ORIGINAL ARTICLE

Prevalence, Severity, and Comorbidity of 12-Month *DSM-IV* Disorders in the National Comorbidity Survey Replication

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Background: Little is known about the general population prevalence or severity of *DSM-IV* mental disorders.

Objective: To estimate 12-month prevalence, severity, and comorbidity of *DSM-IV* anxiety, mood, impulse control, and substance disorders in the recently completed US National Comorbidity Survey Replication.

Design and Setting: Nationally representative face-to-face household survey conducted between February 2001 and April 2003 using a fully structured diagnostic interview, the World Health Organization World Mental Health Survey Initiative version of the Composite International Diagnostic Interview.

Participants: Nine thousand two hundred eighty-two English-speaking respondents 18 years and older.

Main Outcome Measures: Twelve-month *DSM-IV* disorders.

Results: Twelve-month prevalence estimates were anxiety, 18.1%; mood, 9.5%; impulse control, 8.9%; substance, 3.8%; and any disorder, 26.2%. Of 12-month cases, 22.3% were classified as serious; 37.3%, moderate; and 40.4%, mild. Fifty-five percent carried only a single diagnosis; 22%, 2 diagnoses; and 23%, 3 or more diagnoses. Latent class analysis detected 7 multivariate disorder classes, including 3 highly comorbid classes representing 7% of the population.

Conclusion: Although mental disorders are widespread, serious cases are concentrated among a relatively small proportion of cases with high comorbidity.

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COMMUNITY EPIDEMIOLOGICAL surveys estimate that as many as 30% of the adult population in the United States meet criteria for a 12-month *DSM* mental disorder.[1,2] Clinical reappraisal studies confirm these estimates.[3] Although fewer than half these people receive treatment,[4,5] unmet need for treatment may not be a major problem, because a high proportion of untreated cases might be mild or self-limiting. However, no definitive epidemiological data exist on this possibility, because severity has not been a focus of previous psychiatric epidemiological surveys. Although secondary analysis of surveys in the United States[6] and other countries[7,8] suggests that many 12-month cases are mild, this conclusion is based on crude post hoc severity indicators.

Recognizing the importance of obtaining more refined disorder severity data as well as updating available data on the epidemiological features of mental disorders in a number of other ways, the World Health Organization recently expanded its Composite International Diagnostic Interview (CIDI),[9] the interview used in almost all major psychiatric epidemiological surveys in the world over the past decade, to include detailed questions about

See also pages 590, 593, 603, and 629

severity.[10] This expanded CIDI was used in a coordinated series of epidemiological surveys carried out under World Health Organization auspices known as the World Mental Health (WMH) Survey Initiative.[8] The current report presents WMH-CIDI data on prevalence, comorbidity, and severity of 12-month *DSM-IV* disorders from the US National Comorbidity Survey Replication (NCS-R),[11,12] the WMH survey carried out in the United States.

METHODS

SAMPLE

As described in more detail elsewhere,[12,13] the NCS-R is a nationally representative household survey of English speakers 18 years and older in the coterminous United States. Respondents were confined to English speakers because 2 parallel surveys are currently under way in nationally representative samples of Hispanic (in Spanish or English, depending on the preference of the respondent) and Asian American individuals (in a number of Asian languages or English, again depending on the preference of the respondent). These surveys are using the same diagnostic instrument as the NCS-R and are covering the major groups of non-English speakers in the US population. The NCS-R respondents were selected from a multistage clustered area probability sample of households. Face-to-face interviews were carried out between February 2001 and April 2003 by professional interviewers from the Institute for Social Research at the University of Michigan, Ann Arbor. The response rate was 70.9%. The survey was administered in 2 parts. Part 1 included a core diagnostic assessment (n=9282). Part 2 included questions about risk factors, consequences, and other correlates along with assessments of additional disorders that were administered to all part 1 respondents who met lifetime criteria for any disorder plus a probability subsample of other respondents (n=5692). Interviewers explained the study and obtained verbal informed consent prior to beginning each interview. The NCS-R recruitment, consent, and field procedures were approved by the Human Subjects Committees of both Harvard Medical School (Boston, Mass) and the University of Michigan.

MEASURES

Diagnostic Assessment

DSM-IV diagnoses were based on the WMH-CIDI,[10] a fully structured lay interview that generates diagnoses according to *International Classification of Diseases, 10th Revision*[14] and *DSM-IV*[15] criteria. *DSM-IV* criteria are used herein. Twelve-month disorders considered herein include anxiety disorders (panic disorder, generalized anxiety disorder, agoraphobia without panic disorder, specific phobia, social phobia, posttraumatic stress disorder, obsessive-compulsive disorder, separation anxiety disorder), mood disorders (major depressive disorder, dysthymia, bipolar disorder I or II), impulse control disorders (oppositional defiant disorder, conduct disorder, attention-deficit/hyperactivity disorder, intermittent explosive disorder), and substance use disorders (alcohol and drug abuse and dependence). Minor corrections to diagnostic algorithms were made subsequent to previously reported aggregate analyses, leading to small differences in aggregate prevalence estimates.[8] The disorders assessed in part 2 include the 4 childhood disorders (separation anxiety disorder, oppositional defiant disorder, conduct disorder, and attention-deficit/hyperactivity disorder), posttraumatic stress disorder, obsessive-compulsive disorder, and the substance use disorders. Assessment of the childhood disorders in part 2 was limited to respondents in the age range 18 to 44 years based on concerns about recall bias among older respondents. Because all but 1 of the impulse control disorders were assessed only among respondents in the age range 18 to 44 years, overall prevalence of any impulse control disorder was limited to that age range, leading to a much higher prevalence estimate than in a previously reported aggregate analysis (where prevalence was reported for the total sample).[8] *DSM-IV* organic exclusion rules were used in making diagnoses. Diagnostic hierarchy rules were also used in making all diagnoses other than substance use disorders, where abuse was defined with or without dependence in recognition of abuse often being a stage in the progression to dependence. Hierarchy-free diagnoses were consistently used in analyses of comorbidity. As described elsewhere,[12] blind clinical reinterviews using the Structured Clinical Interview for *DSM-IV* (SCID)[16] with a probability subsample of NCS-R respondents found generally good concordance between WMH-CIDI diagnoses and SCID diagnoses.

