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Research Article

AGE DIFFERENCES IN THE PREVALENCE AND CO-MORBIDITY OF DSM-IV MAJOR DEPRESSIVE EPISODES: RESULTS FROM THE WHO WORLD MENTAL HEALTH SURVEY INITIATIVE

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Background: *Although depression appears to decrease in late life, this could be due to misattribution of depressive symptoms to physical disorders that increase in late life.* **Methods:** *We investigated this issue by studying age differences in co-morbidity of DSM-IV major depressive episodes (MDE) with chronic physical conditions in the WHO World Mental Health (WMH) surveys, a series of community epidemiological surveys of respondents in 10 developed countries (n = 52,485) and 8 developing countries (n = 37,265). MDE and other mental disorders were assessed with the Composite International Diagnostic Interview (CIDI). Organic exclusion rules were not used to avoid inappropriate exclusion of cases with physical co-morbidity. Physical conditions were assessed with a standard chronic conditions checklist.* **Results:** *Twelve-month DSM-IV/CIDI MDE was significantly less prevalent among respondents ages 65+ than younger respondents in developed but not developing*

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countries. Prevalence of co-morbid mental disorders generally either decreased or remained stable with age, while co-morbidity of MDE with mental disorders generally increased with age. Prevalence of physical conditions, in comparison, generally increased with age, while co-morbidity of MDE with physical conditions generally decreased with age. Depression treatment was lowest among the elderly in developed and developing countries. Conclusions: *The weakening associations between MDE and physical conditions with increasing age argue against the suggestion that the low estimated prevalence of MDE among the elderly is due to increased confounding with physical disorders. Future study is needed to investigate processes that might lead to a decreasing impact of physical illness on depression among the elderly. Depression and Anxiety 27:351–364, 2010.*

Key words: *elderly; depression; disability; co-morbidity; epidemiology*

INTRODUCTION

Community epidemiological surveys in developed countries consistently find that current prevalence of major depression decreases with age and is especially low among the elderly.[1–3] A number of methodological explanations have been proposed for this finding, suggesting that age-related differentials in mortality, selection out of the household population, willingness to participate in surveys, and willingness to admit psychiatric problems lead to downward bias in prevalence estimates among the elderly.[4,5] However, evidence for these methodological interpretations is weak,[6] leading some commentators to conclude that the prevalence of depression is genuinely low among the elderly.[2]

An important issue in studying late-life depression is that many physical disorders increase in old age, possibly resulting in depression being under-estimated because it is confused with the symptoms of physical disorders.[7] A complicating factor is that some somatic disorders that increase with age can induce depression,[8,9] while late-life depression can increase risk of some physical disorders.[10,11] In an effort to shed light on this issue, we analyzed data on age-related changes in the associations of physical disorders with DSM-IV major depressive episodes (MDE) in the World Health Organization (WHO) World Mental Health (WMH) surveys.[12] Parallel analyses were carried out for co-morbid DSM-IV mental disorders. MDE was defined without either organic exclusions or diagnostic hierarchy rules to facilitate investigation of co-morbidity. Our primary aims were to see whether the presumed decline in MDE prevalence with age is associated with co-morbidity. In studying co-morbidity, we focused on *associations* rather than *conditional prevalence*, as data already exist on age-related changes in prevalence[13–15] but not on age-related changes in associations. An examination of these

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associations is of interest because we would expect them to increase with age if the assessment of MDE is confounded by physical disorders. As a preliminary to these analyses, we also examined MDE prevalence by age as well as age differences in the ratios of recent to lifetime prevalence, age-of-onset distributions, and persistence-severity of 12-month MDE.

METHODS

SAMPLE

Data are presented for 17 countries, 10 classified by the World Bank developed (Belgium, France, Germany, Israel, Italy, Japan, Netherlands, New Zealand, Spain, and United States), and 8 developing (Brazil, Colombia, India, Lebanon, Mexico, South Africa, Ukraine, and Shenzhen in the People's Republic of China).[16] A total of 89,750 adults participated in the surveys 52,485 in developed and 37,265 in developing countries (Table 1). All surveys involved nationally representative household samples except Colombia and Mexico, which featured representative samples of urban areas. Weights were used to adjust for differential probabilities of selection and to match sample socio-demographic distributions with population distributions. The weighted average response rate across surveys was 71.8%, ranging from 45.9% in France to 98.6% in India. Other than in Israel and South Africa, where all respondents were administered the full interview, subsampling was used to reduce respondent burden by dividing the interview into two parts. All respondents completed Part I, which assessed core mental disorders. Part II assessed additional disorders and correlates and was administered to all Part I respondents who met criteria for any Part I disorder plus a probability subsample of other Part I respondents. Part II responses were weighted by the inverse of their probability of selection to adjust for differential selection. Further details about WMH survey methodology are presented elsewhere.[17]

MEASURES

Mental disorders. Mental disorders were assessed using the WHO Composite International Diagnostic Interview (CIDI) Version 3.0,[18] a fully structured lay-administered interview that generates diagnoses for commonly occurring DSM-IV mental disorders. In addition to MDE, these disorders included other mood (dysthymic disorder and bipolar disorder), anxiety (generalized anxiety disorder, panic disorder, agoraphobia without panic disorder, specific phobia, social phobia, post-traumatic stress disorder, adult separation anxiety disorder), substance (alcohol and drug abuse with and without dependence), and intermittent explosive disorder. Blinded clinical reappraisal interviews using the Structured Clinical Interview for DSM-IV (SCID)[19] with a probability subsample of WMH survey respondents from four countries found generally good concordance between diagnoses based on the CIDI and those based on the SCID.[20] DSM-IV/CIDI disorders were defined without organic exclusions and without diagnostic hierarchy rules in order to facilitate analysis of co-morbidity. Although no comparisons were made of differences in diagnoses with and without these exclusions, previous WMH analyses suggest that such differences are slight.[15]

MDE course was examined using retrospectively reported data on age-of-onset, number of lifetime episodes, and number of weeks in episode in the past 12 months. MDE clinical severity was assessed among 12-month cases using the Quick Inventory of Depressive Symptomatology Self-Report (QIDS).[21] Standard QIDS cut-points were used to define episodes as severe, moderate, mild, or not clinically significant. Role impairment among 12-month cases was assessed using the Sheehan Disability Scale (SDS),[22] which asks respondents to rate how much their 12-month depression interferes with their home management, work performance, social life, and personal relationships on a 0–10 visual analogue scale with response anchors of none (0), mild (1–3), moderate (4–6), severe (7–9), and very severe (10). Both the QIDS and the SDS assessed severity for the one month in the past year when symptoms were most severe. Respondents with 12-month MDE were also asked to estimate the number of days out of 365 in the past year they were totally unable to work or carry out their other usual daily activities because of their depression.

