

# A risk index for 12-month suicide attempts in the National Comorbidity Survey Replication (NCS-R)

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## ABSTRACT

**Background.** Clinical judgments about the likelihood of suicide attempt would be aided by an index of risk factors that could be quickly assessed in diverse settings. We sought to develop such a risk index for 12-month suicide attempts among suicide ideators.

**Method.** The National Comorbidity Survey Replication (NCS-R), a household survey of adults aged 18+, assessed the 12-month occurrence of suicide ideation, plans and attempts in a subsample of 5692 respondents. Retrospectively assessed correlates include history of prior suicidality, socio-demographics, parental psychopathology and 12-month DSM-IV disorders.

**Results.** Twelve-month prevalence estimates of suicide ideation, plans and attempts are 2.6, 0.7 and 0.4% respectively. Although ideators with a plan are more likely to make an attempt (31.9%) than those without a plan (9.6%), 43% of attempts were described as unplanned. History of prior attempts is the strongest correlate of 12-month attempts. Other significant correlates include shorter duration of ideation, presence of a suicide plan, and several sociodemographic and parental psychopathology variables. Twelve-month disorders are not powerful correlates. A four-category summary index of correlates is strongly related to attempts among ideators [area under the receiver operator characteristic curve (AUC)=0.88]. The distribution (conditional probability of attempt) of the risk index is: 19.0% very low (0.0%), 51.1% low (3.5%), 16.2% intermediate (21.3%), and 13.7% high (78.1%). Two-thirds (67.1%) of attempts were made by ideators in the high-risk category.

**Conclusions.** A short, preliminary risk index based on retrospectively reported responses to fully structured questions is strongly correlated with 12-month suicide attempts among ideators, with a high concentration of attempts among high-risk ideators.

## INTRODUCTION

Between 2% and 5% of people in the USA attempt suicide sometime in their lives (Moscicki, 1999). Although only a small minority result in death, each attempt carries a chance of death,

serious long-term physical injury, and psychological suffering. Moreover, history of prior attempts strongly predicts subsequent attempts and death (Fawcett *et al.* 1990; Schmidtke *et al.* 1996; Neeleman *et al.* 2004). Clinical judgments about likelihood of suicide attempts consequently have important clinical implications. Although considerable research has attempted to develop suicide prediction models to improve clinical judgments, results have been limited in four ways. Many (Dilsaver *et al.* 1994; Beautrais *et al.* 1996; Gould *et al.* 1996; Shaffer *et al.*

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1996; Strakowski *et al.* 1996; Keilp *et al.* 2001; Koivumaa-Honkanen *et al.* 2001; Johnson *et al.* 2002; Hawton *et al.* 2003; Meltzer *et al.* 2003; Bourgeois *et al.* 2004; Jollant *et al.* 2005; Palmer *et al.* 2005), although not all (Murphy *et al.* 1992; Kessler *et al.* 1999; Mann *et al.* 1999), such studies focused on a restricted set of predictors. Many used clinical rating scales that may be infeasible to administer in some clinical settings. Many used narrowly defined samples (e.g. restricted age range, patients with prior attempts). Most focused on long-term prediction (5–20 years) rather than short-term risk.

This report presents results of a preliminary retrospective attempt to explore the feasibility of developing a clinically useful risk index for 12-month suicide attempts among ideators based on analysis of a cross-sectional survey of the US household population. We focus on individuals reporting suicidal ideation, as it is after evidence of ideation that most suicide risk assessments begin. Previous research has shown that up to 20% of ideators in a given year make a suicide attempt during that year (Kuo *et al.* 2001; Kessler *et al.* 2005a), justifying this focus. We use an actuarial, data-driven approach similar to the approach used successfully to develop prediction models for violent behavior (Dawes *et al.* 1989; Mossman, 1994; Harris *et al.* 2003, 2004; Hilton *et al.* 2004), and less successfully to predict repetitive suicidal behavior (Buglass & Horton, 1974; Kreitman & Foster, 1991; Hawton & Fagg, 1995; Corcoran *et al.* 1997). We focus on potential risk factors that clinicians can assess quickly using fully structured assessments.

