A Comprehensive Model of Predictors of Suicide Attempt in Depressed Individuals and Effect of Treatment-Seeking Behavior:

Results From a National 3-Year Prospective Study

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ABSTRACT

Objective: Multiple factors have an impact on the risk of attempting suicide in depressed individuals. The elevated number of contributing factors and their frequent co-occurrence suggest the need to combine them in integrative models to develop more effective suicide prevention strategies. This report presents a comprehensive model of the 3-year risk of suicide attempt in individuals with major depressive episode (MDE) using a longitudinal nationally representative study, the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC; Wave 1, 2001–2002; Wave 2, 2004–2005).

Methods: Structural equation modeling was used to simultaneously examine effects of 4 broad groups of clinical factors previously identified as potential predictors of suicide attempts: (1) severity of depressive illness, (2) severity of psychiatric and other physical comorbidity, (3) sociodemographic characteristics, and (4) treatment-seeking behavior.

Results: About 3.5% of the 2,587 participants with a *DSM-IV* diagnosis of MDE attempted suicide during the 3-year follow-up period. Several factors predicted attempted suicide independently of each other: the absence of treatment-seeking behavior for MDE, the severity of the depressive illness (ie, recurrent thoughts of death, prior suicide attempts, and severity of the general depressive symptom dimension representing the joint effect of most depressive symptoms), and the severity of comorbidities (ie, severity of the general psychopathology factor representing the mechanisms shared across all comorbid psychiatric disorders and lower mental health–related quality of life). No sociodemographic characteristics independently contributed to this risk.

Conclusions: This model may help identify high-risk individuals with MDE and inform future research on risk of suicide.

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Major depressive disorder and bipolar disorder are the most common psychiatric disorders associated with suicide attempt.[1–4] A history of prior major depressive episode (MDE) and prior suicide attempt are two strong predictors for completed suicide.[2,5] Between 2% and 12% of individuals with an MDE end their lives by committing suicide,[6] and between 3% and 13% of suicide attempters die by suicide within 10 years of their first attempt.[7,8] Developing an accurate predictive model of suicide attempt for individuals with MDE is crucial to preventing suicide attempts, which themselves are associated with significant morbidity, and to developing more effective suicide prevention strategies for high-risk individuals.[9]

Prior research suggests that multiple factors increase the risk of attempting suicide in depressed individuals, including severity of major depression,[2,10–12] specific depressive symptoms[2,11–15] such as worthlessness[2,11–14] and thoughts of death,[2,11] psychiatric comorbidity (eg, anxiety disorders,[2,13,16] alcohol and drug use disorders,[2,11,13,16] personality disorders[2,12,13,17]), chronic physical illness,[2] family history of depression,[2,18] stressful life events,[2,19,20] and certain sociodemographic characteristics such as age,[11,13,21] female sex,[2] and poverty.[13]

Despite this knowledge, prediction of suicide attempts in individuals with MDE is complicated by the fact that each individual risk factor, when examined in isolation, accounts for only a small proportion of the variance in risk.[2,11] Although the elevated number of potential predictors of suicide attempts and their frequent co-occurrence[1,2,22–24] suggest the need to combine them to develop more powerful approaches, few integrative models have been proposed,[2,12] and most of them have relied on samples of convenience and cross-sectional designs.[25]

Prior epidemiologic studies found that treatment-seeking behavior, when examined independently, is associated with increased risk of suicide attempt.[1,26] However, this finding may reflect the strong association between clinical severity and treatment-seeking behavior. To our knowledge, no population-based study has examined the effect of

Clinical Points

- Multiple factors have an impact on the risk of attempting suicide in individuals with a major depressive episode. These factors include severity of depression, severity of psychiatric comorbidity, and low quality of life.
- Seeking treatment for depression has a strong protective effect against risk of suicide attempt.

treatment-seeking behavior on the risk of suicide attempt while taking into account clinical severity.

This report presents a comprehensive model of the 3-year risk of suicide attempt in individuals with MDE using a longitudinal nationally representative study, the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). We used structural equation modeling to simultaneously examine effects of 4 broad groups of clinical factors previously identified as potential predictors of suicide attempts: (1) severity of depressive illness, (2) severity of psychiatric and other physical comorbidity, (3) sociodemographic characteristics, and (4) treatment-seeking behavior (Figure 1). We used a latent variable approach to take into account depressive symptom and disorder co-occurence[27,28] and to be in line with prior studies[23,29] that have suggested that transdiagnostic factors may account for links between individual psychiatric disorders and suicide-related outcomes.

METHODS

Sample

Data were drawn from Wave 1 and Wave 2 of NESARC, a nationally representative face-to-face survey of the US adult population, conducted in 2001–2002 (Wave 1) and 2004–2005 (Wave 2) by the National Institute on Alcoholism and Alcohol Abuse (NIAAA).[30] The target population included the civilian noninstitutionalized population, aged 18 years and older, residing in the United States.[30] The overall response rate at Wave 1 was 81%, resulting in 43,093 interviews. The cumulative response rate at Wave 2 was 70.2%, resulting in 34,653 Wave 2 interviews.[30] The Wave 2 NESARC data were weighted to adjust for nonresponse, demographic factors, and psychiatric diagnoses to ensure that the Wave 2 sample approximated the target population, that is, the original sample minus attrition between the 2 waves.[30] The research protocol, including written informed consent procedures, received full human subjects review and approval from the US Census Bureau and the Office of Management and Budget. Among the 34,653 participants who completed interviews at both waves, the present analysis includes the 2,587 participants who had a *DSM-IV* diagnosis of MDE during the year preceding the Wave 1 interview.