Co-morbid physical disorders. Physical disorders were assessed with a standard chronic conditions checklist containing 14 conditions based on the list in the US National Health Interview Survey.[23,24] Such checklists are widely used in epidemiological studies and yield more accurate reports than open-ended questions.[25] Good concordance has been documented between condition reports based on such checklists and medical records.[26–28] The 14 physical conditions considered here include cardiovascular (heart attack, hypertension, other heart disease, stroke), musculoskeletal (arthritis/rheumatism, chronic back/neck problems), respiratory (seasonal allergies, asthma, other chronic lung disease such as chronic obstructive pulmonary disorder and tuberculosis), and pain (frequent/severe headaches, other chronic pain conditions) along with cancer, diabetes, and ulcers. Although respondents reported the presence of each condition in their lifetime and during the past 12 months, we focus on disorders present in the past 12 months.

Depression treatment. Respondents were asked about treatment obtained at any time in the 12 months before interview for problems with emotions, nerves, or substance use. We examine treatment among respondents with 12-month DSM-IV/CIDI MDE separately in the specialty sector (psychiatrist or other mental health professional), general medical sector (MD or non-MD health professional excluding mental health professionals), human services sector (religious counselors, social workers seen in a human services setting), and the complementary-alternative medical (CAM) sector (e.g., self-help groups, faith healers, traditional healers).

ANALYSIS METHODS

Age differences in prevalence, course, severity, and treatment of MDE were examined using cross-tabulations and mean comparisons. Multiple regression analysis with both linear and logistic link functions was used to study co-morbidity of MDE with other physical and mental disorders. Regression equations were estimated separately in four age groups (18–34, 35–49, 50–64, and 65+) in developed and developing countries. These equations included covariates for sex, income, employment status (employed/self-employed, student, homemaker, retired, and disabled/unemployed), and marital status (married, previously married, and never married). Wald χ^2 tests (logistic regressions) and *F*-tests (linear regressions) were used to evaluate the significance of interactions. We also evaluated whether the conditional prevalence of co-morbid disorders among people with MDE varies with age. Because the data are weighted and clustered, the Taylor series linearization method[29] implemented in the SUDAAN software package[30] was used to estimate standard errors. Statistical significance was evaluated using .05-level two-sided tests.

RESULTS

PREVALENCE

The estimated 12-month prevalence of MDE is 5.5% in developed countries and 5.9% in developing countries (Table 2). These estimates vary significantly

TABLE 1. World Mental Health (MH) survey sample characteristics

Country	Survey[a]	Sample characteristics[b]	Field dates	Age range	Sample size			Response rate[c]
					Part I	Part II	Part II and Age ≤44[d]	
I. Developed								
Belgium	ESEMeD	Stratified multistage clustered probability sample of individuals residing in households from the national register of Belgium residents. NR	2001–2002	18+	2419	1043	486	50.6
France	ESEMeD	Stratified multistage clustered sample of working telephone numbers merged with a reverse directory (for listed numbers) Initial recruitment was by telephone, with supplemental in-person recruitment in households with listed numbers. NR	2001–2002	18+	2894	1436	727	45.9
Germany	ESEMeD	Stratified multistage clustered probability sample of individuals from community resident registries. NR	2002–2003	18+	3555	1323	621	57.8
Israel	NHS	Stratified multistage clustered area probability sample of individuals from a national resident register. NR	2002–2004	21+	4859	4859	–	72.6
Italy	ESEMeD	Stratified multistage clustered probability sample of individuals from municipality resident registries. NR	2001–2002	18+	4712	1779	853	71.3
Japan	WMHJ 2002–2006	Un-clustered two-stage probability sample of individuals residing in households in nine metropolitan areas (Fukiage, Higashi-ichiki, Ichiki, Kushikino, Nagasaki, Okayama, Sano, Tamano, Tendo, and Tochigi)	2002–2006	20+	4129	1682	547	59.2
Netherlands	ESEMeD	Stratified multistage clustered probability sample of individuals residing in households that are listed in municipal postal registries. NR	2002–2003	18+	2372	1094	516	56.4
New Zealand[e]	NZMHS	Stratified multistage clustered area probability sample of household residents. NR	2004–2005	18+	12790	7312	4119	73.3
Spain	ESEMeD	Stratified multistage clustered area probability sample of household residents. NR	2001–2002	18+	5473	2121	960	78.6
United States	NCS-R	Stratified multistage clustered area probability sample of household residents. NR	2002–2003	18+	9282	5692	3197	70.9
II. Developing								
Brazil	São Paulo Megacity	Stratified multistage clustered area probability sample of household residents in the São Paulo metropolitan area	2004–2007	18+	5037	2942	–	81.3

Colombia	NSMH	Stratified multistage clustered area probability sample of household residents in all urban areas of the country (approximately 73% of the total national population)	2003	18–65	4426	2381	1731	87.7
India	WMHI	Stratified multistage clustered area probability sample of household residents in Pondicherry region. NR	2003–2005	18+	2992	1373	642	98.6
Lebanon	LEBANON	Stratified multistage clustered area probability sample of household residents. NR	2002–2003	18+	2857	1031	595	70.0
Mexico	M-NCS	Stratified multistage clustered area probability sample of household residents in all urban areas of the country (approximately 75% of the total national population)	2001–2002	18–65	5782	2362	1736	76.6
South Africa	SASH	Stratified multistage clustered area probability sample of household residents. NR	2003–2004	18+	4315	4315	–	87.1
Ukraine	CMDPSD	Stratified multistage clustered area probability sample of household residents. NR	2002	18+	4724	1719	540	78.3
PRC	Shenzhen	Stratified multistage clustered area probability sample of household residents and temporary residents in the Shenzhen area	2006–2007	18+	7132	2475	1994	80.0

[a]ESEMeD (The European Study of the Epidemiology of Mental Disorders); NHS (Israel National Health Survey); WMHJ2002–2006 (World Mental Health Japan Survey); NZMHS (New Zealand Mental Health Survey); NCS-R (The US National Co-morbidity Survey Replication); NSMH (The Colombian National Study of Mental Health); WMHI (World Mental Health India); LEBANON (Lebanese Evaluation of the Burden of Ailments and Needs of the Nation); M-NCS (The Mexico National Co-morbidity Survey); SASH (South Africa Stress and Health Study); CMDPSD (Co-morbid Mental Disorders during Periods of Social Disruption).

[b]Most WMH surveys are based on stratified multistage clustered area probability household samples in which samples of areas equivalent to counties or municipalities in the US were selected in the first stage followed by one or more subsequent stages of geographic sampling (e.g., towns within counties, blocks within towns, households within blocks) to arrive at a sample of households, in each of which a listing of household members was created and one or two people were selected from this listing to be interviewed. No substitution was allowed when the originally sampled household resident could not be interviewed. These household samples were selected from Census area data in all countries other than France (where telephone directories were used to select households) and the Netherlands (where postal registries were used to select households). Several WMH surveys (Belgium, Germany, Italy) used municipal resident registries to select respondents without listing households. The Japanese sample is the only totally un-clustered sample, with households randomly selected in each of the four sample areas and one random respondent selected in each sample household. 14 of the 17 surveys are based on nationally representative (NR) household samples, while two others are based on nationally representative household samples in urbanized areas (Colombia, Mexico).

