item 9 were associated with increased risk of suicide mortality after analyses adjusted for demographic characteristics, psychiatric diagnoses, PHQ-9 items 1–8, and type of VHA encounter on the assessment date. These results were similar to analyses reported by Simon and colleagues (16), who also documented a significantly elevated risk of suicide associated with higher scores

on item 9 of the PHQ-9 while controlling for other risk factors. However, Simon and colleagues (16) did not report a significant HR for responses of "nearly every day" compared with "not at all." In this study, which had greater statistical power because of the large sample of assessments among VHA users, we observed a significant increased hazard for all item-9 responses compared with a response of "not at all," after adjustment for other predictors.

The crude HRs representing risk of suicidality associated with item 9 of the PHQ-9 reported in this study were lower compared with HRs reported by Simon and colleagues (16); however, their CIs overlapped. We noted differences in the population characteristics of the two samples. It is likely that the VHA patient sample was older and had more males compared with the sample analyzed by Simon and others (16). Only 33.8% of the patients in this study had at least one psychiatric diagnosis, compared with 91% of patients in Simon and colleagues' analyses who were receiving or had recently received mental health treatment. Also, only 18.3% of the total assessments in this study were categorized as indicating severe depression on the basis of items 1–8 of the PHQ-9 compared with 31% of assessments analyzed by Simon's group (16). Patient populations outside the VHA may use the PHQ-9 to primarily assess depression treatment, whereas VHA users who are not receiving depression-specific treatment may be asked to complete the PHQ-9 because of VA/DOD CPGs recommending use of this assessment in primary care (17). Item 9 of the PHQ-9 assessment may better predict suicide among persons who already have mental health symptoms. After the analyses controlled for demographic characteristics, prior mental health care, and PHQ-9 items 1–8, the study results presented in this article were more similar to those reported by Simon and colleagues (16).

Depression diagnosis was not found to be a significant predictor of suicide mortality after the analyses controlled for self-reported depressive severity (PHQ-9 items 1–8) (Table 3, model 3). This suggests that patient reports of depressive-related symptoms were better predictors of suicide mortality compared with diagnosis. Similar to findings by Simon and colleagues (16), self-reported depressive symptoms from items 1–8 appeared less significant after the analyses controlled for item 9 (Table 3, models 4 and 5).

TABLE 3. Relative hazard of suicide mortality following 447,245 PHQ-9 assessments, by proportional hazards regression model[a]

Measure or characteristic	Model 1		Model 2		Model 3		Model 4		Model 5	
	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Response to PHQ-9 item 9 (reference: not at all)										
Several days	2.42	1.79–3.28					1.83	1.30–2.57	1.75	1.24–2.46
More than half the days	2.87	1.83–4.51					2.26	1.39–3.66	2.15	1.32–3.51
Nearly every day	3.74	2.52–5.56					2.99	1.92–4.65	2.85	1.81–4.47
Female (reference: male)			.58	.27–1.27	.58	.27–1.27	.60	.28–1.31	.58	.26–1.27
Age (reference: 18–29)										
30–39			.52	.28–.97	.54	.29–1.00	.53	.29–.98	.55	.29–1.02
40–49			.63	.38–1.05	.67	.40–1.11	.65	.39–1.07	.69	.41–1.14
50–59			.51	.31–.83	.55	.34–.90	.53	.33–.86	.57	.35–.93
60–69			.31	.19–.51	.37	.23–.61	.36	.22–.58	.40	.25–.64
70–79			.44	.26–.74	.61	.36–1.05	.59	.35–1.01	.68	.40–1.17
≥80			.59	.34–1.01	.84	.48–1.46	.80	.46–1.40	.93	.53–1.62
Psychiatric diagnosis[b]										
Serious mental illness			.97	.57–1.65	.98	.58–1.66	.92	.54–1.57	.83	.49–1.41
Anxiety			1.49	1.03–2.17	1.44	1.00–2.08	1.46	1.01–2.11	1.40	.97–2.03
PTSD			.73	.50–1.05	.65	.45–.94	.63	.43–.91	.59	.41–.87
Substance use disorder			1.49	1.05–2.11	1.48	1.04–2.09	1.44	1.02–2.05	1.38	.96–1.98
Depression			1.60	1.15–2.23	1.36	.97–1.90	1.32	.94–1.85	1.21	.87–1.68
Other			1.14	.81–1.62	1.14	.81–1.60	1.12	.79–1.59	1.08	.76–1.54
Depressive severity (reference: minimal depression)										
Mild depression					1.96	1.39–2.78	1.79	1.26–2.54	1.63	1.13–2.37
Moderate depression					2.52	1.74–3.64	2.09	1.42–3.07	1.90	1.27–2.85
Severe depression					2.22	1.55–3.18	1.47	.98–2.21	1.35	.88–2.07
Type of encounter[b]										
Primary care–mental health integration (PC-MHI)									1.08	.70–1.68
Standard primary care									.73	.56–.96
Non–PC-MHI outpatient mental health									1.35	.97–1.89
Other outpatient									1.11	.89–1.38
Inpatient mental health									1.19	.62–2.28
Other inpatient									.84	.38–1.85