Measures

Assessments of DSM-IV past-year Axis I and lifetime Axis II diagnoses at Wave 1. Psychiatric disorders were assessed using the Alcohol Use Disorder and Associated Disabilities Interview Schedule, *DSM-IV* version (AUDADIS-IV), a structured diagnostic instrument administered by trained lay interviewers.[30] Following *DSM-IV* criteria, a diagnosis of MDE required meeting clinical significance criteria (ie, distress or impairment), having a primary mood disorder (ie, excluding substance-induced or general medical conditions), and ruling out bereavement. Other Axis I diagnoses included substance use disorders (alcohol use disorder, drug use disorder, and nicotine dependence), mood disorders (dysthymic disorder and bipolar disorder), anxiety disorders (panic disorder, social anxiety disorder, specific phobia, and generalized anxiety disorder), and pathological gambling. For MDE and all Axis I disorders, diagnoses were made in the 12 months prior to Wave 1. Axis II disorders were assessed on a lifetime basis.[30] The test-retest reliability and validity of AUDADIS-IV measures of *DSM-IV* psychiatric disorders are good to excellent for substance use disorders and fair to good for major depression and other disorders.[31,32]

Sociodemographic characteristics in Wave 1. Sociodemographic characteristics included sex (men vs women), age, marital status (married vs nonmarried), race/ethnicity (white vs nonwhite), and poverty (household income < $20,000). In addition, participants were asked about 12 stressful life events concerning a variety of occupational, familial, financial, and legal issues and whether they had experienced these events in the past year of Wave 1.[30]

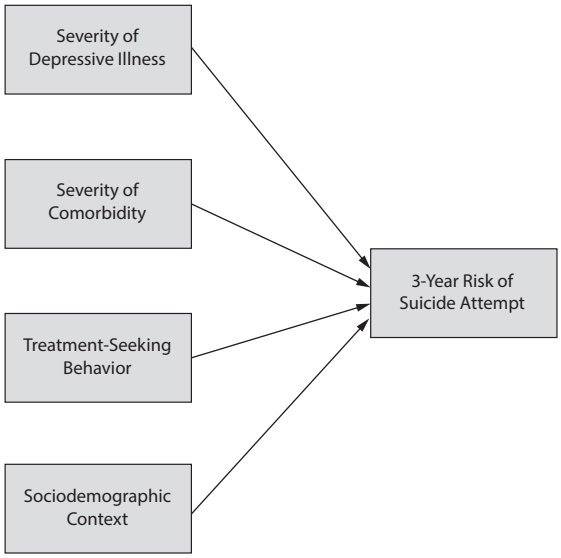
Family history of depression. Family history of depression in first-degree relatives was ascertained in separate modules of the AUDADIS.[32] Subjects were prompted with a definition that included examples for depression and then were asked whether first-degree relatives had experienced this condition.[32] Family history of depression was considered met if the participant reported that any first-degree relative had such history. The test-retest reliability of AUDADIS-ascertained family history of depression is very good.[32]

Psychiatric and other physical health–related quality of life. Participants completed Version 2 of the Short Form 12 Health Survey (SF-12v2),[33] a 12-item measure that assesses quality of life (over the last 4 weeks). The SF-12v2 can be scored to produce a norm-based psychiatric (mental) component summary score and a norm-based (other) physical component summary score. All standardized scale scores range from 0 to 100 with a mean of 50 (standard deviation = 10); higher scores signify better functioning. Studies support the reliability and convergent validity of the SF-12v2 scale scores in both community and clinical samples.[33]

Treatment-seeking behavior for depression. Participants with a past-year MDE who declared going to a hospital or emergency department or having consulted a mental health professional to receive help for low mood during the year preceding the Wave 1 interview were considered to have sought treatment for depression.

Assessment of suicide attempts. To assess lifetime history of suicide attempt, we asked all individuals with a MDE in the past year of Wave 1 whether they ever had attempted suicide. To assess for incident cases of suicide attempt, we

Figure 1. A Conceptual Comprehensive Model Predicting 3-Year Occurrence of Suicide Attempts in Individuals With a 12-Month Diagnosis of Major Depressive Episode at Baseline



asked all Wave 2 respondents, "Since last interview, did you ever attempt suicide?"

Statistical Analysis

Among participants with a past-year *DSM-IV* diagnosis of MDE at Wave 1, we first performed a set of binary logistic regressions and Wald *F* tests indicating measures of association of, respectively, each categorical and each continuous factor assessed at Wave 1 with the 3-year risk of suicide attempt.

Next, we used confirmatory factor analysis (CFA) to identify the latent structure underlying the individual comorbid psychiatric disorders and the latent structure underlying the symptoms of MDE assessed at Wave 1. Building upon the CFA model fit by Blanco et al[34,35] on these data, which generated 3 dimensions ("internalizing I," "internalizing II," and "externalizing"), we performed a bifactor CFA model[23,36–38] to determine whether a general psychopathology factor measured by all psychiatric disorders in addition to disorder-specific factors fit the underlying structure of psychiatric disorders (Supplementary Table 1). Second, we performed the CFA model fit by Li et al,[39] which generated a 3-factor structure of 14 disaggregated *DSM-IV* symptoms of MDE (Supplementary Table 2), to determine whether these 3 symptom-specific factors fit the underlying structure of depression with our data. We examined measures of goodness-of-fit, including the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean squared error of approximation (RMSEA). CFI and TLI values between 0.90 and 0.95 are considered acceptable, and CFI and TLI values greater than 0.95 and RMSEA values less than 0.06 indicate good model fit.[39,40]

