



Research report

Psychiatric disorders, comorbidity, and suicidality in Mexico

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ABSTRACT

Background: Prior studies have reported that psychiatric disorders are among the strongest predictors of suicidal behavior (i.e., suicide ideation, plans, and attempts). However, surprisingly little is known about the independent associations between each disorder and each suicidal behavior due to a failure to account for comorbidity.

Methods: This study used data from a representative sample of 5782 respondents participating in the Mexican National Comorbidity Survey (2001–2002) to examine the unique associations between psychiatric disorders and suicidality.

Results: A prior psychiatric disorder was present in 48.8% of those with a suicide ideation and in 65.2% of those with an attempt. Discrete-time survival models adjusting for comorbidity revealed that conduct disorder and alcohol abuse/dependence were the strongest predictors of a subsequent suicide attempt. Most disorders predicted suicidal ideation but few predicted the transition from ideation to a suicide plan or attempt.

Limitations: M-NCS is a household survey that excluded homeless and institutionalized people, and the diagnostic instrument used did not include an assessment of all DSM-IV disorders which would increase the comorbidity discussed here.

Conclusions: These results reveal a complex pattern of associations in which diverse psychiatric disorders impact different parts of the pathway to suicide attempts. These findings will help inform clinical and public health efforts aimed at suicide prevention in Mexico and other developing countries.

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1. Introduction

Suicidal behaviors, including suicide ideation, plans, and attempts, are prevalent around the world, and psychiatric disorders are one of the strongest and most consistent risk factors across many different countries (Nock et al., 2008). The bulk of the evidence on this risk factor, though, is from studies conducted in developed Western countries. In such

countries, mood disorders and especially major depression have emerged as key predictors of suicidality (Kessler et al., 1999; Nock and Kazdin, 2002) and as a result have had preeminence in programs to detect and treat patients with suicidality (Mann et al., 2005; U.S. Public Health Service, 1999).

New results from both developed and developing countries suggest that these results may not generalize to all countries. According to Nock et al. (2008), although several consistent risk factors for suicidality emerged cross-nationally, an exception was that mood disorders were the strongest diagnostic predictors in developed countries while impulse-control disorders were the strongest predictors in developing countries. Moreover, there is evidence that although a risk index to detect

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12-month suicide attempts for developed and developing countries performs equally well in both group of nations, diverse 12-month DSM-IV mental disorders should be selected for developed and developing countries to tailor an appropriate index (Borges et al., in press). For example, results from a national survey of suicidality in Mexico (Borges et al., 2007) suggest that substance use and impulse-control disorders (i.e., not mood disorders) are actually the strongest predictors in this country. Reports from other developing countries such as South Africa, Nigeria, Ukraine, Israel and China (Bromet et al., 2007; Gureje et al., 2007; Joe et al., 2008; Lee et al., 2007; Levinson et al., 2007) also suggest that psychiatric disorders other than depression may be most useful in predicting suicidality.

A key limitation in most prior studies in this area is that they rely largely on tests of bivariate associations between individual disorders and suicidal behavior (Bostwick and Pankratz, 2000; Kessler et al., 1999; Nock et al., 2008; Phillips et al., 2004; Weissman et al., 1989). Because mental disorders are highly comorbid (Kessler et al., 2005), it is possible that many of the observed bivariate associations are due to the effects of only a small number of disorders. New research in the US using the data from the National Comorbidity Survey–Replication (NCS-R) (Nock et al., 2009a) goes beyond simple bivariate associations to present more elaborate multivariate models that account for psychiatric comorbidity and decompose, 1) which disorders are uniquely associated with suicide attempts and 2) whether different disorders may be related to different parts of the pathway to suicide. These authors found that in the US depression predicts suicide ideation; however, disorders characterized by severe anxiety/agitation (e.g., PTSD) and poor impulse-control (e.g., conduct disorder, substance disorders) predict which suicide ideators go on to make a suicide plan or attempt. Subsequent research has shown a similar pattern using data from 21 different countries around the world (Nock et al., 2009b). Given that most prior research on suicidal behaviors has been conducted in developed countries, the purpose of the current study was to examine these effects in greater detail within a developing country.

The data reported here are from the Mexican National Comorbidity Survey (M-NCS) (Medina-Mora et al., 2005), a nationally representative household survey of adults residing in urban areas in Mexico (roughly 75% of the national population). Following prior work in the NCS-R (Nock et al., 2009a) and cross-cultural analyses in the context of the World Mental Health Surveys (Nock et al., 2009b) the focus here is to examine the unique associations between psychiatric disorders and suicidal behavior in a developing country (i.e., Mexico), to test the effects of comorbidity on suicidal behavior, and to decompose the associations between psychiatric disorders and suicidal behavior by considering effects of psychiatric disorders on multiple forms of suicidal behavior (i.e., suicide ideation, suicide plans, and suicide attempts).

2. Materials and methods

2.1. Sample

The M-NCS is part of the World Health Organization's (WHO) World Mental Health (WMH) Survey Initiative

(Demyttenaere et al., 2004; Kessler and Ustun, 2004), a series of coordinated community epidemiological surveys of psychiatric disorders carried out in over two dozen countries throughout the world (www.hcp.med.harvard.edu/wmh). The survey was based on a stratified, multistage area probability sample of non-institutionalized persons aged 18 to 65 years living in urban areas (population 2500+) of Mexico. About 75% of the Mexican population is urban and meets the above definition. Data collection took place in two phases from September 2001 through May 2002. The response rate was 76.6%, for a total of 5826 interviews, well above the original targeted sample size of 5000 interviews. Forty four respondents without information on key survey identification variables were deleted, leaving a final sample of 5782 respondents.