[a] Models were adjusted for the following variables: model 1, nine-item Patient Health Questionnaire (PHQ-9) item 9; model 2, demographic characteristics and psychiatric diagnoses; model 3, same as model 2 plus depressive severity (PHQ-9 items 1–8); model 4, PHQ-9 item 9, demographic characteristics, psychiatric diagnoses, and depressive severity; model 5, same as model 4 plus inpatient and outpatient encounters on assessment date. HR, hazard ratio

[b] For each subitem, the reference group is the subitem's absence.

Most important, even after the analyses controlled for psychiatric diagnoses, which are known risk factors for suicide (20), as well as self-reported depressive severity (items 1–8), item 9 of the PHQ-9 was associated with suicide mortality in this population.

Although higher scores for item 9 were associated with increased suicide risk, the majority of suicides (71.6%) were by patients who responded "not at all" to item 9 on their most recent PHQ-9 assessment (Table 2). These results were consistent with previous studies, suggesting that relying solely on item 9 of the PHQ-9 to assess suicide risk may miss a large portion of patients at risk of suicide mortality (14).

Patients who died by suicide and did not endorse item 9 of the PHQ-9 may have chosen not to report suicidal ideation. A study designed to explore veterans' perceptions about suicide screening found that veterans denied suicidal ideation for several reasons, including thoughts that suicidal ideation was shameful, belief that their thoughts were too private to share with strangers, and concerns regarding the consequences of divulging their suicidal thoughts (21). Addressing these barriers could improve detection of suicidal ideation in clinic settings, enhancing the predictive utility of assessments like the PHQ-9.

We note that the study had limitations. First, although analyses examined all PHQ-9 assessments available in the CDW, these may not encompass all PHQ-9 assessments given to VHA users in FY 2010. Second, although our aim was to replicate the design used by Simon and colleagues (16), we did not use the same covariates. Specifically, instead of controlling for prior psychiatric care, we controlled for prior psychiatric diagnoses. This may compromise the ability to compare results; however, psychiatric diagnoses are established suicide risk factors, and they indicate provider recognition of mental health treatment needs. Finally, the overall suicide rate was higher among VHA users who received PHQ-9 assessments compared with those who did not; therefore, findings may not be generalizable to the larger population of VHA users.

CONCLUSIONS

To our knowledge, this is the first study that aimed to replicate the suicide mortality analyses conducted by Simon and colleagues (16). We found that endorsement of item 9 from the PHQ-9 was associated with significant increased risk of suicide mortality beyond general symptoms of depression in a population of VHA users who received a PHQ-9 assessment in FY 2010, a population with higher suicide rates compared with the total VHA user population in FY 2010. Appropriate attention should be given to patients in the VHA who report suicidal ideation on item 9 of the PHQ-9; however, a patient should not be removed from consideration of suicide risk on the basis of his or her response to this item alone. Assessing other risk factors is important when determining a patient's risk of suicide.

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