Finally, following our a priori conceptual model (Figure 1), we used a covariance-based structural equation model to examine simultaneously the effects of 17 putative predictors assessed at Wave 1 on the risk of attempted suicide between the 2 waves while taking into account multiple associations across predictors. As indicated in Figure 1, our conceptual model included 4 groups of predictors: (1) severity of depressive illness, (2) severity of psychiatric and other physical comorbidity, (3) sociodemographic characteristics, and (4) treatment-seeking behavior. These 4 groups comprised a total of 17 predictors. Severity of depressive illness measures included severity of MDE, which incorporated 3 latent dimensions measured by the 14 depressive symptoms; age at onset of major depression; number of lifetime MDEs; prior suicide attempts; and family history of major depression. Severity of psychiatric and other physical comorbidity was examined using the general psychopathology factor, measured by 17 Axis I and II disorders, and psychiatric and other physical health–related quality of life measures. Predictors also included sociodemographic characteristics (ie, sex, poverty, race-ethnicity, age, marital status, and number of stressful life events) and treatment-seeking behavior. To determine if specific comorbid disorders or specific MDE symptoms or internalizing I or II or externalizing dimensions of psychopathology predicted future suicide attempts over and above the effects of the 17 factors, we calculated modification indices (ie, χ^2 tests with 1 degree of freedom) to test if any residuals were correlated with the risk of suicide attempt. Because our analysis was exploratory and defined a priori, statistical significance was evaluated using a 2-sided design with α set at .05. To reduce the risk of including significant direct effects related to multiple testing, we considered significant direct effects of items with modification index ≥ 10. Missing data were imputed using Markov chain Monte Carlo methods.[41] Rates of missing data were low, with 9.9% of participants having at least 1 factor with missing data. To examine the robustness of our results, we performed a sensitivity analysis while excluding participants with missing data. All analyses were conducted in Mplus Version 7.2[42] to account for the NESARC's complex design. The default estimator for the analysis was the variance-adjusted weighted least squares, a robust estimator appropriate for ordered categorical observed variables such as the ones used in this study.[42]

RESULTS

Bivariate Associations Between Baseline Clinical Characteristics and 3-Year Risk of Suicide Attempt

Among participants with a 12-month *DSM-IV* diagnosis of MDE (n = 2,587) at Wave 1, 3.5% (SE = 0.5, n = 94) attempted suicide during the 3-year follow-up period. Binary logistic models showed that most comorbid psychiatric disorders (except for specific phobia, alcohol use disorder, pathological gambling, and obsessive-compulsive personality disorder), lower psychiatric and other physical health–related quality

Table 1. Associations of Baseline Indicators of Severity of Depressive Illness, Severity of Psychiatric and Physical Comorbidity, Sociodemographic Characteristics, and Treatment-Seeking Behavior With the 3-Year Occurrence of Suicide Attempts in Individuals With a Past-Year *DSM-IV* Diagnosis of MDE at Wave 1 (N = 2,587)

