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Do PHQ Depression Questionnaires Completed During Outpatient Visits Predict Subsequent Suicide Attempt or Suicide Death?

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Abstract

Objective—As use of standard depression questionnaires in clinical practice increases, clinicians will frequently encounter patients reporting suicidal ideation. We examine whether responses to a brief self-report depression questionnaire predict subsequent suicide attempt or suicide death.

Methods—Electronic records from a large integrated health system were used to link PHQ9 depression questionnaires from outpatient visits to subsequent suicide attempts and suicide deaths. 84,418 outpatients aged 13 and older completed 207,625 questionnaires between 1/1/2007 and 12/31/2011. Electronic medical records, insurance claims, and death certificate data identified 709 subsequent suicide attempts and 46 suicide deaths in this sample.

Results—Cumulative risk of non-fatal or fatal suicide attempt over one year increased from 0.4% among those reporting suicidal ideation “not at all” to 4% among those reporting suicidal ideation “nearly every day”. Self-reported suicidal ideation remained a strong predictor of subsequent suicide attempt after adjusting for age, sex, treatment history, and overall depression severity. Cumulative risk of suicide death over one year increased from 0.03% among those reporting suicidal ideation “not at all” to 0.3% among those reporting suicidal ideation “nearly every day”. Self-reported suicidal ideation remained a moderate predictor of subsequent suicide death after adjusting for age, sex, treatment history, and overall depression severity.

Conclusions—Response to item 9 of the PHQ9 depression questionnaire identifies outpatients at increased risk for suicide attempt or death. This excess risk emerges over several days and continues to grow for several months, indicating that suicidal ideation is an enduring vulnerability rather than a short-term crisis.

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Suicide ranks 10th among causes of death in the US, accounting for 38,000 deaths in 2010 (1). Non-fatal suicide attempts cause approximately 600,000 emergency room visits (2) and 200,000 hospitalizations (3) annually. Early intervention to reduce this morbidity and mortality would require both accurate screening tests and effective interventions for those found to be at risk. While some behavioral interventions have shown promise for preventing suicidal behavior in high-risk patients (4, 5), we have no evidence that any screening test accurately identifies people in the general population at risk for suicide attempt or suicide death (6, 7). Consequently, the US Preventive Services Task Force (6), and others (8, 9) do not recommend screening for risk of suicidal behavior.

Nevertheless, increasing use of standard questionnaires in depression treatment (10–14) means that clinicians will frequently encounter patients who report thoughts of suicide (14, 15). At this time, we cannot offer clinicians any clear guidance regarding immediate or long-term risk in outpatients reporting suicidal ideation. Cross-sectional research has demonstrated that suicidal ideation on self-report questionnaires does agree with clinician assessments of suicidal ideation (16). Longitudinal research has found that structured clinician assessments of suicidal ideation predicts subsequent suicide attempts (17). But no previous research has examined whether self-reported suicidal ideation predicts subsequent suicide attempt. And no previous research has examined how any assessment of suicidal ideation (self-report or clinician assessment) predicts subsequent suicide death.

Here we used electronic medical records data from a large integrated health care system to address three questions of practical interest to clinicians treating depression: Does suicidal ideation reported on standard depression questionnaires accurately identify people at risk for subsequent suicide attempt or death? Do questionnaire responses regarding suicidal ideation add information after accounting for overall severity of depression and other risk factors? What is the immediate risk of suicide attempt and suicide death among outpatients reporting suicidal ideation?

METHODS

Group Health Cooperative is an integrated health system serving approximately 650,000 members in Washington and Idaho. Group Health provides care through an internal group practice and a network of contracted external providers. Members are enrolled through employer-sponsored insurance, individual insurance plans, Medicare, Medicaid, and other subsidized low-income insurance programs. The Group Health Human Subjects Review Committee granted a waiver of consent for this research use of de-identified records data.