All respondents were administered a Part I interview and a selected sub-sample of 2362 received a Part II interview which included questions on risk factors and supplemental psychiatric disorders. The sample receiving Part II consisted of all respondents who screened positive for any disorder on Part I plus a probability sub-sample of other Part I respondents. There was a random selection process embedded into a computer algorithm for the selection of those negative in the first phase of the survey. About one-third of those who scored negative in the Part I interview were randomly assigned to Part II interview. All interviews were conducted at the respondent's home after a careful description of the study goals was provided and informed consent was obtained. No financial incentives were given for respondents' participation. All recruitment and consent procedures were approved by the ethics committee of the National Institute of Psychiatry. Additional details of this study and sample have been published elsewhere (Medina-Mora et al., 2005).

2.2. Measures

Suicidal behaviors and potential risk factors were assessed using Version 3.0 of the WHO CIDI a fully structured lay-administered interview (Kessler and Ustun, 2004; Robins et al., 1988). This structured interview was administered face-to-face using a lap-top computer version that yielded DSM-IV diagnoses. The CIDI used in Mexico was based on the translation of the instrument into Spanish according to WHO recommendations, utilizing material currently in use in Spanish (ICD-10, DSM-IV) and previous translations of the Diagnostic Interview Schedule and earlier versions of the CIDI. These earlier instruments showed good performance in validity studies in Mexico (Caraveo et al., 1991, 1998) and in other Spanish-speaking countries (Wittchen, 1994). The fieldwork was conducted by Berumen and Associates, an established survey research firm in Mexico that employed a group of interviewers who had received training in the CIDI according to the WHO protocol stipulated for participating WMH countries.

2.2.1. Suicidal behavior

The WHO CIDI contains a module that assesses several different suicidal behaviors consistent with prior recommendations and definitions (O'Carroll et al., 1996), such as: 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

Table 1
Prevalence of lifetime DSM-IV disorders among suicidality in the Mexican National Comorbidity Survey (M-NCS).

	Among total sample												Among ideators																								
	Ideation			No ideation			Attempt			No attempt			Plan			No plan			Planned attempt			No planned attempt			Unplanned attempt			No unplanned attempt									
	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c	% ^b	SE	N ^c				
I. Anxiety disorders																																					
Panic disorder	1.6	0.6	10	0.7	0.1	39	2.2	1.0	6	0.9	0.1	53	1.9	1.0	4	2.4	0.9	10	2.6	1.2	5	7.7	3.1	5	1.1	1.1	1	2.6	1.0	9							
General anxiety disorder	1.2	0.5	8	1.0	0.2	58	2.4	1.2	5	1.0	0.2	64	2.2	1.2	4	1.6	0.6	8	2.5	1.6	3	1.6	1.6	1	2.1	1.5	2	1.2	0.6	5							
Specific phobia	18.9	1.9	86	5.8	0.5	316	25.9	4.4	45	6.4	0.5	364	22.8	3.8	43	17.0	2.6	46	26.8	5.5	33	19.1	6.9	14	23.7	6.3	12	15.8	2.9	34							
Social phobia	8.7	1.5	45	2.2	0.2	143	13.2	2.6	25	2.6	0.2	174	12.3	2.7	25	9.2	2.0	28	12.8	3.0	18	14.7	5.2	10	14.1	4.9	7	8.3	1.9	21							
PTSD	3.4	1.0	15	0.9	0.3	37	6.0	1.5	11	1.2	0.3	51	4.6	1.4	10	4.7	1.6	11	7.0	2.2	9	6.6	3.0	5	3.6	2.4	2	4.9	1.9	9							
Separation anxiety disorder	10.3	1.6	48	3.5	0.5	121	15.8	3.4	27	3.8	0.5	148	12.3	2.7	28	11.5	2.9	28	13.7	3.7	18	10.5	3.5	11	20.4	6.5	9	8.6	2.8	16							
Agoraphobia	2.8	0.8	18	0.8	0.1	52	4.7	1.6	10	0.9	0.1	61	3.7	1.4	8	2.5	0.8	11	3.5	1.7	5	4.0	2.6	3	7.6	3.7	5	1.5	0.6	6							
Any anxiety disorder	32.2	2.5	144	12.1	0.9	507	43.4	5.2	74	13.3	0.9	602	39.4	4.2	76	33.2	3.6	84	44.8	6.1	53	43.0	7.9	33	40.3	7.3	21	31.4	4.0	62							
II. Mood disorders																																					
Major depression	11.3	1.5	68	5.8	0.5	352	15.2	2.7	33	7.1	0.5	454	14.7	3.3	36	27.5	3.3	82	16.9	4.1	27	32.9	5.5	33	11.0	4.3	6	27.6	3.8	69							
Dysthymia	3.2	0.8	21	0.9	0.2	52	5.1	1.8	12	1.1	0.2	68	5.2	1.6	13	3.1	1.0	12	6.5	2.4	10	5.1	2.2	6	1.9	1.4	2	3.4	1.1	10							
Bipolar disorder	3.2	0.9	17	1.4	0.2	67	4.9	1.6	10	1.6	0.2	88	5.9	2.0	11	4.3	1.5	16	6.2	2.4	9	10.1	4.0	7	1.7	1.7	1	4.1	1.6	14							
Any mood disorder	13.4	1.7	79	6.9	0.5	405	18.6	3.0	40	8.2	0.5	517	20.1	3.4	46	28.7	3.1	88	21.7	4.3	34	38.4	5.9	37	11.0	4.3	6	29.1	3.6	75							
III. Impulse-control disorders																																					
ODD	9.8	2.4	27	2.0	0.3	45	15.4	4.3	17	2.3	0.3	55	20.2	5.0	20	4.2	1.8	9	20.6	5.7	15	18.3	8.9	4	4.7	3.5	2	3.7	1.9	6							
Conduct disorder	5.9	2.5	14	0.8	0.3	16	12.3	6.8	10	0.9	0.3	20	9.2	6.0	7	3.8	1.7	7	15.4	9.4	7	0.0	0.0	0	5.9	3.7	3	3.3	1.9	4							
ADHD	7.4	1.4	30	2.6	0.4	56	12.5	2.9	17	2.7	0.4	69	10.1	2.4	18	5.7	1.8	12	13.4	3.5	14	5.1	2.8	4	10.6	5.3	3	4.7	1.9	9							
Any impulse-control disorder	17.2	2.9	53	4.5	0.6	94	28.2	6.7	31	4.9	0.6	116	31.2	6.5	35	9.4	2.6	20	35.4	8.6	26	23.4	8.9	8	13.1	6.4	5	8.2	2.7	14							
IV. Substance use disorders																																					
Alcohol abuse or dep.	9.5	1.3	44	6.7	0.6	288	15.2	3.6	22	7.0	0.6	331	15.1	3.3	26	12.4	1.7	38	15.0	4.2	16	22.0	5.8	14	15.7	6.4	6	10.6	1.5	29							
Drug abuse or dep.	4.1	0.9	19	0.8	0.1	45	6.5	2.3	11	1.2	0.2	60	3.2	1.2	8	8.4	2.1	17	5.2	2.4	7	5.3	3.4	3	9.5	5.2	4	7.3	2.1	12							
Any substance use disorder	10.7	1.4	51	6.7	0.6	292	16.6	3.7	25	7.3	0.6	340	15.9	3.3	29	15.7	2.3	43	17.0	4.5	19	22.0	5.8	14	15.7	6.4	6	14.5	2.4	34							
V. Number of disorders																																					
Any disorder	48.8	3.3	216	22.9	1.4	859	65.2	4.9	106	24.7	1.4	1021	62.7	4.8	114	51.9	3.4	141	68.6	5.8	78	69.2	7.9	52	57.7	7.3	28	49.7	4.1	110							
Exactly 1 disorder	22.7	2.6	96	14.8	1.0	506	21.0	4.2	35	15.4	1.0	580	24.4	3.8	47	22.3	2.9	58	21.7	4.9	28	30.8	6.5	23	19.4	6.4	7	23.6	3.3	51							
Exactly 2 disorders	13.4	2.6	54	5.1	0.5	199	21.6	5.7	28	5.6	0.6	241	18.1	5.3	24	13.3	2.4	38	24.5	7.5	19	14.7	6.7	10	15.2	5.7	9	13.9	3.0	32							
Exactly 3 disorders	6.9	1.4	37	1.8	0.2	87	11.5	2.4	22	2.1	0.2	104	10.0	2.3	22	9.1	1.8	24	8.6	2.4	12	7.4	4.4	6	17.9	5.9	10	5.9	1.6	11							
4 or more disorders	5.8	1.3	29	1.2	0.2	67	11.1	2.6	21	1.7	0.2	96	10.3	2.6	21	7.3	1.7	21	13.8	3.6	19	16.4	4.9	13	5.3	3.4	2	6.4	1.6	16							
(N) ^a	(488)				(5294)				(166)				(5616)				(192)				(296)				(118)				(74)				(48)				(248)