Variable	3-Year Occurrence of Suicide Attempts: Yes (n = 94), Value[a]	3-Year Occurrence of Suicide Attempts: No (n = 2,493), Value[a]	OR [95% CI]/ Wald *F* (*P* Value)[b]
Severity of Depressive Illness			
Symptoms of MDE			
Depressed mood	98.1 (1.7)	95.8 (0.5)	2.2 [0.4–13.5]
Anhedonia	98.8 (0.8)	88.1 (0.9)	**11.2 [2.7–45.9]†**
Loss of appetite	66.2 (6.7)	52.1 (1.2)	1.8 [0.99–3.3]
Loss of weight	52.3 (6.8)	40.9 (1.2)	1.6 [0.9–2.7]
Increase of appetite	41.5 (6.8)	34.9 (1.2)	1.3 [0.7–2.4]
Increase of weight	32.3 (6.1)	28.9 (1.1)	1.2 [0.7–2.1]
Insomnia	75.8 (6.5)	78.5 (1.1)	0.9 [0.4–1.8]
Hypersomnia	54.7 (6.7)	49.1 (1.3)	1.3 [0.7–2.2]
Psychomotor retardation	51.3 (7.2)	42.5 (1.2)	1.4 [0.8–2.6]
Psychomotor agitation	71.5 (6.4)	59.1 (1.3)	1.7 [0.9–3.3]
Loss of energy or fatigue	84.8 (5.3)	86.5 (0.8)	0.9 [0.4–2.0]
Feeling of worthlessness	90.6 (4.5)	80.0 (1.1)	2.4 [0.8–7.1]
Diminished ability to think or concentrate, or indecisiveness	92.9 (3.1)	92.2 (0.7)	1.1 [0.4–2.9]
Recurrent thoughts of death	92.1 (3.1)	62.5 (1.3)	**7.0 [3.0–16.6]‡**
Past course of major depression			
Prior suicide attempt	67.2 (6.2)	11.7 (0.8)	**15.4 [8.6–27.5]‡**
No. of lifetime MDEs, mean (SE)	16.6 (4.0)	7.4 (0.4)	**5.4 (*P* = .023)***
First degree relatives with history of depression	81.5 (5.0)	74.8 (1.2)	1.5 [0.8–3.0]
Age at onset of major depression, mean (SE), y	22.1 (1.4)	29.1 (0.4)	**25.5 (*P* < .001)‡**
Severity of Comorbidity			
Comorbid disorder			
Any[c]	97.0 (1.9)	76.1 (1.1)	**10.0 [2.8–36.0]‡**
Dysthymia	36.0 (6.5)	15.8 (0.9)	**3.0 [1.7–5.3]‡**
Mania/hypomania	36.4 (7.0)	16.6 (0.9)	**2.9 [1.6–5.3]†**
GAD	29.0 (6.6)	15.9 (0.9)	**2.2 [1.1–4.2]***
Panic disorder	24.0 (5.2)	12.3 (0.9)	**2.2 [1.2–4.1]****
Social anxiety disorder	28.8 (6.4)	12.7 (0.8)	**2.8 [1.5–5.3]†**
Specific phobia	28.9 (6.4)	19.1 (1.0)	1.7 [0.9–3.2]
Alcohol use disorder	24.7 (6.1)	15.9 (1.0)	1.7 [0.9–3.4]
Drug use disorder	15.1 (4.3)	6.0 (0.6)	**2.8 [1.4–5.6]†**
Nicotine dependence	49.8 (7.0)	27.8 (1.2)	**2.6 [1.5–4.5]†**
Pathological gambling	0.0 (0.0)	0.5 (0.2)	NA
Histrionic PD	17.3 (5.1)	7.7 (0.7)	**2.5 [1.2–5.3]***
Schizoid PD	34.4 (6.8)	12.0 (0.8)	**3.8 [2.1–7.2]‡**
Paranoid PD	48.9 (6.7)	19.7 (1.0)	**3.9 [2.3–6.7]‡**
OCPD	29.2 (5.7)	22.4 (1.1)	1.4 [0.8–2.6]
Dependent PD	16.1 (5.7)	2.5 (0.4)	**7.6 [3.1–18.4]‡**
Avoidant PD	40.4 (6.5)	12.7 (0.8)	**4.7 [2.6–8.3]‡**
Antisocial PD	21.8 (5.2)	11.0 (0.9)	**2.2 [1.2–4.2]***
Quality of life, mean (SE)			
Psychiatric component score (MCS)	35.4 (1.4)	43.9 (0.2)	**34.6 (*P* < .001)‡**
Physical component score (PCS)	41.9 (1.7)	48.2 (0.3)	**14.0 (*P* < .001)‡**
Sociodemographic Characteristics			
Sex			0.7 [0.4–1.3]
Men	27.5 (5.9)	33.7 (1.2)	
Women	72.5 (5.9)	66.3 (1.2)	
Race/ethnicity			0.9 [0.5–1.7]
White	72.5 (5.9)	74.3 (1.7)	
Nonwhite	27.5 (5.9)	25.7 (1.7)	
Marital Status			0.7 [0.4–1.3]
Married	41.0 (6.7)	48.3 (1.3)	
Not married	59.0 (6.7)	51.7 (1.3)	
Age, mean (SE), y	34.2 (1.4)	39.6 (0.4)	**12.8 (*P* < .001)‡**
Poverty (household income < $20,000)	27.5 (1.2)	27.0 (1.2)	**1.86 [1.1–3.2]***
No. of past-year stressful life events, mean (SE)	3.5 (0.3)	3.0 (0.1)	2.2 (*P* = .143)
Seeking Treatment[d]	70.7 (6.0)	42.4 (1.3)	**3.3 [1.8–5.9]‡**

[a]Values are % (SE) unless otherwise noted. Percentages and means are weighted to reflect prevalence/mean in the US population. [b]Crude ORs (*df* = 1) indicate measures of association for binary variables and were estimated using logistic regression. Wald *F* tests indicate the association of continuous variables with future suicide attempts and were estimated using linear regression. ORs and Wald *F* tests in bold are statistically significant with α set a priori fixed at .05. [c]Axis I disorders were past-year diagnoses, whereas Axis II disorders were assessed on a lifetime basis. [d]This crude association does not take into account of the severity of depressive illness and comorbidity or sociodemographic characteristics. Abbreviations: GAD = generalized anxiety disorder, MDE = major depressive episode, NA = not applicable, OCPD = obsessive-compulsive personality disorder, OR = odds ratio, PD = personality disorder, SE = standard error. *$P < .05$. **$P < .01$. †$P < .005$. ‡2-sided P value < .001.

of life, younger age, poverty, treatment-seeking behavior, anhedonia, recurrent thoughts of death, prior suicide attempts, greater number of lifetime MDEs, and younger age at onset of major depression were associated with increased risk for attempting suicide (Table 1).

Structure of Comorbid Psychiatric Disorders and Symptoms of MDE

The bifactor model of the 3 dimensions of psychopathology provided a good fit for the data (CFI = 0.964, TLI = 0.952, RMSEA = 0.020), and the 3-factor CFA model of the 14 *DSM-IV* symptoms of MDE (CFI = 0.941, TLI = 0.922, RMSEA = 0.044) provided an adequate fit for the data (Supplementary Tables 1 and 2).