Since March, 2006, all group practice primary care and mental health providers have been advised to administer the PHQ depression questionnaire (18–21) at every depression treatment visit. Item 9 of the PHQ asks “Over the last two weeks, how often have you been bothered by thoughts that you would be better off dead, or of hurting yourself in some way.” with response options of “Not at all”, “Several Days”, “More than Half the Days”, or “Nearly Every Day.” The study sample included all PHQ questionnaires collected between January 1, 2007 and December 31, 2011 for patients aged 13 or older. The proportion of all

visits with depression diagnoses for which a PHQ score was recorded increased from 5% in 2007 to 48% in 2011.

Suicide attempts were identified using electronic medical records (for services provided at Group Health Cooperative facilities) and insurance claims (for services provided by external providers or facilities). Three criteria were used to identify non-fatal suicide attempts:

- Inpatient or outpatient encounter with ICD-9 diagnosis of definite self-inflicted injury (E950 through E958)
- Inpatient or outpatient encounter with ICD-9 diagnosis of acute injury considered possibly self-inflicted (E980 through E988)
- Inpatient or outpatient encounter with ICD-9 diagnosis of suicidal ideation (V62.84) accompanied by ICD-9 diagnosis of either poisoning (960 through 989) or open wound (870 through 897).

We have previously reported (22) that validation by clinician review of full-text medical records notes found a positive predictive value of 100% for the first criterion and 80% for the second (when compared to definite documentation of both self-inflicted injury and suicidal intent). Review of an additional 100 records to validate the third criterion found a positive predictive value of 86%. Given the relative frequency of these three criteria in our sample (61% definite self-inflicted injury, 31% possible self-inflicted injury, 8% injury/poisoning plus suicidal ideation), we estimate the weighted average positive predictive value to be 92% for all three combined. To evaluate possible under-coding of self-inflicted injury, we examined the proportion of emergency room and hospital encounters with any injury or poisoning diagnosis for which any cause-of-injury code (or E-code) was not recorded. The proportion with no such code is one indicator of the proportion of medically treated suicide attempts that might be missed by reliance on E-codes for identification (23). The proportion of injury or poisoning encounters with no E-code was 29% in 2010.

Suicide deaths were identified by linking membership records to state death certificate and identifying records with ICD-10 cause-of-death codes indicating definite self-inflicted injury (X60 to X84) or possible self-inflicted injury (Y10 through Y34).

Electronic medical records and claims for identification of non-fatal suicide attempts were available through December 31, 2011. Death certificate data were available through December 31, 2010. Electronic medical records and claims data were also used to assess past use of specialty mental health care and past psychiatric hospitalization.

Descriptive analyses examined the cumulative risk of any suicide attempt (fatal or non-fatal) and cumulative risk of suicide death according to response to PHQ item 9. Analyses treated PHQ questionnaires as the unit of analyses, so that each completed questionnaire defined a new period at risk. Each risk period was censored at the time of disenrollment from Group Health, death from causes other than suicide, or the end of the study period. Each patient could contribute multiple overlapping risk periods, and each suicide attempt or death could be linked to multiple prior PHQ questionnaires from a single patient. This approach examines risk based on what was known at the time of the PHQ questionnaire, regardless of

subsequent assessment or treatment. It avoids informative censoring that would occur if likelihood of completing a later PHQ was related to probability of observing a subsequent suicide attempt.

Partly conditional Cox proportional hazards regression was used to estimate the association between response to PHQ item 9 and risk of subsequent suicide attempt or death after accounting for other risk factors (age, sex, history of prior hospitalization or mental health specialty treatment, and response to other PHQ items) (24). These models accounted for clustering of observations within individuals, with standard errors estimated using the robust sandwich estimator for survival data (25). We assessed proportional hazards assumptions examining slopes of scaled Schoenfeld residuals plotted over time and by examining standard diagnostic plots (26).