Abbreviations: PTSD, post-traumatic stress disorder; ODD, oppositional-defiant disorder; ADHD, attention deficit/hyperactivity disorder.

^a Number of cases with the outcome variable.

^b % represents the percentage of people with the DSM-IV disorder among the cases with the outcome variable indicated in the column header. For example: the first cell is the % of those with Panic disorders among those with attempts.

^c Numerator N. Number of cases with the LT disorder among cases with the outcome variable. Columns with “Yes” in the headers represents cases with the dx among those with the outcome, and columns with “No” represents among those without the outcome. Part II disorders assessed in Part II sample, and impulse disorders restricted to age <= 44.

attempted suicide?”). Based on evidence that reports of such potentially 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. Interviews assessed the lifetime presence and age-of-onset of each outcome.

2.2.2. DSM-IV psychiatric disorders

Respondent disorders were assessed using the WHO CIDI (Robins et al., 1988). The diagnostic assessment included measurement of DSM-IV anxiety (panic disorder, generalized anxiety disorder, specific phobia, social phobia, post-traumatic stress disorder, childhood–adult separation anxiety disorder, agoraphobia without panic disorder), mood (major depressive disorder, dysthymia, bipolar disorder), impulse-control (oppositional-defiant disorder, conduct disorder, attention deficit/hyperactivity disorder), and substance use (alcohol abuse or dependence, drug abuse or dependence) disorders. Organic exclusion rules were used in making all respondent diagnoses. Prior studies using 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 sub-sample of respondents from the US survey (Kessler et al., 2005).

2.2.3. Statistical analysis

Cross-tabulations were used to estimate the prevalence of temporally prior psychiatric disorders among respondents with suicide ideation and attempts. Discrete-time survival analysis with time-varying covariates (Efron, 1988) was used to study retrospectively assessed diagnostic correlates of each suicidal behavior (Borges et al., 2000; Kessler et al., 1999). Survival coefficients were converted to odd-ratios (ORs) for ease of interpretation. The 95% confidence intervals (CIs) of the ORs are also reported and have been adjusted for design effects. Standard errors (SE) and significance tests were estimated using the Taylor series method (Wolter, 1985) with SUDAAN (2002) software to adjust for the weighting and clustering of the data. Multivariate significance was evaluated using Wald χ^2 tests based on design-corrected coefficient variance-covariance matrices. Statistical significance was evaluated using two-tailed 0.05-level tests.

