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Validation of a Secondary Screener for Suicide Risk: Results from the Emergency Department Safety Assessment and Follow-up Evaluation (ED-SAFE)

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Abstract

Background: Validated secondary screeners are needed to stratify suicide risk among those with non-negligible risk. This study tested the predictive utility of the Emergency Department Safety Assessment and Follow-up Evaluation (ED-SAFE) Secondary Screener (ESS), one of the screeners listed by The Joint Commission's Patient Safety Goal 15 resources as a potential secondary screener for acute care settings.

Methods: We performed secondary analyses of data collected for the ED-SAFE study. Data were collected during an ED visit for 1,376 patients who endorsed active suicide ideation or a suicide attempt in the past week. Participants were followed for 12 months using telephone based assessments, review of health care records, and National Death Index query. We examined the predictive validity of the individual items, total score, and a scoring algorithm using the total score and critical items. Bivariable analyses, multivariable logistic regression, and test operating characteristics were calculated.

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Results: Of the 1,376 patients enrolled, most were positive for at least one indicator. Four of the indicators were significantly associated with several outcomes. Based on score and critical items, the patients were trichotomized: the three strata were associated with significantly different rates of prospective suicidal behavior, with 52% of the high-risk group engaging in suicidal behavior within 12 months.

Conclusion: The ESS possesses adequate operating characteristics for triage purposes. We recommend validation in new samples to confirm its operating characteristics and potentially reduce its length by removing the substance and agitation items, which offered little predictive utility in this study.

Emergency departments (ED) treat two general categories of patients with suicide risk. The first and most obvious category comprises patients who present with a primary psychiatric chief complaint, for which suicidal ideation or behavior is often present and may even be the primary reason for the presentation. Approximately 4% of all ED visits are related to a psychiatric chief complaint, with 1% of all visits due specifically to suicidal ideation or a suicide attempt.[1–3] The second category of ED patients with suicide risk is composed of those presenting with a non-psychiatric chief complaint but who nevertheless have recent or current suicidal ideation or a recent suicide attempt. Several ED studies enrolling patients with non-psychiatric chief complaints have found that active suicidal ideation (defined as having thoughts of killing oneself) in the week or two before the ED visit is present in about one in ten patients,[4–6] a rate far exceeding general community-based point prevalence rates of approximately 4%.[7] Viewed from a different angle, 36% of suicide decedents make non-psychiatric ED visits in the year prior to death.[8]

Historically, this suicide risk among individuals presenting with non-psychiatric complaints —referred to variously as incidental, latent, or occult risk—has rarely been detected during routine clinical care, because ED workflow tends to focus on addressing the primary presenting complaint. To improve detection of this incidental risk, suicide prevention advocates have promoted universal screening of all patients who present to the ED, regardless of chief complaint.[9,10] Studies funded by the National Institute for Mental Health and others demonstrate the feasibility and effectiveness of universal screening in ED and other acute care settings to improve detection of non-negligible risk.[11–12] When combined with evidence-based interventions, screening can help significantly reduce future suicide attempts.[13]

By design, universal screening approaches for suicide are typically highly sensitive, identify a broad spectrum of suicide risk, and seek to minimize false negatives.[14] Ideally, non-negligible suicide risk is identified rapidly by a small number of primary screening questions, making it feasible in the busy ED, and those identified as at risk are further triaged or stratified with secondary screening. Not all patients with non-negligible suicide risk, as identified by primary screening, need the same level of evaluation and treatment.[14] Managing a medical patient who endorses recent active suicidal ideation with no intent, plan, or behavior in the same way as a patient presenting with a current suicide attempt may result in overly restrictive care for the medical patient and misallocate scarce ED resources, such as constant observation personnel. Overtreatment can result in workflow delays that

have repercussions for the entire ED, especially if the default protocol entails consulting psychiatry for any patient with any level of suicide risk. On the other hand, the medical patient's suicide risk cannot be ignored and should receive some kind of clinical intervention. The Joint Commission[9,15] and others[10,14,16] have emphasized that suicidal patients should be further stratified in an efficient way using a structured, evidence based procedure, and suicide mitigation strategies should be applied accordingly, with more intense interventions, such as one-to-one constant observation, being reserved for those with high risk. While stratification has been discouraged on the basis that suicide risk occurs on a continuum and because of poor performance of existing scales,[17] triage stratification is required by accrediting bodies[9] and is indispensable for medical providers to inform their necessarily categorical choices, such as whether to request a full psychiatric evaluation or implement full safety precautions.

One secondary screener included in The Joint Commission's list of evidence-informed tools is the six-item Emergency Department Safety Assessment and Follow-up Evaluation (ED-SAFE) Secondary Screener (ESS) (Figure 1). The ESS was created by the ED-SAFE team using a review of the literature and vetting with national experts in suicide risk at the time the ED-SAFE began in 2009. The screener consists of six indicators related to suicidal ideation and behavior, psychiatric history, substance use, and agitation. The indicators can be ascertained by the clinician through patient interview, health record review, collateral information (such as from family, friends, EMS, or law enforcement), or clinical observation. The ESS is designed to be used in conjunction with the Patient Safety Screener-3 (PSS-3),[18] a primary suicide risk screener used to detect non-negligible risk. Those who screen positive on the PSS-3 should receive secondary screening with the ESS to further stratify risk. Despite being informed by suicide risk prediction studies, there are no published predictive validity studies specifically examining the ESS. To address this knowledge gap, the current study examined the relation between the ESS and future suicidal behavior using a secondary analysis of existing data collected as part of the ED-SAFE.[11,19,20]