Structural Equation Model of the 3-Year Risk of Attempted Suicide

Many putative predictors assessed at baseline were significantly associated (Supplementary Tables 3 and 4). When multiple associations were modeled across predictors, seeking treatment for depression had a strong protective effect against risk of suicide attempt. The severity of the general psychopathology factor representing the shared effects of all comorbid psychiatric disorders, the severity of the general depressive symptom dimension representing the shared effect of most depressive symptoms, lower mental health–related quality of life, and prior suicide attempts significantly increased the risk of suicide attempt. In addition, beyond the effects of these predictors, recurrent thoughts of death had a significant direct positive effect on risk of suicide attempt. No sociodemographic characteristics had significant effects on this risk (Figure 2). Excluding participants with missing data from our analyses did not alter our results, except for the direct effect of recurrent thoughts of death that did not reach statistical significance (Supplementary Figure 1).

DISCUSSION

In a large nationally representative sample, we sought to build a comprehensive prospective model of the risk of suicide attempt in individuals with MDE at baseline to help integrate information regarding a wide range of clinical predictors from multiple domains and to estimate their relative impact. We found that 3.5% of individuals with MDE in the community at Wave 1 attempted suicide over a 3-year follow-up period. The absence of treatment-seeking behavior for depression, the severity of depression, and the severity of comorbidities at baseline independently predicted suicide attempts between the 2 waves. No sociodemographic characteristics independently predicted this risk. Four main findings emerged from this model.

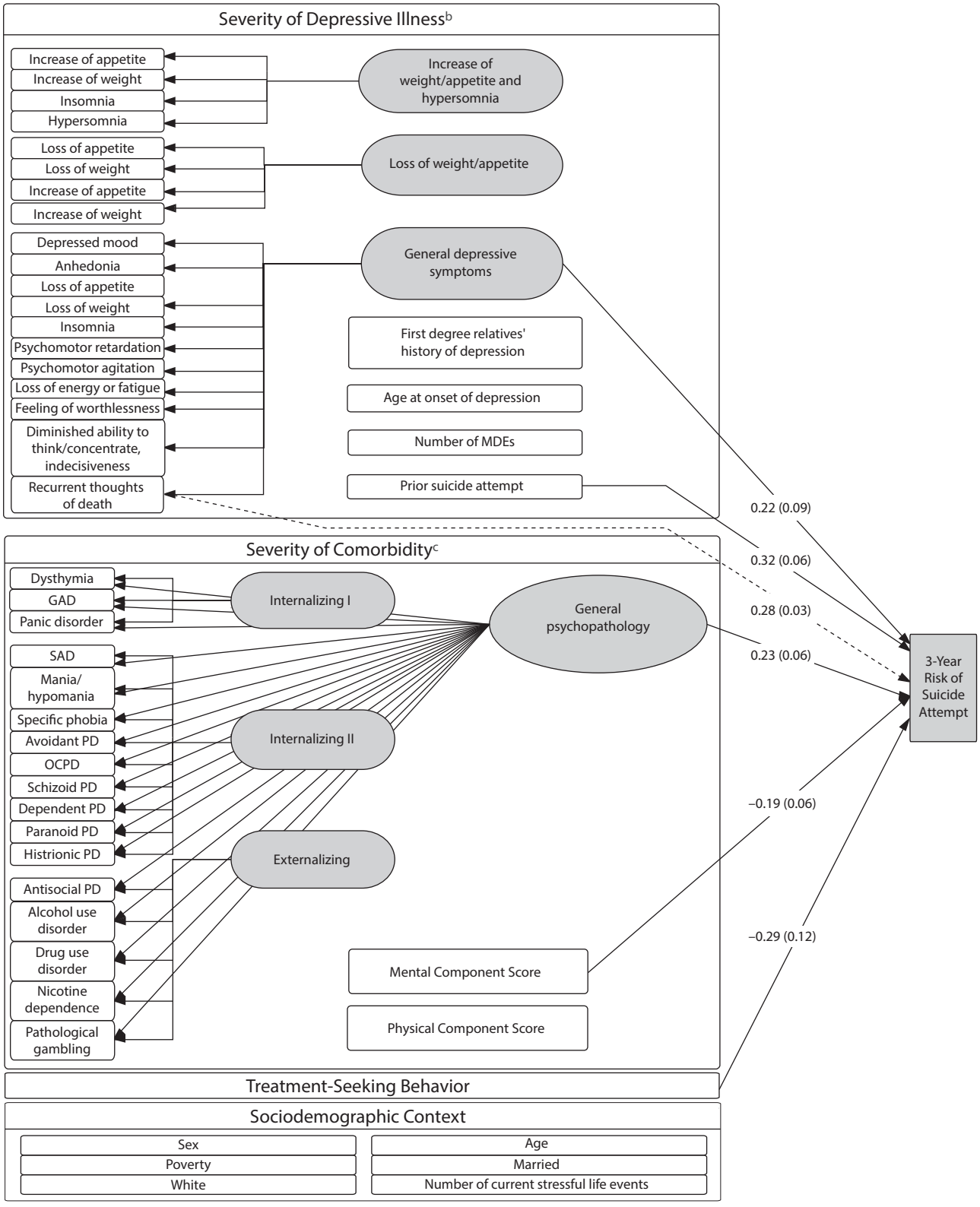
To start, this study is the first, to our knowledge, to show in a nationally representative sample that seeking treatment for MDE prospectively decreases the risk of suicide attempt among individuals with MDE. Treatment-seeking behavior, when examined independently, is consistently associated with increased risk of suicide attempt,[1,26] reflecting the strong association between clinical severity and treatment-seeking behavior.[43–45] Adjusting for these indicators of psychopathology revealed the strong impact of treatment-seeking behavior on suicide risk reduction. In our study, 29.3% of depressed individuals who attempted suicide did not seek help for depression. Improving access to psychiatric health care for individuals with MDE is likely to reduce their risk of attempting suicide.[46]

Second, the 2 strongest predictors of suicide attempts in our model were past history of suicide attempt and recurrent thoughts of death. Although the effect of recurrent thoughts of death did not reach statistical significance in the sensitivity analysis, possibly due to limited statistical power, the association between suicidal ideation and attempt is consistent with prior studies and might be stronger in the short term than in the long term.[2,11,47] As previously suggested,[48] passive suicidal thoughts might be an important clinical marker of suicidal risk at the same level as suicidal ideation. These results suggest that clinicians should actively elicit such information from patients or relatives to assess the best treatment course and to identify subgroups of individuals for future preventive interventions.