Severity

Twelve-month cases were classified as serious if they had any of the following: a 12-month suicide attempt with serious lethality intent; work disability or substantial limitation due to a mental or substance disorder; positive screen results for nonaffective psychosis; bipolar I or II disorder; substance dependence with serious role impairment (as defined by disorder-specific impairment questions); an impulse control disorder with repeated serious violence; or any disorder that resulted in 30 or more days out of role in the year. Cases not defined as serious were defined as moderate if they had any of the following: suicide gesture, plan, or ideation; substance dependence without serious role impairment; at least moderate work limitation due to a mental or substance disorder; or any disorder with at least moderate role impairment in 2 or more domains of the Sheehan Disability Scale.[17] (The Sheehan Disability Scale assessed disability in work role performance, household maintenance, social life, and intimate relationships on 0-10 visual analog scales with verbal descriptors and associated scale scores of none, 0; mild, 1-3; moderate, 4-6; severe, 7-9; and very severe, 10.) All other cases were classified as mild. This classification scheme is somewhat more refined than the one used in comparative analyses of all WMH surveys[8] owing to the NCS-R having more detailed information than the other WMH surveys. To assess the meaning of the severity ratings, we compared number of days in the past 12 months respondents were totally unable to carry out their normal daily activities because of mental or substance problems. The mean of this variable was significantly higher ($F_{2,5689}=17.7$; $P<.001$) among respondents classified as serious (88.3) than those classified as moderate (4.7) or mild (1.9).

Sociodemographic Correlates

Sociodemographic correlates include cohort (defined by age at interview in categories 18-29 years, 30-44 years, 45-59 years, and ≥60 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), completed years of education (0-11 years, 12 years, 13-15 years, and ≥16 years), marital status (married or cohabitating, previously married, and never married), family income, and urbanicity. Family income was defined in relation to the federal poverty line.[18] Low income was less than or equal to 1.5 times the poverty line, low average was more than 1.5 to 3 times the poverty line, high average was more than 3 to 6 times the poverty line, and high was greater than 6 times the poverty line. Urbanicity was coded according to 2000 census definitions[19] and distinguished large (at least 2 million residents) vs smaller metropolitan statistical areas by central cities, suburbs, adjacent areas (areas outside the suburban belt but within 50 miles of the central business district of a central city), and rural areas (more than 50 miles from the central business district of a central city).

ANALYSIS METHODS

Weights were used to adjust for differences in within-household probability of selection, nonresponse, and differ-

ences between the sample and the 2000 census on sociodemographic variables. As described in more detail elsewhere,[13] sociodemographic matching was based on the full 2000 census (which includes non-English speakers and nonhousehold residents, who were excluded from the NCS-R sample) because it was impractical to refine the 2000 census data to have the same restrictions as the NCS-R while still using tract-level census geocode data to adjust for geographic variation in nonresponse. This failure to make exclusions from the census data comparable with those in the NCS-R introduced a small bias into the last part of the weight adjustment.

Prevalence and severity were estimated by calculating means for dichotomous variables. Standard errors were obtained using the Taylor series linearization method[20] implemented in the SUDAAN software system to adjust for the effects of weighting and clustering on the precision of estimates.[21] Comorbidity was studied initially by calculating tetrachoric correlations of disorders among part 2 respondents aged 18 to 44 years. The restriction to part 2 was because some disorders were only assessed in part 2, and the restriction to ages 18 to 44 years was because childhood disorders were assessed only in that age range. Exploratory factor analysis, implemented in SAS version 8.2,[22] was used to reduce the dimensionality of the correlation matrix.

The additivity of associations among the 19 WMH-CIDI disorders was investigated by using log-linear analysis to evaluate the fit of a saturated 2-way marginal model to the 2^{19} logically possible multivariate profiles of disorders.[23] As described later, this analysis documented significant higher-order interactions among the disorders. Based on this result, latent class analysis (LCA),[24,25] a data reduction method that allows for nonadditive associations among comorbid conditions, was used to study multivariate comorbidity among the NCS-R disorders. Latent class analysis postulates a discrete latent variable defining class membership that explains covariance among observed disorders. When this model holds, the observed cell probabilities in the cross-classification among disorders will equal the product of the within-class marginal disorder probabilities multiplied by the class prevalence and summed across classes. This model contains 1 parameter for the probability of each disorder in each of k classes of the latent variable in addition to k parameters for class prevalence. The latent class model was fit for values of k between 1 and 8 using the iterative-fitting NAG FORTRAN library routine E04UCF[26] and the method of maximum likelihood.[27] The comparative fit of LCA models with successively higher values of k was assessed by evaluating the Bayes Information Criterion.[28]

Sociodemographic correlates were examined by transforming the 7 predicted probabilities of class membership from the LCA solution into logits, the natural logarithm of the odds $p_{ic}/(1-p_{ic})$, where p_{ic} is the probability that respondent i is in class c, that were then used as dependent variables in linear regression equations for effects of sociodemographic variables on the odds of class membership. The Taylor series linearization method was used to estimate standard errors. Regression coefficients were exponentiated and interpreted as odds ratios with design-based 95% confidence intervals. Multivariate significance was evaluated with Wald χ^2 tests using Taylor series design-based coefficient variance–covariance matrices. Statistical significance was evaluated using 2-sided, design-based $P<.05$-level tests.

RESULTS

PREVALENCE AND SEVERITY

The more prevalent 12-month disorders (**Table 1**) were specific phobia (8.7%), social phobia (6.8%), and major depressive disorder (6.7%). Anxiety disorders were the most prevalent class (18.1%), followed by mood disorders (9.5%), impulse control disorders (8.9%), and substance disorders (3.8%). Twelve-month prevalence of any disorder was 26.2%, with more than half of cases (14.4% of the total sample) meeting criteria for only 1 disorder and smaller proportions, for 2 (5.8%) or more (6.0%) disorders.