## METHOD

### Sample

Data come from the National Comorbidity Survey Replication (NCS-R). The sample of 9282 respondents aged 18 and older was based on a multi-stage clustered area probability sampling design representative of the US household population. Interviews were carried out between February 2001 and December 2003 (Kessler & Merikangas, 2004). The response rate was 70.9%. Sample households were mailed advance materials followed by an in-person interviewer visit to obtain informed

consent. Consent was verbal rather than written to parallel procedures in the baseline NCS (Kessler *et al.* 1994). Respondents were given a \$50 financial incentive. The Human Subjects Committees of both Harvard Medical School and the University of Michigan approved these recruitment and consent procedures.

The survey was administered in two parts. Part I included the core diagnostic assessment administered to all respondents. Part II, which assessed additional disorders and correlates, was administered to 5692 respondents, consisting of all who met lifetime criteria for a Part I disorder plus a probability subsample of others. The analyses reported here were carried out in the Part II sample, weighted to adjust for over-sampling Part I respondents with a mental disorder, differential probabilities of selection, systematic non-response, and residual socio-demographic and geographic differences between the sample and the 2000 Census. NCS-R sampling and weighting are discussed elsewhere (Kessler *et al.* 2004).

### Measures of suicidal behavior

Suicidal behavior was assessed using questions from the baseline NCS (Kessler *et al.* 1999) about lifetime occurrence, age of onset, and recency of suicide ideation ('Have you ever seriously thought about committing suicide?'), suicide plans ('Have you ever made a plan for committing suicide?'), and suicide attempts ('Have you ever attempted suicide?'). Based on evidence that reports of such embarrassing behaviors are higher in self-administered than interviewer-administered surveys (Turner *et al.* 1998), these questions were printed in a self-administered booklet and referred to by letter. Interviewers asked respondents to report whether the experiences ever happened to them and, if so, to report the age of onset and recency of the experiences. Respondents who reported that 'Experience C' (i.e. a suicide attempt) happened to them in the past 12 months were presented with three statements and asked to give the number of the statement that best described their experience. The three statements were: (1) 'I made a serious attempt to kill myself and it was only luck that I did not succeed'; (2) 'I tried to kill myself, but knew that the method was not fool-proof'; (3) 'My attempt was a cry for help. I did not intend to die'.

Questions were read to respondents who were unable to read.

Consistent with contemporary definitions distinguishing suicidal from self-injurious behavior (O'Carroll *et al.* 1996; APA, 2003), only respondents who endorsed statements 1 or 2 were considered suicide attempters. Respondents who endorsed statement 3 were considered to have made a suicide gesture. An earlier analysis of the baseline NCS (Nock & Kessler, 2006) showed that correlates of endorsing the first two statements were similar to previously documented predictors of completed suicide, while correlates of endorsing the third statement were quite different, justifying the present classification scheme. Three measures of prior suicidal behavior were retrospectively evaluated as possible risk factors for 12-month attempts: presence/absence of any previous attempt (ignoring self-reported intent to die), age of onset of suicidal ideation, and years since onset of ideation.

#### Other possible risk factors

We examined three other sets of possible risk factors: sociodemographics, parental psychopathology, and 12-month respondent DSM-IV mental disorders. The sociodemographics included age, sex, race-ethnicity, marital status, education, religious affiliation, and family income. The measures of parental psychopathology included parent attempted-completed suicide and five disorders—major depression, panic disorder, generalized anxiety disorder, substance dependence, and antisocial personality disorder—exhibited during the respondent's childhood. Parent disorders were assessed with the Family History Research Diagnostic Criteria (FH-RDC) Interview (Andreasen *et al.* 1977) and its expansion (Kendler *et al.* 1997), a method known to have good test-retest reliability but uncertain validity (Zimmerman *et al.* 1988). We recognize that this set of parental disorders is incomplete, but we focused on them because we expected them to be the most commonly occurring disorders associated with a wide range of respondent outcomes. Respondent disorders were assessed with Version 3.0 of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI; Kessler & Ustun, 2004). The assessment included DSM-IV anxiety, mood,

impulse-control, and substance use disorders. NCS-R clinical reappraisal interviews found CIDI diagnoses to have generally good concordance with blinded diagnoses based on the Structured Clinical Interview for DSM-IV (First *et al.* 2002) in a probability subsample of NCS-R respondents (Kessler *et al.* 2005b). Organic exclusion rules and diagnostic hierarchy rules were used in making all respondent diagnoses.

