ORIGINAL ARTICLE

Lifetime Prevalence and Age-of-Onset Distributions of *DSM-IV* Disorders in the National Comorbidity Survey Replication

Ronald C. Kessler, PhD; Patricia Berglund, MBA; Olga Demler, MA, MS; Robert Jin, MA; Kathleen R. Merikangas, PhD; Ellen E. Walters, MS

Context: Little is known about lifetime prevalence or age of onset of *DSM-IV* disorders.

Objective: To estimate lifetime prevalence and age-of-onset distributions of *DSM-IV* disorders in the recently completed National Comorbidity Survey Replication.

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

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

Main Outcome Measures: Lifetime *DSM-IV* anxiety, mood, impulse-control, and substance use disorders.

Results: Lifetime prevalence estimates are as follows: anxiety disorders, 28.8%; mood disorders, 20.8%; impulse-control disorders, 24.8%; substance use disorders, 14.6%; any disorder, 46.4%. Median age of onset is much earlier for anxiety (11 years) and impulse-control (11 years) disorders than for substance use (20 years) and mood (30 years) disorders. Half of all lifetime cases start by age 14 years and three fourths by age 24 years. Later onsets are mostly of comorbid conditions, with estimated lifetime risk of any disorder at age 75 years (50.8%) only slightly higher than observed lifetime prevalence (46.4%). Lifetime prevalence estimates are higher in recent cohorts than in earlier cohorts and have fairly stable intercohort differences across the life course that vary in substantively plausible ways among sociodemographic subgroups.

Conclusions: About half of Americans will meet the criteria for a *DSM-IV* disorder sometime in their life, with first onset usually in childhood or adolescence. Interventions aimed at prevention or early treatment need to focus on youth.

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Author Affiliations:
Department of Health Care Policy, Harvard Medical School, Boston, Mass (Dr Kessler; Mss Demler and Walters; and Mr Jin); Institute for Social Research, University of Michigan, Ann Arbor (Ms Berglund); and Section on Developmental Genetic Epidemiology, National Institute of Mental Health, Rockville, Md (Dr Merikangas).

THE PURPOSE OF THE CURRENT report is to present nationally representative estimates of lifetime prevalence and age-of-onset distributions of the *DSM-IV* disorders assessed in the recently completed National Comorbidity Survey Replication (NCS-R).[1] While the Epidemiological Catchment Area Study[2] and the baseline National Comorbidity Survey (NCS)[3] both reported high lifetime prevalence and generally early age-of-onset distributions of most *DSM-III* (NCS) and *DSM-III-R* (NCS-R) disorders, it is not clear whether similar results will hold for *DSM-IV* disorders because of the greater emphasis on clinically significant distress and impairment in *DSM-IV* than in earlier editions.

See also pages 590, 603, 617, and 629

In addition to examining prevalence and age-of-onset distributions, we distinguish between lifetime prevalence, the proportion of those in the population who had a disorder at some time in their life up to their age at interview, and projected lifetime risk, the estimated proportion of those in the population who will have the disorder by the end of their life. Lifetime risk cannot be estimated directly from community surveys because respondents in such surveys differ in age and, therefore, in number of years of expected future risk. Projections of estimated future risk can be made from survey data, though, using either the Kaplan-Meier method[4] or the slightly more precise actuarial method[5] to estimate survival distributions. Although lifetime risk estimates are useful in assessing societal burden, we are aware of no previous published report that has presented such estimates for a wide range of mental disorders.

METHODS

SAMPLE

As detailed elsewhere,[1] the NCS-R is a nationally representative survey of English-speaking

Table 1. Comparison of Lifetime *DSM-IV*/WMH-CIDI and SCID Hierarchy-Free Diagnoses in the Clinical Calibration Sample (n = 325)

	Odds Ratio (95% CI)	κ (SE)	Area Under ROC Curve	McNemar χ^2_1 Test	Sensitivity, % (SE)	Specificity, % (SE)	Positive Predictive Value, % (SE)	Negative Predictive Value, % (SE)
Anxiety Disorders								
Panic disorder	56.3* (15.5-204.6)	0.45 (0.15)	0.72	0.0	45.8 (13.0)	98.5 (0.5)	48.4 (14.1)	98.4 (0.5)
Agoraphobia	174.8* (39.1-780.6)	0.61 (0.15)	0.81	0.0	62.6 (12.9)	99.1 (0.5)	62.0 (15.7)	99.1 (0.3)
Specific phobia	6.3* (2.7-14.6)	0.33 (0.07)	0.67	0.0	45.2 (8.7)	88.5 (2.3)	43.9 (7.6)	89.0 (2.8)
Social phobia	8.4* (3.9-18.2)	0.35 (0.07)	0.65	5.7*	36.6 (7.0)	93.6 (1.4)	53.9 (7.6)	87.8 (2.6)
Any phobia	9.8* (5.0-19.4)	0.45 (0.06)	0.71	7.5*	51.7 (5.7)	90.2 (1.9)	68.1 (6.0)	82.1 (3.0)
Panic or any phobia	9.9* (5.1-19.5)	0.46 (0.06)	0.71	7.4*	52.6 (5.6)	90.0 (2.0)	68.7 (5.8)	81.9 (3.1)
Posttraumatic stress disorder	64.9* (14.9-281.9)	0.49 (0.10)	0.69	11.4*	38.3 (11.8)	99.1 (0.5)	86.1 (7.7)	91.3 (3.0)
Any anxiety disorder	11.6* (6.0-22.4)	0.48 (0.05)	0.73	12.1*	54.4 (5.3)	90.7 (1.8)	74.5 (5.0)	80.0 (3.2)
Mood Disorders								
Major depressive disorder	18.4* (7.9-42.9)	0.54 (0.06)	0.75	7.2*	55.3 (6.8)	93.7 (1.9)	73.7 (7.0)	86.8 (2.7)
Substance Use Disorders								
Alcohol abuse	93.3* (28.0-311.3)	0.70 (0.06)	0.81	7.3*	64.1 (7.4)	98.1 (1.0)	88.1 (5.6)	92.7 (2.0)
Alcohol dependence	877.0* (105.8-7266.2)	0.56 (0.09)	0.72	18.5*	43.1 (9.3)	99.9 (0.1)	98.7 (1.3)	91.9 (1.7)
Drug abuse	111.8* (26.3-476.3)	0.63 (0.08)	0.76	8.9*	53.7 (12.7)	99.0 (0.5)	88.2 (6.0)	93.8 (2.7)
Drug dependence	74.0* (9.2-625.0)	0.36 (0.12)	0.62	11.3*	25.0 (10.6)	99.6 (0.4)	82.0 (13.9)	94.2 (2.2)
Alcohol or drug abuse	69.6* (21.7-223.5)	0.65 (0.06)	0.78	13.9*	58.7 (7.9)	98.0 (1.0)	89.6 (5.0)	89.0 (3.0)
Alcohol or drug dependence	769.0* (94.0-6290.8)	0.53 (0.08)	0.70	25.0*	41.1 (8.7)	99.9 (0.1)	99.0 (1.1)	88.9 (2.5)
Any Disorder								
Any disorder	13.6* (7.3-25.4)	0.52 (0.05)	0.76	21.1*	62.8 (4.4)	89.0 (2.1)	84.3 (3.2)	71.7 (4.3)