Among respondents with a disorder, 22.3% were classified as serious, 37.3% as moderate, and 40.4% as mild. Severity was strongly related to comorbidity; 9.6% of respondents with 1 diagnosis, 25.5% with 2 diagnoses, and 49.9% with 3 or more diagnoses were classified as serious. The distribution of severity was quite different from the distribution of prevalence across classes of disorder; mood disorders had the highest percentage of serious classifications (45.0%) and anxiety disorders, the lowest (22.8%). The anxiety disorder with the highest percentage of serious classifications was obsessive-compulsive disorder (50.6%), while bipolar disorder had the highest percentage of serious classifications (82.9%) among mood disorders; oppositional defiant disorder, the highest (49.6%) among impulse control disorders; and drug dependence, the highest (56.5%) among substance disorders.

BIVARIATE COMORBIDITY

Tetrachoric correlations between hierarchy-free 12-month disorders (**Table 2**) were almost all positive (98%) and statistically significant (72%). Of only 4 negative correlations, all involved either obsessive-compulsive disorder or separation anxiety disorder, both of which are very uncommon. The 12 highest correlations, each exceeding 0.60, represented well-known syndromes: bipolar disorder (major depressive episode with mania/hypomania), double depression (major depressive episode with dysthymia), anxious depression (major depressive episode with generalized anxiety disorder), comorbid mania/hypomania and attention-deficit/hyperactivity disorder, panic disorder with agoraphobia, comorbid social phobia with agoraphobia, and comorbid substance disorders (both alcohol abuse and dependence with drug abuse and dependence).

Exploratory factor analysis of the correlation matrix was carried out after excluding the disorders associated with negative correlations (obsessive-compulsive disorder and separation anxiety disorder). Two factors had eigenvalues greater than 1 (7.3 and 2.3), while the eigenvalue of the third factor (0.8) was substantially smaller. Both rigid and oblique rotations of the 2-factor solution yielded similar patterns, with high factor loadings on the first factor (Table 2) for internalizing disorders (anxiety disorders, major depressive episode) and on the second factor for externalizing disorders (conduct disorder, substance disorders). Five disorders had factor loadings of 0.30 or higher on both factors (dysthymia, mania/hypomania, oppositional defiant disorder, attention-deficit/hyperactivity disorder, and intermittent explosive disorder), although all 5 had higher loadings on the internalizing than externalizing factor.

Table 1. Twelve-Month Prevalence and Severity of *DSM-IV* and WMH-CIDI Disorders in 9282 Respondents

	Total	Severity		
		Serious	Moderate	Mild
Anxiety disorders				
Panic disorder	2.7 (0.2)	44.8 (3.2)	29.5 (2.7)	25.7 (2.5)
Agoraphobia without panic	0.8 (0.1)	40.6 (7.2)	30.7 (6.4)	28.7 (8.4)
Specific phobia	8.7 (0.4)	21.9 (2.0)	30.0 (2.0)	48.1 (2.1)
Social phobia	6.8 (0.3)	29.9 (2.0)	38.8 (2.5)	31.3 (2.4)
Generalized anxiety disorder	3.1 (0.2)	32.3 (2.9)	44.6 (4.0)	23.1 (2.9)
Posttraumatic stress disorder†	3.5 (0.3)	36.6 (3.5)	33.1 (2.2)	30.2 (3.4)
Obsessive-compulsive disorder‡	1.0 (0.3)	50.6 (12.4)	34.8 (14.1)	14.6 (5.7)
Separation anxiety disorder§	0.9 (0.2)	43.3 (9.2)	24.8 (7.5)	31.9 (12.2)
Any anxiety disorder‖	18.1 (0.7)	22.8 (1.5)	33.7 (1.4)	43.5 (2.1)
Mood disorders				
Major depressive disorder	6.7 (0.3)	30.4 (1.7)	50.1 (2.1)	19.5 (2.1)
Dysthymia	1.5 (0.1)	49.7 (3.9)	32.1 (4.0)	18.2 (3.4)
Bipolar I and II disorders	2.6 (0.2)	82.9 (3.2)	17.1 (3.2)	0 (0)
Any mood disorder	9.5 (0.4)	45.0 (1.9)	40.0 (1.7)	15.0 (1.6)
Impulse control disorders				
Oppositional defiant disorder§	1.0 (0.2)	49.6 (8.0)	40.3 (8.7)	10.1 (4.8)
Conduct disorder§	1.0 (0.2)	40.5 (11.1)	31.6 (7.5)	28.0 (9.1)
Attention-deficit/hyperactivity disorder§	4.1 (0.3)	41.3 (4.3)	35.2 (3.5)	23.5 (4.5)
Intermittent explosive disorder	2.6 (0.2)	23.8 (3.3)	74.4 (3.5)	1.7 (0.9)
Any impulse control disorder§¶	8.9 (0.5)	32.9 (2.9)	52.4 (3.0)	14.7 (2.3)
Substance disorders				
Alcohol abuse†	3.1 (0.3)	28.9 (2.6)	39.7 (3.7)	31.5 (3.3)
Alcohol dependence†	1.3 (0.2)	34.3 (4.5)	65.7 (4.5)	0 (0)
Drug abuse†	1.4 (0.1)	36.6 (5.0)	30.4 (5.8)	33.0 (6.8)
Drug dependence†	0.4 (0.1)	56.5 (8.2)	43.5 (8.2)	0 (0)
Any substance disorder†	3.8 (0.3)	29.6 (2.8)	37.1 (3.5)	33.4 (3.2)
Any disorder				
Any‖	26.2 (0.8)	22.3 (1.3)	37.3 (1.3)	40.4 (1.6)
1 disorder‖	14.4 (0.6)	9.6 (1.3)	31.2 (1.9)	59.2 (2.3)
2 disorders‖	5.8 (0.3)	25.5 (2.1)	46.4 (2.6)	28.2 (2.0)
≥3 disorders‖	6.0 (0.3)	49.9 (2.3)	43.1 (2.1)	7.0 (1.3)

Abbreviation: WMH-CIDI, World Health Organization World Mental Health Survey Initiative version of the Composite International Diagnostic Interview.

*Values are expressed as percentage (standard error). Percentages in the 3 severity columns are repeated as proportions of all cases and sum to 100% across each row.

†Assessed in the part 2 sample (n = 5692).

‡Assessed in a random one third of the part 2 sample (n = 1808).

§Assessed in the part 2 sample among respondents in the age range 18 to 44 years (n = 3199).

‖Estimated in the part 2 sample. No adjustment is made for the fact that 1 or more disorders in the category were not assessed for all part 2 respondents.