#### Statistical analyses

Cross-tabulations were used to estimate 12-month prevalence of ideation, plans and attempts. Multivariate logistic regression analysis (Hosmer & Lemeshow, 1989) was used to estimate associations of retrospectively assessed risk factors with attempts. Logistic regression coefficients and 95% confidence intervals (CIs) were converted to odd ratios (ORs) for ease of interpretation. We also estimated associations of the risk factors with 12-month suicide ideation and, among ideators, with suicide plans. Continuous variables were divided into categories to minimize effects of extreme values. Categories were collapsed to stabilize associations when ORs did not differ meaningfully.

Although the NCS-R is a large survey, the number of respondents with 12-month suicidal ideation is relatively small ( $n=236$ ) and 12-month attempters even smaller ( $n=37$ ). Statistical power is consequently inadequate to detect meaningful ORs of risk factors with low prevalence. For example, for risk factors with 0.05–0.10 prevalence, the minimum ORs detectable with 0.70 power using 0.05-level two-sided tests and correction for design effects are 3.3–4.4. We consequently focused on substantive rather than statistical significance in constructing the risk index, considering an OR of approximately 2.0 meaningful whether or not it was statistically significant. Standard errors and significance tests were estimated using the Taylor series method (Wolter, 1985) using SUDAAN software (Research Triangle Institute, 2002) to adjust for design effects. Multivariate significance was evaluated using Wald  $\chi^2$  tests based on design-corrected coefficient variance-covariance matrices. Statistical significance was evaluated using two-tailed 0.05-level tests.

Table 1. *Twelve-month prevalence of suicide ideation, plans, and attempts*

	Prevalence in the total sample						Prevalence among ideators <sup>a</sup>					
	Ideation		Plan		Attempt		Plan		Attempt with a plan		Attempt without a plan	
	%	(S.E.)	%	(S.E.)	%	(S.E.)	%	(S.E.)	%	(S.E.)	%	(S.E.)
Male	2.2	(0.2)	0.7	(0.2)	0.4	(0.1)	32.3	(6.2)	27.5	(9.5)	11.4	(5.1)
Female	3.0	(0.3)	0.8	(0.1)	0.5	(0.1)	25.8	(4.0)	35.4	(9.9)	8.5	(3.8)
Total	2.6	(0.2)	0.7	(0.1)	0.4	(0.1)	28.3	(3.4)	31.9	(7.4)	9.6	(3.4)
(n)	(5692)		(5692)		(5692)		(236)		(68)		(168)	

<sup>a</sup> The sample included 236 12-month ideators, 68 who reported a 12-month plan and 168 who reported not having a plan. A total of 37 ideators made a 12-month attempt (21 planned and 16 reported to be unplanned). These numbers are all considerably higher than their prevalence in the total sample might suggest because the Part II sample (to whom suicide questions were administered) over-sampled respondents with DSM-IV disorders from the larger Part I sample.

## RESULTS

### Prevalence

Twelve-month prevalence estimates of suicide ideation, plans and attempts are 2.6, 0.7 and 0.4% respectively (Table 1). These are slightly lower than estimates previously reported for respondents aged 18–54 in the NCS-R (Kessler *et al.* 2005a), presumably because adults older than 54 have lower prevalence of these outcomes than younger adults. More than one in four respondents with 12-month suicide ideation reported having a plan. Ideators with a plan were more likely to make an attempt (31.9%) than those who reported not having a plan (i.e. impulsive suicide attempt; 9.6%) ( $\chi^2_1=9.1$ ,  $p=0.004$ ). Despite the comparatively low conditional probability of making an attempt in the absence of reporting a plan, such cases constitute approximately 43% of all attempts.

### Correlates of 12-month suicide attempts among ideators

#### *Sociodemographics*

Significant sociodemographic correlates (ORs in parentheses) of 12-month suicide attempts among ideators include being non-Hispanic Black (5.0) and having low income (4.5) (Table 2). Three other sociodemographic variables also have elevated ORs (2.9–3.6), although they are not statistically significant: age less than 45, 12 or more years education, and previously married. The first of these three is also significantly related to suicide ideation and plans.