Survival models examining the relations among psychiatric disorders, comorbidity, and suicidal behaviors proceeded incrementally, and the logic and methods used are defined in

Table 2

Comorbidities of lifetime suicide attempts with lifetime DSM-IV disorders in the Mexican National Comorbidity Survey (M-NCS).

	Response variable: lifetime attempt among Part II sample = 2362					
	Bivariate models with each disorder in separate model ^a		Multivariate models with all disorders in the same model ^a		Multivariate models with all disorders in the same model. Controlling for number of other disorders ^a	
	OR (95% CI)	χ^2	OR (95% CI)	χ^2	OR (95% CI)	χ^2
I. Anxiety disorders						
Panic disorder	4.2* (1.6–10.8)*	9.3 (0.002)*	0.9 (0.2–4.1)	0.0 (0.88)	1.1 (0.2–5.0)	0.0 (0.91)
General anxiety disorder	5.3* (1.8–15.5)*	9.7 (0.002)*	2.4 (0.8–7.3)	2.3 (0.13)	2.4 (0.7–8.4)	1.9 (0.16)
Specific phobia	5.0* (3.0–8.4)*	39.3 (<0.001)*	2.6* (1.5–4.7)*	12.0 (<0.001)*	2.5* (1.4–4.5)*	9.3 (0.002)*
Social phobia	6.6* (4.2–10.4)*	70.6 (<0.001)*	1.5 (0.9–2.7)	2.2 (0.14)	1.8* (1.1–3.1)*	4.9 (0.027)*
PTSD	11.2* (5.6–22.2)*	49.7 (<0.001)*	2.6* (1.1–6.3)*	4.5 (0.034)*	3.7* (1.5–9.2)*	8.2 (0.004)*
Separation anxiety disorder	5.9* (3.2–10.9)*	34.1 (<0.001)*	2.6* (1.3–5.4)*	7.0 (0.008)*	2.8* (1.3–6.2)*	6.7 (0.010)*
Agoraphobia	7.4* (3.3–16.3)*	25.0 (<0.001)*	2.4* (1.0–5.6)*	4.4 (0.035)*	2.5* (1.2–5.2)*	6.2 (0.013)*
Any anxiety disorder	5.9* (3.7–9.5)*	55.9 (<0.001)*				
II. Mood disorders						
Major depressive disorder	6.3* (4.1–9.7)*	72.9 (<0.001)*	1.8 (1.0–3.2)	3.8 (0.05)	1.9 (0.9–3.9)	3.4 (0.06)
Dysthymia	9.5* (4.8–18.9)*	42.8 (<0.001)*	1.4 (0.4–5.0)	0.3 (0.60)	2.0 (0.7–6.2)	1.6 (0.20)
Bipolar disorder	8.5* (4.2–17.3)*	37.0 (<0.001)*	1.6 (0.6–4.3)	0.9 (0.35)	2.3 (1.0–5.3)	3.7 (0.06)
Any mood disorder	6.8* (4.5–10.2)*	86.6 (<0.001)*				
III. Impulse-control disorders						
ODD	8.5* (4.6–15.8)*	47.9 (<0.001)*	2.7* (1.1–6.6)*	5.1 (0.024)*	3.0* (1.4–6.5)*	7.7 (0.006)*
Conduct disorder	20.8* (6.7–64.8)*	28.6 (<0.001)*	6.3* (1.0–40.9)*	3.9 (0.048)*	6.7* (1.4–32.8)*	5.8 (0.016)*
ADHD	6.0* (3.2–10.9)*	34.3 (<0.001)*	1.3 (0.4–4.0)	0.3 (0.62)	1.5 (0.6–4.2)	0.7 (0.40)
Any impulse-control disorder	8.6* (4.3–17.2)*	39.4 (<0.001)*				
IV. Substance use disorder						
Alcohol abuse or dep.	12.8* (7.5–21.7)*	92.7 (<0.001)*	6.1* (2.6–14.1)*	18.2 (<0.001)*	6.6* (2.8–15.3)*	19.8 (<0.001)*
Drug abuse or dep.	17.7* (7.9–39.3)*	51.7 (<0.001)*	2.0 (0.4–10.6)	0.6 (0.43)	2.6 (0.6–11.1)	1.8 (0.18)
Any substance use disorder	13.5* (7.9–23.2)*	93.9 (<0.001)*				
V. Any disorder	9.1* (5.8–14.5)*	91.6 (<0.001)*				
Overall group effect χ^2 ^b			(–)*	297.3 (<0.001)*	(–)*	38.2 (<0.001)*

Abbreviations: OR, odds-ratio; CI, confidence interval; PTSD, post-traumatic stress disorder; ODD, oppositional-defiant disorder; ADHD, attention deficit/hyperactivity disorder.

* $P < 0.05$, two-sided test.

^a Models are all in survival framework and all control for age, age-squared, sex, cohorts, and int categories. Int categories have cut-off points of 1–5, 6–10, 11–15, ..., 70–75 up to largest int available in dataset. Bivariate model assessed in Part I or II depending on the disorder. Multivariate models assessed in Part II sample; impulse disorders set to “No” in cases with age > 44.

