Table 1. WMH: 12-month service usage in Japan: Percent using any service among people with 12-month mental disorder[†]

Mental disorder	Health care: Mental health specialty: Psychiatrist % (SE)	Health care: Mental health specialty: Non-psychiatrist % (SE)	Health care: Mental health specialty: Any mental health specialty % (SE)	Health care: General medical % (SE)	Health care: Any health care % (SE)	Non-health care: Human Services % (SE)	Non-health care: CAM % (SE)	Non-health care: Any non-health care % (SE)	Any service use % (SE)	n[‡]	n[§]
GAD	–	–	–	–	–	–	–	–	–	18	16
Panic disorder	–	–	–	–	–	–	–	–	–	6	7
Agoraphobia w/o Panic	–	–	–	–	–	–	–	–	–	4	5
Social phobia	–	–	–	–	–	–	–	–	–	8	9
Specific phobia	13.1 (5.6)	3.4 (2.4)	14.2 (5.6)	8.5 (4.1)	18.6 (6.1)	0.0 (0.0)	4.6 (3.1)	4.6 (3.1)	20.7 (6.3)	47	45
Posttraumatic stress disorder[¶]	–	–	–	–	–	–	–	–	–	6	2
Any anxiety disorder[§]	7.7 (3.5)	8.7 (4.1)	15.0 (4.7)	9.0 (2.3)	19.1 (3.6)	2.4 (1.9)	4.2 (2.5)	6.6 (3.6)	21.5 (4.7)	66	23
Major depressive disorder	13.6 (4.9)	14.0 (6.5)	25.2 (6.5)	8.9 (5.2)	27.1 (7.3)	6.7 (3.7)	7.9 (5.5)	14.6 (7.3)	33.8 (8.2)	42	43
Dysthymia	–	–	–	–	–	–	–	–	–	10	10
Bipolar I or II	–	–	–	–	–	–	–	–	–	2	2
Any mood disorder	14.4 (4.9)	12.9 (6.1)	25.1 (6.4)	10.2 (5.2)	26.8 (7.1)	6.2 (3.5)	9.2 (5.4)	15.4 (7.1)	33.0 (8.0)	46	47
Alcohol abuse or dependence[¶]	–	–	–	–	–	–	–	–	–	11	8
Alcohol dependence[§]	–	–	–	–	–	–	–	–	–	3	2
Drug abuse or dependence[¶]	–	–	–	–	–	–	–	–	–	2	1
Drug dependence[¶]	–	–	–	–	–	–	–	–	–	1	0
Any substance[¶]	–	–	–	–	–	–	–	–	–	12	8
Any disorder[§]	7.9 (2.7)	7.0 (2.6)	14.0 (2.9)	6.7 (1.8)	16.9 (2.5)	3.1 (1.8)	3.3 (1.8)	6.3 (2.7)	20.0 (2.8)	102	38
No disorder	1.3 (0.7)	0.3 (0.1)	1.5 (0.7)	3.5 (0.9)	4.8 (1.0)	1.0 (1.0)	0.5 (0.3)	1.5 (0.8)	6.2 (1.6)	375	439
Total part II sample	1.9 (0.7)	0.8 (0.3)	2.5 (0.6)	3.7 (0.8)	5.8 (1.0)	1.2 (0.8)	0.7 (0.3)	1.9 (0.7)	7.3 (1.5)	477	477

GAD, generalized anxiety disorder; WMH-CIDI, World Mental Health version of the World Health Organization Composite International Diagnostic Interview.
[†]Missing cells entries indicate that the unweighted number of patients with disorder who were treated in the sector was less than 30, in which case no estimate was made.
[‡]Unweighted number of respondents meeting criteia for each 12-month DSM-IV/WMH-CIDI disorder.
[§]Weighted number of respondents meeting criteia for each 12-month DSM-IV/WMH-CIDI disorder.
[¶]Part II sample.

Table 2. WMH: 12-month service usage in Japan: Sociodemographic and disorder type predictors of any treatment

	Any treatment given any 12-month disorder OR	(95%CI)
Age (years)		
20–29	0.2	(0.0, 7.9)
30–44	0.9	(0.2, 4.6)
45–59	0.4	(0.1, 1.5)
60+	1.0	–
Overall test of effect	Wald $\chi^2 = 2.4$ d.f. = 3, $P = 0.498$	
Any anxiety disorder		
Yes	4.0	(0.6, 29.4)
No	1.0	–
Overall test of effect	Wald $\chi^2 = 2.2$ d.f. = 1, $P = 0.142$	
Any mood disorder		
Yes	13.4	(0.9, 190.6)
No	1.0	–
Overall Test of Effect	Wald $\chi^2 = 4.2$ d.f. = 1, $P = 0.041$	
Any substance disorder		
Yes	1.8	(0.2, 21.4)
No	1.0	–
Overall test of effect	Wald $\chi^2 = 0.3$ d.f. = 1, $P = 0.614$	
No. years education		
0–11	1.3	(0.1, 13.7)
12	0.7	(0.1, 5.2)
13–15	4.4	(1.4, 13.9)
≥16	1.0	–
Overall test of effect	Wald $\chi^2 = 8.9$ d.f. = 3, $P = 0.030$	
Income		
Low	0.6	(0.1, 2.7)
Low average	0.5	(0.1, 3.3)
High average	0.4	(0.1, 2.0)
High	1.0	–
Overall test of effect	Wald $\chi^2 = 1.6$ d.f. = 3, $P = 0.652$	
Marital status		
Never Married	2.1	(0.1, 88.7)
Separated/Widowed/Divorced	6.8	(0.8, 54.6)
Married/Cohabitating	1.0	–
Overall test of effect	Wald $\chi^2 = 5.4$ d.f. = 2, $P = 0.067$	
Sex		
Male	1.2	(0.4, 3.3)
Female	1.0	–
Overall test of effect	Wald $\chi^2 = 0.1$ d.f. = 1, $P = 0.738$	

CI, confidence interval; OR, odds ratio; WMH, World Mental Health.

mental disorders. Because of these biases, the rates of service use may have been overestimated or underestimated.

Second, we cannot examine the validity of self-reported treatment use in the WMHJ 2002–2003 because we have no comparable data on service use. Potentially biased recall of mental health service use may have occurred,[17] and we therefore have likely underestimated the unmet need for treatment, especially among those with more serious disorders.

Third, the WMH-CIDI was not fully validated against clinical diagnosis in Japan, although it was developed by an expert group with a back-translation procedure and checked though an expert review. The

observed proportion of service use may have been overestimated or underestimated in the present study.

Fourth, small sample size and low prevalence[9] is an important limitation. The present study failed to find significant correlates of service use because all the CI were very wide. A large sample will allow narrowing of the CI. Then the significant correlation will be clarified. Some of these limitations could be resolved by expanding the survey field and including respondents for other areas of Japan.

Even with these limitations, however, the results do highlight a very serious issue. Our results have confirmed that 80% of people with a 12-month mental disorder have not received treatment for it. As for a total sample of part II, the treatment rate was only 7.3%, meaning that more than 90% did not receive treatment. Compared with the results of a previous study by Fujihara and Kitamura carried out more than 10 years ago, the rate of health care use has modestly increased from approximately 10% to 16.9%.[8] Although the mental health-care system has developed in the last 10 years, it remains insufficient for people suffering from mental disorders. Compared with other WMH collaborating countries, the utilization rate in Japan was higher than that in China, Lebanon, Nigeria, Mexico, Italy, and Ukraine, and the same as that in Colombia.[6] The service use rates of Western countries are generally higher than those in Japan; in particular, those in the USA or France are twice those in Japan.

Six percent of the respondents with no disorder visited any services and 77% of them received any health care. This may be because some respondents who had a mental disorder that was not assessed in the present study, visited mental health services. This could also be because distress and impairment in social functioning can be caused not only by a mental disorder that meets the diagnostic criteria, but also by subthreshold symptoms.[18] A further study should clarify the reasons for visiting mental health services among those who do not meet the diagnostic criteria for mental disorders.

As for diagnosis, the utilization rate of those with mood disorders in the past year was relatively higher than that for those with other mental disorders. In particular, it was found that 25.1% of people with any mood disorder (representing 76.1% of those in treatment) have used any mental health care as compared with 10.2% for general medical (representing 30.9% of those in treatment). Compared with the reports of other WMH collaborators, in the USA for people with 12-month MDD, 55.1% of those in treatment used mental health professionals versus 47.5% of those in treatment using general medical;[19] in Colombia for people with 12-month any mood disorder, 66.1% of those in treatment used mental health professionals versus 29.4% of those in treatment using general medical.[20] The primary care system by general practice was developed in the USA, so many depressive patients may easily receive treatment by general practicioners.[21] Miki has reported that 59.5% of patients with primary depression visit general practitioners in Japan.[22] The present study findings suggest that people with severe mental disorder such as depression are referred to mental health professionals by internists in Japan. Meanwhile, the Minister of Health, Labor and Welfare has been promoting a depression prevention campaign for the past few years, so early intervention for depression might function effectively, and the barriers to mental health service usage for the treatment of depressive mood might be reduced somewhat. Those with any substance disorder had very low usage compared with the USAs and other Western countries.[5,6,23] This finding is consistent with the fact that the Japanese government has a strong justice and security policy for controlling the use of illicit and other psychotropic drugs, so the 12-month prevalence of substance disorder is remarkably low.

As for the service sector, as described above, the relatively high rate of utilization of psychiatrists was a feature of Japanese usage. In any diagnostic category, the utilization of psychiatrists was higher than that of general medical. For other countries the utilization of general medical or non-psychiatrist mental health professional was often higher than that of psychiatrists.[5,20,24] The majority of people receiving treatment for mental disorder were treated by psychiatrists in Japan. As for the human service sector or CAM, some people did use these sectors. In particular, people in treatment for mood disorder are likely to use these sectors, with 16.1% utilizing human services and 27.9% utilizing CAM. In comparison, in the USA, the usage rates for those with MDD who are in treatment are 16.1% for human services and 26.7% for CAM;[19] and in Colombia, the usage rates for those with any mood disorder who are in treatment are 20.9% for human services and 19.8% for CAM.[20] The Japanese rate was near that of the USA. In a previous study about CAM in the USA, Eisenberg *et al.* found that people who use CAM do so for chronic disorders such as back problems, depression, anxiety, or headaches.[11] Kessler *et al.* have also found that many people use CAM openly along with treatment by mental health professionals.[25] The situation for Japanese people with mood disorders is probably similar, but the present small sample size and low 12-month prevalence prevent us from carrying out more detailed analysis.