[c]The response rate is calculated as the ratio of the number of households in which an interview was completed to the number of households originally sampled, excluding from the denominator households known not to be eligible either because of being vacant at the time of initial contact or because the residents were unable to speak the designated languages of the survey. The weighted average response rate for all countries included is 71.1%.

[d]Brazil, Israel, and South Africa did not have an age restricted Part II sample. All other countries, with the exception of India and Ukraine (which were age restricted to 39) were age restricted to 44.

[e]New Zealand response rate is calculated on the entire survey sample size, which was of respondents age 16+ totaling 12,992. For purposes of this analysis we only used respondents aged 18+.

TABLE 2. Twelve-month prevalence of DSM-IV/CIDI MDE by country and age

	Age groups										
	All ages		18–34		35–49		50–64		65+		
	%	(se)	%	(se)	%	(se)	%	(se)	%	(se)	Age difference χ^2_3
I. Developed											
Belgium	5.0	(0.5)	6.1	(1.8)	5.2	(0.9)	5.8	(1.4)	2.4	(0.7)	9.1*
France	5.9	(0.6)	8.3	(1.4)	6.0	(0.9)	5.6	(1.2)	2.5	(0.8)	19.1*
Germany	3.0	(0.3)	4.7	(0.8)	2.8	(0.5)	2.9	(0.7)	1.3	(0.4)	13.5*
Israel[a]	6.1	(0.4)	6.3	(0.6)	5.7	(0.7)	6.2	(0.8)	6.0	(0.9)	0.5
Italy	3.0	(0.2)	2.8	(0.4)	2.3	(0.4)	3.8	(0.6)	3.3	(0.7)	6.2
Japan	2.2	(0.4)	4.0	(1.0)	2.1	(0.6)	2.1	(0.5)	1.0	(0.4)	10.8*
Netherlands	4.9	(0.5)	5.9	(1.1)	5.7	(1.2)	4.3	(0.9)	2.4	(0.7)	9.2*
New Zealand[a]	6.6	(0.3)	9.9	(1.1)	7.6	(0.5)	5.8	(0.5)	1.8	(0.3)	138.1*
Spain	4.0	(0.3)	3.6	(0.7)	3.8	(0.5)	5.4	(0.7)	3.6	(0.6)	6.5
United States	8.3	(0.3)	10.4	(0.5)	9.4	(0.5)	7.7	(0.7)	2.6	(0.4)	103.5*
Combined	5.5	(0.1)	7.0	(0.3)	6.0	(0.2)	5.1	(0.2)	2.6	(0.2)	150.2*
II. Developing											
Brazil	10.4	(0.6)	10.9	(0.7)	11.8	(1.2)	9.1	(1.1)	3.9	(1.1)	36.1*
Colombia[b]	6.2	(0.4)	7.6	(0.9)	5.5	(0.7)	4.8	(1.0)	5.9	(1.0)	5.3
India	4.5	(0.4)	2.2	(0.3)	6.3	(0.8)	7.9	(1.2)	5.2	(1.6)	33.0*
Lebanon	5.5	(0.7)	5.2	(1.1)	6.6	(1.1)	5.8	(1.0)	3.1	(1.1)	6.1
Mexico[b]	4.0	(0.3)	3.7	(0.5)	3.7	(0.4)	4.6	(0.9)	5.2	(0.8)	6.3
South Africa	4.9	(0.4)	4.5	(0.6)	5.4	(0.9)	5.6	(1.0)	3.5	(1.1)	3.0
Ukraine	8.4	(0.6)	6.0	(0.7)	6.7	(0.8)	10.1	(1.1)	13.0	(1.7)	21.2*
Combined	5.9	(0.2)	5.3	(0.2)	6.2	(0.3)	6.8	(0.4)	7.5	(0.8)	2.2

*Significant age difference at the .05-level, two-sided test.

[a]The lower end of the age range was 16 in New Zealand and 21 in Israel.

[b]The upper end of the age range was 65 in Colombia and Mexico. As a result, the age groups used in these countries was 18–29, 30–44, 45–54, 55+.

across the four age groups in developed ($\chi^2_3 = 150.2$, $P<.001$) but not developing ($\chi^2_3 = 2.2$, $P=.52$) countries. The significant association in developed countries is due to highest prevalence in the youngest age group (18–34; 7.0%) and lowest in the oldest age group (65+; 2.6%). This pattern is statistically significant in 7 of the 10 developed countries. The exceptions are Israel, Italy, and Spain, all with insignificant age-MDE associations ($\chi^4_3 = 0.5-6.5$, $P=.09-.91$). The association is also insignificant in four of the seven developing countries (Colombia, Lebanon, Mexico, South Africa; $\chi^2_3 = 3.0-6.3$, $P=.10-.39$). In one of the other three (Brazil), the pattern is similar to developed countries, with highest prevalence in the youngest age group and lowest in the oldest age group (10.9% vs. 3.9%, $\chi^2_3 = 36.1$, $P<.001$). An opposite pattern is found in one other developing country (Ukraine), with lowest prevalence among the young and highest among the old (6.0% vs. 13.0%, $\chi^2_3 = 21.2$, $P<.001$). The age trend is significant but not monotonic, in the remaining developing country (India) ($\chi^2_3 = 33.0$, $P<.001$).

AGE-OF-ONSET, COURSE, AND SEVERITY OF MDE

Retrospectively reported MDE age-of-onset (AOO) varies significantly with age in both developed ($\chi^2_3 = 3717.2$, $P<.001$) and developing ($\chi^2_3 = 1596.3$, $P<.001$) countries, with mean AOO increasing monotonically from youngest (19.1–19.3) to oldest (46.3–40.3) age groups (Table 3). The difference between mean age-at-interview and mean AOO of MDE in each age group also increases consistently with age. This is important because it is what we would expect based on substantive processes and argues against a methodological interpretation of the age differences, as methodological confounding would be expected to cause the difference between age-at-interview and AOO to remain constant with age.[31] Mean number of lifetime episodes of MDE among respondents with a lifetime history also increases monotonically with age ($\chi^2_3 = 21.3-36.1$, $P<.001$). Country-specific analyses (not shown, but available on request) find similar age-related patterns of onset-course in each country.