^b Group effect chi-square is for the multi-df tests to assess any difference between all the disorders, while the individual chi-squares only test yes vs no for each disorder.

greater detail elsewhere (Nock et al., 2009a). First, we fitted bivariate models in which only one psychiatric disorder was considered at a time, as usual in the field. Next, we fitted multivariate models that included all psychiatric disorders simultaneously to predict each suicidal behavior. Finally, we also estimated a series of models that allowed for multiplicative interactions among comorbid disorders. The first one was a model that included summary dummy predictor variables for total number of comorbid disorders experienced by each respondent (e.g., separate dummy predictor variables to distinguish respondents with exactly two disorders, exactly three, ..., etc.). This model assumed that interactions were constant across types of disorder and were influenced only by number of disorders. Next we fitted more complex models that allowed for separate interactions between each type of disorder and number of comorbid disorders. The simple model that assumed constant interactions was a good approximation of the data, so we focused on that model in subsequent analyses. Assuming that the relationship between psychiatric disorders and suicidality was causal, we then estimated population attributable risk proportions (PARPs) due to each psychiatric disorder and to all disorders combined based on the results of that simple interaction model. PARPs represent the proportion of cases with a suicide attempt that would be prevented if specified predictor variables were eliminated, assuming causal relations between predictor variables and suicide attempts.

3. Results

3.1. Lifetime prevalence of psychiatric disorders among those with suicidal behavior

Approximately half of all people who have seriously considered killing themselves (48.8%) and two-thirds who make a suicide attempt (65.2%) reported having a prior psychiatric disorder (Table 1). Among respondents with suicide ideation, the prevalence of a psychiatric disorder is higher among those making a planned suicide attempt (68.6%) than

among those making an unplanned (i.e., impulsive) attempt (57.7%).

3.2. Associations between psychiatric disorders and subsequent suicide attempts

The results of the three models testing the associations between prior psychiatric disorders and suicide attempt in the M-NCS are presented in Table 2. Bivariate survival models show that each of the 15 lifetime DSM-IV/CIDI disorders examined is significantly associated with increased risk of the subsequent first onset of a suicide attempt, with ORs from a low of 4.2 (panic) to a high of 20.8 (conduct disorder) (Table 2, Column 1). Overall, anxiety disorders have the lowest ORs (5.9) while substance use disorders have the highest ORs (13.5). In multivariate models including all disorders, there is a large decrease in all ORs estimated (Table 2, Column 2). Although most ORs are still over the null (with the exception of panic), only seven remained statistically significant. The largest OR was again for conduct disorder (6.3). Next, simple interactive multivariate models were estimated that included one dummy variable for each of the 15 disorders plus additional dummy variables for each number of disorders (e.g., exactly one prior disorder, exactly two, etc.). The ORs for individual disorders in these models can be interpreted as the relative odds of a subsequent suicide attempt among respondents with a pure disorder (i.e., only this one disorder) vs those with no disorders. Consistent with the prior model, all pure disorders estimated in this interactive model have increased but lowered ORs when compared to the bivariate model, with eight of them statistically significant, ranging from 1.8 (social phobia) to 6.7 (conduct disorder) (Table 2, Column 3).

3.3. Associations between psychiatric comorbidity and subsequent suicide attempts

Next we evaluated a model in which the only substantive predictors were dummy variables for number of prior disorders (Table 3). A strong positive association was found

Table 3

Comorbidities of lifetime suicide attempts with number of lifetime DSM-IV disorders in the Mexican National Comorbidity Survey (M-NCS).

	Response variable: lifetime attempt among Part II sample = 2362			
	Bivariate model including main effects of number of disorders ^a		Multivariate model including both main effects of number of other disorders and main effects of individual disorders (main effects of individual dx not shown) ^a	
	OR (95% CI)	χ^2	OR (95% CI)	χ^2
Exactly 1 disorder	4.2* (2.4–7.5)*	25.9 (<0.001)*		
Exactly 2 disorders	16.2* (8.0–32.5)*	63.7 (<0.001)*	2.2 (0.8–6.2)	2.4 (0.12)
Exactly 3 disorders	22.5* (13.1–38.7)*	131.4 (<0.001)*	1.2 (0.3–4.4)	0.0 (0.83)
4 or more disorders	39.3* (21.0–73.6)*	137.3 (<0.001)*	0.4 (0.0–3.3)	0.8 (0.37)
Overall group effect χ^2 for number of disorders ^b	(–)*	187.9 (<0.001)*	(–)*	20.0 (<0.001)*

Abbreviations: OR, odds-ratio; CI, confidence interval.

* $P < 0.05$, two-sided test.

^a Models are all in survival framework and all control for age, age-squared, sex, cohorts, and int categories. Int categories have cut-off points of 1–5, 6–10, 11–15, ..., 70–75 up to largest int available in dataset. Multivariate models assessed in Part II sample; impulse disorders set to “No” in cases with age > 44.

^b Group effect chi-square is for the multi-df tests to assess any difference between all the # of disorder dummies, while the individual chi-squares only test yes vs no for each.

Table 4
Comorbidities of lifetime suicidality with lifetime DSM-IV mental disorders and number of disorders in the Mexican National Comorbidity Survey (M-NCS)^a.