RESULTS

Electronic medical records contained 207,265 PHQ questionnaires for 84,418 patients, including 42,333 patients (50%) with a single questionnaire, 17,251 (20%) with two, 9295 (11%) with three, 5373 (6%) with four, and 10,166 (13%) with five or more. Encounters in which questionnaires were administered included 92,440 (45%) with specialty mental health providers, 112,954 (54%) with primary care providers, 1274 (1%) with other medical or surgical specialists, and 597 (<1%) emergency department visits. Using the conventional classification of PHQ scores, depression was minimal (score 0 to 4) in 43,210 or 21% of cases, mild (score 5 to 9) in 52,214 or 25%, moderate (score 10 to 14) in 47,261 or 23%, moderately severe (score 15 to 19) in 37,565 or 18%, and severe in 27,015 or 13%. Response to item 9 regarding thoughts of death or self-harm was “Not at all” in 159,234 or 77% of cases, “Several days” in 29,910 or 14%, “More than half the days” in 10,864 or 5%, and “Nearly every day” in 7257 or 4%.

The number of days of follow-up after the PHQ questionnaire (i.e. before censoring or suicide attempt) ranged from 1 to 1703 (median 360, mean 477). Follow-up was censored because of death not due to suicide for 1214 observations (1%), because of disenrollment from the health plan for 47,620 (23%), and because of the end of the study period for 158,431 (76%).

Death certificate data identified 46 suicide deaths, including 45 attributed to definite self-inflicted injury (death certificate diagnosis X60 to X84) and 1 attributed to possible self-inflicted injury (Y10 to Y34).

Electronic medical records and insurance claims data identified 709 instances of non-fatal suicide attempt. These included 470 diagnoses of definite self-inflicted injury (E950 to E958), an additional 198 diagnoses of possible self-inflicted injury (E980 to E988), and an additional 41 identified by the combination of a poisoning or wound diagnosis linked to a diagnosis of suicidal ideation (V62.84). These suicide attempts included 371 leading to hospitalization and an additional 338 receiving only emergency room or outpatient treatment. Each individual could have more than one nonfatal suicide attempt in the study period; 37 patients had two attempts, 9 patients had three, and 3 had four or five.

The cumulative probability of any suicide attempt (both nonfatal and fatal attempts) according to response to PHQ item 9 is shown in Figure 1. At one year, cumulative probability ranged from approximately 0.4% (1 in 250) for those responding “not at all” to approximately 4% (1 in 25) for those responding “nearly every day”. This pattern was consistent across subgroups defined by sex, age, type of visit where questionnaire was completed, current use of antidepressant medication, or year the questionnaire was completed (see appendix).

Results from Cox proportional hazards models predicting risk of any suicide attempt are shown in Table 1. Without considering other risk factors (Model 1), the relative hazard of any suicide attempt increased according to response to PHQ item 9, with a hazard ratio of approximately 6.4 for those responding “nearly every day” compared to “not at all”. A post-hoc test for trend found a statistically significant ($p < 0.001$) linear relationship between item 9 score and risk of subsequent suicide attempt with a hazard ratio of 1.91 (95% CI: 1.79 to 2.04) for each one-step increase in reported frequency of suicidal thoughts. Risk of any suicide attempt was associated with female sex, younger age, history of specialty mental health treatment, and history of psychiatric hospitalization (Model 2a). Overall depression severity (as measured by PHQ items 1 through 8) was a significant predictor after accounting for demographic characteristics and treatment history (Model 2b). After adjusting for all of these other risk factors, response to PHQ item 9 remained a strong predictor of any suicide attempt (Model 2c).

The cumulative probability of suicide death according to response to PHQ item 9 is shown in Figure 2. At one year, the cumulative probability ranged from approximately 0.03% (1 in 3,000) for those responding “not at all” to approximately 0.3% (1 in 300) for those responding “nearly every day”.