The mean self-reported duration of MDE (in weeks) in the 12 months before interview among 12-month cases increases monotonically from youngest to oldest ages in both developed (25.3 vs. 31.7, $F_{3,2,969} = 4.8$, $P=.002$) and developing (23.1 vs. 33.8, $F_{3,2,289} = 3.6$, $P=.013$) countries. The relationship between age and severity of 12-month MDE, however, differs both by type of country and type of measure. Clinical severity, as assessed by the QIDS, varies inversely with age in developed countries ($\chi^2_3 = 15.2$, $P=.002$), with the percent classified clinically severe lower in the

TABLE 3. Dimensions of DSM-IV/CIDI MDE lifetime onset-course and 12-month persistence-severity by age among WMH respondents with MDE

	Age groups										
	All ages		18–34		35–49		50–64		65+		
	Est	(se)	Est	(se)	Est	(se)	Est	(se)	Est	(se)	Age difference F/χ^{2c}
I. Developed											
A. Lifetime onset and course											
Mean age of onset	28.9	(0.2)	19.1	(0.1)	27.6	(0.3)	35.6	(0.3)	46.3	(0.7)	3717.2*
Mean number of lifetime episodes	14.8	(0.7)	11.0	(1.0)	14.3	(1.0)	18.1	(1.7)	21.9	(3.6)	21.3*
(*n*)	(7,917)		(2,325)		(2,764)		(1,890)		(938)		
B. Twelve-month persistence and severity											
Mean 12-month duration (in weeks)	27.0	(0.5)	25.3	(0.8)	27.2	(0.8)	28.9	(1.1)	31.7	(1.8)	4.8*
Clinically severe (%)[a]	33.9	(1.0)	34.7	(1.7)	39.7	(1.7)	29.6	(2.3)	19.6	(2.8)	15.2*
Severe role impairment (%)[b]	65.8	(1.3)	65.3	(2.0)	68.2	(2.2)	66.2	(3.2)	54.8	(4.7)	12.4*
Mean days out of role	48.3	(1.4)	49.2	(2.2)	52.5	(2.3)	46.4	(3.5)	25.5	(4.4)	12.4*
(*n*)	(2,973)		(1,079)		(990)		(625)		(279)		
II. Developing											
A. Lifetime onset and course											
Mean age of onset	27.2	(0.2)	19.3	(0.2)	29.1	(0.3)	38.5	(0.6)	40.3	(1.1)	1596.3*
Mean number of lifetime episodes	10.9	(0.9)	5.7	(0.5)	9.7	(1.3)	13.8	(1.9)	35.3	(6.7)	36.1*
(*n*)	(4,365)		(1,640)		(1,455)		(885)		(385)		
B. Twelve-month persistence and severity											
Mean 12-month duration (in weeks)	26.0	(0.7)	23.1	(1.1)	25.4	(1.1)	29.2	(1.2)	33.8	(2.3)	3.6*
Clinically severe (%)[a]	41.8	(1.2)	38.3	(1.8)	47.8	(2.5)	43.7	(2.8)	36.8	(3.5)	3.7
Severe role impairment (%)[b]	49.3	(1.6)	49.3	(2.8)	53.1	(2.6)	46.4	(2.7)	42.7	(3.7)	11.4*
Mean days out of role	25.3	(2.1)	16.0	(2.6)	25.0	(3.5)	34.9	(5.4)	50.4	(6.3)	3.6*
(*n*)	(2,293)		(898)		(732)		(455)		(208)		

*Significant age difference at the .05 level, two-sided test.

[a]The percent of cases whose depression was classified either severe or very severe on the self-report version of the Quick Inventory of Depressive Symptomatology.[21]

[b]The percent of cases whose depression-related role impairment was classified either severe or very severe on any dimension of the Sheehan Disability Scales.[22]

[c]Significance was evaluated with an *F* test for the means (age of onset, mean number of lifetime episodes, mean duration) and a χ^2 test for the proportions (the percent of cases classified clinically mild, clinically severe, and having severe role impairment). The χ^2 tests all have 3 degrees of freedom, while the *F* tests have 3 and 7,913 degrees of freedom in developed countries and 3 and 4,361 in developing countries for lifetime means and 3 and 2,969 degrees of freedom in developed countries and 2,289 degrees of freedom in developing countries for 12-month means.

65+ age group (19.6%) than younger age groups (29.6–39.7%). Clinical severity does not vary with age, in comparison, in developing countries ($\chi^2_3 = 3.7$, $P = .296$), although the proportion of 12-month cases rating their recent MDE as causing severe role impairment varies inversely with age in both developed (65.3% vs. 54.8%, $\chi^2_3 = 12.4$, $P = .006$) and developing (49.3% vs. 42.7%, $\chi^2_3 = 11.4$, $P = .010$) countries. Mean number of days out of role in the past year due to MDE among 12-month cases is lowest in the oldest age group in developed countries (25.5 vs. 46.4–52.5, $F_{3,2,969} = 12.4$, $P = .006$), but highest in the oldest age group in developing countries (50.4 vs. 16.0–34.9, $F_{3,2,289} = 3.6$, $P = .013$).

CO-MORBIDITY OF 12-MONTH MDE WITH OTHER 12-MONTH DSM-IV DISORDERS

All 14 12-month DSM-IV disorders considered here are significantly and positively associated with 12-month MDE in the total sample in both developed and developing countries and in both linear and logistic regression models. (Detailed results are not reported, but are available on request.) There is a general tendency for odds-ratios (ORs) of MDE with classes of 12-month co-morbid DSM-IV/CIDI disorders (i.e., mood, anxiety, and substance disorders) and with numbers of such disorders to increase with age (Table 4). More disaggregated analyses (results not reported, but available on request) show that ORs of 12-month MDE with co-morbid 12-month disorders vary significantly with age for six of the 14 co-morbid disorders in developed countries, in four of which the OR is highest in the oldest age group (bipolar disorder, generalized anxiety disorder, PTSD, and panic disorder), and for five of the 14 co-morbid disorders in developing countries, in two of which the OR is highest in the oldest age group (dysthymia and adult separation anxiety disorder).

Despite the ORs generally increasing with age, the conditional prevalence of co-morbid mental disorders

TABLE 4. Twelve-month co-morbidity (odds-ratios) of DSM-IV/CIDI MDE with other 12-month DSM-IV/CIDI disorders by age[a]