	Among total sample				Among ideators					
	Ideation		Attempt		Plan among ideators		Planned attempt		Unplanned attempt	
	OR (95% CI)	χ^2	OR (95% CI)	χ^2	OR (95% CI)	χ^2	OR (95% CI)	χ^2	OR (95% CI)	χ^2
I. Anxiety disorders										
Panic disorder	1.6 (0.5–5.4)	0.7 (0.41)	1.1 (0.2–5.0)	0.0 (0.91)	1.4 (0.3–6.7)	0.2 (0.66)	1.4 (0.4–4.6)	0.3 (0.61)	0.2 (0.0–7.8)	0.7 (0.41)
General anxiety disorder	1.1 (0.4–2.6)	0.0 (0.86)	2.4 (0.7–8.4)	1.9 (0.16)	1.2 (0.3–5.7)	0.1 (0.81)	1.5 (0.5–4.6)	0.4 (0.52)	14.0* (1.0–199.0)*	4.0 (0.047)*
Specific phobia	2.2* (1.5–3.3)*	14.4 (<0.001)*	2.5* (1.4–4.5)*	9.3 (0.002)*	1.4 (0.8–2.4)	1.8 (0.18)	1.8 (0.8–4.0)	2.2 (0.14)	0.9 (0.3–2.8)	0.1 (0.80)
Social phobia	1.9* (1.2–3.2)*	6.8 (0.009)*	1.8* (1.1–3.1)*	4.9 (0.027)*	1.0 (0.5–1.8)	0.0 (0.91)	0.9 (0.4–2.4)	0.0 (0.85)	0.5 (0.1–2.2)	0.8 (0.38)
PTSD	3.4* (1.3–8.5)*	7.0 (0.008)*	3.7* (1.5–9.2)*	8.2 (0.004)*	1.5 (0.7–3.1)	1.1 (0.29)	1.8 (0.6–5.9)	1.1 (0.29)	0.7 (0.1–8.7)	0.1 (0.76)
Separation anxiety disorder	2.4* (1.5–3.9)*	12.4 (<0.001)*	2.8* (1.3–6.2)*	6.7 (0.010)*	1.2 (0.6–2.4)	0.2 (0.68)	1.5 (0.7–3.2)	1.1 (0.30)	2.7 (0.8–8.9)	2.6 (0.11)
Agoraphobia	1.9 (0.9–3.6)	3.4 (0.06)	2.5* (1.2–5.2)*	6.2 (0.013)*	0.9 (0.4–2.1)	0.1 (0.78)	0.9 (0.3–3.3)	0.0 (0.92)	5.0 (0.8–29.2)	3.3 (0.07)
II. Mood disorders										
Major depressive disorder	2.2* (1.4–3.6)*	12.0 (<0.001)*	1.9 (0.9–3.9)	3.4 (0.06)	0.8 (0.3–2.0)	0.2 (0.65)	1.2 (0.5–2.7)	0.1 (0.72)	0.4 (0.1–2.1)	1.2 (0.27)
Dysthymia	2.1 (0.9–5.1)	3.1 (0.08)	2.0 (0.7–6.2)	1.6 (0.20)	2.0 (0.7–6.1)	1.6 (0.21)	2.4 (0.7–8.2)	2.2 (0.14)	0.2 (0.0–6.5)	0.8 (0.37)
Bipolar disorder	3.3* (1.6–6.8)*	11.5 (<0.001)*	2.3 (1.0–5.3)	3.7 (0.06)	2.1 (0.8–5.4)	2.5 (0.11)	2.7 (0.9–7.9)	3.4 (0.07)	0.9 (0.2–3.6)	0.0 (0.82)
III. Impulse-control disorders										
ODD	2.8* (1.3–5.9)*	7.9 (0.005)*	3.0* (1.4–6.5)*	7.7 (0.006)*	3.5* (1.9–6.6)*	15.8 (<0.001)*	1.4 (0.5–4.5)	0.4 (0.52)	0.6 (0.1–4.3)	0.3 (0.61)
Conduct disorder	4.1* (1.1–14.7)*	4.8 (0.029)*	6.7* (1.4–32.8)*	5.8 (0.016)*	1.3 (0.3–5.4)	0.2 (0.69)	15.5* (5.7–41.9)*	30.3 (<0.001)*	0.2* (0.0–0.8)*	5.1 (0.023)*
ADHD	1.4 (0.7–2.7)	1.1 (0.29)	1.5 (0.6–4.2)	0.7 (0.40)	1.0 (0.5–2.2)	0.0 (0.93)	1.6 (0.7–3.9)	1.3 (0.26)	2.1 (0.5–9.7)	1.0 (0.32)
IV. Substance use disorders										
Alcohol abuse or dep.	2.9* (1.6–5.2)*	13.9 (<0.001)*	6.6* (2.8–15.3)*	19.8 (<0.001)*	4.6* (2.1–10.0)*	15.5 (<0.001)*	2.2 (0.8–6.0)	2.4 (0.12)	2.9 (0.8–10.8)	2.6 (0.11)
Drug abuse or dep.	4.8* (1.8–12.7)*	10.0 (0.002)*	2.6 (0.6–11.1)	1.8 (0.18)	0.3 (0.1–1.1)	3.4 (0.07)	1.2 (0.1–9.4)	0.0 (0.89)	0.7 (0.1–3.8)	0.1 (0.72)
V. Number of disorders										
Exactly 2 disorders	1.2 (0.6–2.3)	0.3 (0.58)	2.2 (0.8–6.2)	2.4 (0.12)	1.5 (0.7–3.3)	1.1 (0.29)	1.2 (0.4–3.6)	0.1 (0.73)	2.5 (0.4–16.9)	0.9 (0.35)
Exactly 3 disorders	0.8 (0.3–2.2)	0.2 (0.63)	1.2 (0.3–4.4)	0.0 (0.83)	1.2 (0.4–4.2)	0.1 (0.72)	0.5 (0.1–2.4)	0.7 (0.41)	9.7 (0.5–179.5)	2.4 (0.12)
4 or more disorders	0.2 (0.0–1.1)	3.6 (0.06)	0.4 (0.0–3.3)	0.8 (0.37)	1.1 (0.2–5.4)	0.0 (0.94)	0.4 (0.0–4.8)	0.5 (0.47)	9.5 (0.1–726.5)	1.1 (0.30)
Overall group effect χ^2 for disorders ^b	(–)*	51.8 (<0.001)*	(–)*	38.2 (<0.001)*	(–)*	58.3 (<0.001)*	(–)*	49.2 (<0.001)*	(–)*	30.7 (0.010)*
Overall group effect χ^2 for number of other disorders ^c	(–)*	9.1 (0.028)*	(–)*	20.0 (<0.001)*	(–)*	2.7 (0.44)	(–)*	3.4 (0.33)	(–)*	3.0 (0.39)
(N) ^d	(2362)		(2362)		(416)		(188)		(228)	

Abbreviations: OR, odds-ratio; CI, confidence interval; PTSD, post-traumatic stress disorder; ODD, oppositional-defiant disorder; ADHD, attention deficit/hyperactivity disorder.