As for sociodemographic variables, sex and age do not appear to significantly affect service use. Some reports have indicated that mental health service use decreases over age 65 based on the US community-sample.[5,23,26] Several studies have shown that women use more mental health services than men.[5,23,27] This result may be another specifically Japanese feature, so further examination is necessary. It is an unexpected result that educational background is significantly related to service use, with the utilization rate of people with 13–15 years education being higher than that for others. Those with less education may lack knowledge of mental disorders and mental health care. In contrast, those with higher levels of education are unwilling to seek help for their mental health problems because they would fear a real or perceived loss of social status.

As for the mean number of visits in the past year and the percentage of those receiving minimally adequate treatment from professionals, the present study cannot provide specific Japanese features because of the small sample size. The on-going WMHJ Survey will replicate and expand on the present findings.

ACKNOWLEDGMENTS

The World Mental Health Japan Survey 2002–2003 was carried out in conjunction with the World Health Organization World Mental Health (WMH) Survey Initiative (http://www.hcp.med.harvard.edu/wmh/). We thank the coordinating staff members of WMH for their assistance with the instrumentation and their consultation on field procedures. These activities were supported by the United States National Institute of Mental Health (R01MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (R13-MH066849, R01-MH069864, and R01 DA016558), the Fogarty International Center (FIRCA R01-TW006481), the Pan American Health Organization, Eli Lilly and Company, Ortho-McNeil Pharmaceutical, GlaxoSmithKline, and Bristol-Myers Squibb. The study was supported by grants from the Japan Ministry of Health, Labour, and Welfare. We would like to thank the staff members, Yuko Miyake, PhD, at the National Institute of Mental Health, Japan, and other field coordinators in the WMH Japan 2002–2003 Survey. We also thank the members of WMH services working group.

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Original Article

Social Class Inequalities in Self-rated Health and Their Gender and Age Group Differences in Japan

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BACKGROUND: Few studies have examined social inequalities in self-rated health in Japan, and the issue of gender differences related to social inequalities in self-rated health remains inconclusive.
METHODS: The data derived from interviews with 2987 randomly selected Japanese adults in four prefectures in Japan who completed the cross-national World Mental Health survey from 2002 through 2005. We calculated odds ratios (ORs) of having poor self-rated physical and mental health by two social class indicators independently with multivariate logistic regression models, adjusted for age, gender, marital status, and area. Stratified analyses by gender and age group were also conducted.
RESULTS: The adjusted ORs of the lowest educational attainment category having poor self-rated physical and mental health were 1.42 (95% confidence interval [CI]: 1.15-1.76) and 1.37 (95% CI: 1.10-1.70), respectively. Among females, educational attainment had significant linear associations with self-rated physical and mental health. Adjusted household income was also significantly associated with self-rated physical health among female respondents. No associations were found among males. While educational attainment was associated with self-rated health among the young age group, adjusted household income was associated with self-rated physical health in the middle and old age group.
CONCLUSION: These results indicated social inequalities in self-rated health and prominent social inequalities in self-rated health among females in Japan. Social inequalities in self-rated health seemed to exist across age groups. However, the mechanism of social inequalities in self-rated health could be different depending on the age group.
J Epidemiol 2006; 16:223-232.

Key words: Social Class, Health Status, Sex, Japan

Received May 27, 2006, and accepted June 7, 2006.
The study was supported by grants from the Japan Ministry of Health, Labor, and Welfare.
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Japan demonstrates the longest life expectancy in the world: the life expectancies at birth in Japan were estimated to be 78.4 years for males and 85.3 years for females in 2003.[1] In addition to the improvement of living conditions due to economic growth since the early 1960s, several researchers have noted that, compared to other countries, the relatively smaller social disparities in Japanese society may be a reason for this longevity.[2,3] However, the relatively egalitarian Japanese society has been changing; the gap between social classes has been increasing since the late 1980s,[4] and social inequalities with respect to the health of Japanese society are now becoming a concern.

The relationship between social class and health status is a well-established finding in epidemiologic research,[5-12] which consistently shows that people from higher social classes have lower morbidity and mortality from various diseases, illnesses, and health problems, compared to those from lower social classes.[13-17]

Social inequalities in self-rated health are also well documented; people from lower social classes rate their health poorer compared to those from higher social classes.[18-21] In terms of gender differences in social inequalities of self-rated health, several previously conducted studies have shown that the magnitudes of social class inequalities in self-rated health differ between males and females, with shallower or more inconsistent gradients found among females than males.[20-22] However, some studies show that males and females have a similar pattern of social inequality in self-rated health. Marmot et al[23] demonstrated a similar social gradient in self-rated health and psychological wellbeing between genders. Moreover, Matthews et al[24] indicated that there was no consistent evidence for greater gradients in self-rated health for men; rather, they suggested that the magnitude of social inequalities was greater for women with poor self-rated health at age 23 years and psychological distress at age 33. Clearly, the issue of gender differences with respect to the social inequalities of self-rated health is inconclusive and requires further research.

Social inequalities in self-rated health are well documented in Europe and the United States.[18-25] However, few studies have been conducted to examine them in Japan. Shibuya et al[26] showed that household income adjusted by the number of family members had an independent association with self-rated health, adjusting for income distribution at the prefecture level, and ecological and individual level covariates. They did not, however, examine gender differences in social inequalities in self-rated health. A study conducted by Martikainen et al[20] indicated socioeconomic differences in self-rated health among Japanese employees. They found an inverse association between self-rated health and employment grade among Japanese male employees, while among Japanese female employees they concluded that there were small and inconsistent differences in self-rated health by employment grade. Nishi et al[21] demonstrated an inverse association of self-rated health by employment grade in both male and female Japanese civil servants; however, educational attainment level was a significant predictor for self-rated health only in male employees. Although still limited, the above evidence suggests that social class gradients in self-rated health exist in Japan and that social inequalities in self-rated health seem to be more meaningful among males than females.

According to the national data,[27] it is clear that Japan has been drastically moving toward the popularization of higher education over the last few decades. As people became eager to attain higher education, the range of educational attainment levels has become wide and social inequalities have deepened in Japan.[4] Considering such drastic social changes over the last few decades, social inequalities in self-rated health in Japan should be greater in the younger generation than in older generations as social inequality becomes more manifest.

In this study, we examined the association between self-rated health and social class using educational attainment and household income adjusted for household size independently in random samples from four selected prefectures in Japan. Our aims were: (1) to test the association between relevant social class indicators (educational attainment and adjusted household income) and self-rated physical and mental health; (2) to examine gender differences with respect to the social inequalities of self-rated health; and (3) to examine the age group influence on social inequalities in self-rated health. We hypothesized that people in lower social classes were more likely to report poor self-rated physical and mental health than those in higher social classes, that social inequalities in self-rated health were greater among males than females, and that social inequalities in self-rated health were greater in the younger generation compared to older generations.

METHODS

Survey Populations and Study Sample

The data derive from face-to-face interviews of Japanese adults in Japan collected as part of the cross-national World Mental Health (WMH) survey conducted in 28 countries around the world. In Japan, based on the availability of site investigators and the cooperation of local governments, eight sites in four prefectures were selected as study sites between 2002 and 2005: Okayama Prefecture (the cities of Okayama and Tamano), Nagasaki Prefecture (the city of Nagasaki), Kagoshima Prefecture (the city of Kushikino, and the towns of Fukiage, Ichiki, and Higashiichiki), and Tochigi Prefecture (the city of Sano). The WMH Japan surveys were conducted with a probability sample of adult residents 20 years of age and older at each survey site, based on voter registration lists or resident registries.

Trained interviewers initially contacted 5622 subjects and then interviewed 3517 subjects who agreed to participate in the survey. We excluded 519 subjects who did not meet eligibility criteria: those who had died, moved, or were institutionalized. Eleven subjects did not complete the interview. The sample for the present analysis was drawn from the 2987 respondents who completed the survey from November 2002 through March 2005. The overall response rate (the number of completed interviews divided by the number of eligible subjects) was 58.5 %. In addition, the sub-

jects who did not complete the interview were more likely to be younger than our study subjects, and males were less likely to complete the interviews than females.

The procedures were fully explained to respondents, and written consent was obtained from each respondent at each site. The study was approved by the Committees of Ethics in Research of Human Subjects at Okayama University (for the Okayama site), at Japan National Institute of Mental Health (for the Kagoshima site), at Nagasaki University (for the Nagasaki site), and at Jichi Medical School (for the Tochigi site). The sampling design and procedures have been described in further detail elsewhere.[28]

Measurements

The primary independent variable in this study was social class. We independently used educational attainment and household income adjusted by the number of family members as indicators of social class.

The respondents were categorized into three groups according to the duration of education: 13 years or longer (0), 12 years (1), and 11 years or shorter (2). Household income was estimated by the total of before-tax personal income, the partner's income, other family members' incomes, public pensions, government assistance, and income from other sources in the past year. As all questions on income were asked using categories, we assigned income values based on the mid-point of each category. We adjusted household income for household size with an equivalence elasticity of 0.5, as used in previous studies.[26,29,30] All respondents were categorized into four groups by adjusted household income: (0) highest group, (1) second highest group, (2) second lowest group, and (3) lowest group.

Self-rated health is widely used and there is extensive evidence that it predicts mortality and morbidity. It has been shown to be not only strongly associated with a variety of indicators of well-being[31] but also a strong predictor of mortality in longitudinal studies.[32] Respondents were asked to rate their general physical health on a five-point scale ranging from excellent to poor. We grouped this rating into a binary variable of poor physical health ("poor" and "fair") and good physical health ("good," "very good," and "excellent"). Good physical health was the reference group. Similarly, self-rated mental health was grouped into a binary variable of poor mental health ("poor" and "fair") and good mental health ("good," "very good," and "excellent"). Good mental health was the reference group.

Age was measured in years and categorized into three groups: 20-40, 41-60, and 61 and older. Gender was treated as a bivariate variable; the reference group was male. Marital status was categorized into three groups: married, separated/widowed/divorced, and never married.

Data Analysis

We examined the social inequalities in self-rated physical health and self-rated mental health, hypothesizing that people in lower social classes would have higher odds of having poor self-rated physical and mental health compared to those in higher social classes. We used chi-square tests to estimate bivariate associations between social class (educational attainment and adjusted household income) and other covariates with health outcomes.