	Age groups										Age difference[b]	
	All ages		18–34		35–49		50–64		65+		%	OR
	%[c] (se)	OR[c] (CI)	%[c] (se)	OR[c] (CI)	%[c] (se)	OR[c] (CI)	%[c] (se)	OR[c] (CI)	%[c] (se)	OR[c] (CI)	χ^2_3	
I. Developed												
Any other mood disorder[d]	29.8 (1.0)	43.7* (36.8–51.8)	24.7 (1.6)	20.8* (15.8–27.3)	31.6 (1.8)	43.9* (32.6–59.0)	36.7 (2.1)	96.0* (67.4–136.8)	30.1 (3.1)	93.8* (57.4–153.3)	22.0*	59.4*
Any anxiety disorder[d]	49.7 (1.2)	9.3* (8.4–10.3)	47.7 (1.8)	6.9* (5.8–8.2)	54.0 (1.8)	8.9* (7.4–10.6)	49.7 (2.4)	10.1* (8.1–12.7)	43.5 (3.7)	15.9* (11.1–22.8)	5.6	11.5*
Any substance disorder[d]	8.6 (0.8)	4.2* (3.5–5.1)	14.6 (1.5)	3.7* (2.8–4.8)	6.8 (1.0)	3.6* (2.6–5.0)	2.0 (0.6)	3.1* (1.6–5.9)	0.2 (0.2)	9.2 (0.7–129.0)	29.6*	2.1
Any DSM-IV/CIDI disorder[d]	62.0 (1.2)	12.6* (11.3–14.1)	60.2 (1.9)	8.2* (6.8–9.9)	66.1 (1.9)	12.9* (10.7–15.7)	61.1 (2.3)	15.0* (11.9–18.8)	57.1 (3.7)	25.9* (18.3–36.7)	3.4	28.4*
Number of co-morbid DSM-IV/CIDI disorders												
One[e]	27.7 (1.1)	7.8* (6.8–8.9)	27.1 (1.7)	5.4* (4.3–6.7)	28.7 (1.8)	8.0* (6.4–10.1)	24.1 (2.2)	7.5* (5.6–9.9)	35.0 (3.3)	18.2* (12.4–26.5)	3.7	23.5*
Two[e]	15.9 (0.8)	21.2* (18.0–25.1)	14.2 (1.3)	11.1* (8.3–14.8)	17.2 (1.4)	20.7* (15.5–27.7)	17.8 (1.9)	34.7* (24.0-50.2)	14.5 (2.2)	80.5* (47.3–136.9)	5.0	43.4*
Three or more[e]	18.7 (0.9)	55.4* (45.8–67.0)	19.5 (1.4)	32.6* (24.5–43.3)	20.2 (1.5)	50.5* (36.8–69.2)	19.4 (2.0)	86.6* (57.5–130.4)	7.7 (2.0)	118.8* (41.9–336.6)	10.5*	14.4*
(*n*)		(2,948)		(1,070)		(982)		(620)		(276)		
II. Developing												
Any other mood disorder[d]	22.9 (1.2)	45.4* (36.6–56.5)	20.5 (1.7)	32.8* (24.1–44.7)	20.5 (1.9)	42.3* (27.3–65.4)	23.5 (2.2)	86.1* (42.2–175.8)	45.2 (3.8)	198.6* (106.2–371.5)	18.0*	33.8*
Any anxiety disorder[d]	38.9 (1.3)	5.9* (5.2–6.8)	38.4 (2.3)	5.9* (4.7–7.5)	40.5 (2.5)	5.5* (4.3–6.9)	41.1 (3.2)	6.5* (4.7–9.0)	29.8 (3.9)	5.7* (3.5–9.4)	1.2	1.0
Any substance disorder[d]	7.5 (0.8)	3.5* (2.7–4.5)	8.6 (1.3)	3.6* (2.5–5.2)	8.1 (1.5)	3.5* (2.2–5.6)	4.3 (1.2)	2.3* (1.2–4.5)	3.3 (1.5)	3.5* (1.1–10.9)	23.2*	1.7
Any DSM-IV/CIDI disorder[d]	56.3 (1.5)	8.1* (7.1–9.4)	56.8 (2.5)	8.1* (6.5–10.1)	54.5 (2.3)	7.0* (5.6–8.7)	55.6 (3.5)	8.4* (6.1–11.5)	62.0 (4.6)	15.7* (10.1–24.2)	3.4	8.7*
Number of co-morbid disorders												
One[e]	30.9 (1.3)	5.7* (4.8–6.7)	30.2 (2.2)	5.6* (4.3–7.2)	27.6 (2.0)	4.6* (3.7–5.8)	34.1 (3.0)	6.3* (4.4–9.1)	41.5 (3.9)	11.7* (7.5–18.2)	3.5	12.2*
Two[e]	14.1 (0.9)	14.1* (11.1–17.7)	15.4 (1.7)	14.4* (10.2–20.4)	12.8 (1.4)	11.1* (8.0–15.4)	14.0 (1.7)	14.9* (9.0–24.5)	11.7 (2.7)	33.3* (14.9–74.4)	1.8	3.8
Three or more[e]	11.3 (0.8)	28.5* (21.5–37.8)	11.2 (1.3)	28.0* (19.5–40.3)	14.1 (1.8)	24.2* (14.4–40.7)	7.6 (1.4)	27.0* (13.1–55.8)	8.8 (2.3)	146.8* (43.5–495.6)	8.0*	171.4*
(*n*)		(2,231)		(877)		(716)		(440)		(198)		

*Significant at the .05 level, two-sided test.

[a]The results in this table are based on a series of multivariate logistic regression equations in which a dichotomous predictor for a single 12-month co-morbid disorder was used to predict a dichotomous measure of 12-month MDE controlling for respondent sex, education, and marital status.

[b]Entries in the % columns represent the conditional prevalence estimate (and standard error of that estimate) of each co-morbid disorder among respondents with 12-month MDE. Entries in the OR columns represent the odds-ratio (OR) and 95% Confidence Interval (95% CI) of the OR between MDE and the co-morbid disorder estimated in the logistic regression equation.

[c]The χ^2 tests in the Age Differences columns test the statistical significance of age differences in conditional prevalence of the co-morbid disorders among respondents with MDE (%) and of the ORs between MDE and the co-morbid disorders (OR). The tests are 2 degree of freedom tests in the case of the disorders where prevalence in the 65+ subsample was zero (agoraphobia, adult separation anxiety disorder, and substance disorders).

[d]Other mood disorders include dysthymia and bipolar disorder; Anxiety disorders include panic disorder, generalized anxiety disorder, agoraphobia without panic, specific phobia, social phobia, posttraumatic stress disorder, and adult separation anxiety disorder; Substance disorders include alcohol abuse, alcohol dependence, substance abuse, and substance dependence; Any disorder includes all mood, anxiety, and substance disorders and intermittent explosive disorder.

[e]The ORs associated with number of co-morbid disorders are based on a single equation in each age group to predict 12-month MDE from three dichotomies for one, two, and three or more co-morbid disorders in comparison to the contrast category of no such disorders. As with the other equations, controls were included for sex, education, and marital status.

among people with 12-month MDE generally either remains stable or decreases with age. These differences between logistic and linear regression results are due to a methodological fact: that ORs can be large even when the proportions of people with a co-morbid disorder are small. It is consequently useful to examine patterns of co-morbidity based not only on logistic regression equations but also on linear regression equations. This analysis (detailed results are not shown, but are available on request) showed that even though the ORs of MDE with co-morbid mental disorders generally increase with age, age-related *differences* in prevalence of these disorders between respondents with vs. without MDE are much less consistent. Linear regression coefficients of MDE with co-morbid mental disorders are predominantly lowest among the oldest respondents (9 of 14 disorders, four of them significant: dysthymia, specific phobia, alcohol abuse with dependence, drug abuse with dependence) in developed countries, but as likely to be highest (6 of 14 disorders, two of them significant: bipolar disorder, adult separation anxiety disorder) as lowest (5 of the other 14 disorders, two of them significant: specific phobia, drug abuse) among the oldest respondents in developing countries.