#### *History of suicidal behavior*

Controlling for sociodemographics, respondents with a history of prior attempts have an extremely high OR (95% CI in parentheses) of 12-month attempts: 58.0 (19.8–169.8). Two other aspects of prior suicidal behavior are also meaningfully related to 12-month attempts among ideators: 0–15 years (the lower one-third of the distribution) since first onset of ideation [3.3 (0.7–15.3)], and 12-month suicide plan [3.1 (0.9–10.3)], although neither is statistically significant. Age of onset of ideation, in comparison, is not a significant correlate of 12-month attempts.

#### *Parental psychopathology*

The data are too sparse to evaluate the separate associations of retrospectively reported maternal-only, paternal-only, and both-parent psychopathology with adequate statistical power. We consequently used summary measures of disorders in either/both parents as correlates of 12-month suicide attempts among ideators. Significant correlates (ORs in parentheses) include parental depression (15.7), generalized anxiety disorder (3.8), and panic disorder (6.0) (Table 3). Parental antisocial personality disorder also has a meaningfully elevated OR (1.9).

#### *Respondent 12-month DSM-IV disorders*

Respondent 12-month DSM-IV disorders are consistently significant correlates (ORs in the range 2.1–14.9) of 12-month ideation even after controlling for sociodemographics, prior suicidal behavior, and parental psychopathology

Table 2. Sociodemographic correlates of 12-month suicide ideation in the total sample, suicide plans among ideators, and suicide attempts among ideators<sup>a</sup>

	Among ideators					
	Ideation		Plan		Attempt	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Age (yr) <sup>b</sup>						
18–44	2.2	(1.5–3.0)	2.6	(1.1–6.3)	2.9	(0.6–14.2)
45+	1.0	—	1.0	—	1.0	—
$\chi^2_1$ (p value)	20.3	(<0.001)*	4.8	(0.029)*	1.8	(0.17)
Sex						
Female	1.3	(1.0–1.8)	0.7	(0.3–1.5)	1.2	(0.3–5.1)
Male	1.0	—	1.0	—	1.0	—
$\chi^2_1$ (p value)	3.2	(0.07)	0.9	(0.33)	0.0	(0.84)
Race-ethnicity						
Non-Hispanic White	1.0	—	1.0	—	1.0	—
Non-Hispanic Black	0.9	(0.5–1.4)	0.9	(0.4–2.2)	5.0	(1.4–17.8)
Hispanic	0.9	(0.5–1.6)	0.8	(0.2–3.0)	1.1	(0.2–6.1)
Other	0.9	(0.5–1.4)	2.9	(0.8–10.5)	1.0	(0.1–21.4)
$\chi^2_3$ (p value)	0.7	(0.88)	3.1	(0.38)	10.3	(0.016)*
Education						
Less than high school	1.0	—	1.0	—	1.0	—
High school graduate or more	0.8	(0.6–1.3)	0.8	(0.3–2.1)	2.9	(0.6–13.5)
$\chi^2_3$ (p value)	0.8	(0.37)	0.3	(0.59)	1.9	(0.16)
Family income <sup>c</sup>						
Poverty	1.8	(1.4–2.4)	1.0	(0.5–2.0)	4.5	(1.6–12.5)
All others	1.0	—	1.0	—	1.0	—
$\chi^2_1$ (p value)	19.0	(<0.001)*	0.0	(0.95)	8.7	(0.003)*
Marital status <sup>d</sup>						
Previously married	1.2	(0.8–1.8)	1.6	(0.7–3.5)	3.6	(0.8–16.4)
All others	1.0	—	1.0	—	1.0	—
$\chi^2_1$ (p value)	0.6	(0.43)	1.4	(0.24)	2.8	(0.09)
Religion						
Protestant	1.0	—	1.0	—	1.0	—
Catholic	0.6	(0.4–0.9)	1.1	(0.5–2.4)	1.1	(0.2–5.4)
All other religions	1.1	(0.6–1.8)	0.7	(0.3–1.6)	0.7	(0.1–6.3)
None	1.5	(1.0–2.5)	0.8	(0.3–2.2)	1.1	(0.2–6.1)
$\chi^2_3$ (p value)	17.8	(<0.001)*	0.9	(0.82)	0.3	(0.96)

OR, Odds ratio; CI confidence interval.

<sup>a</sup> Based on multivariate logistic regression equations.

<sup>b</sup> Age was originally classified into four categories (18–29, 30–44, 45–59, 60+) and collapsed into this dichotomy based on the ORs in the collapsed categories not differing significantly.