Abbreviations: CI, confidence interval; ROC, receiver operating characteristic; SCID, Structured Clinical Interview for *DSM-IV*; WMH-CIDI, World Mental Health Survey version of the Composite International Diagnostic Interview.
*$P \leq .05$.

household residents aged 18 years and older in the coterminous United States. Face-to-face interviews were carried out by professional interviewers from the Institute for Social Research at the University of Michigan, Ann Arbor, between February 2001 and April 2003. The response rate was 70.9%. The survey was administered in two parts. Part I included a core diagnostic assessment of all respondents (n=9282) that took an average of about 1 hour to administer. Part II included questions about risk factors, consequences, other correlates, and additional disorders. In an effort to reduce respondent burden and control study costs, part II was administered only to 5692 of the 9282 part I respondents, including all part I respondents with a lifetime disorder plus a probability subsample of other respondents. Interviewers explained the study and obtained verbal informed consent prior to beginning each interview. Recruitment and consent were approved by the Human Subjects Committees of Harvard Medical School, Boston, Mass, and the University of Michigan.

MEASURES

Diagnostic Assessment

The NCS-R diagnoses are based on the World Mental Health Survey Initiative Version of the World Health Organization Composite International Diagnostic Interview (WMH-CIDI),[6] a fully structured lay-administered diagnostic interview that generates both *International Classification of Diseases, 10th Revision,*[7] and *DSM-IV*[8] diagnoses. The *DSM-IV* criteria are used here. Diagnoses include anxiety disorders (panic disorder, agoraphobia without panic disorder, specific phobia, social phobia, generalized anxiety disorder, posttraumatic stress disorder, obsessive-compulsive disorder, separation anxiety disorder), mood disorders (major depressive disorder, dysthymia, bipolar I and II disorders), a series of four disorders that share a common feature of difficulty with impulse control (intermittent explosive disorder, oppositional-defiant disorder, conduct disorder, attention-deficit/hyperactivity disorder), and four substance use disorders (alcohol abuse, drug abuse, alcohol dependence, drug dependence). Posttraumatic stress disorder, obsessive-compulsive disorder, drug abuse, and drug dependence were included in part II because they all required extensive introductory questions that precluded the quick skipout of noncases that we wanted in part I. The four disorders that require onset of symptoms in childhood (separation anxiety disorder, oppositional-defiant disorder, conduct disorder, and attention-deficit/hyperactivity disorder) were also included in part II and limited to respondents in the age range of 18 to 44 years because of concerns about recall bias among older respondents. All other disorders were included in part I. Organic exclusion rules and hierarchy rules were used to make all diagnoses other than the diagnoses of substance use disorders. Substance use disorders were diagnosed without hierarchy in the recognition that abuse often is a stage in the progression to dependence. Blind clinical reinterviews with the Structured Clinical Interview for *DSM-IV* (SCID)[9] (**Table 1**) generally were in good concordance with WMH-CIDI diagnoses for anxiety, mood, and substance use disorders. Impulse-control diagnoses were not validated.

Retrospective age-of-onset reports were obtained in the WMH-CIDI using a series of questions designed to avoid the implausible response patterns obtained when using the standard CIDI age-of-onset question.[10] The sequence began with a question designed to emphasize the importance of accurate responses: "Can you remember your exact age the very first time you (HAD THE SYNDROME)?" Respondents who answered "no" were probed for a bound of uncertainty by moving up the age range incrementally (eg, "Was it before you first started school?" "Was it before you became a teenager?"). Age of onset was set at the upper end of the bound (eg, age 12 years for respondents who reported that onset was before they became

a teenager). Experimental research has shown that this sequence of questions yields responses with a much more plausible age-of-onset distribution than the standard CIDI age-of-onset question.[11] Although age-of-onset questions were asked about both important symptoms (eg, first panic attack) and full syndromes, the ages used herein are for syndromes.

Predictor Variables

Predictor variables included cohort (defined by age at interview 18-29, 30-44, 45-59, or ≥60 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or other), education (students vs nonstudents with 0-11, 12, 13-15, or ≥16 years of education), and marital status (married/cohabitating, previously married, never married). Marital status was coded for each year of each respondent's life. Education was also coded as a time-varying predictor by assuming an orderly educational history, with 8 years of education corresponding to being a student up to age 14 years, and with other durations based on this benchmark.

ANALYSIS METHODS

The data were weighted to adjust for differential probabilities of selection, differential nonresponse, and residual differences in sociodemographic variables between the sample and tract-level 2000 US Census population. An additional part II weight adjusted for oversampling of part I cases. Weighting is described in more detail elsewhere.[1]

Lifetime prevalence was estimated as the proportion of respondents who had ever had a given disorder up to their age at interview. Age of onset and projected lifetime risk as of age 75 years were estimated using the two-part actuarial method implemented in SAS version 8.2.[12] The actuarial method differs from the more familiar Kaplan-Meier[4] method in using a more accurate way of estimating onset within a given year.[5] This method assumes constant conditional risk of onset during a given year of life across cohorts.

Sociodemographic predictors were examined using discrete-time survival analysis with person-years as the unit of analysis.[13] Sociodemographic variables that change over time (educational attainment, marital status) were treated as time-varying predictors. Changes in the effects of predictors across cohort were evaluated by including interactions between predictors and cohort.

Standard errors of prevalence estimates and survival coefficients were estimated using the Taylor series linearization method[14] implemented in the SUDAAN software system.[15] Multivariate significance tests were made with Wald χ^2 tests using Taylor series design-based coefficient variance-covariance matrices. Standard errors of lifetime risk estimates were estimated using the jackknife repeated replication method[16] implemented in a SAS macro.[12] All significance tests were evaluated at .05 with two-sided tests.