METHODS

Overview

Detailed descriptions of the ED-SAFE study design, setting, participants, procedures, data collection, human subjects' protections, adverse event reporting, and outcomes have been published previously.[11,13,19,20] Briefly, it was a hybrid type 2 implementation trial that used a three phase, interrupted time series design to (1) assess the feasibility and effectiveness of universal suicide risk screening in adult ED patients and (2) test the efficacy of a multi-component intervention to reduce suicidal behavior among people who screen positive for suicide risk. All participants enrolled into the longitudinal part of the study were followed for one year after their index ED visit using multi-method ascertainment of suicide-related ideation and behavior. Trained, supervised, blinded interviewers at a centralized research call center conducted outcome assessments at 6, 12, 24, 36, and 52 weeks. Additionally, trained chart abstractors at each site conducted health care chart reviews for the 12-month observation period, and the National Death Index was queried for deaths, including cause of

death and probability of suicide. The current analyses use data from the longitudinal, clinical trial part of the study. It included all data from the baseline assessment and chart review completed for the index ED visit to ascertain the indicators making up the ESS and all sources of follow-up data to ascertain the presence of suicidal behavior longitudinally. Institutional review boards at each site approved the study. All participants gave informed consent. A NIMH-appointed Data Safety Monitoring Board oversaw and monitored the ED-SAFE.

Setting

Participants in the ED-SAFE were recruited in eight general EDs ranging from small community hospitals to large academic centers and spanning seven U.S. states. Annual patient census ranged from 27,145 to 54,075 and all but one of the sites were teaching hospitals. Data were collected from August 2010 through November 2013.

Participants

Throughout the study phases, adult ED patients with any level of self-harm ideation or behavior noted as part of their ED assessment were identified in real time by embedded research staff and further assessed to confirm the presence of either active suicidal ideation or a suicide attempt within the past week. These non-negligible risk patients were further interviewed for eligibility into the longitudinal, clinical trial portion of the study. Exclusion criteria included (1) being medically or cognitively unable to participate in the assessment or counseling, (2) currently dwelling in a non-community setting, (3) currently in state custody or with pending legal action, (4) having no permanent residence or reliable telephone service, (5) having an insurmountable language barrier, and (6) previous ED-SAFE enrollment.

Measures

Demographics.—We collected data on age, sex, ethnicity, race, education, employment, marital status, and living circumstances.

ESS.—The indicators we ascertained were (1) having both active ideation in the past week and a lifetime suicide attempt, (2) having begun a suicide plan, (3) recent or current intent to act on ideation, (4) a lifetime history of a psychiatric hospitalization, (5) a pattern of excessive substance abuse, and (6) current irritability, agitation, or aggressiveness. Data for the ESS indicators were collected by the research staff using patient interview and clinical chart review. There were two reasons we chose to use the ESS data collected by research assistants for our analyses, rather than ESS screeners documented by ED clinicians during clinical care. First, the research assistants collected data on the ESS indicators for all three phases of the study, while the ESS was only introduced clinically in the last phase. Since all participants in the third phase of the study received the intervention, the clinician-administered ESS screener data was confounded by intervention effects. Second, we had much more consistency and stronger quality control measures for research staff ascertainment of the indicators as compared with clinical staff ascertainment, and therefore have greater confidence in the quality and completeness of the data collected by research

staff. Appendix 1 shows how each of the ESS indicators was operationalized for the current study.

Giving one point per indicator endorsed, the ESS can be summed to create a total score ranging from 0 to 6. The ESS contains critical items as well, including having begun a suicide plan and having recent or current suicidal intent, which can be used in conjunction with the sum score to help define risk stratification. This approach of focusing on suicide plan and intent follows a long tradition in the field of suicide risk assessment, is supported by several studies,[21] and has recently become the definition of high risk, also known as serious risk, used by The Joint Commission.[15] Consequently, in addition to examining the raw sum score alone, we created a stratification procedure using the raw sum score and presence of critical items as follows: “mild” means a patient obtained a sum score of 0 to 2 and has no intent or plan, “moderate” means a patient obtained a sum score of 3 to 4 or has intent or plan (not both), and “high” means a patient obtained a sum score of 5 to 6 or has both intent and plan. In the current analyses, any patient who presented to the ED with an actual suicide attempt was automatically considered as high risk.

Suicidal Behavior.—The presence of suicidal behavior across the 12-month follow-up was assigned to each participant using all sources of data available, including telephone assessments, medical records, and the National Death Index (NDI). The telephone assessment used the full version of the Columbia Suicide Severity Rating Scale (CSSRS)[21] to ascertain suicide-related behaviors. We created two composite outcomes:[13] “suicide attempts” was defined as fatal or non-fatal suicide attempts, and “any suicidal behavior” was defined as any suicidal behavior, including preparatory, aborted, and interrupted attempts, in addition to fatal or non-fatal attempts. We followed standard accepted definitions for these constructs.[22]

Analysis

We calculated descriptive statistics for all data. We created variables for each of the two outcome variables for the first 6 weeks and the entire 12 months after the index visit, resulting in a short-term (6 weeks) and long-term (12 months) event horizon for both “suicide attempt” and “any suicidal behavior” outcomes. Analyses included reliability of the ESS scale (Cronbach’s alpha), separate examination of the predictive utility of the individual indicators with a focus on teasing apart the relative importance of suicidal plan and intent, the raw sum, and the stratification using the raw sum in conjunction with critical items. Chi-square analyses were used for bivariable analyses and logistic regression for multivariable analyses. Finally, we calculated test operating characteristics, including sensitivity, specificity, positive predictive value, and negative predictive value for each of the strata, and created receiver operating characteristic (ROC) curves and calculated the area under the curve (AUC) for each outcome. All analyses were completed using SPSS, version 24.0.[23]

RESULTS

Description of the Sample

We enrolled 1,376 individuals. Table 1 presents the sample's descriptive characteristics. Most patients were positive for at least one ESS indicator. The least prevalent indicator was previous psychiatric hospitalization (n = 898, 65%), and the most prevalent indicator was having begun a suicide plan (n = 1,185, 86%). The internal consistency was low: Cronbach's alpha was 0.42.