<sup>c</sup> Family income was originally classified into four categories based on the ratio of income to number of family members: less than or equal to the official Department of Labor federal poverty line (defined in the table as families living in poverty), 1–3, 3–6, and 6+ times the poverty line. The dichotomous classification used here is based on the ORs in the collapsed categories not differing significantly.

<sup>d</sup> Marital status was originally classified into separate categories of married, cohabiting, separated/divorced, widowed, and never married. The dichotomous classification used here is based on the ORs in the collapsed categories not differing significantly.

\* Significant at the 0.05 level, two-sided test.

(Table 4). A strong dose–response relationship exists between number of disorders and odds of ideation ( $\chi^2_2=269.1$ ,  $p<0.001$ ). The pattern is attenuated, however, in statistically predicting suicide plans among ideators, with only four of 19 disorders significant and the dose–response relationship with number of disorders considerably weaker ( $\chi^2_2=13.4$ ,  $p=0.001$ ). The pattern is even more attenuated in statistically predicting

suicide attempt among ideators after controlling for suicide plan, with only three disorders significant (4.5–7.4) and the dose–response relationship not significant ( $\chi^2_2=0.3$ ,  $p=0.960$ ).

#### A summary risk index for 12-month suicide attempt among ideators

A summary risk index was constructed by cross-classifying the dichotomy for history of prior

Table 3. Associations of parental psychopathology during respondent's childhood with 12-month suicide ideation in the total sample, suicide plans among ideators, and suicide attempts among ideators<sup>a</sup>

	Among ideators					
	Ideation		Plan		Attempt	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Suicide attempt	3.0*	(1.7–5.1)*	1.3	(0.4–4.1)	0.8	(0.3–2.2)
Major depression	2.4	(0.9–6.6)	0.5	(0.1–4.3)	15.7*	(2.9–83.7)*
Panic disorder	2.1*	(1.4–3.1)*	1.8	(0.7–4.5)	6.0*	(1.1–31.4)*
Generalized anxiety disorder	2.5*	(1.8–3.6)*	1.5	(0.6–3.8)	3.8*	(1.2–11.4)*
Substance dependence	2.1*	(1.3–3.4)*	1.0	(0.3–3.4)	0.2	(0.0–1.3)
Antisocial personality disorder	2.0*	(1.3–3.0)*	1.0	(0.3–3.0)	1.9	(0.5–7.5)
(n)	(5692)		(236)		(236)	

OR, Odds ratio; CI confidence interval.

<sup>a</sup> Based on separate multivariate logistic regression equations for each indicator of parental psychopathology, controlling for socio-demographics and the respondent's history of prior suicidal behavior.

\* Significant at the 0.05 level, two-sided test.

attempts with a 0–11 count of the other risk factors with substantively meaningful ORs. The latter include five sociodemographics (age 18–44, non-Hispanic Black, 12 or more years education, low income, previously married), shorter duration of ideation (0–15 years since onset of ideation), having a suicide plan in the prior 12 months, and four indicators of parental psychopathology (depression, generalized anxiety disorder, panic disorder, antisocial personality disorder). History of prior attempts was distinguished from other risk factors because of its high OR. A 0–11 count of the other risk factors was used despite the wide range of ORs (1.9–15.7) to avoid over-fitting the sparse data and to create a scoring rule that was simple and clinically feasible.

Inspection of the relationship between the 0–11 summary measure and 12-month attempts led us to collapse the summary measure into a trichotomy based on the number of risk factors present (0–2, 3–4, 5–11). A six-category risk index was created by cross-classifying this trichotomy with prior attempts. The area under the receiver operator characteristic curve (AUC) of this index is 0.89 in statistically predicting 12-month attempts among ideators. This means that a randomly selected ideator who attempted suicide in the 12 months before the interview could be distinguished after the fact with 89% accuracy from a randomly selected ideator who did not make a 12-month attempt based on their index scores. AUC increased only modestly (to 0.90) when we added information about

12-month DSM-IV disorders, leading us not to include respondent disorders in the final index.