Logistic regression analyses were used to estimate odds ratios (ORs) of having poor self-rated physical and mental health by two social class indicators (educational attainment and adjusted household income). We entered social class indicators as categorical variables first and then added the covariates to the models, regardless of their statistical significance. The covariates based on theory are age in years, gender, marital status, and area. We calculated the adjusted OR and 95% confidence interval (CI) of having poor self-rated physical and mental health by the two social class indicators (educational attainment and adjusted household income) independently. A test for linear trend was performed for each model. We also conducted a stratified analysis by gender for both outcomes in order to accomplish our second aim as well as a stratified analysis by age group in order to achieve our third aim. The standard errors for the ORs were calculated using the Wald test.[33] All analyses were conducted with the SAS® statistical package.[34]

RESULTS

Table 1 represents the selected characteristics of the study population, which consisted of Japanese adults in Japan 20 years of age and older who completed the survey (n=2987). Forty-eight percent (n=1443) of the respondents reported poor physical health, while 41% (n= 1234) reported poor mental health. Both the mean and median ages were 54 years. Fifty-six percent of the respondents were female. Approximately 72% of the respondents were married, while 13% had never married. Both the mean and median years of educational attainment were 12 years. Thirty percent of the respondents had received education for equal to or shorter than 11 years, while 34% had received education for 13 years or longer. Forty-three percent of the respondents were from the Okayama site, while 7% were from the Nagasaki site. The proportion of respondents who had poor self-rated physical health varied significantly by age group, marital status, educational attainment, adjusted household income, and area. There was no statistically significant association between self-rated physical health and gender. Similarly, the proportion of respondents who reported poor self-rated mental health varied significantly by age group, gender, marital status, adjusted household income and area, while there was no statistically significant association between self-rated mental health and educational attainment.

Table 2 shows the adjusted ORs of having poor self-rated health by educational attainment and adjusted household income along with the p values for the linear trend test for each model. Controlling for age, gender, marital status, and area, the ORs of the lowest educational attainment category having poor self-rated physical and mental health were 1.42 (95% CI: 1.15-1.76) and 1.37 (95% CI: 1.10-1.70), respectively. The associations between two social class indicators (educational attainment and adjusted household income) and self-rated physical health were significantly linear (p=0.04 and p=0.01, respectively).

We found no significant associations between social class indicators and self-rated physical and mental health among male respondents, while we identified significant social inequalities in self-rated physical and mental health among female respondents (Table 2). The ORs of the lowest educational attainment category having poor self-rated physical and mental health among female respondents were 1.63 (95% CI: 1.21-2.21) and 1.46 (95% CI: 1.08-1.97), respectively. The ORs of the second lowest and the lowest adjusted household income categories having poor self-rated physical health among female respondents were 1.38 (95% CI: 0.98-1.95) and 1.57 (95% CI: 1.14-2.17), respectively.

In order to explore the mechanisms of gender differences with respect to social inequalities in self-rated health, we conducted a further stratified analysis by employment situation in addition to gender (Table 3). The ORs of the lowest educational category having poor self-rated physical and mental health among female workers were 1.72 (95% CI: 1.19-2.50) and 1.43 (95% CI: 1.00-2.07), respectively. The ORs of the lowest and second lowest adjusted household income groups having poor self-rated physical health were 1.55 (95% CI: 1.05-2.30) and 1.59 (95% CI: 1.03-2.46), respectively. The associations between educational attainment level and self-rated physical and mental health among housewives were similar to those among employed females, although they were not significant. However, adjusted household income seemed to be associated with only self-rated physical health and not with mental health among housewives. We identified no significant association between social class and self-rated health among male respondents stratified by employment situation (Not shown in the table).

Age group influence on the association between social class and self-rated health was identified by stratified analysis by age

Table 1. Characteristics of survey sample in the WHO World Mental Health Japan Survey 2002-2003 (n=2987).

		Poor physical health		Poor mental health	
	n(%)	1443(48.3%)	p-value	1234(41.3%)	p-value
Age (mean/median: 54 years)					
20-40 years	739 (24.8)	254 (34.4)	<0.0001	280 (37.9)	0.03
41-60	1166 (39.0)	571 (49.0)		511 (43.9)	
61+	1082 (36.2)	618 (57.1)		443 (40.9)	
Gender					
Male	1314 (44.0)	656 (49.9)	n.s.	519 (39.5)	0.07
Female	1673 (56.0)	787 (47.1)		715 (42.8)	
Marital status					
Married	2142 (71.7)	1033 (48.2)	<0.0001	860 (40.2)	0.01
Divorced/Separated/Widowed	456 (15.3)	254 (55.7)		217 (47.6)	
Never married	388 (13.0)	155 (40.0)		156 (40.2)	
Education (years of education)	(mean/median: 12)				
13 years or longer	945 (34.0)	387 (41.0)	<0.0001	357 (37.8)	n.s.
12 years	976 (35.2)	446 (45.7)		402 (41.2)	
11 years or shorter	854 (30.8)	486 (56.9)		357 (41.8)	
Adjusted household income					
Highest group	550 (24.5)	248 (45.1)	0.006	217 (39.5)	0.04
2nd highest	574 (25.6)	249 (43.4)		216 (37.6)	
2nd lowest	560 (25.0)	281 (50.2)		233 (41.6)	
Lowest group	557 (24.9)	293 (52.6)		255 (45.8)	
Area					
Okayama	1274 (42.7)	583 (45.8)	0.025	505 (39.6)	0.007
Kagoshima	955 (32.0)	472 (49.5)		382 (40.0)	
Nagasaki	208 (7.0)	117 (56.3)		106 (51.2)	
Tochigi	548 (18.4)	270 (49.3)		241 (44.0)	

group (Table 4). Among respondents who were between 20 and 40 years old, the OR of the lowest educational attainment category having poor self-rated physical health was 1.96 (95% CI: 1.18-3.24), and the ORs of the lowest and the second lowest educational attainment categories having poor self-rated mental health were 1.85 (95% CI: 1.17-3.05) and 1.46 (95% CI: 1.04-2.05), respectively. Among respondents who were between 41 and 60 years of age, the ORs of the lowest and the second lowest adjusted household categories having poor self-rated physical health were 1.26 (95% CI: 0.91-1.75) and 1.61 (95% CI: 1.11-2.34), respectively. Associations between educational attainment level and self-rated health were also identified but were not significant. Among those 61 years old and older, the OR of the lowest adjusted household income group with poor self-rated physical health was 1.57 (95% CI: 1.01-2.45). The association between both social class indicators (educational attainment and household income) and self-rated physical health was significantly linear (p=0.04, p=0.003, respectively).

DISCUSSION

The primary objective of this research was to examine the existence of social gradients in health among the general population in Japan. The results of our study indicated a gradient association between self-rated physical and mental health with levels of educational attainment. The respondents with lower levels of educational attainment were more likely to rate their physical and mental health as poor than those with higher educational attainment.

U or J-shaped associations were found to exist between adjusted household income and self-rated physical and mental health for all respondents (Table 2), between adjusted household income and mental health for males (Table 2), and between adjusted household income and self-rated physical health for female workers (Table 3). A recent study in Japan reported that leisure-time physical activity, a health-related habit, was less among both higher-class and lower-class occupations, indicating a reversed U-

Table 2. Adjusted* odds ratios (ORs) and their 95% confidence intervals (CIs) for poor self-rated physical and mental health according to social class indicators (educational attainment and adjusted household income) and p values for trend test stratified by gender.

	All (n=2986)			Male (n=1314)			Female (n=1673)		
	n (%)	OR (95% CI)	p†	n (%)	OR (95% CI)	p†	n (%)	OR (95% CI)	p†
Self-rated physical health									
Educational attainment model									
13 years or longer	945 (34.0)	1.00	0.04	454 (37.2)	1.00	n.s.	491 (31.6)	1.00	0.02
12 years	976 (35.2)	1.10 (0.91-1.33)		417 (37.2)	1.07 (0.82-1.41)		559 (36.0)	1.15 (0.89-1.49)	
11 years or shorter	854 (30.8)	1.42 (1.15-1.76)		350 (26.7)	1.21 (0.89-1.64)		504 (32.4)	1.63 (1.21-2.21)	
Adjusted household income model									
Highest	550 (24.5)	1.00	0.01	294 (29.3)	1.00	n.s.	256 (20.7)	1.00	<0.001
2nd highest	574 (25.6)	0.95 (0.75-1.21)		293 (29.3)	0.90 (0.65-1.25)		281 (22.7)	1.02 (0.71-1.44)	
2nd lowest	560 (25.0)	1.21 (0.95-1.54)		237 (23.7)	1.04 (0.78-1.57)		323 (26.1)	1.38 (0.98-1.95)	
Lowest	557 (24.9)	1.23 (0.98-1.55)		177 (17.7)	0.92 (0.66-1.28)		380 (30.7)	1.57 (1.14-2.17)	
Self-rated mental health									
Educational attainment model									
13 years or longer	945 (34.1)	1.00	0.22	454 (37.2)	1.00	n.s.	491 (31.7)	1.00	0.04
12 years	975 (35.2)	1.17 (0.97-1.41)		417 (34.1)	1.11 (0.84-1.48)		558 (35.9)	1.22 (0.95-1.58)	
11 years or shorter	854 (30.8)	1.37 (1.10-1.70)		350 (28.7)	1.29 (0.95-1.76)		504 (32.5)	1.46 (1.08-1.97)	
Adjusted household income model									
Highest	549 (24.5)	1.00	0.12	294 (29.4)	1.00	n.s.	255 (20.6)	1.00	0.004
2nd highest	574 (25.6)	0.92 (0.73-1.18)		293 (29.3)	0.86 (0.61-1.21)		281 (22.7)	0.98 (0.69-1.39)	
2nd lowest	560 (25.0)	1.09 (0.85-1.39)		237 (23.7)	1.07 (0.75-1.53)		323 (26.1)	1.11 (0.80-1.56)	
Lowest	557 (24.9)	1.13 (0.90-1.42)		177 (17.7)	1.11 (0.80-1.55)		380 (30.7)	1.14 (0.83-1.56)	

* : all ORs were adjusted by age, marital status, and area.
† : p value for trend test

Table 3. Adjusted* odds ratios (ORs) and their 95% confidence intervals (CIs) for poor self-rated physical and mental health according to social class indicators (educational attainment and adjusted household income) and p values for trend test among females stratified by employment situation.