Unadjusted Analyses

Tables 2 and 3 show the association between each demographic characteristic, ESS indicators, ESS sum score, various ESS stratifications, and each of the suicide behavior outcomes. Items 1 to 4 were each significantly associated with outcomes at each time point, as was endorsing intent *and* plan (Items 2 and 3). Item 5, substance use, was not associated with any outcome except for "any suicidal behavior" at 12 months. Item 6, irritability/aggression, was not significantly associated with outcomes at any point.

Multivariable Analyses

Tests for multicollinearity among the six indicators yielded low condition index (< 12.14), low variance inflation (< 1.21), and high tolerance (> 0.996), indicating low collinearity. Table 4 summarizes the logistic regression results. Item 1, ideation AND lifetime attempt; Item 2, plan; and Item 4, psychiatric hospitalization, were independently associated with suicide attempt at 6 weeks. Item 2, plan, and Item 4, psychiatric hospitalization, were independently associated with the suicide attempt at 12 months. Similar patterns were noted for the "any suicidal behavior" outcome (Table 4). Appendix 2 shows that the utility of the first four items held when the regressions were limited to patients without a current attempt.

ROC

The ROCs are depicted in Figure 2. The AUC for each outcome was as follows: suicide attempt at 6 weeks: 0.64 (95% CI: 0.59–0.69; $p < 0.001$); suicide attempt at 12 months: 0.63 (95% CI: 0.60–0.67; $p < 0.001$); any suicidal behavior at 6 weeks: 0.61 (95% CI: 0.58–0.64; $p < 0.001$); and any suicidal behavior at 12 months: 0.62 (95% CI: 0.59–0.65; $p < 0.001$). Chi squares for trend showed significant associations between the ESS sum score and each of the suicide outcomes (Table 3).

Three Group Stratification: Mild, Moderate, High

Table 5 and Appendix 3 show a statistically significant step increase across mild, moderate, and high strata for both suicide outcomes at 6 weeks and 12 months. The test operating characteristics of three strata are shown in Table 6a (strata based on simple sum) and Table 6b (strata based on sum and critical items). A moderate cut-off led to high sensitivity but poor specificity, while a high cut-off led to moderate sensitivity and specificity.

DISCUSSION

While implementing universal screening improves suicide risk detection,[11,18] many ED clinicians fear it will impede workflow if mitigation plans and resources are not tailored to risk stratification. Indeed, this fear might come true if we treat all patients with some identified suicide risk with identical, conservative protocols, like being disrobed and searched, placed under constant observation, and receiving a full psychiatric evaluation. However, evidence-informed methods for triaging or stratifying patients and guiding decision making has been lacking. Using the ESS sum score and critical items to define three strata (mild, moderate, high), < 2% of patients in the mild stratum had a suicide attempt in the six weeks after the index visit, compared to > 9% of the high stratum. Similarly, in the long term, approximately 17% of the mild stratum had some type of suicidal behavior in the 12 months after their index visit compared to over 50% of high stratum patients. Interestingly, our results examining specific indicators suggest that the current emphasis on presence of plan and intent for defining high risk should be further evaluated. While plan alone, intent alone, and the combination of plan and intent all were associated with prospective suicidal behavior, two other indicators (the presence of active ideation with lifetime attempt and a past psychiatric hospitalization) were at least as strongly associated with suicidal behavior in unadjusted analyses. In the multivariable regression that included all six indicators, having a suicide plan rose to the strongest predictor across all outcomes and time points, while suicidal intent tended to be non-significant, suggesting the presence of a plan may be more important in defining high risk than having intent. Finally, the operating characteristics revealed patterns consistent with expectations for a screener with a primary purpose of early triage, namely strong sensitivity but relatively weak specificity. We would recommend initial completion of the secondary screener by the nurse followed by further suicide risk assessment by the ED physician for all three strata, with those in the high risk stratum being prioritized for full safety precautions and evaluation by a mental health clinician. For additional suggestions, one can refer to the American College of Emergency Physicians' iCARE2 tool that elaborates on suicide risk mitigation strategies.[16,24]

There are other screeners that can be used for secondary screening and stratification. In recent years, the Columbia-Suicide Severity Rating Scale (C-SSRS)[21] Triage version has gained attention. It contains six items that assess passive suicidal ideation, active suicidal ideation, suicide method, suicidal intent, a detailed suicide plan, and lifetime and three-month presence of any suicidal behavior, including preparatory behavior, abortive attempts, interrupted attempts, or a suicide attempt. Similar to the ESS, it can be used to create three risk strata. Mild risk is defined as having active ideation but without method, intent, plan or lifetime suicidal behavior. Moderate risk is defined as having active ideation and suicidal method but without intent or plan, or having lifetime suicidal behavior but not in the past three months. High risk is defined as patients with suicidal intent or plan or as having suicidal behavior in the past three months. Posner and colleagues[21] showed that adolescents with the two highest levels of ideation severity, namely intent or intent with plan, on the full version of the C-SSRS were at increased risk of a prospective suicide attempt. However, there are no published psychometric data on the C-SSRS Triage version and the proposed

three-group stratification approach. It is notable that the C-SSRS Triage focuses only on suicidal ideation and behavior; although suicidal behavior is necessarily preceded at some point by ideation, Berman[25] cautions against focusing too heavily on ideation in assessing suicide risk. The ESS includes other non-suicide-specific risk factors, such as a history of past psychiatric hospitalizations, which has substantive empirical support in the literature and was a confirmed independent predictor in our analyses.

Another secondary screening tool is the SAMHSA ED decision support tool created using a rigorous RAND (Research and Development Corporation) expert consensus methodology. It too has recently been validated with ED-SAFE data using methods similar to those reported here.[26] The primary differences between the ESS and the SAMHSA tool rest in the specific indicators and in the stratification algorithm. The ESS uses the presence of both active ideation and a lifetime attempt as an indicator, while the SAMHSA tool uses lifetime attempt as a separate indicator, regardless of whether active ideation is currently present. While the ESS uses a psychiatric hospitalization as an indicator, the SAMHSA tool uses any significant mental health history as an indicator. Finally, the SAMHSA tool does not use critical items, like plan and intent, as part of stratification logic in contrast with the current analyses of the ESS.