CO-MORBIDITY OF 12-MONTH MDE WITH 12-MONTH CHRONIC PHYSICAL DISORDERS

As with mental disorders, all 14 physical conditions are positively related to MDE in linear models in both developed (12 statistically significant) and developing (all 14 significant) countries. (Detailed results are not presented, but are available on request.) Eleven of the 14 are also positively related to MDE in logistic models in developed countries (eight significant) and 13 of the 14 in developing countries (12 significant). A similar pattern exists for both aggregated classes and numbers of co-morbid physical conditions, where 18 of 22 associations are positive (17 statistically significant) (Table 5). However, unlike the situation with co-morbid mental disorders, where ORs generally increase with age, ORs of MDE with physical conditions generally are unrelated to age. The differences that do exist usually reflect the OR being lowest rather than highest in the oldest age groups.

A similar pattern can be seen in the linear regression results in developed countries (results not shown, but available on request), where prevalence differences in co-morbid physical conditions between people with vs. without MDE consistently (13 of 14 conditions) decrease with age (8 statistically significant). This pattern is less consistent in developing countries, where the prevalence difference is lower with increasing age for only five conditions and none of these is statistically significant. These decreasing associations with age occur despite the fact that conditional prevalence of physical conditions among people with MDE consistently increases with age in both developed and developing countries. This increase is statistically significant for 10 of 14 co-morbid conditions (the exceptions being seasonal allergies, asthma, ulcers, and headaches, for none of which is there a meaningful age difference) in developed countries. In developing countries, this increase is statistically significant for 9 of 14 co-morbid conditions (the exceptions being stroke, seasonal allergies, asthma, chronic pains and headaches).

AGE-RELATED DIFFERENCES IN TREATMENT OF 12-MONTH MDE

Approximately half (54.3%) of respondents with 12-month MDE in developed countries and one-quarter (25.2%) in developing countries reported receiving some type of treatment for emotional problems in the year before interview (Table 6). The proportion that received treatment varies significantly with age in developed countries ($\chi^2_3 = 34.9$, $P<.001$) and is lowest in the oldest age group (44.0% vs. 48.4–61.7%). This pattern of under-treatment can be seen in the youngest age group as well as in the oldest, although the pattern in the oldest age group is more pronounced than in the youngest age group when we focus on the specialty sector.

DISCUSSION

The above results must be interpreted in the context of several limitations: First, individuals with severe physical or neurocognitive impairment may have been less likely to participate, presumably reducing our estimates of the associations between MDE and physical conditions more among elderly than younger respondents. Second, physical conditions were assessed with a checklist, whereas mental disorders were assessed with a comprehensive diagnostic interview. This could have led to greater attenuation of estimated associations involving physical than mental disorders. It also reduced our ability to investigate specific patterns of co-morbidity in the detail needed to generate insights into the causal dynamics underlying these associations. Future studies will need to use more precise measures of physical disorders to address this problem. Third, the fact that the assessments were made with fully structured interviews rather than clinical interviews might have artificially inflated estimates of co-morbidity between diagnoses of MDE and the other disorders due to overlap in core symptoms (e.g., lethargy and insomnia), although we tried to minimize this problem by not using organic exclusion rules in making diagnoses of mental disorders.

Notwithstanding these limitations, our results are consistent with previous studies in showing that recent MDE is less prevalent among older than younger respondents in developed countries.[2,32] The finding

TABLE 5. Twelve-month co-morbidity (odds-ratios) of DSM-IV/CIDI MDE with chronic physical disorders by age[a]