	Employment situation								
	Housewife (n=601)			Worker (n=1010)			Retired (n=62)		
	n (%)	OR (95% CI)	p†	n (%)	OR (95% CI)	p†	n (%)	OR (95% CI)	p†
Self-rated physical health									
Educational attainment model									
13 years or longer	115 (19.6)	1.00	0.22	364 (40.2)	1.00	0.14	12 (20.0)	1.00	n.s.
12 years	189 (32.1)	1.30 (0.79-2.13)		351 (38.7)	1.19 (0.77-1.46)		19 (31.7)	1.16 (0.22-6.01)	
11 years or shorter	284 (48.3)	1.54 (0.87-2.75)		191 (21.1)	1.72 (1.19-2.50)		29 (48.3)	1.00 (0.14-7.02)	
Adjusted household income model									
Highest	64 (13.7)	1.00	0.13	191 (26.2)	1.00	0.03	1 (2.5)	not applicable	
2nd highest	82 (17.6)	1.26 (0.64-2.47)		191 (26.2)	0.91 (0.59-1.38)		8 (20.0)		
2nd lowest	142 (30.5)	1.10 (0.59-2.03)		168 (22.9)	1.59 (1.03-2.46)		13 (32.5)		
Lowest	178 (38.2)	1.58 (0.87-2.85)		184 (25.7)	1.55 (1.05-2.30)		18 (45.0)		
Self-rated mental health									
Educational attainment model									
13 years or longer	115 (19.6)	1.00	0.20	364 (40.2)	1.00	0.55	12 (20.0)	1.00	n.s.
12 years	189 (32.1)	1.28 (0.77-2.13)		350 (38.7)	1.21 (0.90-1.65)		19 (31.7)	1.13 (0.21-6.308)	
11 years or shorter	284 (48.3)	1.42 (0.78-2.58)		191 (21.1)	1.43 (1.00-2.07)		29 (48.3)	1.13 (0.21-9.98)	
Adjusted household income model									
Highest	64 (13.7)	1.00	n.s.	190 (25.9)	1.00	0.04	1 (2.5)	not applicable	
2nd highest	82 (17.6)	0.84 (0.43-1.66)		191 (26.6)	1.00 (0.66-1.52)		8 (20.0)		
2nd lowest	142 (30.5)	0.81 (0.44-1.50)		168 (22.9)	1.39 (0.90-2.13)		13 (32.5)		
Lowest	178 (38.2)	0.82 (0.45-1.49)		184 (25.1)	1.39 (0.94-2.05)		18 (45.0)		

* : all ORs were adjusted by age, marital status, and area.
† : p value for trend test

shaped association between occupational class and health-related behaviors in Japan.[35] A greater commitment to work and longer overtime hours among those who earned high incomes and were employed in high-class occupations, such as managers, may cause poor physical and mental health status in Japan.

Overall, our results suggested that educational attainment was a better predictor of self-rated health than adjusted household income. Shibuya et al[26] showed that adjusted household income was a strong predictor of self-rated health, controlling regional income inequalities in Japan. One of the possible reasons for the inconsistency between our results and those of Shibuya et al might be differences in the study population. They used random samples of the general population throughout Japan, while we used random samples from selected areas, which did not include urban cities.

Our secondary objective in conducting this research was to examine gender differences related to social inequalities in self-rated health. We identified significant social inequalities in self-rated physical and mental health only among female respondents. Our results were somewhat inconsistent with previously conducted studies. Martikainen et al[20] showed the association between self-rated health and employment grade among 40- to 60-year-old Japanese male employees in selected cities, but they indicated small or inconsistent social inequalities in self-rated health among Japanese female employees. One possible reason for this inconsistency with our results could be the difference in indicators of social class. They used employment grade as a social class indicator. As they noted, their indicator could not be a relevant measure of female social class, and therefore they suggested that a household-based measure could be a better indicator for females. On the other hand, it is possible that their indicator is a better measure for males than educational attainment and household income, especially for middle-aged males. Unfortunately, we did not use employment or occupational classification as an indicator of social class in the present study. A further study should directly test this hypothesis using multiple measures of social class, education, income, and occupation.

A previously conducted study by Nishi et al[21] showed an inverse association of self-rated health with employment grade in both male and female Japanese civil servants aged 35 years or

Table 4. Adjusted* odds ratios (ORs) and their 95% confidence intervals (CIs) for poor self-rated physical and mental health according to social class indicators (educational attainment and adjusted household income) and p values for trend test for all respondents and stratified analysis by age groups.

	Age (year)								
	20-40 (n=739)			41-60 (n=1165)			61 and older (n=1082)		
	n (%)	OR (95% CI)	p†	n (%)	OR (95% CI)	p†	n (%)	OR (95% CI)	p†
Self-rated physical health									
Educational attainment model									
13 years or longer	409 (60.2)	1.00	n.s.	405 (36.9)	1.00	0.13	131 (13.2)	1.00	0.04
12 years	244 (35.9)	0.88 (0.62-1.26)		485 (44.1)	1.28 (0.97-1.67)		247 (24.8)	0.76 (0.49-1.17)	
11 years or shorter	27 (4.0)	1.96 (1.18-3.24)		209 (19.2)	1.28 (0.91-1.79)		618 (62.1)	1.32 (0.88-1.98)	
Adjusted household income model									
Highest	83 (16.2)	1.00	n.s.	350 (35.6)	1.00	0.07	117 (15.7)	1.00	0.003
2nd highest	145 (28.3)	0.64 (0.36-1.14)		177 (27.4)	1.16 (0.84-1.60)		160 (21.5)	0.94 (0.58-1.53)	
2nd lowest	149 (29.1)	1.04 (0.59-1.84)		187 (18.0)	1.61 (1.11-2.34)		234 (31.4)	1.14 (0.72-1.81)	
Lowest	135 (26.4)	0.93 (0.53-1.62)		187(19.0)	1.26 (0.91-1.75)		235 (31.5)	1.57 (1.01-2.45)	
Self-rated mental health									
Educational attainment model									
13 years or longer	409 (60.2)	1.00	0.17	405 (36.9)	1.00	0.56	131 (13.2)	1.00	0.25
12 years	244 (35.9)	1.46 (1.04-2.05)		484 (44.1)	1.13 (0.86-1.48)		247 (24.8)	0.76 (0.49-1.18)	
11 years or shorter	27 (4.0)	1.85 (1.17-3.05)		209 (19.0)	1.27 (0.91-1.77)		618 (62.1)	1.15 (0.77-1.72)	
Adjusted household income model									
Highest	83 (16.2)	1.00	n.s.	349 (35.6)	1.00	0.05	117 (15.7)	1.00	0.17
2nd highest	145 (28.3)	0.70 (0.39-1.23)		269 (27.4)	1.12 (0.81-1.50)		160 (21.5)	0.85 (0.52-1.40)	
2nd lowest	149 (29.1)	1.18 (0.67-2.06)		177 (18.0)	1.26 (0.87-1.83)		234 (31.4)	0.96 (0.60-1.54)	
Lowest	135 (26.4)	0.83 (0.48-1.46)		187 (19.0)	1.34 (0.96-1.86)		235 (31.5)	1.20 (0.77-1.88)	

*: all ORs were adjusted by age, gender, marital status, and area.
†: p value for trend test

older in a city. They also found an inverse association of self-rated health with education, but only in male employees. This discrepancy with our results could be due to differences in the study populations. Their study population comprised civil servants in an urban city, while ours consisted of the general population from selected areas, excluding urban cities. In addition, because their study subjects were all civil servants, the range of social classes that they captured could have been narrower than that of our study population.

The results of the stratified analysis by gender and employment situation indicated that female workers have significant social inequalities in self-rated physical and mental health. We also saw some associations between educational attainment level and self-rated physical and mental health among housewives. However, housewives had no associations between adjusted household income level and self-rated mental health. The effect of multiple social roles on self-rated mental health could be one explanation for the greater social inequalities in self-rated mental health among female workers than among housewives. According to national polls conducted in 2000, 84.9% of two-income couples reported that the wife was responsible for daily household affairs such as cleaning, washing, and cooking.[36] Multiple social roles are thought to affect an individual's health in two ways: role overload and role enhancement.[37] From the former perspective, female multiple-role experiences are likely to lead to role overload and conflict, which result in poor physical and mental health. From the latter perspective, female multiple-role experiences could benefit and enhance physical and mental health. Previous research suggests that the health enhancing effect of multiple-role experiences among females is less clear or even absent for lower social classes, while it is more prominent among higher social classes.[38] The functioning of multiple social roles, therefore, could be different depending on social class, and household financial conditions could be an important factor in determining the function of multiple social roles. Further longitudinal studies will be required to examine the mechanism of inequalities in health among Japanese females.

We identified a significant association of educational attainment with self-rated physical health and a gradient association of educational attainment with self-rated mental health among

respondents 20 to 40 years of age. On the other hand, no associations were found between adjusted household income and self-rated health. Educational attainment, therefore, could be a better social class indicator than household income for younger generations. Among middle-aged respondents, there was a gap found with respect to physical and mental health by educational attainment level, although the associations were not clearly linear. Adjusted household income had a significant association with self-rated physical health, and it seemed to have an inverse association with mental health. One reason that household income seemed to be a more significant predictor of self-rated health than educational attainment in this group was, as previous studies have indicated,[20,21] that employment grade may be an important indicator in a middle-aged population and that household income may link to employment grade more closely than educational attainment. Among those 61 years old and older, adjusted household income showed a significant association with self-rated physical health. Those in the lowest income group were at significantly higher risk of having poor self-rated physical health, compared with those in the highest household income group. The other associations between social class and self-rated heath seemed to be either U- or J-shaped, although they were not significant.

Our data suggested that social inequalities exist across all age groups. However, the appropriate indicators for social class may be different depending on the age group; educational attainment may be a better social class indicator for a younger generation, while adjusted household income may be a better indicator for older generations. The different results among age groups suggest differences in the mechanisms of social inequalities in self-rated health, that is, how social class influences self-rated health across age groups. For example, among young respondents, differences in their future prospects as a result of their educational attainment levels could affect self ratings for physical and mental health, while among older respondents material conditions based on their financial situation could be the most important factor in influencing self rated health.