Although the current study has several strengths, including prospective outcomes utilizing multiple data sources, it has several potential limitations. The sample consisted of patients with active suicidal ideation or a suicide attempt in the week before an index ED visit. Such patients represent a more severe subgroup of ED patients detected as being at risk of suicide. Second, the validation criterion was suicidal behavior. Although it is usually beneficial to assess prospective behavior as an outcome, ED-SAFE interventions received during and after the ED encounter may have confounded the association between predictors and outcome in a way that an alternative validation criterion, such as an independent clinician risk assessment during the ED visit, would not. Third, the original ESS refers to past two weeks' ideation but in the current analyses, we only had access to responses based on the past week because that was the timeframe of items used in the baseline interview. Finally, for the current study, the ESS indicators were operationalized based on self-report and chart review, but not clinician assessment. When the ESS is applied in the clinical setting as intended, self-report and chart review would be augmented by collateral report and clinical impression to ascertain each indicator.

CONCLUSION

This study represents an evidence-informed effort to stratify patients with suicide risk and guide ED physicians' decision-making. The ESS possesses adequate operating characteristics when considering the tool's initial triage purpose. It goes beyond suicidal ideation to assess well-recognized risk factors for suicide, including history of psychiatric hospitalization, prior attempt, and substance use, as well as state factors, namely intoxication and agitation. We recommend prospective validation in new samples to confirm its operating characteristics and potentially reduce its length by removing the substance abuse and agitation items, which appeared to offer little predictive utility in the current study. Although

the ESS cannot replace a full mental health assessment, it can help to direct limited mental health resources to patients who need them most.

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Appendix

Appendix 1:

How Each of the Secondary Screener Indicators Was Operationalized

Construct	Item wording	Source
1. Positive on recent ideation and lifetime attempt	Yes to "At any time during the past week, including today, have you actually had any thoughts of killing yourself?" AND Yes to "At any time in your life, including today, have you made a suicide attempt?" OR Yes to "Is your current visit due to a suicide attempt?"	Baseline assessment
2. Suicide "plan" (Method)	Yes to "At any time during the past week, including today, have you thought about HOW you might do this?" OR Yes to "Is your current visit due to a suicide attempt?"	Baseline assessment
3. Intent	Yes to "At any time during the past week, including today, have you had any intention of acting on these thoughts of killing yourself?" OR Yes to "Is your current visit due to a suicide attempt?"	Baseline assessment
4. Lifetime psychiatric hospitalization	"Have you ever been hospitalized for a psychological or emotional problem?" OR "Psychiatric inpatient hospitalizations" within past 6 months	Baseline assessment Chart review
5. Pattern of excessive substance use	'How often do you have a drink containing alcohol? 'How many drinks containing alcohol do you have on a typical day when you are drinking? 'How often do you have four or more drinks on one occasion?' 'An alcohol use disorder, like alcohol abuse or dependence?' 'Any drug use disorder, like drug abuse or dependence?' 'Alcohol abuse (current intoxication or evidence of any problem use) 'Blood alcohol level indicates intoxication' 'Intentional illegal or prescription drug misuse' 'Any positive urine tox screen' Substance abuse inpatient hospitalizations	Baseline assessment Chart review
6. Irritable, agitated, or aggressive	"Feeling so restless you couldn't sit still" OR "An anxiety disorder?" OR Thoughts or threats of harm toward other people	Baseline assessment Chart review

Appendix 2:

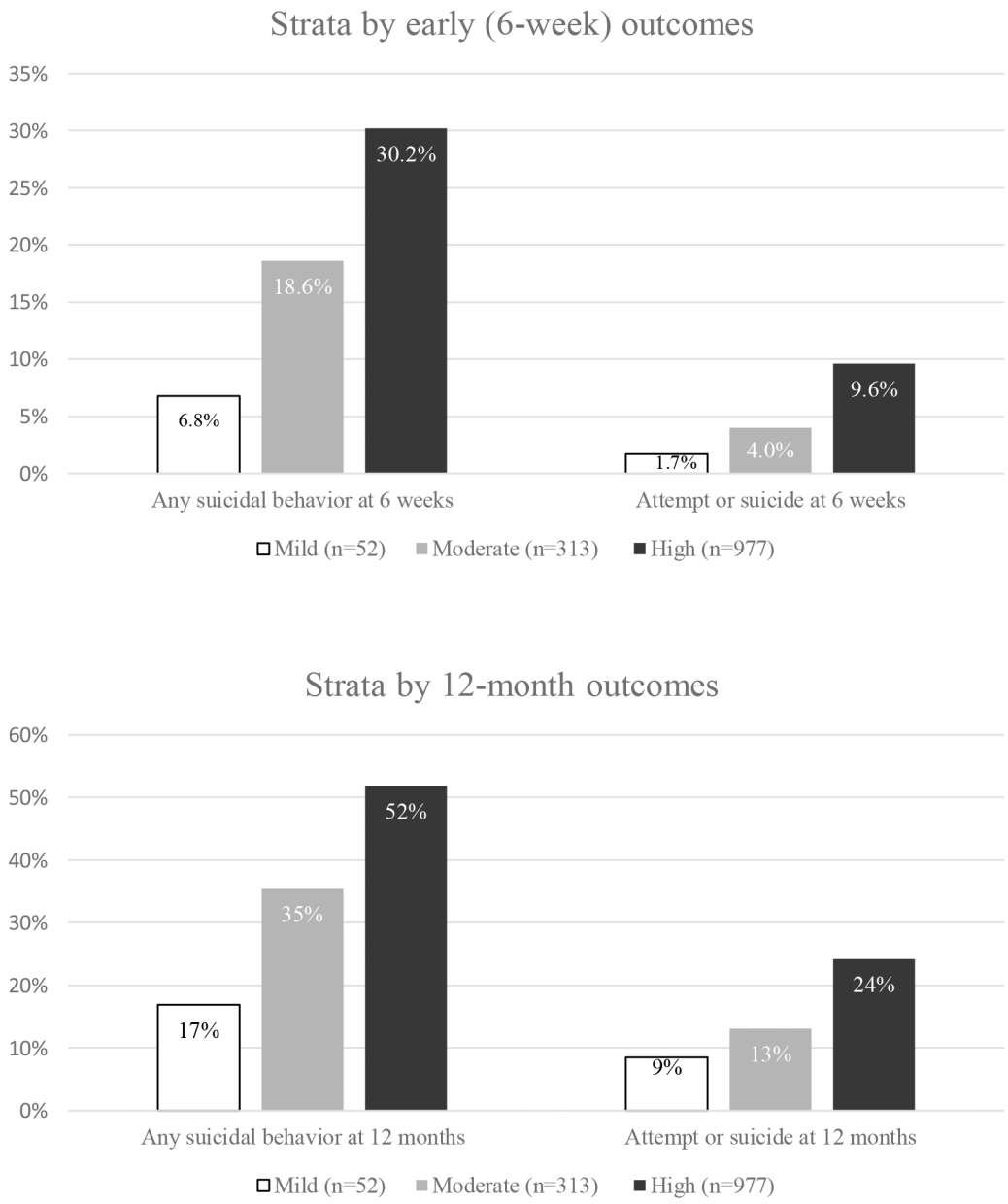
Logistic regression of secondary screener-6 predictors and suicide outcomes only for those presenting to the ED with active suicidal ideation but no suicidal behavior