¶The estimated prevalence of any impulse control disorder is larger than the sum of the individual disorders because the prevalence of intermittent explosive disorder, the only impulse control disorder that was assessed in the total sample, is reported herein for the total sample rather than for the subsample of respondents among whom the other impulse control disorders were assessed (part 2 respondents in the age range 18-44 years). The estimated prevalence of any impulse control disorder, in comparison, is estimated in the latter subsample. Intermittent explosive disorder had a considerably higher estimated prevalence in this subsample than in the total sample.

MULTIVARIATE COMORBIDITY

Of the 524 288 (2^{19}) logically possible multivariate disorder profiles among the 19 NCS-R disorders, 433 were observed. Nearly 80% involved highly comorbid cases (3 or more disorders) (**Table 3**), accounting for 27% of all respondents with a disorder and 55.9% of all instances of these disorders. Importantly, the distribution of comorbidity was significantly different (χ^2_3=110.2; $P<.001$) from the distribution we would expect to find if the multivariate structure among the disorders was due entirely to the 2-way associations that are the focus of factor analysis. This finding led us to reject the use of confirmatory factor analysis to carry out more in-depth exploration of comorbid profiles. Instead, LCA was used to study nonadditive comorbid profiles. Alcohol abuse and dependence were collapsed into a single category for purposes of this analysis because their separation violates the LCA assumption of conditional independence within classes. The same was done for drug abuse and dependence. Major depressive episode and dysthymia were collapsed based on their extremely high tetrachoric correlation.

A 7-class LCA model provided the best fit for the data. The 7 classes differed greatly in prevalence (**Table 4**), from 68.5% in class 1 to 0.7% in class 7. Prevalence was inversely related both to number of disorders (Table 4) and severity (Table 4), although there were meaningful inversions between classes 4 and 5. Although subsets of the classes formed a general hierarchy (eg, classes 2, 4, and 6 represent profiles of increasingly comorbid internalizing disorders), some disorders

Table 2. Tetrachoric Correlations Among Hierarchy-Free 12-Month *DSM-IV* and WMH-CIDI Disorders and Factor Loadings From a Principal Axis Factor Analysis of the Correlation Matrix (n = 3199)*

	Panic Disorder	Agoraphobia	Specific Phobia	Social Phobia	GAD	PTSD	OCD	SAD	MDE	Dysthymia
Anxiety disorders										
Panic disorder	1.0									
Agoraphobia	0.64†	1.0								
Specific phobia	0.49†	0.57†	1.0							
Social phobia	0.48†	0.68†	0.50†	1.0						
GAD	0.46†	0.45†	0.35†	0.47†	1.0					
PTSD	0.49†	0.47†	0.44†	0.43†	0.44†	1.0				
OCD‡	0.42	0.44	0.21	0.16	0.33	0.57†	1.0			
SAD	0.39†	0.31	0.32†	0.34†	0.36†	0.49†	–0.79	1.0		
Mood disorders										
MDE	0.48†	0.52†	0.43†	0.52†	0.62†	0.50†	0.42†	0.37†	1.0	
Dysthymia	0.54†	0.44†	0.44†	0.55†	0.55†	0.50†	0.36	0.41†	0.88†	1.0
MHE	0.51†	0.52†	0.39†	0.46†	0.49†	0.44†	0.40	0.40†	0.63†	0.56†
Impulse control disorders										
ODD	0.40†	0.48†	0.45†	0.47†	0.27†	0.53†	0.52	0.46†	0.48†	0.48†
Conduct disorder	0.26	0.24	0.17	0.28†	0.07	0.27	–0.81	–0.07	0.12	0.31
ADHD	0.38†	0.42†	0.34†	0.51†	0.46†	0.43†	0.26	0.37†	0.50†	0.51†
IED	0.32†	0.35†	0.27†	0.30†	0.31†	0.21†	0.25	0.29	0.39†	0.36†
Substance disorders										
Alcohol abuse	0.27†	0.22	0.10	0.22†	0.25†	0.27†	0.31†	0.09	0.24†	0.33†
Alcohol dependence	0.25	0.33	0.21†	0.31†	0.31†	0.34†	0.25	0.10	0.37†	0.38†
Drug abuse	0.16	0.08	0.07	0.22†	0.24†	0.14	0.32	0.06	0.25†	0.42†
Drug dependence	0.27	0.29	0.26	0.44†	0.35†	0.25	0.36	–0.81†	0.40†	0.56†
Prevalence	3.4	1.6	10.1	8.8	4.4	3.7	1.3	0.9	10.3	2.4
Percentage comorbid	80	97	62	74	85	75	65	71	76	99
Factor 1§	0.70	0.76	0.65	0.71	0.63	0.64	. . .	. . .	0.80	0.74
Factor 2§	0.12	0.09	0.03	0.18	0.17	0.16	. . .	. . .	0.19	0.33

	MHE	ODD	Conduct Disorder	ADHD	IED	Alcohol Abuse	Alcohol Dependence	Drug Abuse	Drug Dependence
Anxiety disorders									
Panic disorder									
Agoraphobia									
Specific phobia									
Social phobia									
GAD									
PTSD									
OCD‡									
SAD									
Mood disorders									
MDE									
Dysthymia									
MHE	1.0								
Impulse control disorders									
ODD	0.55†	1.0							
Conduct disorder	0.32†	0.50†	1.0						
ADHD	0.60†	0.58†	0.39†	1.0					
IED	0.43†	0.37†	0.42†	0.38†	1.0				
Substance disorders									
Alcohol abuse	0.37†	0.29	0.40†	0.27†	0.41†	1.0			
Alcohol dependence	0.41†	0.36	0.39	0.30	0.37†	1.0†	1.0		
Drug abuse	0.43†	0.40	0.41	0.36†	0.30†	0.67†	0.63†	1.0	
Drug dependence	0.38†	0.43	0.44	0.55†	0.38†	0.63†	0.71†	1.0†	1.0
Prevalence	3.8	1.1	1.0	4.1	6.6	5.0	2.2	2.4	0.7
Percentage comorbid	87	93	70	78	70	77	100	79	100
Factor 1§	0.66	0.60	0.26	0.60	0.39	0.11	0.21	0.08	0.29
Factor 2§	0.34	0.34	0.47	0.34	0.37	0.89	0.86	0.92	0.88

Abbreviations: ADHD, attention-deficit/hyperactivity disorder; GAD, generalized anxiety disorder; IED, intermittent explosive disorder; MDE, major depressive disorder; MHE, manic/hypomanic disorder; OCD, obsessive-compulsive disorder; ODD, oppositional defiant disorder; PTSD, posttraumatic stress disorder; SAD, separation anxiety disorder; WMH-CIDI, World Health Organization World Mental Health Survey Initiative version of the Composite International Diagnostic Interview.