	Age groups										Age difference[b]	
	All ages		18–34		35–49		50–64		65+		%	OR
	%[c] (se)	OR[c] (CI)	%[c] (se)	OR[c] (CI)	%[c] (se)	OR[c] (CI)	%[c] (se)	OR[c] (CI)	%[c] (se)	OR[c] (CI)	χ^2_3	
I. Developed												
Cardiovascular[d]	19.5 (1.0)	1.0 (0.9–1.2)	5.8 (1.0)	2.2* (1.5–3.3)	14.1 (1.5)	1.4* (1.1–1.8)	39.4 (2.5)	1.5* (1.2–1.9)	58.0 (3.5)	1.4* (1.0–1.9)	177.9*	4.4
Musculoskeletal[d]	41.2 (1.2)	1.7* (1.6–1.9)	25.1 (1.7)	2.0* (1.6–2.4)	44.3 (2.0)	2.2* (1.8–2.6)	57.0 (2.4)	2.0* (1.7–2.5)	68.7 (3.2)	2.3* (1.6–3.1)	117.6*	1.4
Respiratory[d]	33.4 (1.2)	1.5* (1.4–1.7)	33.7 (1.8)	1.4* (1.1–1.6)	35.3 (1.9)	1.6* (1.3–1.9)	33.1 (2.4)	1.7* (1.4–2.2)	25.2 (3.1)	1.4 (1.0–2.0)	1.9	2.3
Pain conditions[d]	13.2 (0.7)	2.3* (2.0–2.7)	8.8 (1.0)	2.2* (1.6–2.8)	12.9 (1.2)	2.4* (1.9–3.1)	19.8 (2.1)	2.9* (2.2–3.9)	19.8 (2.8)	2.3* (1.5–3.4)	21.2*	1.4
Cancer	4.0 (0.4)	0.9 (0.7–1.1)	1.4 (0.3)	1.9* (1.0–3.4)	4.1 (0.8)	1.6* (1.0–2.5)	6.4 (1.2)	1.1 (0.7–1.7)	9.9 (2.2)	1.1 (0.6–1.8)	23.9*	7.4
Diabetes	5.2 (0.6)	1.0 (0.8–1.3)	0.9 (0.3)	1.0 (0.6–1.8)	3.9 (0.8)	1.5 (0.9–2.3)	10.8 (1.6)	1.3 (0.9–1.8)	17.3 (3.1)	1.4 (0.9–2.1)	45.4*	1.1
Ulcers	4.2 (0.5)	2.2* (1.7–2.8)	2.6 (0.6)	2.4* (1.3–4.3)	5.2 (0.8)	2.5* (1.7–3.7)	5.5 (1.1)	2.1* (1.4–3.4)	5.7 (1.5)	1.6 (0.8–2.9)	4.1	0.8
Number of disorders												
Any	71.5 (1.1)	1.9* (1.7–2.1)	61.2 (1.9)	2.0* (1.7–2.4)	73.8 (1.8)	2.4* (1.9–2.9)	81.7 (2.1)	2.1* (1.6–2.8)	87.9 (2.2)	2.0* (1.2–3.1)	55.7*	2.4
One[e]	24.0 (1.0)	1.4* (1.2–1.6)	26.2 (1.7)	1.5* (1.2–1.8)	27.8 (1.8)	1.8* (1.4–2.3)	18.8 (2.0)	1.3 (0.9–1.8)	11.3 (2.1)	0.8 (0.5–1.5)	10.6*	9.5*
Two[e]	19.6 (0.9)	1.9* (1.6–2.2)	19.6 (1.5)	2.2* (1.8–2.8)	19.3 (1.6)	2.2* (1.7–2.9)	19.3 (2.0)	1.8* (1.3–2.6)	21.1 (3.0)	1.8* (1.1–3.1)	21.6*	3.8
Three or more[e]	28.0 (1.1)	2.7* (2.4–3.2)	15.5 (1.3)	3.6* (2.8–4.8)	26.7 (1.9)	3.9* (3.1–5.1)	43.6 (2.5)	3.6* (2.6–4.9)	55.6 (3.6)	3.0* (1.9–4.9)	107.8*	3.4
(*n*)	(2,948)		(1,070)		(982)		(620)		(276)			
II. Developing												
Cardiovascular[d]	22.4 (1.0)	1.4* (1.2–1.6)	8.5 (0.9)	1.8* (1.3–2.5)	23.8 (2.4)	1.4* (1.1–1.9)	50.0 (3.1)	1.5* (1.1–2.0)	66.5 (3.7)	1.8* (1.2–2.7)	93.7*	1.3
Musculoskeletal[d]	43.2 (1.7)	2.2* (1.9–2.6)	33.3 (2.6)	2.7* (2.1–3.5)	46.8 (2.8)	2.2* (1.8–2.8)	57.2 (3.0)	1.5* (1.1–2.1)	75.8 (3.5)	2.3* (1.5–3.6)	24.0*	8.4*
Respiratory[d]	21.6 (1.4)	1.7* (1.4–2.1)	20.2 (2.7)	1.7* (1.2–2.6)	22.6 (2.4)	1.7* (1.2–2.2)	22.9 (3.2)	1.6* (1.0–2.3)	25.7 (4.8)	1.8* (1.1–2.9)	1.8	0.5
Pain conditions	19.5 (1.3)	2.4* (2.0–2.9)	15.1 (1.6)	2.7* (2.1–3.6)	21.3 (2.1)	2.4* (1.8–3.2)	25.9 (2.6)	2.1* (1.5–2.9)	32.4 (5.2)	2.2* (1.3–3.8)	0.9	1.5
Cancer	0.8 (0.2)	1.0 (0.5–1.8)	0.5 (0.4)	–(–,–)[e]	0.5 (0.3)	0.9 (0.3–2.9)	1.6 (0.6)	0.9 (0.4–2.2)	2.7 (1.0)	1.2 (0.6–2.8)	9.4*	8.9*
Diabetes	5.0 (0.6)	1.3 (1.0–1.7)	0.9 (0.3)	1.2 (0.6–2.5)	5.9 (1.3)	1.6 (0.9–2.7)	13.4 (2.2)	1.4 (1.0–2.1)	14.8 (4.4)	1.5 (0.7–2.9)	37.2*	2.2
Ulcers	9.0 (0.8)	2.4* (1.9–3.0)	4.9 (0.9)	2.0* (1.3–3.0)	14.0 (2.1)	3.3* (2.2–4.8)	12.2 (2.4)	2.3* (1.4–3.7)	12.0 (2.5)	1.8 (1.0–3.4)	12.4*	5.0
Number of disorders												
Any	72.0 (1.3)	2.6* (2.2–3.0)	63.6 (2.3)	3.0* (2.3–3.8)	76.7 (2.3)	2.5* (1.9–3.2)	84.7 (2.2)	2.0* (1.4–2.9)	89.2 (2.7)	1.5 (0.8–2.8)	20.6*	4.4
One[e]	22.1 (1.5)	1.7* (1.4–2.0)	26.6 (2.4)	2.1* (1.5–2.7)	20.9 (2.3)	1.5* (1.0–2.0)	15.0 (2.2)	1.2 (0.8–1.9)	8.0 (2.4)	0.6 (0.2–1.4)	3.6	11.6*
Two[e]	19.6 (1.4)	2.5* (2.0–3.0)	19.0 (2.3)	3.0* (2.2–4.1)	22.7 (2.3)	2.3* (1.6–3.3)	18.8 (2.9)	1.9* (1.1–3.3)	10.5 (2.8)	0.7 (0.3–1.5)	5.3	9.9*
Three or more[e]	30.3 (1.7)	4.7* (3.8–5.8)	18.1 (2.3)	7.5* (5.3–10.8)	33.1 (2.8)	4.2* (3.0–6.0)	50.9 (3.4)	3.2* (2.0–5.0)	70.7 (4.0)	2.2* (1.1–4.4)	31.7*	8.2*
(*n*)	(2,231)		(877)		(716)		(440)		(198)			

*Significant at the .05 level, two-sided test.

[a]The results in this table are based on a series of multivariate logistic regression equations in which a dichotomous predictor for a single 12-month co-morbid disorder was used to predict a dichotomous measure of 12-month MDE controlling for respondent sex, education, and marital status.

[b]The χ^2 tests in the Age Differences columns test the statistical significance of age differences in conditional prevalence of the co-morbid disorders among respondents with MDE (%) and of the ORs between MDE and the co-morbid disorders (OR).

[c]Entries in the % columns represent the conditional prevalence estimate (and standard error of that estimate) of each co-morbid disorder among respondents with 12-month MDE. Entries in the OR columns represent the odds-ratio (OR) and 95% Confidence Interval (95% CI) of the OR between MDE and the co-morbid disorder estimated in the logistic regression equation.

[d]Cardiovascular conditions include heart attack, hypertension, other heart disease, stroke; musculoskeletal conditions include arthritis/rheumatism, chronic back/neck problems; respiratory conditions include seasonal allergies, asthma, other chronic lung disease such as chronic obstructive pulmonary disorder and tuberculosis; pain conditions include frequent/severe headaches, other chronic pain conditions.

[e]The ORs associated with number of co-morbid disorders are based on a single equation in each age group to predict 12-month MDE from three dichotomies for one, two, and three or more co-morbid disorders in comparison to the contrast category of no such disorders. As with the other equations, controls were included for sex, education, and marital status.

TABLE 6. Past year treatment of emotional problems among respondent with 12-month DSM-IV/CIDI MDE by age