Third, although most comorbid psychiatric disorders are strongly associated with the risk of suicide attempt in individuals with MDE,[2,11–13,16–18] we found that their effects on this risk occurred exclusively through the general psychopathology factor accounting for the shared effects of all comorbid psychiatric disorders. These results extend previous findings that both internalizing (eg, major depressive disorder) and externalizing disorders (eg, substance use disorders) increase the risk of suicide attempt[11,23] by indicating that this risk is not uniquely due to any specific psychiatric disorder, but rather associated with mechanisms shared across all disorders[23] and predicted by the number and severity of disorders.[11,23,49,50] Our study calls attention to the importance of detecting and treating comorbid psychiatric disorders and the value of interventions that can simultaneously target multiple psychiatric disorders.[51]

Fourth, although many psychosocial and environmental factors, such as stressful life events, have been implicated as risk factors for suicide attempt,[2,13,19] none of the sociodemographic characteristics assessed in this study independently predicted the risk of suicide attempt in our model. Because the effects of psychiatric illness and psychosocial adversity are bidirectional,[1] separating their effects on the risk of suicide attempt can be difficult. However, our results suggest that after taking into account the severity of psychopathology, sociodemographic variables, which are often not modifiable (eg, age, race/ethnicity), may play a lesser role in the risk of suicide attempt than previously thought. For example, the increased risk of suicide attempt among women or individuals with lower socioeconomic status could be explained at least in part by their greater prevalence of MDE, but once individuals have MDE, sociodemographic characteristics may not add any more risk.

Figure 2. Structural Equation Model of the 3-Year Risk of Suicide Attempt in a General Population Sample of Adults With a Major Depressive Episode (n = 2,587)[a]



[a]Regression coefficients shown are standardized. Values in parentheses indicate their standard errors. Only significant effects (2-sided $P < .05$) are represented in the model. [b]Dotted line indicates direct effect above and beyond the association attributable to the latent variables. There is no other latent factor or disorder or symptom of MDE with modification index ≥ 10 to predict suicide attempt in addition. [c]Axis I disorders were past-year diagnoses, whereas Axis II disorders were assessed on a lifetime basis.

Abbreviations: GAD = generalized anxiety disorder, MDE = major depressive episode, OCPD = obsessive-compulsive personality disorder, PD = personality disorder, SAD = social anxiety disorder.

Our study has several limitations. First, although this study examined a wide range of psychiatric disorders, several disorders (eg, borderline personality disorder and psychotic disorders) known to be linked to suicide attempts[52–54] were not included in the Wave 1 of the NESARC. Second, the number of incident suicide attempt cases was relatively modest (n = 94). Uniform conventions for power analysis in structural equation modeling have not been adopted. However, there is consensus that a ratio of 5 cases for every estimated parameter should be maintained for adequate power (ie, 80%).[55] Because our study focused on the effects of 17 baseline factors on the 3-year risk of suicide attempt, 85 incident cases were required for adequate power, suggesting that our analysis was sufficiently powered. Third, we modeled bipolarity (ie, lifetime history of a manic or hypomanic episode) as a comorbidity of major depression in line with prior work.[56–61] However, predictors of suicide attempt might differ between bipolar and unipolar major depression. Lack of statistical power prevented us from applying our model in these subgroups separately (the number of incident cases of suicide attempt was 47 in both subpopulations). Future studies would benefit from reproducing our model while distinguishing bipolar and unipolar major depression. Finally, our model does not capture many social ecological dimensions of suicide risk reduction such as the protective role of increasing positive connectedness with family, peers, psychiatric health professionals, community organizations, and social institutions.[9,62]

In summary, we propose a comprehensive model of suicide attempt in adults with MDE using a large longitudinal national study. Several domains are implicated in the risk of suicide attempt among individuals with MDE. Clinicians assessing individuals with a MDE should query about prior suicide attempts, recurrent thoughts of death, quality of life, the severity of the general depressive symptom dimension, and the number and severity of Axis I and Axis II comorbid disorders to evaluate the risk for future suicide attempts. We also found that seeking treatment for depression had a strong protective effect against risk of suicide attempt. This model may inform future research on risk of suicide and help identify high-risk individuals for intervention trials among adults with MDE.

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Supplementary material: Available at PSYCHIATRIST.COM.

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Supplementary Material

Article Title: A Comprehensive Model of Predictors of Suicide Attempt in Depressed Individuals and Effect of Treatment-Seeking Behavior: Results From a National 3-Year Prospective Study

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List of Supplementary Material for the article

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SUPPLEMENTARY MATERIAL

Supplementary Table 1. Bifactor model of past-year Axis I disorders and lifetime Axis II disorders in individuals with a twelve-month DSM-IV diagnosis of Major Depressive Episode (N=2587) in Wave 1 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC).