	Suicide attempt 6 weeks (n = 109; 8%)		Suicide attempt 12 months (n = 287; 22%)		Any suicidal behavior 6 weeks (n = 364; 27%)		Any suicidal behavior 12 months (n = 638; 46%)	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Item 1	**1.92**	**1.04–3.56**	1.37	0.95–1.99	**1.78**	**1.27–2.50**	**1.51**	**1.14–2.01**
Item 2	**2.76**	**1.07–7.09**	**2.41**	**1.42–4.11**	**1.81**	**1.16–2.82**	**2.16**	**1.50–3.11**
Item 3	1.32	0.75–2.32	1.14	0.80–1.62	**1.40**	**1.02–1.94**	**1.41**	**1.06–1.86**

	Suicide attempt 6 weeks (n = 109; 8%)		Suicide attempt 12 months (n = 287; 22%)		Any suicidal behavior 6 weeks (n = 364; 27%)		Any suicidal behavior 12 months (n = 638; 46%)	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Item 4	1.87	0.98–3.58	**2.19**	**1.46–3.30**	**1.77**	**1.24–2.51**	**2.00**	**1.49–2.69**
Item 5	1.09	0.64–1.86	**1.50**	**1.04–2.16**	1.03	0.75–1.41	1.15	0.87–1.52
Item 6	1.13	0.56–2.28	1.22	0.77–1.94	1.03	0.69–1.53	1.00	0.71–1.43
Model	Chi: 24.94***		Chi= 52.92***		Chi= 57.65***		Chi=87.30***	

Item 1= Active ideation and lifetime attempt; Item 2= Plan; Item 3= Intent; Item 4= Psychiatric hospitalization; Item 5=Excessive substance use; Item 6= Aggressive/irritable

*** p<0.001



Appendix 3: Association between final strata and prospective outcomes at (a) 6 weeks and (b) 12 months

This figure shows the step change in prospective suicidal behavior associated with strata based on the secondary screener

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1. **Did the patient screen positive on both PSS-3 items—active ideation in past 2 weeks AND a past attempt?**

□ Yes □ No □ Refused □ Patient unable to complete

2. **Has the individual begun a suicide plan?**

□ Yes □ No □ Refused □ Patient unable to complete

3. **Has the individual recently had intent to act on his/her ideation?**

□ Yes □ No □ Refused □ Patient unable to complete

4. **Has the patient ever had a psychiatric hospitalization?**

□ Yes □ No □ Refused □ Patient unable to complete

5. **Does the patient have a pattern of excessive substance use?**

□ Yes □ No □ Refused □ Patient unable to complete

6. **Is the patient irritable, agitated, or aggressive?**

□ Yes □ No □ Refused □ Patient unable to complete

Note: Clinician should use all sources of information to ascertain if these indicators are present, including patient interview, collateral interview, chart review, and direct observation.

Figure 1:
Shown are the six indicators of the Emergency Department Safety Assessment and Follow-up Evaluation Secondary Screener (ESS).