*Part 2 respondents in the age range 18 to 44 years (n = 3199).

†Significant at the $P<.05$ level, 2-sided test.

‡Assessed in a random one third of the part 2 sample among respondents in the age range 18 to 44 years (n = 1025).

§Varimax rotation

were more prevalent in the lower than higher classes (eg, oppositional defiant disorder and conduct disorder were more prevalent in class 2 than class 4, while panic disorder and all 3 types of phobia were more prevalent in class 4 than class 6). These inversions show that the classes are not merely points of density on the 2 factor analysis dimensions.

The 7 LCA classes can be interpreted by examining the mean number ($_d$) and content of within-class disorders. Class 1 represents unaffected respondents ($_d$=0.1).

Table 3. The Distribution of Hierarchy-Free 12-Month *DSM-IV* and WMH-CIDI Disorders in 3199 Respondents*

	Respondents	Cases	Diagnoses†	Profiles‡
No. of disorders				
0	66.4 (0.9)	. . .	. . .	. . .
1	16.9 (0.7)	50.3 (1.5)	23.2 (1.4)	3.9
2	7.6 (0.4)	22.7 (1.2)	20.9 (1.4)	17.1
≥3	9.1 (0.6)	27.0 (1.8)	55.9 (2.4)	79.0

Abbreviations: NCS-R, National Comorbidity Survey Replication; WMH-CIDI, World Health Organization World Mental Health Survey Initiative version of the Composite International Diagnostic Interview.

*Part 2 NCS-R respondents in the age range 18 to 44 years. Values are expressed as percentage (standard error).

†The proportion of respondents with more than 2 diagnoses ranged from 3.8% with exactly 3 to 0.03% with 15 and averaged 4.5 diagnoses per respondent with more than 2 diagnoses. When the diagnosis is taken as the unit of analysis, the results in this column show that more than half of all 12-month diagnoses occurred to respondents with 3 or more disorders.

‡The 19 disorders generate 2^{19} (524 288) logically possible multivariate disorder profiles, of which 433 are observed in the sample of part 2 respondents in the age range 18 to 44 years.

Class 2 represents pure ($_d$=1.2) internalizing disorders. Class 3 represents pure ($_d$=1.2) externalizing disorders. Class 4 represents comorbid ($_d$=2.9) internalizing disorders. Class 5 represents comorbid ($_d$=2.0) internalizing and/or externalizing disorders dominated by comorbid social phobia and attention-deficit/hyperactivity disorder. Class 6 represents highly comorbid ($_d$=4.9) major depressive episodes. Class 7 represents highly comorbid ($_d$=7.5) bipolar disorder. Although the classes with high comorbidity (classes 4, 6, and 7) included only about 7% of the sample, 43.6% of serious cases were in these classes.

SOCIODEMOGRAPHIC CORRELATES

Using the predicted probabilities of LCA class membership as outcomes, correlates of being largely unaffected (class 1) included being male, non-Hispanic black or Hispanic, and married, having a college education, having high income, and residing in a rural area (**Table 5**). Correlates of pure internalizing disorders (class 2) include being female and married, having a high education, and residing in the suburbs of small metropolitan areas. Correlates of pure externalizing disorders (class 3) included being young, male, and Hispanic, not having low income, and residing in a rural area. Correlates of comorbid internalizing disorders (class 4) included being female and previously married and residing either in suburbia or in an outlying nonrural area. Correlates of comorbid internalizing and/or externalizing disorders (class 5) included being young, male, and married and resid-

Table 4. Conditional Probabilities and Distributions of Hierarchy-Free 12-Month *DSM-IV* and WMH-CIDI Disorders Based on a 7-Class Latent Class Analysis (n = 3199)*

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
Within-class disorder prevalences							
Panic disorder	0.9	1.5	2.5	32.8	0	10.9	73.0
Agoraphobia	0	0	0	23.7	1.5	3.0	45.8
Specific phobia	4.8	15.6	2.0	53.0	25.4	36.0	83.9
Social phobia	2.1	15.9	3.6	51.3	40.2	41.0	88.4
Generalized anxiety disorder	0.1	13.2	3.5	23.2	0	38.6	50.5
Posttraumatic stress disorder	1.0	5.8	1.5	19.5	14.1	22.8	54.8
Major depressive episode/dysthymia	0	40.7	5.3	40.7	0	94.6	89.3
Manic/hypomanic episode	0	6.5	11.1	10.2	0	54.1	93.8
Oppositional defiant disorder	0	1.1	1.3	0.7	15.9	11.7	39.3
Conduct disorder	0.3	0.3	3.0	0	15.0	6.7	11.9
Attention-deficit/hyperactivity disorder	0.9	5.9	0	7.7	39.0	56.2	64.0
Intermittent explosive disorder	1.4	12.7	22.1	14.6	21.8	40.5	45.1
Alcohol abuse or dependence	0.2	0	43.6	13.2	14.4	42.5	5.6
Drug abuse or dependence	0	0	21.5	0	11.9	31.2	5.2
Class prevalence	68.5	14.5	7.4	5.0	2.3	1.6	0.7
Within-class disorder distributions, No.							
0	88.9	25.7	24.4	2.6	9.7	0	0.9
1	10.5	40.1	40.9	12.2	26.1	0.8	0.2
2	0.6	25.4	25.6	27.0	35.2	4.2	0
≥3	0	8.9	9.1	58.2	29.0	95.0	98.8
Within-class severity distributions							
None	86.8	25.1	23.8	2.6	9.5	0	0.9
Mild	7.6	22.7	28.5	23.2	30.7	1.3	0.2
Moderate	4.5	37.3	30.7	40.0	44.5	28.1	5.2
Serious	1.1	14.9	17.0	34.2	15.2	70.5	93.8

Abbreviation: WMH-CIDI, World Health Organization World Mental Health Survey Initiative version of the Composite International Diagnostic Interview.