CFI		**0.964**			
TLI		**0.952**			
RMSEA		**0.020**			
Disorder		**General Psychopathology factor**	**Internalizing I**	**Internalizing II**	**Externalizing**
Dysthymia		0.33	0.35		
GAD		0.41	0.87		
Panic disorder		0.43	0.23		
Social Anxiety Disorder		0.65		0.57	
Specific phobia		0.48		0.16	
Mania/Hypomania		0.47		-0.16	
Avoidant PD		0.73		0.30	
Dependent PD		0.86		0.05	
OCPD		0.58		-0.10	
Histrionic PD		0.67		-0.37	
Schizoid PD		0.64		0.08	
Paranoid PD		0.82		-0.08	
Alcohol use disorder		0.16			0.61
Drug use disorder		0.38			0.85
Nicotine dependence		0.31			0.50
Pathological gambling		0.26			0.19
Antisocial PD		0.42			0.47
Factor correlation					
General Psychopathology factor		1.00			
Internalizing I		0.00	1.00		
Internalizing II		0.00	0.00	1.00	
Externalizing		0.00	0.00	0.00	1.00

Abbreviations: CFI, Comparative Fit Index; TLI, Tucker-Lewis Index; RMSEA, Root Mean Square Error of Approximation; MDE, major depressive episode; GAD, generalized anxiety disorder; PD, personality disorder; OCPD, obsessive-compulsive personality disorder.

Supplementary Table 2. Confirmatory factor analysis model of the 14 disaggregated DSM-IV criteria for Major Depressive Episode in individuals with a twelve-month DSM-IV diagnosis of Major Depressive Episode (N=2587) in Wave 1 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC).

CFI		**0.941**		
TLI		**0.922**		
RMSEA		**0.044**		
Disorder		**General depressive symptoms**	**Loss of weight/appetite**	**Increase of weight/appetite and hypersomnia**
Depressed mood		0.31		
Anhedonia		0.20		
Loss of appetite		0.84	0.80	
Loss of weight		0.75	0.67	
Increase of appetite			-0.94	0.49
Increase of weight			-0.79	0.45
Insomnia		0.48		-0.46
Hypersomnia				0.65
Psychomotor retardation		0.34		
Psychomotor agitation		0.51		
Loss of energy or fatigue		0.13		
Feeling of worthlessness		0.20		
Diminished ability to think or concentrate, or indecisiveness		0.28		
Recurrent thoughts of death		0.18		
Factor correlation				
General depressive symptoms		1.00	-0.28	-0.26
Loss of weight/appetite		-0.28	1.00	0.12
Increase of weight/appetite and hypersomnia		-0.26	0.12	1.00

Abbreviations: CFI, Comparative Fit Index; TLI, Tucker-Lewis Index; RMSEA, Root Mean Square Error of Approximation.

Supplementary Table 3. Associations of the latent variables with observed predictors in the structural equation model of the 3-year risk of suicide attempt in a general population sample of adults with a major depressive episode (n=2,587).

Associations	Loss of weight/appetite	General depressive symptoms	Increase of weight/appetite and hypersomnia	General psychopathology factor
Loss of weight/appetite	1.00			
General depressive symptoms	-0.24*	1.00		
Increase of weight/appetite and hypersomnia	-0.67***	-0.01	1.00	
General psychopathology factor	0.06	0.35***	0.04	1.00
Family history of major depression	-0.24**	0.18*	0.19*	0.17*
Age of onset of major depression	0.23***	-0.23***	-0.15**	-0.26***
Number of MDEs	0.02	-0.03	-0.01	0.03
Prior suicide attempt	-0.28***	0.55***	0.04	0.33***
Mental Component Score	0.16**	-0.32***	-0.05	-0.39***
Physical Component Score	-0.03	0.01	-0.06	-0.03
Treatment-seeking behavior	-0.12	0.35***	0.17*	0.31***
Sex	-0.10	0.02	-0.30***	0.14*
Household income<$20000	0.06	-0.02	-0.06	0.11
Race/Ethnicity	-0.12	-0.05	0.04	0.09
Age	-0.11*	0.15**	0.04	0.03
Marital status	-0.12	-0.05	0.04	0.01

Number of current stressful life events	0.01	0.05	0.04	0.10***

Coefficients are probit regression coefficients.
*** two-sided p-value (p) <.001; ** p<.01; * p<.05.
Abbreviation: MDE=major depressive episode.