There are several limitations in this study. First, the results may be limited by the use of a biased sample. We used random samples from only selected sites, mainly from western Japan, and did not include a metropolitan city. Second, the relatively low response rate (58.5%) may also limit the interpretation of our results. Subjects who did not complete the survey were likely to be younger than our study sample and likely to be men, which may lead to a potential bias due to non-response. Third, our study was also limited by weak measurement of social class. Assessment of social class is quite complex.[9,39] Although we used two social class indicators, imprecise measurements of social class could have distorted the association between social class and self-rated health. Additional measures of social class (such as occupation and wealth) would have increased the reliability of our findings. Fourth, we used an interview survey to measure self-rated health, which may lead to somewhat different results from those obtained by studies using self-administrated questionnaires. Finally, although we showed differences in self-rated health status across social class, we need to be cautious about inferring a causal association between social class and health status from our cross-sectional study. The mechanism of reverse causation could be possible, especially for adjusted household income and health.

In summary, the results of this study imply discrepancies in self-rated physical and mental health along lines of social class in Japan. Japanese females disproportionately experienced social inequalities in self-rated health. In addition, although we identified social inequalities in self-rated health across all age groups, differences in the respective mechanisms of social inequalities in self-rated health were suggested.

ACKNOWLEDGMENTS

The World Mental Health Japan Survey 2002-2003 was carried out in conjunction with the World Health Organization (WHO) World Mental Health Survey Initiative (Chairs, Prof. Ronald C Kessler, Harvard Medical School, and Dr. Bedhan Ustun, WHO); http://www.hcp.med.harvard.edu/wmh/. We thank the coordinating staff members of WMH for their assistance in the instrumentation and their consultation on field procedures.

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General Hospital Psychiatry 29 (2007) 123–133
General Hospital Psychiatry

Mental disorders among adults with asthma: results from the World Mental Health Survey

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Received 2 November 2006; accepted 20 December 2006

Abstract

Objective: Our objectives were (a) to determine which common mental disorders are associated with asthma in the general population after controlling for age and sex, and (b) to assess whether the associations of mental disorders with asthma are consistent across diverse countries.
Method: Eighteen population surveys of household-residing adults were carried out in 17 countries (N=85,088). Mental disorders were assessed with the Composite International Diagnostic Interview 3.0, a fully structured diagnostic interview. The disorders considered here are 12-month anxiety disorders (generalized anxiety disorder, panic disorder/agoraphobia, posttraumatic stress disorder and social phobia), depressive disorders (dysthymia and major depressive disorder) and alcohol use disorders (abuse and dependence). Asthma was ascertained by self-reports of lifetime diagnosis among a subsample (n=42,697).
Results: Pooled estimates of age-adjusted and sex-adjusted odds of mental disorders among persons with asthma relative to those without asthma were 1.6 [95% confidence interval (95% CI)=1.4, 1.8] for depressive disorders, 1.5 (95% CI=1.4, 1.7) for anxiety disorders and 1.7 (95% CI=1.4, 2.1) for alcohol use disorders.

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0163-8343/$ – see front matter
doi:10.1016/j.genhosppsych.2006.12.006

Conclusion: This first cross-national study of the relationship between asthma and mental disorders confirms that a range of common mental disorders occurs with greater frequency among persons with asthma. These results attest to the importance of clinicians in diverse settings being alert to the co-occurrence of these conditions.

Keywords: Adult; Asthma; Cross-sectional; Mental disorders

1. Introduction

Asthma is a major public health problem in industrialized countries, and its prevalence has been increasing in both developed and developing countries in recent decades [1,2]. A considerable number of studies have suggested that there is an association between asthma, particularly at the severe end, and some mental disorders. In research among adults, studies conducted among clinical and general practice samples have found higher-than-expected rates of anxiety disorders (particularly panic disorder) and major depression among those with asthma [3–10]. However, treatment-seeking biases limit the extrapolation of findings from clinical studies to resolving the question of whether asthma and mental disorders are associated in the general population [11].

Some studies have investigated the asthma–mental disorder relationship in the adult general population [11–16]. Collectively, these studies suggest that asthma is related to both mood and anxiety disorders, although this conclusion could be considered premature due to the limitations of many of these studies. These limitations include nonuse of diagnostic measures of mental disorders [12–14], limited age range of participants [16,17] or a limited number of mental disorders investigated [12–15,17]. The study by Goodwin et al. [11], an exception to these limitations, investigated the association between asthma and a range of *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* mental disorders in a general population sample of adults in Germany. They found that lifetime severe asthma was significantly associated with a number of anxiety disorders, bipolar disorder and any severe mental disorder. Lifetime nonsevere asthma was significantly associated with any anxiety disorder, anxiety disorder not otherwise specified and any somatoform disorder. Current severe asthma was associated with a number of anxiety disorders, and current nonsevere asthma was associated with any affective disorder, although not with major depressive disorder on its own. This latter result may have been a power issue, suggested by the fact that the odds ratio (OR) for the association between current nonsevere asthma and any affective disorder was significant, while the ORs for the two components of the any-affective-disorder group (major depressive disorder and bipolar disorder) were of a magnitude similar to that for any affective disorder, yet nonsignificant.

In summary, findings from adult population studies suggest that both mood and anxiety disorders are associated with asthma; yet, in the most informative of these studies [11], asthma was more consistently associated with anxiety disorders, rather than with major depressive disorder. One of the challenges in determining the association of comorbid mental and physical conditions is obtaining samples big enough to provide sufficient numbers with both conditions. The current study aims to extend this literature in two main ways. First, it provides information on the association between mental disorders and lifetime asthma from a meta-analysis of surveys from the World Mental Health Surveys, an approach that has the advantage of being able to provide pooled estimates that overcome the problems of small sample sizes from individual surveys. Second, this study is based on general population surveys that used consistent diagnostic measures of a range of mental disorders, representing both developed and developing regions of the world, thus providing a more global perspective on the association between asthma and mental disorders than has been available thus far. The World Mental Health Surveys have been conducted in over 20 countries using the latest structured psychiatric interviews, generating *DSM-IV* diagnoses for a range of mental disorders and collecting information on chronic physical conditions and other covariates.

The objectives of this paper are (a) to determine which common mental disorders (depressive disorders, anxiety disorders and alcohol use disorders) are significantly associated with asthma after controlling for age and sex, and (b) to assess whether the associations of mental disorders with asthma are consistent across adult populations in diverse countries in Europe, the Americas, Asia and the Middle East.

2. Methods

2.1. Samples

Eighteen surveys were carried out in 17 countries in the Americas (Colombia, Mexico and United States), Europe (Belgium, France, Germany, Italy, The Netherlands, Spain and Ukraine), the Middle East (Israel and Lebanon), Africa (Nigeria and South Africa), Asia [Japan and separate surveys in Beijing and Shanghai, People's Republic of China (PRC)] and the South Pacific (New Zealand). An effort was made to recruit as many countries as possible for the initiative. The final set of countries was determined by the availability of collaborators in the country who were able to obtain funding for the survey. All surveys were based on multistage clustered area probability household samples. All interviews were carried out face-to-face by trained lay interviewers. The six Western European surveys were carried out jointly [18]. Sample sizes ranged from

2372 (The Netherlands) to 12,992 (New Zealand), with a total of 85,088 respondents. Response rates ranged from 45.9% (France) to 87.7% (Colombia), with an overall weighted response rate of 70.8%.

The World Mental Health Survey Initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (WMH-CIDI) is a long interview; thus, to reduce respondent burden, a strategy of short (Part 1) and long (Parts 1 and 2) forms of the interview was adopted by most countries. A subsample of respondents who completed the first half of the interview (Part 1), which included core diagnostic assessments, and who reported to have no lifetime history of disorder, were terminated at the midpoint of the interview. All respondents who met criteria for any lifetime mental disorder in Part 1 were retained in the second half of the interview (Part 2), along with a probability subsample of noncases. The default value for the noncase probability of selection was 25%, although this varied across countries depending on their survey priorities. Part 2 samples typically retained between 33% and 67% of Part 1 respondents. Part 2 respondents were weighted by the inverse of their probability of selection for Part 2 of the interview to adjust for differential sampling. Analyses in this article were based on the weighted Part 2 sample (n=42,697). Additional weights were used to adjust for differential probabilities of selection within households and to match the samples to population sociodemographic distributions. The samples showed substantial cross-national differences in age structure (younger in less developed countries) and educational status (lower in less developed countries).

2.2. Training and field procedures

The central World Mental Health staff trained bilingual supervisors in each country. Consistent interviewer training documents and procedures were used across surveys. The WHO translation protocol [19] was used to translate instruments and training materials. Two surveys were carried out in bilingual form (Dutch and French in Belgium; Russian and Ukrainian in Ukraine). In Nigeria, interviews were conducted in four languages, Yoruba, Hausa, Igbo and Efik, which are the dominant languages in the regions where the survey was carried out. Others were carried out exclusively in the country's official language. Persons who could not speak these languages were excluded. Standardized descriptions of the goals and procedures of the study, data use and protection, and the rights of respondents were provided in both written and verbal forms to all potentially eligible respondents before obtaining verbal informed consent for participation in the survey. Quality control protocols, which are described in more detail elsewhere [20], were standardized across countries to check on interviewer accuracy and to specify data cleaning and coding procedures. The institutional review board of the organization that coordinated the survey in each country approved and monitored compliance with procedures for obtaining informed consent and protecting human subjects.

2.3. Mental disorder status

All surveys used the WMH-CIDI (now CIDI 3.0) [21], a fully structured diagnostic interview used to assess disorders and treatment. The mental disorders considered in this paper were present in the prior 12 months and included anxiety disorders (generalized anxiety disorder, panic disorder and/or agoraphobia, posttraumatic stress disorder and social phobia), depressive disorders (dysthymia and major depressive disorder) and alcohol use disorders (abuse and dependence). Disorders were assessed using the definitions and criteria of the *DSM-IV* [22]. CIDI organic exclusion rules were imposed in making all diagnoses. Methodological evidence collected in WHO-CIDI field trials and later clinical calibration studies showed that all the disorders considered herein were assessed with acceptable reliability and validity in the original CIDI [23] and the WMH-CIDI [20].