* $p < 0.05$, two-sided test.

^a Each column represents a separate multivariate model in survival framework, with all rows as predictors controlling for age, age², sex, cohorts, and int categories. Outcome variable indicated in each column header.

Multivariate models assessed in Part II sample; impulse disorders set to “No” in cases with age > 44.

^b Group effect chi-square is for the multi-df tests to assess any difference between all the disorders, while the individual chi-squares only test yes vs no for each disorder.

^c Group effect chi-square is for the multi-df tests to assess any difference between all the # of disorder dummies, while the individual chi-squares only test yes vs no for each.

^d Denominator sample size of the models.

between these predictors and subsequent suicide attempt, with ORs ranging from a low of 4.2 for one disorder (compared to respondents with no disorders) up through 39.3 for four or more disorders. The ORs for high numbers of disorders in a model that also included predictors for the 15 types of disorders (i.e., as in Table 2) showed the existence of sub-additive effects of comorbidities involving large numbers of disorders. In other words, as the number of comorbid disorders goes up, the relative odds of a suicide attempt increase at a decreasing rate.

3.4. Unique associations among psychiatric disorders and each suicidal outcome

We next examined the unique associations between each disorder and each of the five suicidal behaviors measured (Table 4). Consistent associations are seen between each disorder and suicide ideation (all ORs are positive and 10 are statistically significant). Conditional associations with suicide plans among ideators are both less consistent and less powerful (10 of the 15 ORs positive, only 2 statistically significant). Conditional associations with attempts among planners tended to be more positive and with larger ORs than those among unplanned attempts, with conduct disorder showing the only statistically significant OR (OR = 15.5). Among unplanned attempts nine ORs were below the null and one of them was statistically significant (conduct disorder, OR = 0.2). Also, among unplanned attempts general anxiety disorder had a high and elevated OR (14.0).

3.5. Population attributable risk proportions

We calculated population attributable risk proportions (PARPs) to test population-level effects. The PARP estimates reveal that the predictive effects of psychiatric disorders on suicide attempts are largely due to effects on ideation rather than on the transitions from ideation to plans or attempts (Table 5). For all disorders combined, the PARPs suggest that almost three-fourths (73.2%) of all suicide attempts are associated with prior DSM-IV/CIDI disorders and that this strong aggregate association is due largely to the association between disorders and suicide ideation (76.4%), with much smaller PARPs of disorders predicting the onset of a suicide plan among ideators (0.7%), attempts among ideators with a plan (14.6%), and attempts among ideators without a plan (36.2%). Anxiety disorders play the largest role in accounting for the onset of ideation and attempts, followed closely by

mood disorders. Anxiety and substance use disorders play the largest roles in accounting for attempts among ideators without a plan.

4. Discussion

In this nationally representative urban sample of respondents from Mexico, we found that a psychiatric disorder was present in 48.8% of those with a suicide ideation and in 65.2% of those with an attempt. Although all disorders were associated with increased odds of a subsequent suicide attempt in bivariate models, more elaborate multivariate models that adjusted for comorbidity suggested that conduct disorder and alcohol abuse or dependence were the most important predictors in this sample, increasing the likelihood of an attempt by about six times. Other individual disorders, mainly anxiety disorders, followed in the list of predictors with increasing ORs of about 2–3 fold. In multivariate models, mood disorders produced increased but non-significant ORs for suicide attempt. Most associations of psychiatric disorders with suicidality were due to the prediction of suicidal ideation. Very few disorders accounted for the transition between ideation and a suicide plan (only oppositional-defiant disorder and alcohol abuse or dependence), or between ideation and planned attempt (only conduct disorder) and between ideation and unplanned attempt (conduct disorder reduced the risk and general anxiety disorder increased it). The inverse association between conduct disorder and unplanned attempts is surprising and we recommend caution in weighting this finding too heavily given that the seven other associations between conduct disorder and suicidal behaviors tested in this study were all positive and consistently among the strongest ORs observed in this study. Results suggested that interventions to reduce psychiatric disorders would have a high impact on suicide ideation (76% reduction) and attempts (73% reduction).

This study in a developing country confirms findings from psychological autopsy studies on the high prevalence of psychiatric disorders among those with a suicide attempt, suggesting that psychiatric disorders should be target for suicidal interventions even in countries where low socioeconomic status and unemployment have been pointed as key risk factors (Ortiz-Hernandez et al., 2007). The prevalence of psychiatric disorders among suicide attempters in Mexico is lower than the prevalence reported in the US (79.6%) (Nock et al., 2009a); however, this may be due to the overall higher prevalence of psychiatric disorders in the US compared to

Table 5

Population attributable risk proportions (PARPs) of DSM-IV disorders in the Mexican National Comorbidity Survey (M-NCS).