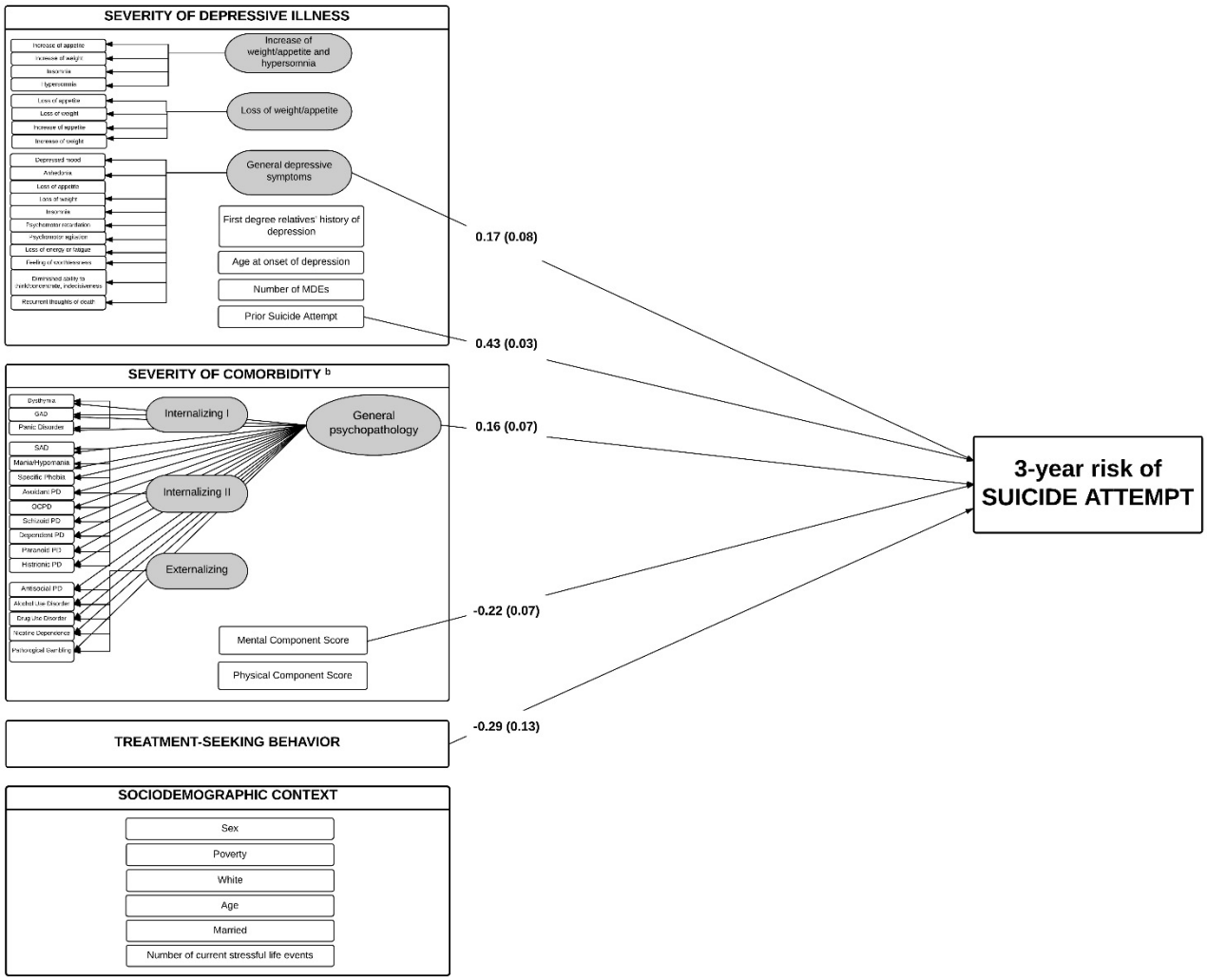
Supplementary Table 4. Associations across observed predictors in the structural equation model of the 3-year risk of suicide attempt in a general population sample of adults with a major depressive episode (n=2,587).

Associations	Family history of major depression	Age of onset of Depression	Number of MDEs	Prior suicide attempt	Mental Component Score	Physical Component Score	Treatment-seeking behavior	Sex	Household income <$20000	Race/ Ethnicity	Age	Marital status	Number of current stressful life events
Family history of major depression	1.00												
Age of onset of Depression	-0.12*	1.00											
Number of MDEs	0.13*	-0.19***	1.00										
Prior suicide attempt	0.11	-0.40**	0.18**	1.00									
Mental Component Score	-0.06	-0.05	-0.17**	-0.28***	1.00								
Physical Component Score	-0.01	-0.22***	-0.15**	-0.15**	0.52***	1.00							
Treatment-seeking behavior	0.05	-0.03	0.12*	0.31***	-0.22***	-0.14**	1.00						
Sex	-0.06	0.01	0.05	-0.01	0.11*	0.08	-0.16*	1.00					
Household income < $20000	0.04	0.05	0.05	0.16	-0.30***	-0.31***	0.02	-0.12*	1.00				

Race/Ethnicity	0.08	-0.06	0.07	-0.05	0.07	0.11*	0.10	0.01	-0.20*	1.00			
Age	0.01	0.70***	0.07*	-0.20**	-0.16**	-0.36**	0.02	-0.03	0.06	0.07	1.00		
Marital status	0.05	0.16**	0.01	-0.09	0.03	0.01	0.09	-0.12*	-0.39***	0.09	0.20**	1.00	
Number of current stressful life events	0.15**	-0.21***	0.015	0.13*	-0.14**	0.01	-0.01	0.01	0.14**	-0.08	-0.28***	-0.19**	1.00

Coefficients are probit regression coefficients.
*** two-sided p-vaslue (p) <.001; ** p<.01; * p<.05.
Abbreviation: MDE=major depressive episode.

Supplementary Figure 1. Structural equation model of the 3-year risk of suicide attempt in a general population sample of adults with a major depressive episode: sensitivity analysis excluding participants with at least one missing data (n = 2,332).[a]



[a] Regression coefficients shown are standardized. Values in brackets indicate their standard errors. Only significant effects (two-sided $p<.05$) are represented in the model. There is no other latent factor or disorder or symptom of MDE with modification index greater or equal to 10 to predict suicide attempt in addition.

[b] Axis I disorders were past year diagnoses while Axis II disorders were assessed on a lifetime basis.

Abbreviations: MDE, major depressive episode; GAD, generalized anxiety disorder; SAD, social anxiety disorder; OCPD, obsessive-compulsive personality disorder; PD, personality disorder.