2.4. Asthma status

In a series of questions on chronic conditions adapted from the US National Health Interview Survey, respondents were asked about the lifetime presence of selected chronic conditions. Respondents were asked, "Did a doctor or other health professional ever tell you that you had any of the following illnesses. . .asthma?" Clinical guidelines for the diagnosis of asthma, such as those issued by the American Thoracic Society, recommend a combination of methods, including medical history, physical examination and respiratory function tests [1,11], but such methods are not feasible in large epidemiological surveys and, indeed, international asthma prevalence surveys such as the European Community Respiratory Health Survey (ECRHS) have used self-reported symptoms of asthma to determine the condition [1,24]. An investigation of the correspondence of self-reported chronic conditions in the US National Health Interview Survey with medical records abstracted in the prior 3 years found self-reported current asthma to be in fairly good agreement with medical record, although underreported by 20–30% [25]. The definition of asthma used in this survey was self-report of a diagnosis of asthma — not simply a self-report of asthma, so it may correspond more closely still to actual medical records. The German population study by Goodwin et al. [11], which has used the most comprehensive methods of assessing asthma among population surveys investigating asthma–mental disorder comorbidity, reported physician confirmation of lifetime asthma in about 78% of those endorsing a screening question about current asthma. That study reported a 5.7% prevalence of lifetime asthma in the German population, which is fairly comparable with the 4.5% estimate of lifetime asthma that this study observed in the German population.

2.5. Analytical methods

The prevalence of specific mental disorders was estimated separately among respondents with and respondents without lifetime asthma. The ORs of the association between lifetime asthma and specific mental disorders and between lifetime asthma and mental disorder groups (any depressive disorder, any anxiety disorder or any alcohol use disorder) were calculated in each survey with at least 25 respondents who reported to have asthma. The ORs were calculated in logistic regression equations that adjusted for age and sex. Associations were not further adjusted for socioeconomic status, as some research suggests that socioeconomic status may be part of the background vulnerability giving rise to asthma–mental disorder comorbidity [16]. For countries in which the cross-classification of mental disorder and asthma status was null, the OR was not calculated. Ninety-five percent confidence intervals for prevalence estimates and ORs were estimated using the Taylor series method [26] with SUDAAN software [27] to adjust for clustering and weighting. Pooled estimates of mental disorder prevalence rates were not reported due to significant variations in the prevalence rates of mental disorders across surveys.

Using meta-analytical methods to summarize results across surveys, pooled estimates of ORs describing the association of each mental disorder and mental disorder groups with asthma across surveys were developed. The pooled estimate of ORs was weighted by the inverse of the variance of the estimate for each survey with a reported OR. The confidence intervals for the pooled estimates of ORs were estimated using methods described by DerSimonian and Laird [28]. For each association of a specific mental disorder with asthma, we assessed whether the heterogeneity of OR estimates across surveys was greater than expected by chance [28], using a conservative α value of $<.05$.

Funnel graphs plot the OR for each survey on a log scale (y-axis) against the precision of the estimate of each OR (x-axis). Precision is the reciprocal of the standard error of the OR estimate. The "funnel" in these graphs shows the 95% confidence intervals (95% CIs) around the pooled estimate of the OR at varying levels of precision. Each survey's estimate was plotted on the funnel graph, showing whether it falls within the 95% CI of the pooled estimate given the estimated precision of the individual survey estimate. Less precise estimates are located to the left (where the funnel is wider); more precise estimates are located to the right (where the funnel is narrower). These graphs provide a visual summary both of the overall (pooled) relationship between asthma and depressive disorders, anxiety disorders and alcohol use disorders and of the extent to which individual country estimates cluster around the pooled estimate.

3. Results

3.1. Sample characteristics

The proportion of the sample aged ≥60 years was higher in developed countries than in developing countries, and the percentage with ≥12 years of education was also generally higher in developed countries (Table 1). The sample size

Table 1
Sample characteristics and asthma prevalence

Country	Part 1 sample (n)	Part 2 subsample (n)	Mean age[a]	Aged ≥ 60 years (%)	Female (%)	≥Secondary education (%)	Asthma prevalence[b]	
							n	Weighted prevalence (%)
Americas								
Colombia	4426	2381	36.6	5.3	54.5	46.4	93	3.0
Mexico	5782	2362	35.2	5.2	52.3	31.4	63	2.2
United States	9282	5692	45.0	21.2	53.0	83.2	751	11.6
Asia and South Pacific								
Japan	2436	887	51.4	34.9	53.7	70.0	57	5.4
Beijing, PRC	2633	914	39.8	15.6	47.5	61.4	37	2.3
Shanghai, PRC	2568	714	42.9	18.7	48.1	46.8	28	5.1
New Zealand	12992	7312	44.6	20.7	52.2	60.4	1357	17.2
Europe								
Belgium	2419	1043	46.9	27.3	51.7	69.7	61	5.8
France	2894	1436	46.3	26.5	52.2	NA	111	7.5
Germany	3555	1323	48.2	30.6	51.7	96.4	63	4.5
Italy	4712	1779	47.7	29.2	52.0	39.5	86	4.6
The Netherlands	2372	1094	45.0	22.7	50.9	69.7	102	8.5
Spain	5473	2121	45.5	25.5	51.4	41.7	130	5.7
Ukraine	4725	1720	46.1	27.3	55.1	79.5	54	1.8
Middle East and Africa								
Lebanon	2857	602	40.3	15.3	48.1	40.5	9	1.2
Nigeria	6752	2143	35.8	9.7	51.0	35.6	17	0.6
Israel	4859	4859	44.4	20.3	51.9	78.3	353	7.2
South Africa	4315	4315	37.1	8.8	53.6	38.9	256	5.8

[a] Age range ≥18 years, except for Colombia, Mexico (18–65 years), Japan (≥20 years) and Israel (≥21 years).
[b] Lifetime diagnosis of asthma.

Table 2
Prevalence (%) of depressive disorders among persons with asthma versus persons without asthma, and age-adjusted and sex-adjusted odds of association

Country	Major depression			Dysthymia		
	Without asthma (%)	With asthma (%)	OR (CI) (adjusted for age and sex)	Without asthma (%)	With asthma (%)	OR (CI) (adjusted for age and sex)
Colombia	5.7	19.7	3.8 (1.8, 8.3)*	0.9	6.7	7.5 (1.6, 34.7)*
Mexico	4.1	5.0	1.2 (0.4, 3.0)	0.9	0.7	0.7 (0.1, 3.5)
United States	7.9	11.3	1.4 (1.1, 1.7)*	2.1	3.7	1.7 (1.1, 2.6)*
Japan	2.2	2.8	1.2 (0.3, 4.3)	0.8	0.6	0.9 (0.1, 7.1)
Beijing	2.3	4.0	2.5 (0.8, 8.1)	0.3	1.3	2.8 (0.3, 26.9)
Shanghai	1.7	2.2	1.4 (0.2, 7.8)	0.4	0.0	
New Zealand	6.0	9.5	1.5 (1.2, 1.8)*	1.7	2.6	1.5 (1.0, 2.1)*
Belgium	5.5	6.5	1.2 (0.4, 3.2)	1.4	0.3	0.2 (0.0, 2.2)
France	5.8	9.3	1.5 (0.7, 3.2)	1.5	3.2	2.6 (0.7, 9.9)
Germany	2.9	5.6	2.1 (0.5, 9.4)	0.8	4.3	5.4 (0.8, 37.3)
Italy	3.0	5.9	2.2 (1.1, 4.4)*	1.0	1.6	1.6 (0.4, 5.9)
The Netherlands	5.1	7.2	1.4 (0.6, 3.5)	1.7	2.6	1.6 (0.6, 4.4)
Spain	3.8	8.8	2.7 (1.6, 4.5)*	1.3	2.7	2.5 (1.1, 6.0)*
Ukraine	9.2	25.5	2.7 (1.4, 5.2)*	3.9	16.7	3.6 (1.5, 8.6)*
Lebanon	1.8	3.8		0.7	0.0	
Nigeria	1.1	8.8		0.2	0.0	
Israel	5.9	8.1	1.4 (0.9, 2.1)	1.2	1.4	1.1 (0.5, 2.7)
South Africa	4.6	9.5	2.1 (1.1, 4.0)*	0.1	0.0	
Pooled OR			1.6 (1.4, 1.8)*			1.7 (1.4, 2.1)*

OR is not listed and the percentage of those with asthma is shown as 0.0 if fewer than 25 respondents have asthma or if the cross-classification of mental disorder and asthma is null.
* $P<.05$.

numbers provided in Table 1 are the numbers of respondents completing Part 2 of the interview, including the question concerning the presence of asthma. Consistent with the multicountry ECRHS [24,29], the prevalence of lifetime asthma was highest in two English-speaking developed countries: New Zealand and the United States (Table 1). Also consistent with ECRHS findings, age and sex patterns in asthma prevalence were not consistent across countries (data not shown).

3.2. Depressive disorders and asthma

Prevalence estimates for major depression among persons with asthma varied from 2% to 26% across the surveys (Table 2), but generally fell in the 5–10% range. The prevalence of dysthymia among those with asthma was typically lower. Age-adjusted and sex-adjusted ORs measuring the association of major depression with asthma were significant for 7 of 16 surveys for which ORs were calculated and for 5 of 14 surveys in the case of dysthymia. Variability in OR estimates across the surveys was not found to be greater than expected by chance for either major depression ($P=.26$) or dysthymia ($P=.25$). Pooled ORs indicate that both major depression (OR=1.6) and dysthymia (OR=1.7) are significantly associated with asthma.

Fig. 1 shows the funnel graph of age-adjusted and sex-adjusted ORs for depressive disorders for all surveys. The central line indicates the pooled estimate of the association between asthma and depressive disorders (OR=1.6; 95% CI=1.4, 1.8). Curved funnel lines show the 95% CI around the pooled estimate for a given level of precision. Two

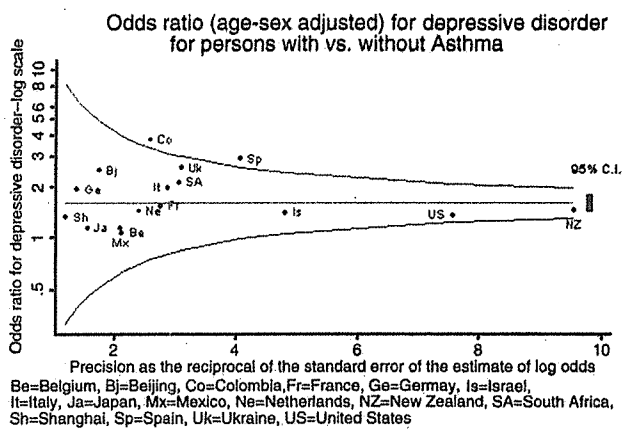

Fig. 1. Pooled OR (95% CI) of the association between any depressive disorder and asthma, with survey-specific ORs plotted as a function of the precision of the estimate.