*Part 2 respondents in the age range 18 to 44 years. Values are expressed as percentages.

Table 5. Sociodemographic Correlates (Odds Ratios) of Latent Class Analysis Class Membership Probabilities (n = 3199)*

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
Age, y							
18-29	0.9 (0.7-1.1)	0.9 (0.7-1.0)	1.4 (1.2-1.6)†	0.8 (0.7-1.0)	1.4 (1.2-1.7)†	1.1 (0.8-1.4)	1.0 (0.9-1.1)
30-44	1.0	1.0	1.0	1.0	1.0	1.0	1.0
χ^2_1	1.9	2.4	15.5†	3.1	14.2†	0.3	0.4
Sex							
Female	0.7 (0.6-0.9)†	1.6 (1.4-1.8)†	0.6 (0.5-0.7)†	1.9 (1.7-2.2)†	0.6 (0.6-0.7)†	1.4 (1.1-1.7)†	1.1 (0.9-1.2)
Male	1.0	1.0	1.0	1.0	1.0	1.0	1.0
χ^2_1	9.3†	52.2†	51.3†	87.0†	46.1†	9.5†	1.0
Race/ethnicity							
Non-Hispanic white	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Non-Hispanic black	2.1 (1.4-3.0)†	1.2 (1.0-1.4)	0.9 (0.8-1.1)	0.9 (0.7-1.0)	1.2 (1.0-1.4)	0.5 (0.4-0.7)†	1.1 (0.9-1.2)
Hispanic	2.0 (1.3-3.0)†	1.0 (0.8-1.2)	1.3 (1.0-1.7)†	0.9 (0.7-1.1)	1.1 (0.9-1.3)	0.5 (0.4-0.8)†	0.9 (0.8-1.0)
Other	0.9 (0.4-1.8)	1.0 (0.7-1.3)	0.8 (0.6-1.1)	0.9 (0.7-1.3)	1.4 (0.9-2.0)	1.1 (0.6-2.1)	1.2 (0.9-1.5)
χ^2_3	23.4†	4.4	7.8†	3.3	6.2	32.7†	5.9
Education, y							
0-11	0.3 (0.2-0.5)†	0.7 (0.5-1.0)†	1.0 (0.7-1.3)	1.2 (1.0-1.6)	1.0 (0.7-1.3)	2.6 (1.7-4.0)†	1.1 (0.9-1.4)
12	0.5 (0.4-0.8)†	0.8 (0.7-0.9)†	1.0 (0.8-1.3)	1.0 (0.8-1.3)	1.0 (0.8-1.2)	1.6 (1.2-2.2)†	1.2 (1.0-1.3)†
13-15	0.6 (0.4-0.9)†	0.9 (0.8-1.1)	1.0 (0.9-1.2)	1.2 (1.0-1.5)	1.0 (0.8-1.2)	1.4 (1.1-1.9)†	1.0 (0.9-1.1)
≥16	1.0	1.0	1.0	1.0	1.0	1.0	1.0
χ^2_3	25.2†	18.5†	0.4	5.9	0.2	21.2†	7.8
Marital status							
Married or cohabitating	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Previously married	0.2 (0.1-0.4)†	0.9 (0.7-1.1)	0.8 (0.6-1.2)	1.7 (1.2-2.3)†	0.6 (0.5-0.9)†	3.0 (1.9-4.8)†	1.2 (0.9-1.6)
Never married	0.6 (0.4-0.8)†	0.8 (0.7-0.9)†	1.2 (1.0-1.5)	1.1 (0.9-1.3)	0.7 (0.6-0.9)†	1.5 (1.1-2.0)†	1.0 (0.8-1.2)
χ^2_2	32.5†	9.1†	6.1†	8.8†	13.3†	28.0†	1.7
Family income‡							
Low	0.7 (0.4-1.2)	1.0 (0.7-1.3)	0.7 (0.6-0.9)†	1.2 (0.9-1.6)	1.0 (0.8-1.2)	1.4 (0.9-2.1)	1.2 (1.0-1.5)
Low average	0.6 (0.4-1.0)†	1.0 (0.8-1.3)	0.9 (0.7-1.1)	1.2 (0.9-1.6)	0.9 (0.7-1.2)	1.4 (1.0-2.0)	1.1 (0.9-1.3)
High average	0.7 (0.5-1.0)†	1.0 (0.8-1.2)	1.0 (0.8-1.3)	1.2 (0.9-1.5)	1.0 (0.8-1.3)	1.4 (1.0-1.8)†	1.0 (0.9-1.1)
High	1.0	1.0	1.0	1.0	1.0	1.0	1.0
χ^2_3	6.4	0.2	9.4†	2.7	1.7	7.3	3.5
County urbanicity§							
Central city ≥2 million residents	0.6 (0.4-0.8)†	1.0 (0.8-1.3)	0.7 (0.6-0.9)†	1.0 (0.8-1.3)	1.6 (1.3-2.0)†	2.0 (1.4-2.8)†	1.2 (1.1-1.4)†
Central city <2 million residents	0.6 (0.4-1.0)†	1.1 (1.0-1.4)	0.7 (0.6-0.9)†	1.1 (0.9-1.3)	1.6 (1.4-1.8)†	1.6 (1.2-2.2)†	1.3 (1.1-1.4)†
Suburbs of central city ≥2 million residents	0.6 (0.4-0.8)†	1.1 (0.8-1.5)	0.7 (0.6-0.9)†	1.3 (1.1-1.6)†	1.6 (1.3-1.9)†	1.7 (1.3-2.3)†	1.2 (1.0-1.5)†
Suburbs of central city <2 million residents	0.5 (0.3-0.8)†	1.3 (1.1-1.6)†	0.6 (0.5-0.8)†	1.4 (1.1-1.7)†	1.6 (1.4-1.9)†	2.1 (1.5-2.9)†	1.2 (1.0-1.4)†
Adjacent area	0.6 (0.4-0.8)†	1.1 (1.0-1.4)	0.7 (0.6-0.8)†	1.2 (1.0-1.5)†	1.6 (1.2-2.0)†	1.7 (1.3-2.1)†	1.1 (1.0-1.3)
Rural area	1.0	1.0	1.0	1.0	1.0	1.0	1.0
χ^2_5	19.6†	9.0	40.2†	12.6†	74.4†	41.6†	23.0†

*Part 2 respondents in the age range 18 to 44 years. Values are expressed as odds ratio (95% confidence interval).