	Among total sample		Among ideators		
	Ideation	Attempt	Plan	Planned attempt	Unplanned attempt
Any mood disorder	0.389	0.318	−0.045	−0.031	−0.041
Any anxiety disorder	0.423	0.437	0.040	0.099	0.264
Any impulse disorder	0.193	0.180	0.017	0.033	−0.013
Any substance disorder	0.220	0.197	0.004	0.044	0.156
Any disorder	0.764	0.732	0.007	0.146	0.362
(N) ^a	(2362)	(2362)	(416)	(188)	(228)

^a Denominator sample size.

Mexico (Demeyttenaere et al., 2004; Nock et al., 2009a) and not to a low relative risk associated with psychiatric disorders in Mexico.

Our analyses replicate the findings from a prior study in the US (Nock et al., 2009a), showing that bivariate associations of psychiatric disorders with suicidality are limited because there are large effects of comorbidity on individual disorders. The current study extends earlier work by illuminating the larger role that conduct disorder and alcohol use disorder play in the onset of suicidal behavior among Mexicans. Other reports from individual developing countries participating in the WMH Surveys (Demeyttenaere et al., 2004) also have found larger than expected roles of impulse-control, substance use, and anxiety disorders in the onset of suicidal behavior in South Africa (Joe et al., 2008), Nigeria (Gureje et al., 2007), Ukraine (Bromet et al., 2007), and Israel (Levinson et al., 2007). In China, more consistent with reports from developed Western countries, mood and anxiety disorders have emerged as the strongest diagnostic predictors of suicidal behavior (Lee et al., 2007). On the other hand, in developed European countries participating in the WMH Surveys (Bernal et al., 2007) depression, dysthymia, GAD and PTSD were the disorders more related to suicide ideation and attempt. Whether this series of results will hold in these individual countries when more complex models are used is a matter for future work, but merged data from the WMH Surveys suggest that, as a group, in developing countries other disorders were stronger predictors of suicide attempts including: conduct disorder, oppositional-defiant disorder, intermittent-explosive disorder, drug and alcohol abuse, and PTSD (Nock et al., 2009b). The reasons for this difference in the risk of individual disorders in developed and developing countries are not known and represent an important direction for future suicide research.

The risk for suicide attempt was strongly related to the number of disorders, as previously reported (Beautrais et al., 1996; Kessler et al., 1999; Nock et al., 2008). As in the US sample (Nock et al., 2009a), the current analyses add to the literature in showing that despite this strong dose–response relation, sub-additive interactive effects were observed, suggesting that there is a decay in the predictive power of comorbidity as the number of comorbidities gets larger. Analysis of possible factors associated with these large levels of comorbidity, such as increasing levels of stress and large amounts of negative lifetime experiences that may lead to a high likelihood of suicidal behavior will be future topics of our inquiries. Whether the dose–response found for number of disorders and risk of suicidality could be applied to completed suicide is a matter of further discussion, beyond the scope of this report. Nevertheless, some caution for simple generalization of our findings is needed, since at least one recent report on psychiatric comorbidity and risk of completed suicide failed to find a similar dose–response as reported here (Walby et al., 2006).

While risk factor analyses pointed to substance use and impulse-control disorders as the main psychiatric disorders to consider in Mexico, PARP results shifted the focus to anxiety and mood disorders. This is consistent with the similar ORs observed among several disorders in this report (Table 4) and to the fact that anxiety disorders have, overall, much higher prevalence in Mexico than other psychiatric disorders (Medina-Mora et al., 2007, 2005). The complex

picture of diverse psychiatric disorders impacting on suicidality in Mexico, both on clinical and public health practice, needs to be carefully considered when implementing preventive strategies in the country. Although it is clear that suicide prevention efforts should include a focus on screening and treating psychiatric disorders in both developed and developing countries, simply translating experiences and manuals for public health control of suicidality from other, usually developed nations, does not seem appropriate in the light of these results.

The study findings must be evaluated in the context of several study limitations. First, the M-NCS is a household survey that excluded homeless and institutionalized people, both populations known to have high prevalence of suicidal behavior (Desai et al., 2003). Second, the diagnostic instrument used in the M-NCS did not include an assessment of all DSM-IV disorders, some of which have been linked to increased risk of suicidal behaviour and increase the comorbidity discussed here, such as schizophrenia and other non-affective psychoses (Harkavy-Friedman et al., 2004; Kessler et al., 1999). Third, validity and reliability data were not obtained on the measures of ideation, plans and attempts. Fourth, although we examined suicide ideation, plans, and attempts, we did not measure other important self-injurious behaviors such as suicide gestures (e.g., Nock and Kessler, 2006) and non-suicidal self-injury (e.g., Nock and Prinstein, 2005), and so the epidemiology of these outcomes awaits further study. Fifth, we did not examine the severity and/or recency of disorders in these models and whether these factors could help explain some (but not all) of the findings regarding the transitions from ideation to attempt. Finally, these analyses used data on retrospectively reported ages of onset that are subject to recall errors, which likely lead the results reported here to be conservative with regard to the magnitude of the problem of nonfatal suicide-related outcomes in Mexico.

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The authors state that the study sponsor(s) had no involvement in the design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

Conflict of interest

Dr. Kessler has been a consultant for GlaxoSmithKline Inc., Kaiser Permanente, Pfizer Inc., Sanofi-Aventis, Shire Pharmaceuticals, and Wyeth-Ayerst; has served on advisory boards for Eli Lilly & Company and Wyeth-Ayerst; and has had research support for his epidemiological studies from Bristol-Myers Squibb, Eli Lilly & Company, GlaxoSmithKline, Johnson & Johnson Pharmaceuticals, Ortho-McNeil Pharmaceuticals Inc., Pfizer Inc., and Sanofi-Aventis.

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