Table 3
Prevalence (%) of anxiety disorders among persons with asthma versus persons without asthma, and age-adjusted and sex-adjusted odds of association

(A)

Country	Generalized anxiety			Agoraphobia or panic disorder		
	Without asthma (%)	With asthma (%)	OR (CI) (adjusted for age and sex)	Without asthma (%)	With asthma (%)	OR (CI) (adjusted for age and sex)
Colombia	1.0	0.7	0.6 (0.1, 5.9)	2.1	4.5	2.0 (0.8, 5.2)
Mexico	0.6	0.0		1.3	1.1	0.7 (0.2, 3.4)
United States	3.7	6.7	1.7 (1.2, 2.5)*	3.5	4.7	1.3 (0.9, 1.8)
Japan	1.5	2.2	1.7 (0.4, 7.8)	0.7	0.7	0.8 (0.1, 6.7)
Beijing	1.1	3.6	2.9 (0.5, 17.2)	0.4	0.0	
Shanghai	0.8	0.0		0.1	0.0	
New Zealand	2.7	4.7	1.7 (1.2, 2.2)*	2.0	3.2	1.5 (1.0, 2.1)*
Belgium	0.9	3.5	4.0 (0.8, 19.6)	1.6	0.0	
France	1.8	5.3	2.8 (1.0, 7.7)*	1.4	1.2	0.8 (0.1, 4.1)
Germany	0.5	0.0		1.0	3.2	4.1 (1.4, 12.0)*
Italy	0.5	0.0		1.0	0.4	0.4 (0.1, 3.3)
The Netherlands	1.1	0.6	0.6 (0.1, 3.3)	1.5	4.1	3.0 (0.7, 12.9)
Spain	0.9	2.2	2.8 (0.8, 10.0)	0.8	1.2	1.6 (0.5, 5.7)
Ukraine	2.3	3.4	1.2 (0.2, 6.1)	1.7	10.6	6.0 (2.1, 16.8)*
Lebanon	0.2	0.0		0.2	0.0	
Nigeria	0.0	0.0		0.3	0.0	
Israel	2.6	3.2	1.2 (0.6, 2.3)	0.9	1.5	1.7 (0.7, 4.1)
South Africa	1.7	5.1	2.7 (1.1, 6.5)*	5.1	12.5	2.6 (1.5, 4.3)*
Pooled OR			1.7 (1.4, 2.1)*			1.7 (1.4, 2.0)*

(B)

Country	Social phobia			Posttraumatic stress disorder		
	Without asthma (%)	With asthma (%)	OR (CI) (adjusted for age and sex)	Without asthma (%)	With asthma (%)	OR (CI) (adjusted for age and sex)
Colombia	2.8	3.3	1.1 (0.3, 3.6)	0.6	0.0	
Mexico	1.9	5.7	2.9 (1.1, 7.5)*	0.5	2.1	3.6 (0.9, 15.1)
United States	6.8	7.5	1.0 (0.8, 1.3)	3.4	4.9	1.3 (0.8, 1.9)
Japan	0.5	1.9	3.8 (0.7, 22.1)	0.3	1.6	4.3 (1.0, 19.6)
Beijing	0.3	0.9	5.0 (0.8, 29.4)	0.3	0.0	
Shanghai	0.0	0.0		0.1	0.0	
New Zealand	4.9	6.0	1.1 (0.9, 1.4)	2.6	5.1	1.8 (1.3, 2.6)*
Belgium	1.1	1.1	0.9 (0.1, 6.8)	0.7	0.3	0.5 (0.1, 4.4)
France	2.4	5.6	2.1 (0.7, 6.9)	2.0	6.6	3.3 (0.9, 12.3)
Germany	1.8	1.5	1.0 (0.2, 4.5)	0.7	0.0	
Italy	1.0	2.8	3.2 (0.5, 20.6)	0.7	1.7	2.8 (0.5, 14.5)
The Netherlands	1.2	1.8	1.4 (0.5, 4.1)	1.9	9.1	5.5 (1.5, 20.8)*
Spain	0.5	3.7	8.1 (1.8, 35.8)*	0.4	1.7	3.8 (1.2, 12.7)*
Ukraine	2.1	1.1	0.8 (0.1, 5.2)	2.6	13.0	4.1 (1.0, 17.8)
Lebanon	0.6	0.0		1.7	1.1	
Nigeria	0.3	0.0		0.0	0.0	
Israel				0.6	0.3	0.6 (0.1, 4.2)
South Africa	1.7	5.0	3.1 (1.5, 6.5)*	0.6	0.5	0.8 (0.1, 6.2)
Pooled OR			1.3 (1.1, 1.5)*			1.8 (1.4, 2.3)*

OR is not listed and the percentage of those with asthma is shown as 0.0 if fewer than 25 respondents have asthma or if the cross-classification of mental disorder and asthma is null.
* $P<.05$.

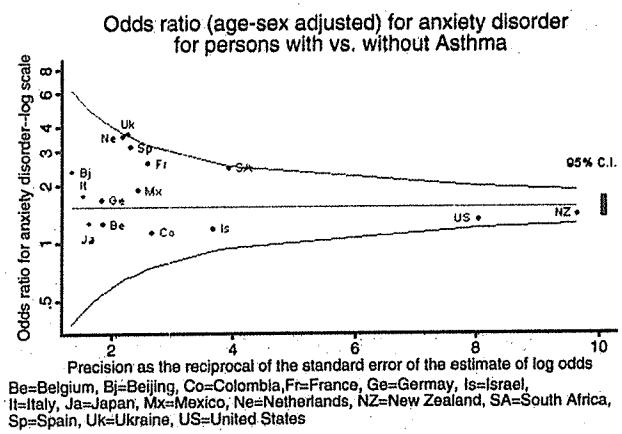

Fig. 2. Pooled OR (95% CI) of the association between any anxiety disorder and asthma, with survey-specific ORs plotted as a function of the precision of the estimate.

important observations can be made from this graph: first, that all estimates, except those for Spain and Columbia, fell within the 95% CIs of the pooled estimate; and, second, that the estimates of those countries within the funnel cluster in fairly close proximity to the pooled estimate. These observations support the conclusion that persons with lifetime asthma are more likely to experience depressive disorders than otherwise comparable persons without lifetime asthma.

3.3. Anxiety disorders and asthma

The prevalences of specific anxiety disorders among people with and without asthma are reported in Table 3A and B. Because specific anxiety disorders were less common than depressive disorders, it was not possible to estimate ORs for many of the participating surveys. Given the relatively small sample sizes, it is not surprising that OR estimates were significant for some surveys but not for others, even when the confidence intervals of OR estimates included the pooled estimate. The heterogeneity test for variability among the ORs was nonsignificant for generalized anxiety disorder ($P=.71$), agoraphobia/panic ($P=.07$) and posttraumatic stress disorder ($P=.14$), although it was significant for social phobia ($P=.02$). Given the limited number of cases available in each survey, the pooled estimate of the OR provides a more precise estimate of the association of anxiety disorder with asthma. Across the four anxiety disorders, pooled ORs were all significantly greater than 1 and fell within the 1.3–1.8 range.

Table 4
Prevalence (%) of alcohol use disorders among persons with asthma versus persons without asthma, and age-adjusted and sex-adjusted odds of association

Country	Alcohol abuse or dependence		
	Without asthma	With asthma	OR (CI) (adjusted for age and sex)
Colombia	2.2	12.5	8.9 (3.0, 26.5)*
Mexico	2.2	2.7	1.6 (0.3, 9.4)
United States	2.8	5.1	1.8 (1.2, 2.7)*
Japan	1.1	1.6	1.6 (0.2, 14.9)
Beijing	2.5	1.0	0.9 (0.2, 5.0)
Shanghai	0.5	0.2	0.8 (0.1, 8.0)
New Zealand	2.5	4.1	1.5 (1.0, 2.1)
Belgium	1.3	1.2	0.9 (0.1, 11.3)
France	0.8	0.5	0.6 (0.1, 5.4)
Germany	1.2	1.7	1.8 (0.2, 19.5)
Italy	0.1	0.0	
The Netherlands	1.6	3.0	2.0 (0.4, 10.3)
Spain	0.3	1.0	2.9 (0.2, 34.6)
Ukraine	6.0	13.2	5.4 (0.6, 50.1)
Lebanon	1.1	0.0	
Nigeria	0.7	0.0	
Ismel	1.1	1.7	1.7 (0.7, 4.0)
South Africa	4.9	5.9	1.4 (0.6, 2.9)
Pooled OR			1.7 (1.4, 2.1)*

OR is not listed and the percentage of those with asthma is shown as 0.0 if fewer than 25 respondents have asthma or if the cross-classification of mental disorder and asthma is null.
* $P<.05$.

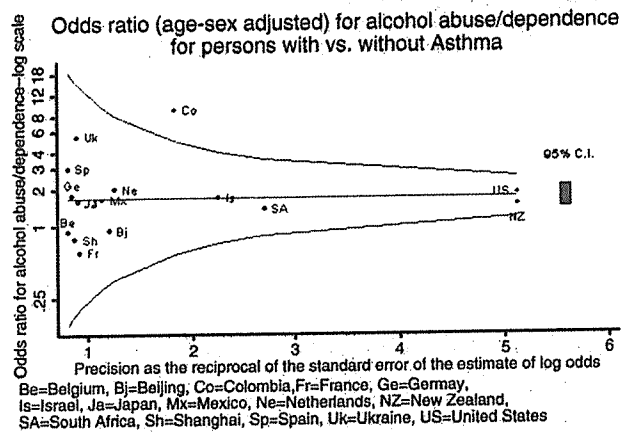

Fig. 3. Pooled OR (95% CI) of the association between any alcohol use disorder and asthma, with survey-specific ORs plotted as a function of the precision of the estimate.

The association of any anxiety disorder with asthma (Fig. 2) showed a pattern similar to that observed for any depressive disorder. The pooled estimate of the OR was 1.5 (95% CI=1.4, 1.7). Among survey-specific estimates, all but one (Ukraine) fell within the 95% CI of the pooled estimate. These results indicate that the strength of the association of anxiety disorders, as a class, with asthma is comparable to that observed for depressive disorders.

3.4. Alcohol use disorders and asthma

The prevalence of alcohol abuse or dependence among those with asthma was highly variable across countries (Table 4). ORs for the association of alcohol abuse or dependence with asthma were significantly greater than 1 in only 2 of 15 surveys with estimable ORs, but the estimates were not found to be heterogeneous across surveys ($P=.45$). The pooled estimate for the association of alcohol abuse or dependence and asthma was 1.7 (95% CI=1.4, 2.1), with 14 of 15 survey estimates falling within the 95% CI of the pooled estimate (Fig. 3). These results suggest that alcohol abuse or dependence tends to occur with greater frequency among persons with asthma.