†Significant at the $P<.05$ level, 2-sided test.

‡Family income is defined in relation to the official federal poverty line for families of the size and composition of the respondent's family.[18] Low income is defined as less than or equal to 1.5 times the poverty line, low average as more than 1.5 to 3 times the poverty line, high average as more than 3 to 6 times the poverty line, and high as greater than 6 times the poverty line.

§Coded according to the 2000 census definitions.[19] Central cities and suburbs are defined by the Census Bureau for each consolidated metropolitan statistical area and metropolitan statistical area in the United States. Adjacent areas are defined as all areas beyond the outer boundary of the suburban belt but within 50 miles of the central business district of a central city. Rural areas include all territory more than 50 miles from the central business district of a central city.

ing in a nonrural area. Correlates of highly comorbid major depression (class 6) included being female, non-Hispanic white or other non-Hispanic/nonblack race/ethnicity, and unmarried, having low education and less than high income, and residing in a nonrural area. Correlates of highly comorbid bipolar disorder (class 7) included termination of schooling with the completion of high school and residing in cities or suburbs. Sociodemographic variation was strongest and most diverse in predicting either being unaffected (class 1) or having highly comorbid major depression (class 6). Sociodemographic variation was weakest in predicting pure internalizing disorders (class 2) and highly comorbid bipolar disorder (class 7).

COMMENT

Four limitations of the NCS-R are relevant to the analyses reported herein. First, the sample underrepresents several important population segments, including the homeless, those in institutions, and those who cannot speak English. The first 2 of these exclusions reduce prevalence estimates. In addition, those with mental illness

might be more reluctant than others to participate in a mental health survey. This is relevant because the 70.9% response rate means that nearly 30% of eligible respondents are not represented in the sample. Evidence for selection bias related to mental illness has been reported in other community surveys,[29-31] although no evidence for it was found in an NCS-R nonresponse survey.[13] To the extent that this bias exists, it will make NCS-R estimates conservative.

Second, participants might have underreported 12-month prevalence. This possibility is consistent with evidence in the methodological evidence that embarrassing behaviors are often underreported.[32] Experimental studies show that this underreporting bias can be reduced by using strategies aimed at decreasing embarrassment,[3,33] a number of which were used in the NCS-R.[10] To the extent that these strategies were unsuccessful, the NCS-R estimates are likely to be conservative.

Third, the WMH-CIDI is a lay-administered interview. However, as reported elsewhere,[13] a clinical reappraisal study using the SCID[16] found generally good individual-level concordance between the WMH-CIDI and SCID and conservative estimates of prevalence compared with the SCID.

Fourth, the NCS-R did not include all *DSM-IV* diagnoses. Schizophrenia and other nonaffective psychoses are notably missing. Nonaffective psychoses were excluded from the NCS-R core because previous studies have shown they are dramatically overestimated in lay-administered interviews.[34-38] These same studies showed that the vast majority of respondents with nonaffective psychoses met criteria for CIDI anxiety, mood, or substance disorders and were consequently captured as cases. However, if severity is underestimated in the WMH-CIDI, results will be conservative.

Within the context of these limitations, NCS-R results are generally consistent with the earlier Epidemiologic Catchment Area (ECA) Study and National Comorbidity Survey (NCS)[1] in finding 12-month mental disorders to be highly prevalent. The 26.2% estimate of any disorder in the NCS-R is very close to estimates of 28.1% in the ECA[2] Study and 29.5% in the NCS.[1] However, this great similarity should not be overinterpreted, because the 3 surveys differed greatly in sampling frames, age ranges, diagnostic systems used to define disorders, and measures and it is impossible to draw firm conclusions about time trends in prevalence from these comparisons. In light of these different design elements, the 3 most prevalent NCS-R disorders (specific phobia, social phobia, and major depressive disorder) are identical to the 3 most prevalent disorders in the NCS and to 2 of the 3 in the ECA Study. The exception is social phobia, which was not comprehensively assessed in the ECA Study.

The NCS-R findings that anxiety disorders are more prevalent than mood disorders and that mood disorders are more prevalent than substance disorders are also consistent with both ECA Study and NCS findings. The NCS-R prevalence estimates can also be directly compared with those in more than a dozen countries that participated in the World Health Organization WMH Survey Initiative.[8] The NCS-R prevalence estimates are consistently higher than in these other countries. However, as with the ECA Study and NCS, within-country differences in disorder prevalence in the NCS-R are quite similar to those reported so far in other WMH countries.[39,40]

The externalizing disorders in NCS-R have been much less well studied than anxiety, mood, and substance disorders in previous adult surveys. The limited evidence on intermittent explosive disorder[41] is consistent with the NCS-R prevalence estimate of 2.6%, but we are aware of no comparable information on other impulse control disorders among adults. These disorders are routinely assessed in surveys of children.[42-44] The NCS-R 12-month prevalence estimates of all but 1 of the childhood-onset impulse disorders are much smaller than in surveys of youth. The exception is attention-deficit/hyperactivity disorder, with 12-month NCS-R prevalence approximately 50% as high as the estimates in surveys of youth. This is consistent with independent evidence that as many as half of children with attention-deficit/hyperactivity disorder continue to have symptoms as adults.[45]

The NCS-R results regarding severity support the secondary analyses in showing that many mental disorders are mild. Indeed, nearly twice as high a proportion of NCS-R cases were mild (40.4%) as opposed to serious (22.3%). Nonetheless, the 14.0% of respondents with serious or moderate disorder is substantial. The 5.7% with a serious disorder (22.3% of the 26.2% overall prevalence) is almost identical to the estimated prevalence of *serious mental illness*, using the Substance Abuse and Mental Health Services Administration definition of the term, in the baseline NCS.[46] The finding that mood disorders are more likely than anxiety disorders to be classified as serious is consistent with a cross-national comparative analysis of 5 earlier CIDI surveys that used a less precise measure of severity[7] as well as with the results of the more recent WMH surveys.[8]

Patterns of bivariate comorbidity are broadly consistent with the ECA Study and NCS in showing the vast majority of disorders positively correlated. Relative magnitudes of associations are also quite similar across the 3 surveys, with high rank-order correlations of odds ratios among comorbid pairs in the NCS vs published odds ratios[47] in both the NCS (0.79) and the ECA Study (0.57). Major internal patterns of comorbidity are also quite consistent across surveys, such as the stronger odds ratios within the mood disorders than the anxiety disorders, very high odds ratios between anxiety and mood disorders, and odds ratios between anxiety and mood disorders generally being higher than between pairs of anxiety disorders.