	Age groups										
	All ages		18–34		35–49		50–64		65+		
	%	(se)	%	(se)	%	(se)	%	(se)	%	(se)	Age difference χ^2_3
I. Developed											
Specialty	29.3	(1.0)	28.4	(1.9)	34.2	(1.9)	28.8	(2.2)	14.0	(2.4)	29.3*
General medical	36.0	(1.0)	29.1	(1.6)	41.2	(1.9)	41.7	(2.4)	36.7	(3.4)	19.7*
Health care	50.4	(1.1)	44.6	(1.9)	57.6	(1.9)	54.0	(2.4)	41.6	(3.5)	32.7*
Human services	7.3	(0.6)	5.5	(0.8)	9.8	(1.2)	8.2	(1.5)	3.9	(1.5)	8.6*
CAM[a]	7.8	(0.7)	7.5	(1.2)	8.8	(1.2)	8.9	(1.5)	2.0	(0.9)	10.0*
Any	54.3	(1.2)	48.4	(2.0)	61.7	(1.9)	58.3	(2.4)	44.0	(3.6)	34.9*
(*n*)	(2,973)		(1,079)		(990)		(625)		(279)		
II. Developing											
Specialty	12.6	(1.1)	13.6	(1.8)	14.2	(1.7)	10.4	(1.9)	2.8	(1.2)	3.6
General medical	10.8	(0.8)	8.6	(1.1)	12.2	(1.4)	13.2	(2.1)	13.8	(3.4)	1.7
Health care	20.7	(1.1)	18.1	(1.8)	24.6	(2.0)	22.4	(2.7)	15.7	(3.4)	4.6
Human services	4.3	(0.6)	4.0	(1.1)	4.5	(0.9)	4.5	(1.1)	5.0	(2.1)	0.4
CAM[a]	3.4	(0.5)	3.1	(0.7)	4.4	(1.0)	3.3	(1.2)	0.8	(0.5)	9.1*
Any	25.2	(1.2)	22.1	(1.9)	29.4	(2.0)	28.0	(3.0)	21.0	(3.7)	5.5
(*n*)	(2,244)		(883)		(721)		(442)		(198)		

*Significant age difference at the .05 level, two-sided test.
[a]Complementary-Alternative Medical (CAM) sector (e.g., herbalists, chiropractors, faith-healers, and self-help groups).

that MDE generally does not decrease with age in developing countries is also consistent with the small number of previous studies that have examined this pattern in developing countries;[33–36] although those studies generally found depression to increase with age whereas we found that association with age to be for the most part insignificant. We did not investigate reasons for the differing relationship between age and depression between developed and developing countries, but this should be the focus of future study. Our findings of higher mean MDE AOO and longer time lag between AOO and current age with increasing age are both substantively plausible and inconsistent with evidence of age-related recall bias in previous epidemiological surveys.[31] We attribute this difference between the WMH results and the results of previous survey to the use of an innovative AOO probing technique in the WMH surveys that has been shown experimentally to reduce recall bias.[37]

The finding that retrospectively reported number of lifetime episodes increases with age among respondents with a history of MDE is, like the finding for AOO, substantively plausible. It is also consistent with previous research.[3,8] The finding that age is positively related to duration of 12-month depressive symptoms among 12-month cases, in comparison, is inconsistent with previous research that found no association between age and 12-month duration of depressive episodes.[39,40] It should be noted, though, that these earlier studies were based on much smaller samples than the WMH series. Our results regarding longer episode duration among the oldest respondents are also consistent across types of countries. We also found consistently across countries that despite the longer duration of recent episodes, recent MDE was reported to cause less role impairment among older than younger people. At least two previous studies also found that symptom severity and severity of role impairment due to 12-month depression are both inversely related to age.[6,41] One plausible interpretation of the lower impact of depression on role impairment with increasing age is that role demands decrease with age. However, this interpretation does not explain the finding that symptom severity also decreases significantly with age in developing countries. Another possibility is that depression subtypes change with age and that the subtypes more typical of older people are less severe and impairing than those more typical of younger people.[42,43] Although no attempt was made here to examine depressive symptom profiles by age to investigate this interpretation, this would be a useful extension of the current results.

Our finding that 12-month prevalence of some mental disorders decreases with age while prevalence of most physical disorders increases with age is consistent with much previous research.[13,14] We are aware of little previous research, though, other than earlier WMH analyses[15,44] on age differences in the associations of depression with co-morbid disorders. Our findings that these associations generally increase with age when they involve co-morbid mental disorders but decrease with age when they involve co-morbid physical disorders are consequently of special interest. The most plausible interpretation of the generally increasing age-related ORs with other mental disorders is that co-morbid cases have a more persistent course

than pure cases. Although it is beyond the scope of the current report to investigate the reasons for such an effect, it is noteworthy that this could also be implicated in the longer duration of depressive episodes among the elderly. The fact that the role impairment associated with depression is lowest among the elderly is all the more striking in light of the greater persistence and higher co-morbidity of MDE with other mental disorders among the elderly.

The generally decreasing age-related ORs of MDE with physical disorders are more interpretable because the age patterns in prevalence are different for MDE (decreasing prevalence with age) and most physical disorders (increasing prevalence with age). In a situation of this sort, it is likely that the decreasing ORs are at least partially attributable to a decrease in the causal effects of physical disorders on MDE. Whether or not causal effects of MDE on co-morbid physical disorders also decrease with age is difficult to say because the implications of such a decrease on the prevalence of physical disorders would be negligible in light of the much lower prevalence of MDE than chronic physical conditions among the elderly. In either case, though, the existence of these patterns argue against the suggestion that the low prevalence of MDE among the elderly in developed countries is due to increased confounding of depression symptoms with symptoms of chronic physical conditions.

Our results shed no light on why physical disorders might have decreasing effects on MDE among the elderly. One possibility proposed in the literature is that elderly people are more accepting than those of younger ages of the inevitability of physical illness, resulting in the otherwise adverse psychological effects of physical disorders being buffered.[6] A related suggestion is that elderly people are "immunized" from the negative psychological effects of adversity by prior life experience.[45] Although we are aware of no direct test of these hypotheses, elderly people have been shown to be more likely than younger people to cope with adversity by using strategies that accept and adapt rather than try to change their situations[46] and that disengage from stressful situations in ways that reduce adverse emotional effects.[47] Other research has shown similar age differences in coping with physical illness,[48] but has not investigated whether these differences lead to reductions in the causal effects of physical disorders on depression. Investigation of these buffering effects is an important next step that, while beyond the scope of this study, might help delineate positive patterns of response to the increasing physical infirmity of advanced age. Another possibility is that elderly people might have reduced capacity to register or express mood states due to autonomic, neuroendocrine, or cognitive dysfunction that lead to reduced prevalence of mood disorders in old age.[49] It is unclear, though, how this or any of the other explanations proposed in the literature would account for the fact that age-related decline in depression prevalence is largely confined to developed countries. New theorizing is required to explain this specification.

CONCLUSION

We found that the widely documented decrease in the prevalence of MDE among the elderly is much more pronounced in developed than developing countries. We found that even though the prevalence of chronic physical conditions increased with age in both developed and developing countries, the association between depression and chronic conditions generally decreases with age. This result argues against the view that the apparent decrease in clinical depression among the elderly is due to increasing confounding of the symptoms of depression with the symptoms of chronic physical conditions. It is unclear why the age gradient in depression differs in developed vs. developing countries, but this difference represents an important and previously neglected specification that provides an opportunity to investigate cross-national differences in age-related correlates. Such an investigation might shed light on the reasons for the decline in depression with age in developed countries. It is also unclear why the associations between depression and co-morbid physical conditions decrease with age despite the prevalence of these conditions increasing with age and the persistence of depression increasing with age. An understanding of the causal processes involved in this uncoupling of depression from physical illness in old age could have important implications for interventions with patients who have co-morbid mental–physical disorders.

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