RESULTS

LIFETIME PREVALENCE

The most prevalent lifetime disorders (**Table 2**) were major depressive disorder (16.6%), alcohol abuse (13.2%), specific phobia (12.5%), and social phobia (12.1%). Anxiety disorders were the most prevalent class of disorders (28.8%), followed by impulse-control disorders (24.8%), mood disorders (20.8%), and substance use disorders (14.6%). The lifetime prevalence of any disorder was 46.4%, while 27.7% of respondents had two or more lifetime disorders and 17.3% had three or more.

Prevalence estimates varied significantly with age for all but a handful of disorders. A monotonic increase in prevalence was generally found from the youngest (18-29 years) to a higher (for the most part, 30-44 years) age group and then a decline in the older age group(s). Prevalence was always lowest, sometimes substantially so, in the oldest age group (≥60 years). The most dramatic differences of this sort were for drug abuse and drug dependence, posttraumatic stress disorder, and bipolar I and II disorders. Prevalence differences were much less marked among the other three age groups.

AGE OF ONSET DISTRIBUTIONS

The distributions of cumulative lifetime risk estimates were standardized and examined for fixed percentiles (**Table 3**). Two patterns emerged. First, the median age of onset (ie, 50th percentile on the age-of-onset distribution) was much earlier for anxiety disorders (age 11 years) and impulse-control disorders (age 11 years) than for substance use disorders (age 20 years) and mood disorders (age 30 years). Second, age of onset was concentrated in a very narrow age range for most disorders, with interquartile ranges (IQRs) (ie, the number of years between the 25th and 75th percentiles of the age-of-onset distributions) of only 8 years (age 7-15 years) for impulse-control disorders, 9 years (age 18-27 years) for substance use disorders, and 15 years (age 6-2 years) for anxiety disorders compared with 25 years (age 18-43 years) for mood disorders.

Most disorder-specific age-of-onset distributions shared important features with other disorders in their class. In particular, the median age of onset was earlier for each impulse-control disorder (age 7-15 years) than for any substance (age 19-23 years) or mood (age 25-32 years) disorder, while the IQR was consistently narrower for each of the impulse-control (1-6 years) and substance use (6-12 years) disorders than for any mood disorder (25-26 years). The age-of-onset distributions of anxiety disorders were more diverse, with specific phobia and separation anxiety disorder having very early median ages of onset (age 7 years) and very narrow IQRs (4-7 years), social phobia having a later median age of onset (age 13 years) and a narrow IQR range (7 years), and other anxiety disorders having much later median ages of onset (age 19-31 years) and much wider IQRs (16-27 years).

PROJECTED LIFETIME RISK

Projected lifetime risk as of age 75 years based on the age-of-onset distributions (Table 3) was 9% higher than lifetime prevalence estimates reported in Table 2 for anxiety disorders, 34% higher for mood disorders, 2% higher for impulse-control disorders, 12% higher for substance use disorders, and 9% higher for any disorder. Predictably, disorders with the largest increases between prevalence and projected risk were those with late age-of-onset distributions: major depressive disorder, generalized anxiety disorder, and posttraumatic stress disorder. Consistent with the prevalence data, projected risk was highest for anxi-

Table 2. Lifetime Prevalence of *DSM-IV*/WMH-CIDI Disorders in the Total NCS-R Sample and by Age

	Prevalence, % (SE)					
		Age, y				
	Total	18-29	30-44	45-59	≥60	χ^2_3*
Anxiety Disorders						
Panic disorder	4.7 (0.2)	4.4 (0.4)	5.7 (0.5)	5.9 (0.4)	2.0 (0.4)	52.6†
Agoraphobia without panic	1.4 (0.1)	1.1 (0.2)	1.7 (0.3)	1.6 (0.3)	1.0 (0.3)	4.5
Specific phobia	12.5 (0.4)	13.3 (0.8)	13.9 (0.8)	14.1 (1.0)	7.5 (0.7)	54.3†
Social phobia	12.1 (0.4)	13.6 (0.7)	14.3 (0.8)	12.4 (0.8)	6.6 (0.5)	109.0†
Generalized anxiety disorder	5.7 (0.3)	4.1 (0.4)	6.8 (0.5)	7.7 (0.7)	3.6 (0.5)	39.9†
Posttraumatic stress disorder‡	6.8 (0.4)	6.3 (0.5)	8.2 (0.8)	9.2 (0.9)	2.5 (0.5)	37.9†
Obsessive-compulsive disorder§	1.6 (0.3)	2.0 (0.5)	2.3 (0.9)	1.3 (0.6)	0.7 (0.4)	6.8
Separation anxiety disorder	5.2 (0.4)	5.2 (0.6)	5.1 (0.6)	‖	‖	0.0
Any anxiety disorder¶	28.8 (0.9)	30.2 (1.1)	35.1 (1.4)	30.8 (1.7)	15.3 (1.5)	89.9†
Mood Disorders						
Major depressive disorder	16.6 (0.5)	15.4 (0.7)	19.8 (0.9)	18.8 (1.1)	10.6 (0.8)	49.9†
Dysthymia	2.5 (0.2)	1.7 (0.3)	2.9 (0.4)	3.7 (0.7)	1.3 (0.3)	10.6†
Bipolar I-II disorders	3.9 (0.2)	5.9 (0.6)	4.5 (0.3)	3.5 (0.4)	1.0 (0.3)	62.0†
Any mood disorder	20.8 (0.6)	21.4 (0.9)	24.6 (0.9)	22.9 (1.2)	11.9 (1.0)	58.0†
Impulse-Control Disorders						
Oppositional-defiant disorder	8.5 (0.7)	9.5 (0.9)	7.5 (0.8)	‖	‖	3.0
Conduct disorder	9.5 (0.8)	10.9 (1.0)	8.2 (0.8)	‖	‖	7.6†
Attention-deficit/hyperactivity disorder	8.1 (0.6)	7.8 (0.8)	8.3 (0.9)	‖	‖	0.2
Intermittent explosive disorder	5.2 (0.3)	7.4 (0.7)	5.7 (0.6)	4.9 (0.4)	1.9 (0.5)	74.7†
Any impulse-control disorder	24.8 (1.1)	26.8 (1.7)	23.0 (1.3)	‖	‖	4.0†
Substance Use Disorders						
Alcohol abuse	13.2 (0.6)	14.3 (1.0)	16.3 (1.1)	14.0 (1.1)	6.2 (0.7)	60.2†
Alcohol dependence	5.4 (0.3)	6.3 (0.7)	6.4 (0.6)	6.0 (0.7)	2.2 (0.4)	45.2†
Drug abuse	7.9 (0.4)	10.9 (0.9)	11.9 (1.0)	6.5 (0.6)	0.3 (0.2)	168.7†
Drug dependence	3.0 (0.2)	3.9 (0.5)	4.9 (0.6)	2.3 (0.4)	0.2 (0.1)	90.0†
Any substance use disorder	14.6 (0.6)	16.7 (1.1)	18.0 (1.1)	15.3 (1.0)	6.3 (0.7)	71.4†
Any Disorder						
Any disorder¶	46.4 (1.1)	52.4 (1.7)	55.0 (1.6)	46.5 (1.8)	26.1 (1.7)	115.4†
Two or more disorders¶	27.7 (0.9)	33.9 (1.3)	34.0 (1.5)	27.0 (1.6)	11.6 (1.0)	148.3†
Three or more disorders¶	17.3 (0.7)	22.3 (1.2)	22.5 (1.1)	15.9 (1.3)	5.3 (0.7)	140.7†
Sample Sizes						
Part I	9282	2338	2886	2221	1837	
Part II	5692	1518	1805	1462	907	
Part II obsessive-compulsive disorder subsample	1808	493	566	457	292	