Further evaluation showed that the six-category index could be collapsed to four categories without a meaningful loss of information (AUC=0.88) (Table 5). The first category (very low risk; 19% of all ideators) includes ideators with no history of prior attempts and a low number of other risk factors, none of whom made a 12-month attempt. The second category (low risk; 51% of all ideators) includes ideators with no history of prior attempts and a medium number of other risk factors, 3.5% of whom made a 12-month attempt. The third category (intermediate risk; 16.2% of all ideators) combines ideators who have a history of prior attempts and a low number of other risk factors with ideators who have no history of prior attempts and a high number of other risk factors. Approximately one-fifth of respondents in this category (21.3%) made a 12-month attempt. The fourth category (high risk; 13.7% of all ideators) combines ideators who have a history of prior attempts and either a medium or high number of other risk factors. Respondents in this category had a 78.1% probability of making a 12-month attempt, accounting for 67.1% of all such attempts. Sensitivity analysis found only a small reduction in prediction accuracy (AUC=0.84) when the sample of attempters was restricted to respondents who endorsed the most extreme of the three NCS-R intent statements (i.e. I made a

Table 4. Associations of 12-month DSM-IV disorders with 12-month suicide ideation in the total sample, suicide plans among ideators, and suicide attempts among ideators<sup>a</sup>

	Among ideators					
	Ideation		Plan		Attempt	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
<b>I. Anxiety disorders</b>						
Panic disorder	8.5*	(6.1–12.0)	2.0	(0.8–4.7)	1.0	(0.3–3.3)
Agoraphobia without panic	5.1*	(2.3–11.6)	3.3	(0.8–14.1)	1.5	(0.0–59.8)
Generalized anxiety disorder	4.9*	(2.9–8.1)	0.9	(0.4–1.8)	4.5*	(1.4–14.4)
Specific phobia	4.1*	(3.0–5.5)	1.6	(0.7–3.4)	1.1	(0.4–3.3)
Social phobia	6.6*	(4.8–9.2)	3.5*	(1.7–7.0)	1.7	(0.5–6.1)
Post-traumatic stress disorder	6.4*	(4.2–9.5)	2.2	(0.9–5.4)	1.0	(0.2–4.3)
Obsessive-compulsive disorder	6.9*	(2.1–22.4)	2.7	(0.3–26.5)	1.1	(0.1–8.9)
Adult separation anxiety disorder	5.5*	(2.3–13.1)	0.8	(0.1–4.3)	0.4	(0.0–5.9)
Any anxiety disorder	7.2*	(5.4–9.6)	3.2*	(1.4–7.2)	1.0	(0.2–4.6)
<b>II. Mood disorders</b>						
Major depressive disorder	8.7*	(6.6–11.4)	2.4*	(1.1–5.0)	0.8	(0.3–2.0)
Dysthymic disorder	6.2*	(3.5–11.2)	2.6*	(1.1–6.1)	1.1	(0.2–7.1)
Bipolar disorder	9.6*	(6.4–14.3)	1.7	(0.7–4.6)	1.7	(0.4–7.0)
Any mood disorders	14.8*	(10.5–20.9)	4.3*	(2.0–9.4)	1.2	(0.4–3.8)
<b>III. Impulse-control disorders</b>						
Intermittent explosive disorder	2.1*	(1.1–4.2)	0.7	(0.2–2.7)	0.3	(0.0–2.5)
Attention-deficit hyperactivity disorder	4.4*	(2.8–6.9)	2.0	(0.8–5.3)	0.5	(0.1–2.2)
Conduct disorder	2.8*	(1.1–7.2)	0.7	(0.1–7.6)	7.3*	(1.4–37.2)
Oppositional-defiant disorder	14.9*	(7.2–31.0)	1.7	(0.4–7.3)	1.5	(0.4–6.2)
Any impulse-control disorder	4.4*	(3.1–6.3)	1.4	(0.6–3.2)	0.6	(0.2–1.6)
<b>IV. Substance use disorders</b>						
Alcohol abuse or dependence	4.8*	(3.0–7.7)	0.9	(0.3–2.4)	0.9	(0.2–4.2)
Alcohol dependence	7.4*	(3.7–14.8)	3.2	(1.4–7.0)	0.6	(0.1–4.8)
Illicit drug abuse or dependence	4.1*	(2.1–8.0)	1.1	(0.3–3.9)	2.9	(0.7–11.6)
Illicit drug dependence	11.2*	(4.5–27.9)	1.6	(0.4–6.9)	7.4*	(2.0–27.5)
Any substance use disorder	5.1*	(3.2–8.2)	1.2	(0.5–2.8)	0.9	(0.3–3.3)
<b>V. Number of disorders</b>						
Any	12.6*	(8.5–18.7)	4.0*	(1.1–15.0)	1.1	(0.1–8.8)
Exactly one	5.8*	(3.6–9.3)	2.1	(0.5–8.8)	0.9	(0.1–7.1)
Exactly two	15.6*	(9.6–25.5)	2.5	(0.5–12.6)	0.9	(0.1–9.8)
Three or more	33.7*	(21.2–53.7)	6.8*	(1.7–27.1)	1.2	(0.1–11.4)
(n)	(5692)		(236)		(236)	

OR, Odds ratio; CI confidence interval.