Results from Cox proportional hazards models predicting suicide death are shown in Table 2. Without considering other risk factors (Model 1), the relative hazard of suicide attempt was significantly increased with any reported thoughts of self-harm compared to those responding “not at all”. Wide confidence limits for hazard ratios reflect the small numbers of suicide deaths. A post-hoc test for trend found a statistically significant ($p < 0.001$) linear relationship between item 9 score and risk of subsequent suicide death with a hazard ratio of 1.92 (95% CI: 1.53 to 2.41) for each one-step increase in reported frequency of suicidal thoughts. Risk of suicide death was significantly higher among men. Older age, history of specialty mental health care, and history of psychiatric hospitalization were also associated with increased risk of suicide death, but these associations were not statistically significant (Model 2a). After adjusting for demographic characteristics and treatment history, overall depression severity was significantly associated with increased risk of suicide death (Model 2b). After accounting for all of these other predictors, response to PHQ item 9 remained a statistically significant predictor of suicide death (Model 2c).

Table 3 displays the actual numbers of suicide attempts and suicide deaths during the first day, first 7 days, and first 30 days following the PHQ questionnaire according to response to item 9. The data regarding early suicide attempts illustrate that absolute risk was low even in those reporting frequent suicidal ideation, and that approximately one quarter of suicide

attempts soon after assessment occurred among patients reporting suicidal ideation “not at all”. The data regarding early suicide deaths also show a low absolute risk immediately following assessment, but numbers are too small to draw conclusions regarding relationship to PHQ responses.

Table 4 reports the number of individual patients with any suicide attempt and the number dying by suicide according to each individual’s highest-ever response across all administrations of the PHQ questionnaire. Approximately one fifth of suicide attempts and one fifth of suicide deaths occurred among the 70% of patients who responded “not at all” on every occasion.

DISCUSSION

Among outpatients completing PHQ depression questionnaires, response to item 9 regarding suicidal ideation was a strong predictor of suicide attempt and suicide death over the following year. The 13% of patients who reported thoughts of death or self-harm “more than half the days” or “nearly every day” accounted for 53% of suicide attempts and 54% of suicide deaths. Among those reporting frequent suicidal ideation, immediate risk of suicidal behavior was low. But increased risk emerged over several days and persisted for several months.

Our findings apply to PHQ depression questionnaires completed during outpatient visits to primary care or mental specialty providers. Our sample of questionnaires from emergency department visits was too small to specifically evaluate risk in that setting. We cannot determine if our findings would generalize to non-clinical settings such as community screening.

We should acknowledge potential misclassification of suicide attempts in both directions. Regarding false negatives, death certificate data may miss 10 to 25% of all suicide deaths (27–30). Given that approximately 30% of emergency room visits and hospitalizations with injury or poisoning diagnoses were not assigned a cause-of-injury code, our method for identifying nonfatal suicide attempts could miss 30% of emergency room visits or hospitalizations for self-inflicted injury. Regarding false positives, review of full-text records for a sample of cases (described above) did not confirm suicide attempt in approximately 7% of those identified using visit or hospital diagnosis data. Either type of misclassification might bias the associations we report if either error was related to prior PHQ responses or to other risk factors. Random or non-specific misclassification would lead to a conservative bias (reducing measures of association).

We should caution that reporting no suicidal ideation on the PHQ questionnaire does not rule out risk of subsequent suicide attempt. As shown in Table 4, approximately one fifth of suicide attempts and suicide deaths occurred among patients never reporting suicidal ideation. As shown in Table 3, approximately one fourth of suicide attempts within one week of completing a PHQ questionnaire occurred in patients reporting suicidal ideation “not at all”. We cannot determine whether these unexpected suicide attempts reflect sudden increases in suicidal ideation after a visit or some patients’ reluctance to reveal suicidal

ideation on a self-report questionnaire. No systematic data are available regarding changes in suicidal ideation among patients treated in community practice or how such changes are related to suicidal behavior. Given the significant proportion of suicide attempts among patients recently denying suicidal ideation, this is a priority area for future research.