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

*The χ^2 test evaluates the statistical significance of age-related differences in estimated prevalence; *df* = 1 for separation anxiety disorder, oppositional-defiant disorder, conduct disorder, attention-deficit/hyperactivity disorder, and any impulse-control disorder.

†Significant age difference ($P \leq .05$).

‡Assessed only in the part II sample (n = 5692).

§Assessed only in a random third of the part II sample (n = 1808).

‖Assessed only among part II respondents aged 18 to 44 years (n = 3199).

¶These summary measures were analyzed in the full part II sample (n = 5692). Obsessive-compulsive disorder, separation anxiety disorder, oppositional-defiant disorder, conduct disorder, and attention-deficit/hyperactivity disorder were coded as absent among respondents who were not assessed for these disorders.

ety disorders (31.5%), but the order was reversed for impulse-control and mood disorders—the former having higher prevalence (24.8% vs 20.8%) and the latter higher projected risk (28.0% vs 25.4%). Substance use disorders had the lowest projected risk (16.3%). The individual disorders with the highest projected risk were identical to those with the highest prevalence. Over 80% of projected new onsets were estimated occur to people who had already had disorders. This can be seen by noting that the overall projected lifetime risk in the total sample was only 4.4% higher than the lifetime prevalence reported in Table 2 (50.8% vs 46.4%), while disorder-specific risk-vs-prevalence differences added to 20.4%.

COHORT EFFECTS

Dummy variables defining age groups 18 through 29, 30 through 44, 45 through 59, and 60 years or older (corresponding roughly to cohorts born in the years 1970 or later, 1955-1969, 1940-1954, and earlier than

Table 3. Ages at Selected Percentiles on the Standardized Age-of-Onset Distributions of *DSM-IV*/WMH-CIDI Disorders, With Projected Lifetime Risk at Age 75 Years

	Projected Lifetime Risk at Age 75 y, % (SE)	Age at Selected Age-of-Onset Percentiles, y							
		5	10	25	50	75	90	95	99
Anxiety Disorders									
Panic disorder	6.0 (0.3)	6	10	16	24	40	51	56	63
Agoraphobia without panic	1.6 (0.2)	6	7	13	20	33	48	51	54
Specific phobia	13.2 (0.4)	4	5	5	7	12	23	41	64
Social phobia	12.6 (0.4)	5	6	8	13	15	23	34	52
Generalized anxiety disorder	8.3 (0.4)	8	13	20	31	47	58	66	75
Posttraumatic stress disorder*	8.7 (0.6)	6	9	15	23	39	53	61	71
Obsessive-compulsive disorder†	1.9 (0.3)	10	11	14	19	30	48	54	54
Separation anxiety disorder‡	5.2 (0.4)	5	5	6	7	10	13	14	17
Any anxiety disorder§	31.5 (1.1)	5	5	6	11	21	41	51	65
Mood Disorders									
Major depressive disorder	23.2 (0.6)	12	14	19	32	44	56	64	73
Dysthymia	3.4 (0.3)	7	11	17	31	43	51	57	73
Bipolar I-II disorders	5.1 (0.3)	11	13	17	25	42	50	57	65
Any mood disorder	28.0 (0.8)	11	13	18	30	43	54	63	73
Impulse-Control Disorders									
Oppositional-defiant disorder‡	8.5 (0.7)	5	6	8	13	14	16	17	18
Conduct disorder‡	9.5 (0.8)	6	7	10	13	15	17	17	18
Attention-deficit/hyperactivity disorder‡	8.1 (0.6)	5	6	7	7	8	11	11	16
Intermittent explosive disorder	5.4 (0.3)	6	8	11	15	20	26	37	46
Any impulse-control disorder‡	25.4 (1.1)	5	6	7	11	15	18	23	36
Substance Use Disorders									
Alcohol abuse*	15.1 (0.7)	15	16	18	21	29	39	44	54
Alcohol dependence*	6.5 (0.4)	16	17	19	23	31	41	50	56
Drug abuse*	8.5 (0.4)	15	16	17	19	23	29	36	46
Drug dependence*	3.4 (0.3)	15	16	18	21	28	36	41	49
Any substance use disorder§	16.3 (0.6)	15	16	18	20	27	37	41	54
Any Disorder									
Any disorder§	50.8 (1.2)	5	5	7	14	24	42	51	64

Abbreviation: WMH-CIDI, World Mental Health Survey version of the Composite International Diagnostic Interview.
*Assessed only in the part II sample (n = 5692).
†Assessed only in a random third of the part II sample (n = 1808).
‡Assessed only among part II respondents aged 18 to 44 years (n = 3199).
§These summary measures were analyzed in the full part II sample (n = 5692). Obsessive-compulsive disorder, separation anxiety disorder, oppositional-defiant disorder, conduct disorder, and attention-deficit/hyperactivity disorder were coded as absent among respondents who were not assessed for these disorders.