<sup>a</sup> Based on separate multivariate logistic regression equations for each DSM-IV disorder and a single equation for number of disorders, controlling for a risk profile defined by the cross-classification of history of prior suicide attempts with a count of other predictors evidencing meaningful ORs in previous equations (sociodemographics, respondent's history of prior suicidal behavior, parental psychopathology).

\* Significant at the 0.05 level, two-sided test.

serious attempt to kill myself and it was only luck that I did not succeed').

## DISCUSSION

The results are limited in five important ways. First, our analysis was based on retrospective reports. Enthusiasm for the strength of the risk index should consequently be reserved until it is cross-validated prospectively. Risk factors that vary over time (e.g. marital status, income) are of special concern because they might have changed after attempts. Retrospective recall of

parental psychopathology also might have been influenced by attempts. Second, the single NCS-R question used to distinguish attempts from gestures may have yielded a less accurate classification of intent than one based on clinical assessment. Third, we considered only a restricted set of DSM-IV disorders and assessed neither their severity nor their chronicity, which might have downplayed the associations between disorders and attempts. Fourth, the low base rate of attempts led to low statistical power, which caused us to work with coarse predictor classifications and an unweighted

Table 5. *Distribution of the summary risk index and association with 12-month suicide attempts among ideators (n = 236)*

Risk category <sup>a</sup>	Prevalence among ideators		Probability of suicide attempt	
	%	(S.E.)	%	(S.E.)
Very low	19.0	(2.7)	0.000	—
Low	51.1	(3.3)	0.035	(0.017)
Intermediate	16.2	(1.7)	0.213	(0.073)
High	13.7	(2.6)	0.781	(0.077)

<sup>a</sup> Very low risk is defined as having no history of a prior suicide attempt and no more than two of the following 11 other risk factors: sociodemographics (age 18–44, non-Hispanic Black, 12 or more years education, low income, previously married), history of prior suicidal behavior (0–15 years since first onset of ideation, 12-month suicide plan), and parental psychopathology (depression, generalized anxiety disorder, panic disorder, antisocial personality disorder). Low risk is defined as having no history of a prior suicide attempt and 3–4 of the 11 other risk factors. Intermediate risk is defined either as having no history of a prior suicide attempt and 5–11 other risk factors or as having a history of one or more prior suicide attempts and 0–2 of the 11 other risk factors. High risk is defined as having a history of one or more prior suicide attempts and 3–11 other risk factors.

summary score to minimize risk of over-fitting the model, possibly resulting in underestimation of the strength of association between the risk index and attempts. Efforts to compensate for low power by including substantively meaningful variables in the risk index that were not statistically significant might have led to over-fitting. Fifth, the fact that the index was not cross-validated in a separate sample from the one in which it was developed means that we can expect shrinkage of prediction accuracy when the index is applied to new samples. This shrinkage might be substantial in light of the numerous steps taken in development, raising the possibility of over-fitting the data.

It is noteworthy, in light of these limitations, that most of the significant sociodemographic risk factors – young age, low socio-economic status, previous marriage – are consistent with prior findings (Petronis *et al.* 1990; Moscicki, 1997, 1999; Kessler *et al.* 1999), as is the finding that past attempts are powerfully related to future attempts (Goldstein *et al.* 1991; Moscicki, 1997, 1999; Brown *et al.* 2000; Hulten *et al.* 2001). The elevated risk of attempts among non-Hispanic Blacks, in comparison, is not consistent with previous findings, although no previous research has examined race-ethnicity as a correlate of attempts among ideators.