Treating clinicians were aware of PHQ results, and the risks we observe reflect the consequences of any clinical response to reported suicidal ideation. While we cannot directly measure how clinicians responded to PHQ questionnaires, we expect that clinicians typically attempted to assess immediate risk and initiate referrals, intensification of treatment, or even hospitalization. The elevated risk associated with response to PHQ item 9 was observed in spite of any such clinical responses. But providers' immediate interventions may explain why the absolute risk in the first days after PHQ completion was low, even among patients reporting frequent suicidal ideation.

If self-report questionnaires identify risk of suicide attempt, this creates an opportunity for intervention and a potential liability. Unfortunately, concerns regarding liability may sometimes close off opportunities for intervention. Such concerns led to the development of an 8-item PHQ, omitting item 9 regarding thoughts of death or self-harm (31–33). This reduced questionnaire is intended for use in community or screening settings where an immediate clinical response is not feasible. But use of the full questionnaire in those settings might identify a large number of people at risk of suicide attempt who would otherwise go undetected. We hope that concerns regarding liability will not close off a potential avenue for prevention.

While we find that response to item 9 of the PHQ identifies outpatients at increased risk of suicidal behavior, this finding alone is not sufficient to justify population-based screening for secondary or selective prevention. Justification for population-based screening and prevention would require both evidence that screening predicts risk in the general population and evidence that some feasible intervention can reduce that risk (6, 8). Some specific behavioral treatments (4, 5) and outreach interventions (34–37) have been shown to reduce risk of suicidal behavior in high-risk groups, such as survivors of suicide attempt. Additional research would be needed to evaluate the effectiveness of prevention programs in at-risk outpatients identified by screening.

Our findings do, however, have implications for current practice. Systematic use of the PHQ (or some other standard outcome assessment) is an essential element of effective depression treatment (38, 39). If providers routinely assess severity of depression, they will frequently encounter self-reported suicidal ideation. In our sample, approximately 1 in 10 outpatients receiving depression treatment reported such thoughts “more than half the days” or “nearly every day”. Clinicians and health systems will require evidence-based guidance regarding the implications of self-reported suicidal ideation. We find that outpatients reporting suicidal ideation “more than half the days” or “nearly every day” are at increased risk for suicide attempt or suicide death. While the immediate risk of suicidal behavior in this group is low, excess risk emerges over several days and continues to grow for several months. Clinical response to suicidal ideation typically emphasizes immediate risk and urgent interventions. Our data argue for more attention to sustained and organized follow-up care to address

ongoing risk. Suicidal ideation should be viewed as an enduring vulnerability rather than simply a short-term crisis.