1940) were used to predict lifetime disorders using discrete-time survival analysis. The odds ratios (ORs) were statistically significant in the vast majority of comparisons, with a consistent positive association between recency of cohort and OR of onset (**Table 4**). The largest cohort effects were associated with drug use disorders and the smallest with phobias and childhood-onset impulse-control disorders.

The cohort model was elaborated to evaluate whether intercohort differences decreased significantly with increasing age, a pattern that might be expected either if lifetime risk was actually constant across cohorts but appeared to vary with cohort because onsets occurred earlier in more recent cohorts than in earlier cohorts (due to either secular changes in environmental triggers or age-related differences in age-of-onset recall accuracy) or if differential mortality had an increasingly severe effect on sample selection bias with increasing age. Differences were examined separately for first onsets in the age ranges 1 through 12, 13 through 19, 20 through 29, 30 through 39, 40 through 49, and 50 through 59 years, the last of these age intervals being the upper end of the age distribution of the second-oldest cohort quartile, making it impossible to study intercohort differences beyond this age. No evidence of decreasing cohort effects with increasing age was found for anxiety or mood disorders (**Table 5**). In contrast, dramatic differences emerged for substance use disorders, with much higher cohort effects in the teens and 20s than in either childhood or the 30s through 50s.

SOCIODEMOGRAPHIC PREDICTORS

A number of sociodemographic variables were significantly related to lifetime risk of NCS-R disorders in survival analyses that controlled for cohort (**Table 6**). Women had a significantly higher risk than men of anxiety and mood disorders. Men had a significantly higher risk than women of impulse-control and substance use disorders. Non-Hispanic blacks and Hispanics had a significantly lower risk than non-Hispanic whites of anxiety, mood, and substance use disorders

Table 4. Cohort (Age at Interview) as a Predictor of Lifetime Risk of *DSM-IV*/WMH-CIDI Disorders in the NCS-R*

	Lifetime Risk by Age at Interview (Years) Compared With Respondents Aged ≥60 y, Odds Ratio (95% CI)			
	18-29	30-44	45-59	χ^2_3
Anxiety Disorders				
Panic disorder	6.4† (3.8-10.5)	5.0† (3.0-8.5)	4.1† (2.4-6.9)	61.5‡
Agoraphobia without panic	2.3† (1.2-4.6)	2.5† (1.2-5.1)	2.0 (0.9-4.1)	7.4
Specific phobia	2.1† (1.7-2.7)	2.1† (1.7-2.7)	2.1† (1.6-2.6)	49.3‡
Social phobia	2.5† (2.0-3.0)	2.5† (2.0-3.1)	2.1† (1.6-2.6)	89.6‡
Generalized anxiety disorder	4.6† (2.9-7.1)	4.1† (2.7-6.1)	3.3† (2.1-5.1)	54.7‡
Posttraumatic stress disorder§	6.3† (3.7-10.5)	5.5† (3.4-9.0)	4.8† (3.0-7.8)	55.7‡
Obsessive-compulsive disorder‖	6.3 (1.0-37.8)	5.0 (0.9-28.5)	2.5 (0.4-14.9)	6.0
Separation anxiety disorder¶	1.1 (0.8-1.5)	1.0		0.1††
Any anxiety disorder§#	3.0† (2.4-3.6)	3.1† (2.5-3.9)	2.5† (2.0-3.1)	123.3‡
Mood Disorders				
Major depressive disorder	7.3† (5.9-9.0)	4.5† (3.5-5.6)	2.7† (2.2-3.3)	370.7‡
Dysthymia	4.9† (3.1-7.7)	4.4† (3.0-6.5)	3.8† (2.5-5.8)	62.5‡
Bipolar I-II disorders	22.4† (11.3-44.7)	9.5† (4.7-19.2)	4.8† (2.5-9.3)	125.7‡
Any mood disorder	8.6† (6.8-10.8)	4.9† (3.8-6.3)	2.9† (2.3-3.7)	419.4‡
Impulse-Control Disorders				
Oppositional-defiant disorder¶	1.4† (1.1-1.8)	1.0	1.0	6.3‡††
Conduct disorder¶	1.4† (1.1-1.7)	1.0	1.0	9.4‡††
Attention-deficit/hyperactivity disorder¶	1.5† (1.1-2.0)	1.0	1.0	6.1‡††
Intermittent explosive disorder	7.3† (4.2-12.4)	4.3† (2.3-7.8)	2.5† (1.4-4.3)	39.0‡
Any impulse-control disorder¶	15.2† (9.9-23.4)			††
Substance Use Disorders				
Alcohol abuse or dependence	4.5† (3.4-6.1)	3.2† (2.5-4.2)	2.4† (1.8-3.3)	133.2‡
Alcohol dependence	6.4† (4.2-9.8)	3.7† (2.3-5.8)	2.9† (1.9-4.5)	79.6‡
Drug abuse or dependence	61.3† (20.4-183.6)	49.7† (16.6-148.2)	24.8† (8.2-75.4)	99.7‡
Drug dependence	45.4† (10.2-202.0)	35.0† (7.8-156.5)	13.8† (2.7-69.2)	69.0‡
Any substance use disorder	4.9† (3.6-6.6)	3.7† (2.8-4.8)	2.7† (2.0-3.7)	138.0‡
Any Disorder				
Any disorder**	4.1† (3.5-4.9)	3.6† (2.9-4.3)	2.4† (2.0-2.8)	280.6‡

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

*Based on discrete-time survival models with person-years as the unit of analysis.

†Significant difference compared with those aged 60 years or older ($P \leq .05$, 2-sided test).

‡Significant intercohort differences in global test.

§Estimated in the part II sample (n = 5692).

‖Estimated in a random third of the part II sample (n = 1808).

¶ Estimated among respondents aged 18 to 44 years in the part II sample (n = 3199).

#Obsessive-compulsive disorder was coded as absent among respondents who were not assessed for this disorder.

**Estimated for the full part II sample. Obsessive-compulsive disorder, separation anxiety disorder, oppositional-defiant disorder, conduct disorder, and attention-deficit/hyperactivity disorder were coded as absent among respondents who were not assessed for these disorders.

††*df* = 1 for separation anxiety disorder, oppositional-defiant disorder, conduct disorder, attention-deficit/hyperactivity disorder, and any impulse-control disorder comparing respondents aged 18 to 29 years with the omitted control group of respondents aged 30 to 44 years.