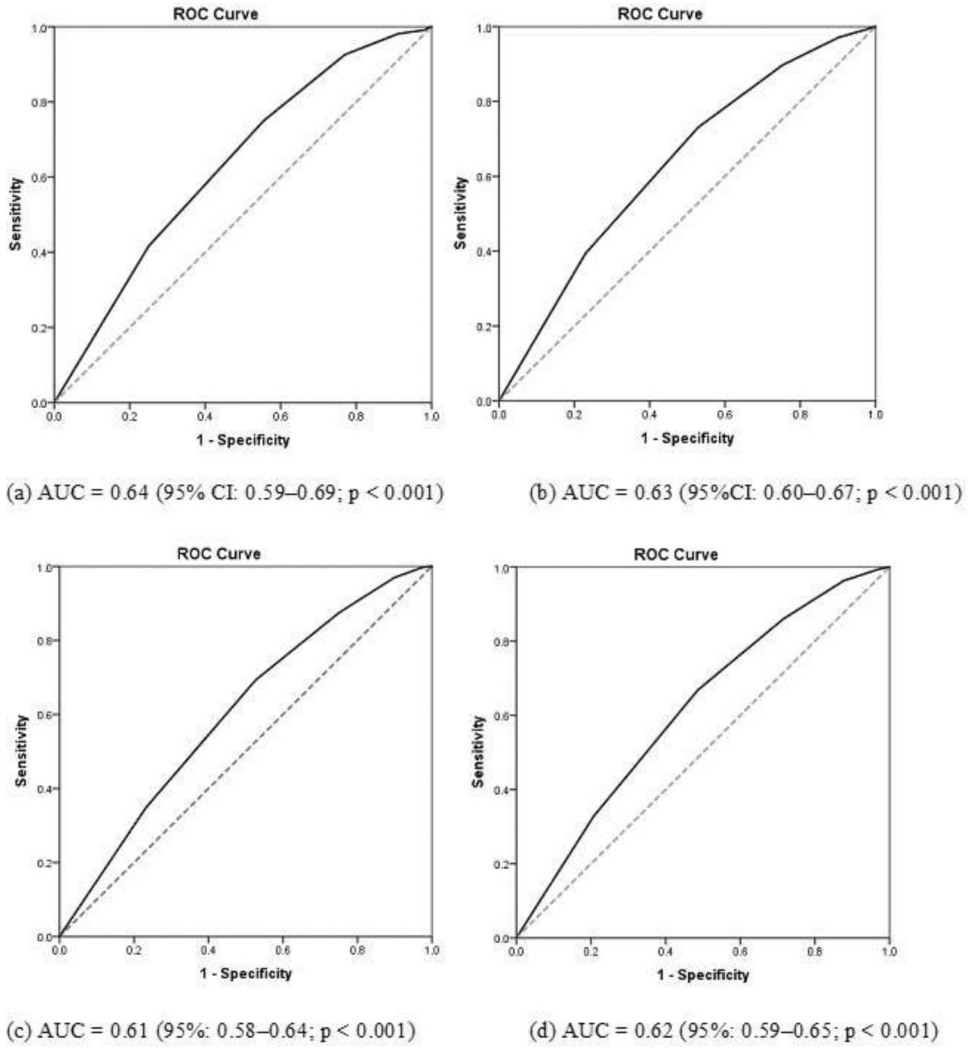

Figure 2:

ROC curve of associations between secondary screener score and outcomes: (a) association between score and suicide attempt at 6 weeks; (b) association between score and suicide attempt at 12 months; (c) association between score and any suicidal behavior at 6 weeks; and (d) association between score and any suicidal behavior at 12 months.

Table 1.

Description of Sample

		n	%
Age (years)	18–24	321	23.3%
	25–−34	321	23.3%
	35–−44	332	24.1%
	45–−54	262	19.0%
	55–−64	117	8.5%
	≥65	23	1.7%
Sex	Male	607	44%
	Female	769	56%
Ethnicity	Hispanic	171	12%
	Non-Hispanic	1205	88%
Race	White	1057	77%
	Black/African American	234	17%
	Asian	17	1%
Education	Less than high school	279	20%
	High school graduate	394	29%
	Post-high school	703	51%
Employment	Employed full-time	259	19%
	Not employed full-time	1117	81%
Marital status	Single (never married)	701	51%
	Married	259	19%
	Divorced/widowed/other	416	30%
Living circumstances	Living alone	361	26%
	Not living alone	1015	74%
Secondary screener items	Item 1: Active ideation and lifetime attempt	986	72%
	Item 2: Plan	1185	86%
	Item 3: Intent	971	71%
	Intent AND plan	907	66%
	Item 4: Psych hospitalization	898	65%
	Item 5: Excessive substance use	977	71%
	Item 6: Aggressive/irritable	1144	83%
	Secondary screener sum score (median)	5.0	IQR (4–6)
Simple strata	Mild (score 0–−2)	122	9%
	Moderate (score 3–4)	485	35%
	High (score 5–6)	769	56%
Final strata	Mild (score 0–2)	59	4%
	Moderate (score 3–4 or Intent or Plan)	328	24%
	High (5–6 or “Intent AND plan”)	989	72%
Suicide outcomes	Suicide attempt at 6 weeks	109	8%
	Suicide attempt at 12 months	287	22%

	n	%
Any suicidal behavior at 6 weeks	364	27%
Any suicidal behavior at 12 months	638	46%

Table 2.