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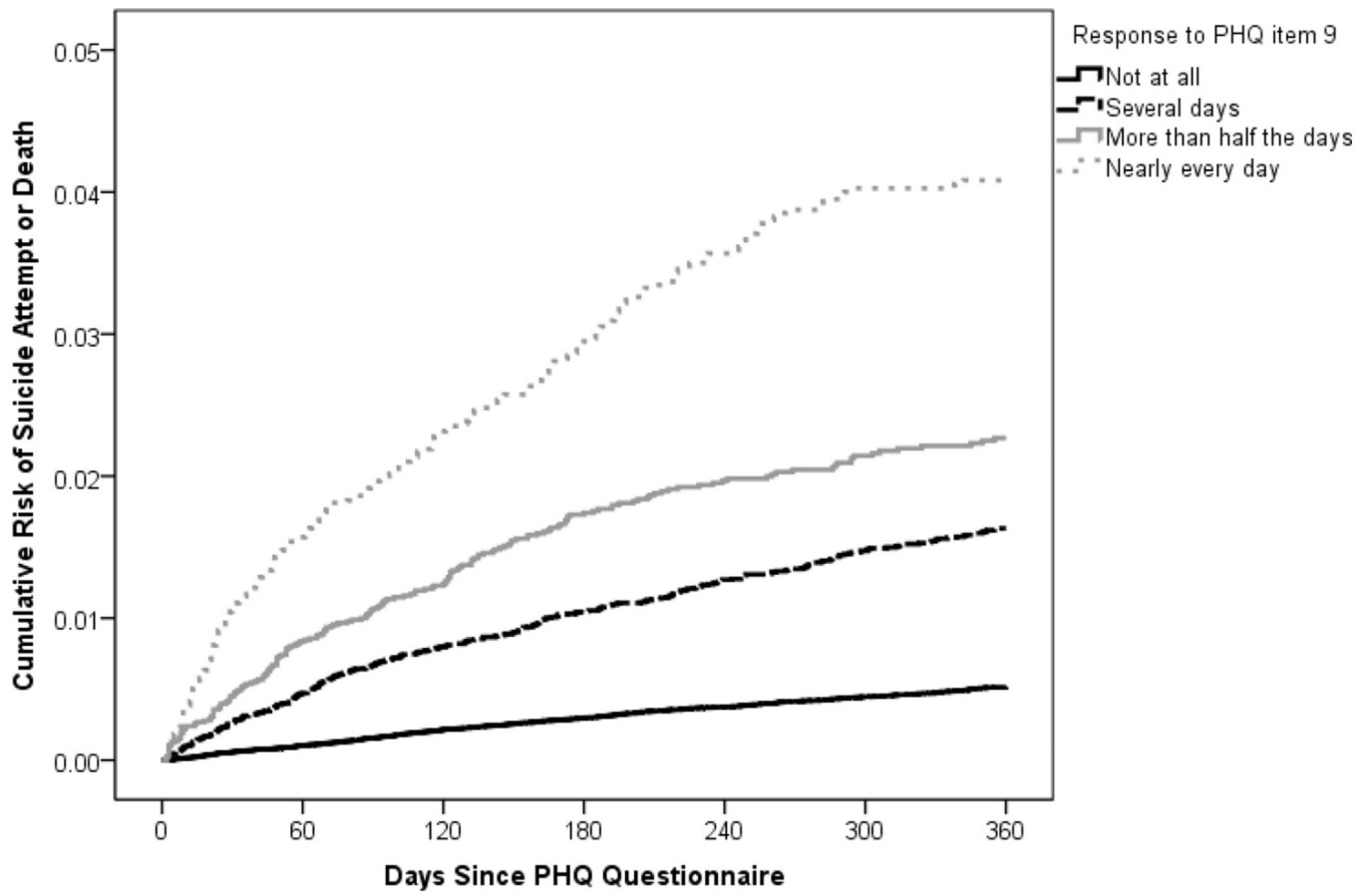


Figure 1. Probability of suicide attempt or death according to response to PHQ item 9 regarding suicidal ideation.