(the latter only among non-Hispanic blacks). Low education was associated with a high risk of substance use disorders. Marital disruption was associated with 3 of the 4 classes of disorder, the exception being impulse-control disorder.

To determine whether increasing prevalence in more recent cohorts was concentrated in certain population segments, we also examined whether sociodemographic correlates varied by cohort. Although at least one significant interaction was found for each sociodemographic predictor, the pattern was not consistent (results available on request from the authors). The most notable results were as follows: Sex differences in anxiety, mood, and impulse-control disorders did not differ across cohorts, but women were more similar to men in substance use disorders in recent cohorts. The significant inverse associations with substance use disorders of education and being married existed only in recent cohorts.

COMMENT

The results reported herein are limited by four possible biases, all of which make the prevalence and risk estimates conservative. First, people with a history of mental illness might have been less likely than others to participate in the survey either because of sample frame exclusions (eg, excluding homeless people from the sampling frame), differential mortality, or greater reluctance to participate. There is evidence that bias of the latter sort (reluctance to participate) exists in psychiatric epidemiological surveys,[17] although no evidence of such

Table 5. Variations in the Effects of Cohort (Age at Interview) in Predicting Lifetime Risk of *DSM-IV*/WMH-CIDI Disorders*

	Lifetime Risk by Age at Interview (Years), Odds Ratio (95% CI)					
	1-12	13-19	20-29	30-39	40-49	50-59
Anxiety Disorders (χ^2_{11} = 35.5)†‡						
Age at interview, y						
19-29	2.9§ (2.4-3.6)	3.1§ (2.2-4.4)	3.9§ (1.8-8.4)	. . .	. . .	. . .
30-44	3.0§ (2.3-3.9)	3.1§ (2.1-4.5)	4.4§ (2.1-9.0)	5.8§ (3.4-9.9)	2.5§ (1.1-5.8)	. . .
45-59	2.3§ (1.9-2.9)	2.6§ (1.8-3.8)	3.2§ (1.5-6.7)	2.7§ (1.3-5.5)	3.3§ (1.8-6.2)	4.9§ (2.7-8.9)
≥60	1.0	1.0	1.0	1.0	1.0	1.0
χ^2	135.0‖ (*df* = 3)	54.4‖ (*df* = 3)	18.4‖ (*df* = 3)	52.5‖ (*df* = 2)	15.2‖ (*df* = 2)	28.4‖ (*df* = 1)
Mood Disorders (χ^2_{12} = 28.7)‡						
Age at interview, y						
19-29	8.8§ (4.8-16.0)	8.0§ (5.5-11.6)	9.2§ (6.1-13.9)	9.2§ (2.3-36.0)	. . .	. . .
30-44	6.0§ (2.9-12.3)	4.3§ (2.8-6.6)	4.5§ (3.0-6.8)	6.5§ (4.1-10.3)	5.1§ (2.9-8.9)	. . .
45-59	3.6§ (1.9-6.9)	2.8§ (1.9-4.2)	2.9§ (1.8-4.5)	2.9§ (1.9-4.3)	3.1§ (2.0-4.9)	3.5§ (2.3-5.5)
≥60	1.0	1.0	1.0	1.0	1.0	1.0
χ^2	68.2‖ (*df* = 3)	216.7‖ (*df* = 3)	133.5‖ (*df* = 3)		35.5‖ (*df* = 2)	33.0‖ (*df* = 1)
Substance Use Disorders (χ^2_{11} = 100.8)‡						
Age at interview, y						
19-29	1.5 (0.6-3.9)	11.3 (5.4-24.0)	3.4§ (2.0-5.7)	. . .	. . .	. . .
30-44	0.7 (0.4-1.5)	9.2§ (4.1-20.3)	3.0§ (1.8-4.9)	2.0§ (1.8-4.9)	0.5 (0.2-1.6)	. . .
45-59	0.2§ (0.0-0.7)	4.4§ (2.0-9.4)	3.7§ (2.4-5.8)	2.2§ (1.1-4.7)	0.5 (0.2-1.5)	2.4 (0.7-7.7)
≥60	1.0	1.0	1.0	1.0	1.0	1.0
χ^2	23.5‖ (*df* = 3)	95.2‖ (*df* = 3)	35.7‖ (*df* = 3)	6.2‖ (*df* = 2)	2.8 (*df* = 2)	2.2 (*df* = 1)

Abbreviations: CI, confidence interval; WMH-CIDI, World Mental Health Survey version of the Composite International Diagnostic Interview.

*Based on discrete-time survival models with person-years as the unit of analysis. Total sample models evaluated the significance of interactions between cohort and person-years in the lives of respondents. This was not done for impulse-control disorders because the vast majority of such disorders have onsets in a very narrow time window. Cohort × person-year interactions had significant predictive value for each of the 3 disorder groups. Based on these results, subsample models were estimated for the effects of cohort in each of the first 6 decades of life (including 11- and 12-year-olds in the earliest decade to distinguish teenagers from other parts of the life span). All analyses were carried out in the full part II sample.

†In the analysis of anxiety disorders, obsessive-compulsive disorder was coded as absent among respondents who were not assessed for this disorder.

‡Significant interaction between cohort and person-years in the lives of respondents in the total sample.

§Significant difference compared with the before-1940 cohorts (age ≥60 years) ($P \leq .05$, 2-sided test).

‖Significant intercohort differences in the global test.

bias was found in a nonrespondent survey carried out in conjunction with the NCS-R.[18]

Second, lifetime prevalence was likely to be underreported in the sample because of the well-known bias against reporting embarrassing behaviors.[19] This type of bias is not ruled out by the concordance found between diagnoses based on the WMH-CIDI and independent clinical reinterviews, as similar bias can occur in clinical interviews. Experimental studies to evaluate the effects of strategies designed to decrease embarrassment and to increase accurate reporting have consistently shown significant increases in reports of mental illness.[20,21] As discussed in more detail elsewhere,[6] a number of these strategies were used in the NCS-R, but it is unlikely that they were completely successful.

Third, the method used to estimate lifetime risk was based on the assumption of constant conditional risk of first onset in a given year of life among people who differ in age at interview. This assumption is almost certainly incorrect in light of evidence for significant intercohort differences in lifetime prevalence. Because the estimated prevalence was higher in more recent cohorts, lifetime risk in younger cohorts will be underestimated in models based on the assumption of constant intercohort conditional risk.