The finding that respondent mental disorders are not reliably associated with suicide attempt over and above reports of parental psychopathology is surprising, given previous evidence that respondent mental disorders mediate the relationship of parental psychopathology with offspring suicide attempts (Brent *et al.* 1996, 2002). A possible reason for this discrepancy is that the research that documented this mediation focused on adolescent respondents. A very different pattern was found in associations with ideation in the total sample and with plans among ideators, where ORs of parent disorders were much smaller than those of respondent disorders. This pattern is most plausibly interpreted to mean that the associations of respondent disorders with attempts are mediated by ideation and plans, while respondent perceptions of parent disorders might be markers either of latent causes (e.g. genetic influences) (Statham *et al.* 1998; Brent & Mann, 2005) or of features of respondent disorders that are not assessed in the CIDI (e.g. severity, chronicity). Adjudication among these competing possibilities in future research will require a more rigorous assessment of parent disorders and a more fine-grained dimensional assessment of respondent disorders.

The finding that information about diagnosis is not strongly related to attempts among ideators controlling for plans has practical importance because it is much easier to administer the simple NCS-R questions about suicide ideation and plans than to carry out diagnostic interviews. However, as previous research found disorder severity, which was not considered in our analysis, to be an important predictor of suicide attempts (Oquendo *et al.* 2004; Fergusson *et al.* 2005; Sokero *et al.* 2005), future work is needed to evaluate whether measures of disorder severity would improve the accuracy of the risk index.

The presence of a suicide plan, often considered the pre-eminent indicator of imminent risk, did not emerge as the strongest correlate of attempts. This does not mean that plans need not be assessed, as they are important both for clinical management (e.g. treatment contracting, removing the means for suicide) and for prediction of attempts. Yet 43% of attempters described their attempts as unplanned. This characterization has to be incorrect in a

rigorous sense, as all suicide attempts, including impulsive attempts, are 'planned' even if the 'plan' occurred only a few seconds before the attempt. However, attempters who report not having a plan presumably mean that they lacked a plan conceived prior to the situation in which the attempt occurred. Future research should investigate this issue by debriefing 'unplanned' attempters about the sequence of thoughts and decisions that led up to their attempts.

The finding that a simple retrospectively reported risk index is strongly related to 12-month suicide attempts among ideators would be of great clinical value if the index was corroborated prospectively, especially in light of concerns regarding the effectiveness of detecting and intervening with people at high risk of suicide attempts (Gaynes *et al.* 2004; Kessler *et al.* 2005a). These results are of particular clinical value given that the risk factors in the final index can be assessed with relative ease in clinical settings and that most of the factors (e.g. age, ethnicity, income, marital status, history of parental psychopathology) are unaffected by attempts to 'fake good'. The results reported here are sufficiently promising to warrant an attempt at large-scale prospective replication, for which a precedent exists (Pokorny, 1983).

To ensure sufficient statistical power, such an investigation should focus on people with suicidal ideation who are assessed with an expanded version of the current risk index and tracked to document subsequent attempts. To maximize generalizability, this research would ideally be conducted with a minimally selected sample, such as patients who screen positive for suicidal ideation in primary care settings, although it would also be useful to carry out such a study in a sample of out-patient mental health specialty patients who report suicidal ideation. Although a fairly large number of patients would have to be screened to find a large enough subsample with suicidal ideation for powerful analysis, the logistics of such an undertaking would not be daunting. Analyses should evaluate more refined coding of the current risk factors as well as risk factors not studied here (e.g. a broader set of disorders, measures of disorder severity or chronicity). It would also be useful to develop the model in one subsample and cross-validate it in another and to consider alternative methods of

data collection, such as computer-assisted self-assessment, to improve completeness and honesty of reports (Greist *et al.* 1973; Kobak *et al.* 1996; Turner *et al.* 1998).

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A complete list of NCS publications and the full text of all NCS-R instruments can be found online at [www.hcp.med.harvard.edu/ncs](http://www.hcp.med.harvard.edu/ncs). Send correspondence to [ncs@hcp.med.harvard.edu](mailto:ncs@hcp.med.harvard.edu). The NCS-R is carried out in conjunction with the World Health Organization World Mental Health (WMH) Survey Initiative. We thank the staff of the WMH Data Collection and Data Analysis Coordination Centers for assistance with instrumentation, fieldwork, and consultation on data analysis. These activities were supported by the NIMH (R01 MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (R13-MH066849, R01-MH069864, and R01 DA016558), the Fogarty International Center (FIRCA R01-TW006481),

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## DECLARATION OF INTEREST

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