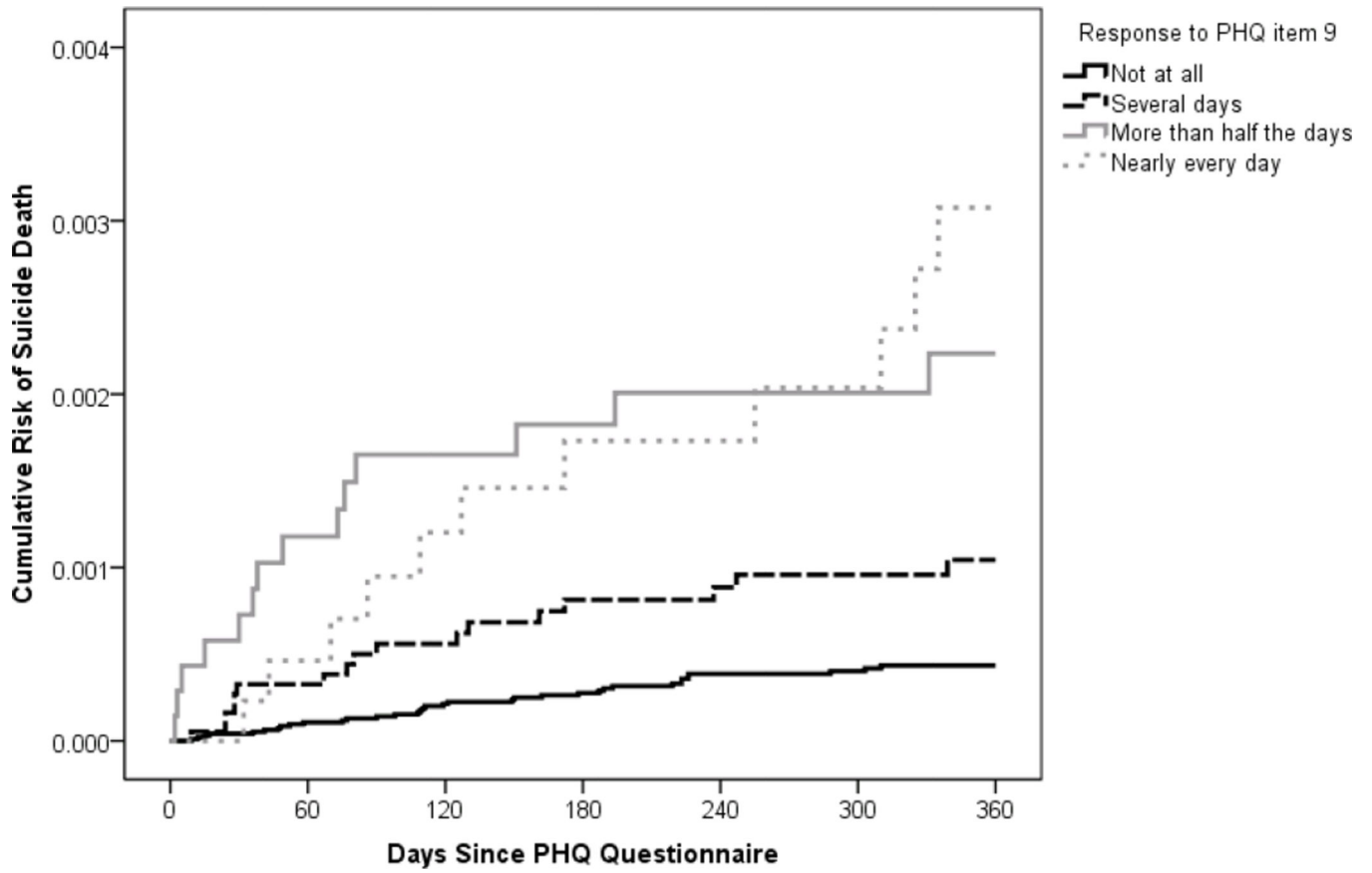


Figure 2.
Probability of suicide death according to response to PHQ item 9 regarding suicidal ideation

Table 1

Results of proportional hazards models regarding risk of suicide attempt or suicide death

	Number of Events*	Model 1: PHQ Item 9 only	Model 2a: Demographics and Treatment History	Model 2b: Demographics, Treatment History, PHQ items 1-8	Model 2c: Demographics, Treatment History, PHQ items 1-8, and PHQ item 9
PHQ Item 9 Response					
Not at all	304	Reference			Reference
Several days	143	2.82 (2.41-3.29)			2.1 (1.77-2.50)
More than half the days	95	4.12 (3.34-5.08)			2.71 (2.14-3.44)
Nearly every day	102	6.37 (5.07-8.01)			3.86 (2.96-5.03)
Female (vs Male)	458		1.14 (0.88-1.49)	1.08 (0.83-1.41)	1.14 (0.88-1.48)
Age					
13 to 17	117		Reference	Reference	Reference
18 to 29	136		0.58 (0.40-0.84)	0.55 (0.38-0.79)	0.61 (0.42-0.88)
30 to 44	159		0.38 (0.27-0.52)	0.36 (0.26-0.5)	0.42 (0.30-0.58)
45 to 64	195		0.31 (0.22-0.43)	0.30 (0.21-0.41)	0.34 (0.24-0.47)
>= 65	37		0.10 (0.06-0.17)	0.11 (0.07-0.18)	0.12 (0.07-0.20)
History of specialty mental health care	483		1.92 (1.55-2.39)	1.93 (1.55-2.39)	1.77 (1.42-2.21)
History of psychiatric hospitalization	149		4.38 (3.32-5.79)	4.23 (3.19-5.60)	3.88 (2.93-5.15)
Depression score from PHQ items 1-8					
0 to 4 (minimal)	56			Reference	Reference
5 to 9 (mild)	102			1.36 (1.08-1.71)	1.22 (0.97-1.54)
10 to 14 (moderate)	148			1.70 (1.25-2.30)	1.28 (0.94-1.75)
15 or more (severe)	338			2.93 (2.18-3.94)	1.62 (1.17-2.24)