Fourth, age at onset can be recalled incorrectly, possibly as a function of age at interview and in conjunction with age-related failure to recall lifetime disorders. Simon and Von Korff[10] reported evidence of this problem in the Epidemiologic Catchment Area study, in which age-at-onset reports were a mean of approximately 10 years before the interview regardless of the respondent's age. This kind of age-related age-at-onset telescoping in conjunction with age-related failure to report past disorders can create the false appearance of a cohort effect.[22] Although the NCS-R used a novel probing strategy to assess age at onset that was shown experimentally to correct the biased data pattern found by Simon and Von Korff,[11] it is unlikely that this strategy corrected completely for age-related recall bias.

Based on these considerations of possible bias, the NCS-R estimates of lifetime prevalence and projected risk are likely to be conservative. The estimates of anxiety, mood, and substance use disorders are broadly consistent with those found in previous community surveys in the United States[3,23] and elsewhere in the world[24,25]: (1) A high proportion of the population met the criteria for one or more of these disorders at some time in their life. (2) Major depressive disorder, specific phobia, social phobia, and alcohol abuse were the most common individual disorders. (3) Anxiety disorders were the most common class of disorders. The main inconsistency with previous results is that the estimated prevalence of substance use disorders was considerably lower in the NCS-R

Table 6. Sociodemographic Predictors of Lifetime Risk of *DSM-IV*/WMH-CIDI Disorders*

	Lifetime Risk, Odds Ratio (95% CI)				
	Any Anxiety Disorder†	Any Mood Disorder†	Any Impulse-Control Disorder‡	Any Substance Use Disorder†	Any Disorder†
Sex					
F	1.6§ (1.5-1.8)	1.5§ (1.3-1.7)	0.7§ (0.6-0.8)	0.4§ (0.3-0.4)	1.1 (1.0-1.2)
M	1.0	1.0	1.0	1.0	1.0
χ^2_1	90.8§	44.7§	18.3§	204.6§	2.8
Race/ethnicity					
Non-Hispanic white	1.0	1.0	1.0	1.0	1.0
Non-Hispanic black	0.8§ (0.6-0.9)	0.6§ (0.5-0.8)	0.7 (0.5-1.1)	0.6§ (0.5-0.8)	0.7§ (0.6-0.8)
Hispanic	0.7§ (0.6-0.9)	0.8§ (0.6-0.9)	0.7 (0.5-1.1)	0.9 (0.7-1.2)	0.8 (0.6-1.0)
Other	1.2 (0.9-1.5)	1.1 (0.8-1.4)	1.1 (0.7-1.7)	1.2 (0.8-1.9)	1.0 (0.8-1.3)
χ^2_3	14.1§	28.4§	8.3§	17.7§	16.1§
Education‖					
Student	1.3 (0.9-1.9)	0.8 (0.6-1.2)	0.8 (0.3-2.2)	1.0 (0.6-1.8)	1.2 (0.8-1.7)
Nonstudent/0-11 y	1.1 (0.8-1.6)	0.9 (0.7-1.1)	0.9 (0.4-2.5)	1.9§ (1.2-3.0)	1.1 (0.8-1.5)
Nonstudent/12 y	0.9 (0.6-1.4)	1.0 (0.9-1.2)	1.0 (0.4-2.5)	1.5 (1.0-2.3)	1.1 (0.9-1.4)
Nonstudent/13-15 y	1.1 (0.8-1.5)	1.2 (0.9-1.5)	1.1 (0.4-3.1)	1.4 (0.8-2.3)	1.1 (0.8-1.5)
Nonstudent/≥16 y	1.0	1.0	1.0	1.0	1.0
χ^2_4	2.4	7.0	0.9	39.0§	1.2
Marital status‖					
Married/cohabitating	1.0	1.0	1.0	1.0	1.0
Previously married	1.8§ (1.4-2.2)	1.9§ (1.6-2.3)	1.8 (0.7-4.4)	3.9§ (2.8-5.3)	2.1§ (1.6-2.6)
Never married	1.0 (0.7-1.3)	1.0 (0.8-1.2)	1.4 (0.6-3.2)	1.2 (1.0-1.6)	1.0 (0.8-1.2)
χ^2_2	35.8§	46.9§	1.9	88.7§	39.3§
Sample size	5692	5692	3199	5692	5692

Abbreviations: CI, confidence interval; WMH-CIDI, World Mental Health Survey version of the Composite International Diagnostic Interview.
*Based on discrete-time survival models with person-years as the unit of analysis.
†Based on the full part II sample (n = 5692). In the case of any anxiety disorder, obsessive-compulsive disorder was coded as absent among respondents who were not assessed for this disorder.
‡Based on part II respondents aged 18 to 44 years (n = 3199).
§$P \leq .05$, 2-sided test.
‖Time-varying predictor.

than in the NCS. This is presumably because the *DSM-IV* criteria are stricter than the *DSM-III-R* criteria (especially in requiring criterion A symptoms to cluster in a single year of life).

Although we know of no previous attempt to estimate the lifetime prevalence of *DSM-IV* oppositional-defiant disorder, conduct disorder, or attention-deficit/hyperactivity disorder in a nationally representative sample of adults, the NCS-R estimates are in the range reported in epidemiological surveys of adolescents.[26,27] The NCS-R prevalence estimate for intermittent explosive disorder is also consistent with the scant data on the prevalence of that disorder.[28] Given that previous epidemiological surveys excluded these impulse-control disorders, it is striking that their combined lifetime prevalence is higher than that for either mood disorders or substance use disorders.

High prevalence estimates in previous psychiatric epidemiological surveys have been a source of two concerns to mental health policy analysts. The first is that the estimates are so high as to be scientifically implausible.[29] We addressed this issue earlier when we noted that concordance is generally good between WMH-CIDI and SCID diagnoses and that the WMH-CIDI is conservative relative to the SCID. A critic might conclude that the *DSM-IV* system itself is overly inclusive. However, it is noteworthy that preliminary analyses of the 12-month NCS-R data show that even those 12-month WMH-CIDI disorders that were classified as mild were associated with levels of impairment equivalent to those caused by clinically significant chronic physical disorders. Based on this evidence, it would be difficult to make a principled argument for narrowing the diagnostic criteria in future editions of the DSM to raise the threshold for clinical significance.