Unadjusted Associations Between Demographic Characteristics and Outcomes

		Suicide attempt 6 weeks (n = 109; 8%)		Suicide attempt 12 months (n = 287; 22%)		Any suicidal behavior 6 weeks (n = 364; 27%)		Any suicidal behavior 12 months (n = 638; 46%)	
		n (%)	Chi	n (%)	Chi	n (%)	Chi	n (%)	Chi
Age group (years)	18–24 (n = 321)	31 (10%)	0.88 (n.s.)	55 (17%)	4.94 (n.s.)	70 (22%)	**6.71**†	113 (35%)	**22.87**‡
	25–34 (n = 321)	21 (7%)		73 (23%)		81 (25%)		141 (44%)	
	35–44 (n = 332)	28 (8%)		73 (22%)		91 (27%)		166 (50%)	
	45–54 (n = 262)	20 (8%)		59 (23%)		76 (29%)		143 (55%)	
	55–64 (n = 117)	8 (7%)		24 (21%)		42 (36%)		68 (58%)	
	≥ 65 (n = 23)	1 (4%)		3 (13%)		4 (17%)		7 (30%)	
Gender	Male (n = 607)	36 (6%)	**5.90***	119 (20%)	1.03 (n.s.)	133 (22%)	11.52†	258 (43%)	**6.52***
	Female (n = 769)	73 (10%)		168 (22%)		231 (30%)		380 (49%)	
Ethnicity	Hispanic (n = 171)	12 (7%)	0.22 (n.s.)	23 (14%)	**6.49***	44 (26%)	0.05 (n.s.)	68 (40%)	3.42 (n.s.)
	Non-Hispanic (n = 1205)	97 (8%)		264 (22%)		320 (27%)		570 (47%)	
Race	White (n = 1057)	89 (8%)	1.55 (n.s.)	236 (22%)	**5.97***	276 (26%)	0.27 (n.s.)	503 (47%)	2.73 (n.s.)
	Black/African American (n=234)	20 (9%)	0.15 (n.s.)	45 (19%)	0.45 (n.s.)	76 (33%)	**5.26***	112 (48%)	0.25 (n.s.)
	Asian (n = 17)	0 (0%)	1.48 (n.s.)	2 (12%)	0.86 (n.s.)	1 (6%)	3.74 (n.s.)	3 (18%)	**5.71***
Education	Less than high school (n = 279)	30 (11%)	**6.23***	72 (26%)	6.65*	89 (32%)	6.13*	146 (52%)	7.41*
	High school graduate (n = 394)	35 (9%)		85 (22%)		105 (27%)		189 (48%)	
	Post-high school (n = 703)	44 (6%)		130 (19%)		170 (24%)		303 (43%)	
Employment	Employed full-time (n = 259)	10 (4%)	**7.21**†	32 (12%)	**13.97**‡	40 (15%)	**19.88**‡	87 (34%)	**20.94**‡
	Not employed full-time (n = 1117)	99 (9%)		255 (23%)		324 (29%)		551 (49%)	
Marital status	Single (never married) (n = 701)	66 (9%)	**6.11***	149 (21%)	0.29 (n.s.)	177 (25%)	1.52 (n.s.)	300 (43%)	**7.67***
	Married (n = 259)	21 (8%)		51 (20%)		68 (26%)		126 (49%)	
	Divorced/ widowed/ other (n = 416)	22 (5%)		87 (21%)		119 (29%)		212 (51%)	
Living circumstances	Living alone (n = 361)	26 (7%)	0.65 (n.s.)	80 (22%)	0.50 (n.s.)	103 (29%)	1.09 (n.s.)	182 (50%)	3.23 (n.s.)
	Not living alone (n = 1015)	83 (8%)		207 (20%)		261 (26%)		456 (45%)	

* $p < 0.05$;

† $p < 0.01$;

‡ $p < 0.001$;

n.s., not significant.

Table 3.

Unadjusted Associations Between Screening Characteristics and Outcomes

		Suicide attempt 6 weeks (n =109; 8%)		Suicide attempt 12 months (n = 287; 22%)		Any suicidal behavior 6 weeks (n = 364; 27%)		Any suicidal behavior 12 months (n = 638; 46%)	
		n (%)	Chi	n (%)	Chi	n (%)	Chi	n (%)	Chi
Secondary screener items	Item 1: Active ideation and lifetime attempt (n = 986)	94 (10%)	**12.39**‡	233 (24%)	**16.21**‡	299 (30.3%)	**26.79**‡	502 (50.9%)	**28.92**‡
	Item 2: Plan (n = 1185)	104 (9%)	**8.55**†	269 (23%)	**17.56**‡	335 (28%)	**14.48**‡	585 (49%)	**30.91**‡
	Item 3: Intent (n = 971)	90 (9%)	**8.21**†	226 (23%)	**11.68**†	288 (30%)	**17.44**‡	494 (51%)	**26.97**‡
	Intent AND plan (n = 907)	88 (10%)	**11.37**†	219 (24%)	**16.98**‡	277 (31%)	**22.24**‡	474 (52%)	**35.97**‡
	Item 4: Psych hospitalization (n = 898)	87 (10%)	**11.06**‡	232 (26%)	**38.80**‡	283 (32%)	**34.03**‡	482 (54%)	**55.53**‡
	Item 5: Excessive substance use (n = 977)	80 (8%)	0.33 (n.s.)	219 (22%)	**4.96***	256 (26%)	0.11 (n.s.)	459 (47%)	0.51 (n.s.)
	Item 6: Aggressive/ irritable (n =1144)	97 (9%)	2.89 (n.s.)	245 (21%)	1.28 (n.s.)	310 (27%)	1.45 (n.s.)	535 (47%)	0.44 (n.s.)
Sum score	0 (n = 2)	0 (0%)	**23.75**‡	0 (0%)	**49.55**‡	0 (0%)	**43.40**‡	0 (0%)	**68.38**‡
	1 (n = 28)	1 (4%)		2 (7%)		1 (4%)		4 (14%)	
	2 (n = 92)	1 (1%)		7 (8%)		10 (11%)		20 (22%)	
	3 (n = 190)	6 (3%)		23 (12%)		36 (19%)		67 (35%)	
	4 (n = 295)	19 (6%)		47 (16%)		68 (23%)		128 (43%)	
	5 (n = 415)	37 (9%)		97 (23%)		124 (30%)		214 (52%)	
	6 (n = 354)	45 (13%)		111 (31%)		125 (35%)		205 (58%)	

* $p < 0.05$;

† $p < 0.01$;

‡ $p < 0.001$;

n.s., not significant.

Table 4.

Logistic Regression of Secondary Screener Predictors and Suicide Outcomes

	Suicide attempt 6 weeks (n = 109; 8%)		Suicide attempt 12 months (n = 287; 22%)		Any suicidal behavior 6 weeks (n = 364; 27%)		Any suicidal behavior 12 months (n = 638; 46%)	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Item 1	**1.92**	**1.07–3.46**	1.36	0.96–1.93	**1.63**	**1.19–2.25**	**1.38**	**1.05–1.80**
Item 2	**2.80**	**1.09–7.18**	**2.49**	**1.47–4.23**	**1.81**	**1.16–2.80**	**2.16**	**1.51–3.10**
Item 3	1.34	0.78–2.32	1.16	0.82–1.63	1.31	0.95–1.79	**1.32**	**1.01–1.70**
Item 4	**1.84**	**1.12–3.01**	**2.41**	**1.73–3.34**	**1.97**	**1.48–2.63**	**2.16**	**1.70–2.76**
Item 5	1.00	0.64–1.57	1.28	0.94–1.75	0.85	0.65–1.11	0.97	0.76–1.24
Item 6	1.60	0.86–2.99	1.13	0.78–1.63	1.17	0.83–1.64	1.03	0.76–1.38
Model	Chi: 33.08 *		Chi = 69.67 *		Chi = 68.03 *		Chi = 100.15 *	

Item 1, Active ideation and lifetime attempt; Item 2, Plan; Item 3, Intent; Item 4, Psychiatric hospitalization; Item 5, Excessive substance use; Item 6, Aggressive/irritable.