* - based on PHQ most proximal to event date

Table 2

Results of proportional hazards models regarding risk of suicide death

	Number of Events*	Model 1: PHQ Item 9 only	Model 2a: Demographics and Treatment History	Model 2b: Demographics, Treatment History, PHQ items 1–8	Model 2c: Demographics, Treatment History, PHQ items 1–8, and PHQ item 9
PHQ Item 9 Response					
Not at all	17	Reference			Reference
Several days	11	2.64 (1.57–4.44)			1.75 (1.06–2.89)
More than half the days	13	5.89 (3.14–11.08)			3.41 (1.74–6.66)
Nearly every day	5	5.28 (2.14–13.03)			2.49 (0.95–6.57)
Female (vs Male)	12		0.09 (0.04–0.19)	0.08 (0.04–0.19)	0.09 (0.04–0.2)
Age					
13 to 17	1		Reference	Reference	Reference
18 to 29	7		4.65 (0.54–39.75)	4.11 (0.48–35.14)	4.29 (0.5–36.55)
30 to 44	12		7.78 (0.88–68.78)	6.91 (0.78–60.9)	7.31 (0.83–64.29)
45 to 64	16		6.72 (0.79–57.5)	6.07 (0.7–52.84)	6.41 (0.74–55.35)
>= 65	10		8.48 (1.04–68.98)	8.19 (1–67.41)	8.85 (1.08–72.26)
History of specialty mental health care	31		1.34 (0.67–2.65)	1.36 (0.69–2.69)	1.24 (0.62–2.47)
History of psychiatric hospitalization	14		5.21 (2.17–12.52)	4.75 (1.97–11.44)	4.38 (1.82–10.51)
Depression score from PHQ items 1–8					
0 to 4 (minimal)	3			Reference	Reference
5 to 9 (mild)	6			1.33 (0.71–2.51)	1.21 (0.65–2.23)
10 to 14 (moderate)	12			2.26 (1.12–4.57)	1.77 (0.91–3.43)
15 or more (severe)	25			3.97 (1.6–9.86)	2.34 (0.91–6.02)

* - based on PHQ most proximal to event date

Table 3

Timing of suicide attempt or suicide death according to suicidal ideation rating from most recent PHQ questionnaire.

	Any Suicide Attempt			Suicide Death				
	# of PHQ Questionnaires	Within 1 Day	Within 7 Days	Within 30 Days	# of PHQ Questionnaires	Within 1 Day	Within 7 Days	Within 30 Days
Not at all	159,234	4	21	82	97,165	0	0	2
Several days	29,910	4	22	70	18,869	0	0	4
More than half the days	10,864	3	20	59	6944	0	3	5
Nearly every day	7257	2	20	84	4515	0	0	1
Total	207,265	13	83	295	127,493	0	3	12

Table 4

Person-level classification of ever suicide attempt or ever suicide death according to highest-ever response to PHQ item 9

Highest-ever response (score)	# of people	Ever Suicide Attempt	Ever Suicide Death
Not at all (0)	59,425	144	9
Several days (1)	14,160	150	12
More than half the days (2)	6058	134	12
Nearly every day (3)	4775	216	13
Total	84,418	644	46