The second concern about high prevalence estimates is that, even if accurate, they correspond to many more people than can be helped by currently available treatment resources[30] and consequently have no practical short-term implications other than perhaps reducing support for parity of treatment with physical disorders.[31] In considering these issues it is important to note that mental disorders, like physical disorders, differ widely both in severity and in need for treatment.[32,33] The fact that nearly half the population will meet the criteria for a mental disorder at some time in their life does not mean that they will all need treatment. As shown in a separate NCS-R report,[34] a substantial proportion of 12-month *DSM-IV* cases are mild. In addition, treatments with demonstrated cost-effectiveness are not available for all mental disorders. If cost-effective treatments were to become available, it is likely that anticipated resource deficits would be counterbalanced at least in part by increased demand and willingness to pay, consistent with reactions to recently pub-

lished research on the cost-effectiveness of treating subthreshold hypercholesterolemia.[35-38]

The NCS-R age-of-onset distributions are consistent with those reported in previous epidemiological surveys[25,39] in finding that anxiety disorders have the earliest ages of onset and mood disorders the latest. However, we are aware of no previous attempt to examine the temporal concentration of ages of onset or to highlight the concentration of ages of onset for most disorders in a very narrow time span. It is also striking that the upper bounds of the age-of-onset IQRs for disorders with narrow ranges are all quite young: age 15 years for impulse-control disorders and anxiety disorders with narrow IQRs and age 27 years for substance use disorders. These are opposite the patterns found for almost all chronic physical disorders, with conditional risk increasing with age and the upper bound of the IQR in late middle age or old age.[40] Whatever else we can say about mental disorders, then, they are distinct from chronic physical disorders because they have their strongest foothold in youth, with substantially lower risk among people who have matured out of the high-risk age range.

An important issue in assessing the societal burden of mental disorders is whether the evidence of increasing prevalence in recent cohorts is real or a methodological artifact. The fact that NCS-R cohort effects vary in plausible ways (eg, the largest ORs are associated with drug use disorders, which are known independently to have increased among cohorts that went through adolescence beginning in the 1970s) and the fact that sociodemographic correlates of cohort effects are substantively plausible (eg, the increasing similarity of women and men with regard to substance use disorders in recent cohorts) argue that the observed cohort effect is at least partly due to substantive rather than methodological factors. In addition, no evidence was found for the convergence among cohorts with increasing age that would be expected if methodological factors were responsible for intercohort variation in prevalence estimates. In addition, we used a nonresponse survey, weighting to correct for nonresponse bias,[18] and a special age-at-onset probing strategy to reduce recall bias[6] to minimize the effects of methodological factors on the results. Nonetheless, residual effects of methodological factors are likely, based on the fact that longitudinal studies show that mental disorders are associated with early mortality[41] and the fact that resolved mental disorders reported in baseline interviews often are not reported in follow-up interviews.[42] To the extent that these biases are at work, the high prevalence found in the younger NCS-R cohorts might also apply to older cohorts.

Based on the considerations in the last paragraph, we suspect that NCS-R intercohort differences in age of onset are due to a combination of substantive and methodological factors. A more definitive evaluation will require longitudinal trend comparisons. Even before such data become available, though, the NCS-R results clearly document that mental disorders are highly prevalent, that lifetime prevalence is, if anything, underestimated, that age-of-onset distributions for most of the disorders considered herein are concentrated in a relatively narrow age range during the first two decades of life, and that later-onset disorders occur in large part as temporally secondary comorbid conditions. To the extent that cohort effects in the data are due to methodological factors, similar patterns might have occurred in earlier cohorts. Given the enormous personal and societal burdens of mental disorders, these observations should lead us to direct a greater part of our thinking about public health interventions to the child and adolescent years and, with appropriately balanced considerations of potential risks and benefits, to focus on early interventions aimed at preventing the progression of primary disorders and the onset of comorbid disorders.

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Correspondence: Ronald C. Kessler, PhD, Department of Health Care Policy, Harvard Medical School, 180 Longwood Ave, Boston, MA 02115 (kessler@hcp.med.harvard.edu).
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Additional Information: Collaborating investigators of the National Comorbidity Survey Replication include Ronald C. Kessler, PhD (principal investigator, Harvard Medical School, Boston, Mass), Kathleen Merikangas, PhD (coprincipal investigator, National Institute of Mental Health, Rockville, Md), Doreen Koretz, PhD (Harvard University, Cambridge, Mass), James Anthony, PhD, MSc (Michigan State University, Lansing), William Eaton, PhD (The Johns Hopkins University, Baltimore, Md), Meyer Glantz, PhD (National Institute on Drug Abuse), Jane McLeod, PhD (Indiana University, Bloomington), Mark Olfson, MD, PhD (Columbia University College of Physicians and Surgeons, New York, NY), Harold Pincus, MD (University of Pittsburgh, Pittsburgh, Pa), Greg Simon, MD (Group Health Cooperative, Seattle, Wash), Michael Von Korff, ScD (Group Health Cooperative), Philip Wang, MD, DrPH (Harvard Medical School), Kenneth Wells, MD, MPH (University of California, Los Angeles), Elaine Wethington, PhD (Cornell University, Ithaca, NY), and Hans-Ulrich Wittchen, PhD (Institute of Psychology, Technical University Dresden, Dresden, Germany, and Max Planck Institute of Psychiatry, Munich, Germany).
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Correction

Errors in Byline, Author Affiliations, and Acknowledgment. In the Original Article titled "Lifetime Prevalence and Age-of-Onset Distributions of *DSM-IV* Disorders in the National Comorbidity Survey Replication," published in the June issue of the ARCHIVES (2005;62: 593-602), an author's name was inadvertently omitted from the byline and author affiliations footnote on page 592, and another author's affiliation was listed incorrectly. The byline should have appeared as follows: "Ronald C. Kessler, PhD; Patricia Berglund, MBA; Olga Demler, MA, MS; Robert Jin, MA; Kathleen R. Merikangas, PhD; Ellen E. Walters, MS." The author affiliations footnote should have appeared as follows: "**Author Affiliations:** Department of Health Care Policy, Harvard Medical School, Boston, Mass (Dr Kessler; Mss Demler and Walters; and Mr Jin); Institute for Social Research, University of Michigan, Ann Arbor (Ms Berglund); and Section on Developmental Genetic Epidemiology, National Institute of Mental Health, Rockville, Md (Dr Merikangas)." On page 601, the first sentence of the acknowledgment should have appeared as follows: "The authors appreciate the helpful comments of William Eaton, PhD, and Michael Von Korff, ScD." Online versions of this article on the *Archives of General Psychiatry* Web site were corrected on June 10, 2005.