* $p < 0.001$

Table 5.

Strata and Associations with Suicidal Behavior

	Number of patients in stratum	Suicide attempt at 6 weeks	Suicide attempt at 12 months	Any suicidal behavior at 6 weeks	Any suicidal behavior at 12 months
Simple strata					
Mild (score 0–2)	n = 122	2 (2%)	9 (7%)	11 (9%)	24 (20%)
Moderate (score 3–4)	n = 485	25 (5%)	70 (14%)	104 (21%)	195 (40%)
High (score 5–6)	n = 769	82 (11%)	208 (27%)	249 (32%)	419 (55%)
Chi test for trend across strata		**19.30** *	**42.33** *	**39.11** *	**61.82** *
Final strata					
Mild (score 0–2)	n = 59	1 (2%)	5 (9%)	4 (7%)	10 (17%)
Moderate (score 3–4 or Intent OR Plan)	n = 328	13 (4%)	43 (13%)	61 (19%)	116 (35%)
High (score 5–6 or Intent AND Plan)	n = 989	95 (10%)	239 (24%)	299 (30%)	512 (52%)
Chi test for trend across strata		**13.50** *	**23.12** *	**29.38** *	**48.01** *

* $p<0.001$

Table 6a.

Diagnostic Values of Simple Secondary Screener Strata (Mild 0–2; Moderate 3–4; High 5–6) From Emergency Department Safety Assessment and Follow-Up Evaluation Data in Determining Prospective Suicidal Behavior Split by Cut-Off of Moderate and Cut-Off OF High

	SS High/moderate versus mild									
	Sensitivity	**95% CI**	**Specificity**	**95% CI**	**PPV**	**95% CI**	**NPV**	**95% CI**	**LR**	**95%CI**
Suicide attempt at 6 weeks	98%	94–99%	10%	8–11%	9%	7–10%	98%	94–99%	1.08	1.08–1.09
Suicide attempt at 12 months	99%	94–98%	10%	9–12%	22%	20–25%	93%	87–96%	1.08	1.08–1.08
Any suicidal behavior at 6 weeks	97%	95–98%	11%	9–13%	28%	26–31%	91%	85–95%	1.09	1.09–1.09
Any suicidal behavior at 12 months	96%	95–98%	13%	11–16%	49%	46–52%	80%	72–86%	1.11	1.11–1.11
	SS High versus mild/moderate									
	Sensitivity	**95% CI**	**Specificity**	**95% CI**	**PPV**	**95% CI**	**NPV**	**95% CI**	**LR**	**95%CI**
Suicide attempt at 6 weeks	75%	66–82%	46%	43–49%	11%	9–13%	96%	94–97	1.39	1.37–1.40
Suicide attempt at 12 months	73%	67–77%	49%	46–52%	27%	24–30%	87%	84–89%	1.41	1.40–1.42
Any suicidal behavior at 6 weeks	68%	65–73%	49%	46–52%	32%	29–36%	81%	78–84%	1.33	1.32–1.34
Any suicidal behavior at 12 months	66%	62–69%	53%	49–56%	55%	51–58%	64%	60–68%	1.39	1.37–1.40

PPV, positive predictive value; NPV, negative predictive value; LR, likelihood ratio.

Table 6b.

Diagnostic Values of Final Secondary Screener Strata (Scores Plus Critical Items) from Emergency Department Safety Assessment and Follow-Up Evaluation Data in Determining Prospective Suicidal Behavior Split by Cut-Off of Moderate and Cut-Off of High

	SS High/moderate versus mild									
	Sensitivity	**95% CI**	**Specificity**	**95% CI**	**PPV**	**95% CI**	**NPV**	**95% CI**	**LR**	**95%CI**
Suicide attempt at 6 weeks	99%	95–100%	5%	4–6%	8%	8–8%	98%	89–100%	1.04	1.02–1.06
Suicide attempt at 12 months	98%	96–99%	5%	4–6%	21%	21–22%	92%	81–96%	1.03	1.01–1.06
Any suicidal behavior at 6 weeks	99%	97–99%	5%	4–7%	27%	27–28%	93%	83–97%	1.05	1.03–1.07
Any suicidal behavior at 12 months	98%	97–99%	7%	5–9%	48%	47–48%	83%	72–91%	1.05	1.03–1.08
	SS High versus mild/moderate									
	Sensitivity	**95% CI**	**Specificity**	**95% CI**	**PPV**	**95% CI**	**NPV**	**95% CI**	**LR**	**95%CI**
Suicide attempt at 6 weeks	87%	79–93%	29%	27–32%	10%	9–10%	96%	94–98%	1.24	1.14–1.34
Suicide attempt at 12 months	83%	78–87%	31%	28–34%	24%	23–25%	88%	84–90%	1.21	1.13–1.29
Any suicidal behavior at 6 weeks	82%	78–86%	32%	29–35%	30%	29–32%	83%	80–86%	1.20	1.13–1.28
Any suicidal behavior at 12 months	80%	77–83%	35%	32–39%	52%	50–53%	67%	63–71%	1.24	1.16–1.33

PPV, positive predictive value; NPV, negative predictive value; LR, likelihood ratio.