The factor analysis found a very similar 2-dimensional solution as in the NCS.[48] A similar structure was found in a study of comorbidity among primary care patients.[49] However, the log-linear analysis showed clearly that powerful interactions exist among NCS-R disorders that are not captured by the additive model on which factor analysis is based. Latent class analysis was used to study these profiles. This is a departure from the confirmatory factor analysis approach used in other recent studies of comorbidity.[48-50] The LCA results documented progression within and overlap between internalizing and externalizing disorders, with a clear divergence from a simple 2-dimensional progression due to panic and pho-

bia being considerably more prevalent in the comorbid internalizing class than in the highly comorbid internalizing and externalizing classes. This is an intriguing specification that was also found a decade ago in an LCA analysis of the NCS data.[51] It is conceivable that this pattern reflects a protective effect of comorbid panic and phobias against externalizing disorders, possibly through risk aversion.

The NCS-R LCA results share several other features with the earlier NCS LCA results. Both include separate classes of pure and comorbid internalizing disorders with low prevalence of bipolarity. Both have highly comorbid classes with a small proportion of the sample (4.9% in NCS and 7.3% in NCS-R) having a high concentration of severe cases. The implicit progression among these classes warrants a more fine-grained investigation of transitions in lifetime comorbidity. Such an investigation goes beyond the scope of the current report.

The results regarding sociodemographic correlates are broadly consistent with previous surveys in finding that mental disorders (ie, low probability of membership in latent class 1) are associated with a general pattern of disadvantaged social status, including being female, unmarried, and having low socioeconomic status.[8,52-59] The finding that non-Hispanic black and Hispanic individuals have significantly lower risk of disorders is inconsistent with this general pattern, but the same relationship was found in the baseline NCS.[1] It is not clear whether the associations of achieved social statuses (ie, marital status, socioeconomic status) with prevalence are due to effects of environmental experiences on mental disorders, effects of mental disorders on achieved social status, unmeasured common biological causes, or some combination. In the case of the ascribed social statuses (ie, sex and race/ethnicity), the causal effects clearly flow from the statuses and their correlates to the disorders, although the relative importance of environmental and biological mediators is unclear. The significant associations of race/ethnicity, marital status, education, and income with positive disorder classes are largely confined to predicting highly comorbid major depression (class 6). This means the associations of these important sociodemographic variables with 12-month *DSM-IV* disorders are due largely to effects on a comparatively rare (16% of the population) profile of high comorbidity.

CONCLUSION

The NCS-R results show 12-month *DSM-IV* disorders to be highly prevalent in the United States. Although more than one third of cases were mild, the prevalence of moderate and serious cases was substantial (14.0% of the population). Although anxiety disorders were by far the most common mental disorders, the proportion of serious cases was lower than for other classes of disorder. Mood disorders were the next most common and had the highest proportion of serious cases. Impulse control disorders, which have been neglected in previous epidemiological studies of adult mental disorders, were found in more than one third of cases and had a higher proportion of serious cases than either anxiety or substance disorders. More than 40% of 12-month cases were comorbid. Multivariate comorbidity profiles generally conformed to a 2-dimensional model of progression and overlapped between internalizing and externalizing disorders but with notable exceptions that were masked in conventional additive analysis. Severity was strongly related to comorbidity. Many of the most consistently documented sociodemographic correlates of disorder were related largely to a relatively small proportion of the population made up of people with highly comorbid major depression. Clarification of the implications of these results for public health interventions requires more dynamic analysis of the lifetime onset and cumulation of comorbid disorders.

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Birnbaumer et al (page 799) investigated neuronal, peripheral, and subjective correlates of fear conditioning in criminal psychopaths using an aversion differential pavlovian conditioning paradigm. The psychopaths were either criminal offenders on bail or were on parole. During emotional learning they failed to show differential activation in the limbic-prefrontal circuitry and showed no conditioned skin conductance responses despite intact processing of the stimulus contingency. Hence, deficient fear conditioning may underlie the emotional detachment and antisocial behaviors that characterize psychopathy.

Correction

Errors in Byline, Author Affiliations, and Acknowledgment. In the Original Article titled "Prevalence, Severity, and Comorbidity of 12-Month *DSM-IV* Disorders in the National Comorbidity Survey Replication," published in the June issue of the ARCHIVES (2005;62:617-627), an author's name was inadvertently omitted from the byline on page 617. The byline should have appeared as follows: "Ronald C. Kessler, PhD; Wai Tat Chiu, AM; Olga Demler, MA, MS; Kathleen R. Merikangas, PhD; Ellen E. Walters, MS." Also on that page, the affiliations paragraph should have appeared as follows: Department of Health Care Policy, Harvard Medical School, Boston, Mass (Drs Kessler, Chiu, Demler, and Walters); Section on Developmental Genetic Epidemiology, National Institute of Mental Health, Bethesda, Md (Dr Merikangas). On page 626, the acknowledgment paragraph should have appeared as follows: We thank Jerry Garcia, BA, Sara Belopavlovich, BA, Eric Bourke, BA, and Todd Strauss, MAT, for assistance with manuscript preparation and the staff of the WMH Data Collection and Data Analysis Coordination Centres for assistance with instrumentation, fieldwork, and consultation on the data analysis. We appreciate the helpful comments of William Eaton, PhD, Michael Von Korff, ScD, and Hans-Ulrich Wittchen, PhD, on earlier manuscripts. Online versions of this article on the *Archives of General Psychiatry* Web site were corrected on June 10, 2005.