4. Discussion

This report provides the first cross-national population-based assessment of the association of lifetime asthma with a range of common mental disorders among adults. Although the prevalence of 12-month mental disorders and asthma varies greatly across individual surveys, the association of the two shows much less cross-national variability, with survey estimates of the association between asthma and mental disorder groups (depressive, anxiety and alcohol use) in the vast majority of countries clustering around pooled estimates. This consistency of results across surveys is notable in light of the fact that the participating surveys included countries that differ markedly in culture, language and level of socioeconomic development. Key findings are that depressive, anxiety and alcohol use disorders are all significantly, albeit modestly, associated with asthma and that the degree of association is fairly similar across mental disorder groups.

Previous research on the adult general population has been suggestive of a relationship between asthma and both anxiety and mood disorders, but in the most comprehensive population study investigating a range of *DSM-IV* disorders,

the relationship was more consistently observed for anxiety disorders than for mood disorders and was not observed at all for substance use disorders [11]. The current study replicates the finding for anxiety disorders, confirms a similar-magnitude relationship with depressive disorders and demonstrates for the first time a relationship with alcohol use disorders. The magnitude of the associations observed here is similar to those of previous population studies, with associations between asthma and the any-depressive-disorder and any-anxiety-disorder groups in this study being 1.5 and 1.6, respectively, compared with 1.5–2.1 in other population studies, which have used diagnostic measures of mental disorders [11,16,17].

A strength of this study is that the estimates are pooled across a large number of consistently conducted surveys. Individual surveys might appear to yield disparate results if examined individually, yet whether country-specific ORs are statistically significant varies largely as a function of variation in sample or cell size. More important is the fact that country-specific ORs do not typically differ significantly from each other, allowing confidence in pooled estimates, and that estimates from most individual surveys fall within the 95% CIs of the pooled estimates. This result reflects the usefulness of a meta-analytical approach when investigating the co-occurrence of mental and physical problems (where the smaller number of people with both disorders reduces power in an individual survey).

These results need to be interpreted in light of the limited assessment of asthma. There are two main aspects to this limitation. First, it is a lifetime measure, not a measure of current symptoms; second, although it is a measure of asthma diagnosis, it is self-reported diagnosis. With regard to the issue of time period (lifetime vs. current), the study by Goodwin et al. [11] found that associations between any severe mental disorder were virtually identical for lifetime severe versus current severe asthma (although only significant in the former) and were somewhat stronger for current nonsevere asthma versus lifetime nonsevere asthma. Other research by Goodwin and Eaton [15] found that panic attacks were associated with current asthma under treatment, but not with remitted asthma, which suggests that the lifetime measure used here could have resulted in somewhat attenuated estimates of the association between asthma and mental disorders. However, as noted above, the estimates obtained in this study are in line with other population studies using diagnostic measures of mental disorders. Additionally, our measure of reported diagnosis rather than symptoms means that the associations observed are not likely to be an artifact of the known relationship between symptoms of anxiety and depression and self-reports of asthma symptoms [13], since this bias is not observed with self-reported diagnoses of asthma [13,30].

With regard to the second issue relating to asthma ascertainment, it is not clear how much discrepancy there might be between self-reported diagnosis and physician-confirmed diagnosis of lifetime asthma. Goodwin et al. [11] report the proportion of physician-confirmed lifetime asthma from among those who endorsed a screening question about current asthma, so this is not directly comparable to the current study. While acknowledging this limitation, it is reassuring to note that the estimates of asthma prevalence for the German population across the two studies are fairly comparable (with the present study being the more conservative of the two), as are the associations obtained between lifetime asthma and mental disorders.

Lastly, on the limitations of asthma ascertainment, it should be noted that there were neither measures of asthma severity nor measures of asthma medication use. The associations reported are therefore averaged across the full spectrum of asthma severity and, as such, are likely to underestimate the magnitude of the relationship between mental disorders and severe asthma.

Due to the cross-sectional nature of the surveys, the observed associations do not provide information with regard to the direction of the relationship between asthma and mental disorders. Other research suggests that, in contrast to earlier thinking on the role of psychological factors in asthma, mental disorders are probably not etiologic; atopic and immunologic factors are more probably the prime causal candidates for the development of asthma [1]. A study by Goodwin et al. [16] on a longitudinal sample of 18- to 21-year-olds in New Zealand found that the associations between asthma and mental disorders disappeared altogether when adverse childhood conditions and other unspecified correlates were controlled for, allowing the possibility that asthma and mental disorders are associated through other common factors. Adverse childhood conditions may well explain the association observed here between asthma and alcohol use disorders. It does not, however, mean that the link between asthma and mental disorders is spurious. By whatever mechanisms they come to be associated, the interplay of mental disorders with asthma may be mutually self-perpetuating. Katon et al. [31] have developed a model of the possible cognitive and behavioral mechanisms that link anxiety and depressive symptoms with asthma, each serving to maintain the other. Other research, too, confirms the important clinical consequences of the co-occurrence of depressive and anxiety disorders with asthma. Anxiety and depression have been found to influence the perception of asthma symptoms and the response to asthma symptoms [3,32], reduce treatment adherence and increase hospitalization [32–35], and reduce quality of life [9,14,32,35,36].

Given these clinical ramifications, the results of this study confirm the importance of awareness among clinicians, in whichever setting they work, of the significant overlap of asthma with mental disorders.

Acknowledgments

The surveys included in this report were carried out in conjunction with the WHO World Mental Health Survey Initiative. We thank the World Mental Health staff for assistance with instrumentation, fieldwork and data analysis. These activities were supported by the US National Institute of Mental Health (R01MH070884); the John D. and Catherine T. MacArthur Foundation; the Pfizer Foundation; the US Public Health Service (R13-MH066849, R01-MH069864 and R01-DA016558); the Fogarty International Center (FIRCA R01-TW006481); the Pan American Health Organization; Eli Lilly and Co.; Ortho-McNeil Pharmaceutical, Inc.; GlaxoSmithKline; and Bristol-Myers Squibb. A complete list of World Mental Health publications can be found at http://www.hcp.med.harvard.edu/wmh/. The Chinese World Mental Health Survey Initiative was supported by the Pfizer Foundation. The Colombian National Study of Mental Health was supported by the Ministry of Social Protection, with supplemental support from the Saldarriaga Concha Foundation. The ESEMeD project was funded by the European Commission (contract QLG5-1999-01042; SANCO 2004123); the Piedmont Region, Italy; Fondo de Investigación Sanitaria, Instituto de Salud Carlos III, Spain (FIS 00/0028); Ministerio de Ciencia y Tecnología, Spain (SAF 2000-158-CE); Departament de Salut, Generalitat de Catalunya, Spain; other local agencies; and an unrestricted educational grant from GlaxoSmithKline. The Israel National Health Survey was funded by the Ministry of Health, with support from the Israel National Institute for Health Policy and Health Services Research and the National Insurance Institute of Israel. The World Mental Health Japan Survey was supported by the Grant for Research on Psychiatric and Neurological Diseases and Mental Health (H13-SHOGAI-023, H14-TOKUBETSU-026 and H16-KOKORO-013) from the Japan Ministry of Health, Labor and Welfare. The Lebanese National Mental Health Survey was supported by the Lebanese Ministry of Public Health, the WHO Lebanon, anonymous private donations to IDRAC (Institute for Development, Research, Advocacy and Applied Care, Lebanon) and unrestricted grants from Janssen Cilag, Eli Lilly, GlaxoSmithKline, Roche and Novartis. The Mexican National Comorbidity Survey was supported by The National Institute of Psychiatry Ramon de la Fuente (INPRFMDIES 4280) and the National Council on Science and Technology (CONACyT-G30544-H), with supplemental support from the PanAmerican Health Organization. Te Rau Hinengaro: The New Zealand Mental Health Survey was supported by the New Zealand Ministry of Health, the Alcohol Advisory Council and the Health Research Council. The Nigerian Survey of Mental Health and Wellbeing was supported by the WHO Geneva, the WHO Nigeria and the Federal Ministry of Health, Abuja, Nigeria. The South Africa Stress and Health Study was supported by the US National Institute of Mental Health (R01-MH059575) and the National Institute of Drug Abuse, with supplemental funding from the South African Department of Health and the University of Michigan. The Ukraine Comorbid Mental Disorders During Periods of Social Disruption study was funded by the US National Institute of Mental Health (RO1-MH61905). The US National Comorbidity Survey Replication was supported by the National Institute of Mental Health (U01-MH60220), with supplemental support from the National Institute of Drug Abuse, the Substance Abuse and Mental Health Services Administration, the Robert Wood Johnson Foundation (grant 044708) and the John W. Alden Trust.

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Journal of Affective Disorders xx (2007) xxx–xxx

JOURNAL OF AFFECTIVE DISORDERS

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Research report

Depression–anxiety relationships with chronic physical conditions: Results from the World Mental Health surveys ☆

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Received 2 November 2006; received in revised form 5 January 2007; accepted 9 January 2007

Abstract

Background: Prior research on the association between affective disorders and physical conditions has been carried out in developed countries, usually in clinical populations, on a limited range of mental disorders and physical conditions, and has seldom taken into account the comorbidity between depressive and anxiety disorders.

Methods: Eighteen general population surveys were carried out among adults in 17 countries as part of the World Mental Health Surveys initiative (N=42, 249). DSM-IV depressive and anxiety disorders were assessed using face-to-face interviews with the Composite International Diagnostic Interview (CIDI 3.0). Chronic physical conditions were ascertained via a standard checklist. The relationship between mental disorders and physical conditions was assessed by considering depressive and anxiety disorders independently (depression without anxiety; anxiety without depression) and conjointly (depression plus anxiety).

Results: All physical conditions were significantly associated with depressive and/or anxiety disorders but there was variation in the strength of association (ORs 1.2–4.5). Non-comorbid depressive and anxiety disorders were associated in equal degree with physical conditions. Comorbid depressive–anxiety disorder was more strongly associated with several physical conditions than were single mental disorders.

Limitations: Physical conditions were ascertained via self report, though for a number of conditions this was self-report of diagnosis by a physician.

Conclusions: Given the prevalence and clinical consequences of the co-occurrence of mental and physical disorders, attention to their comorbidity should remain a clinical and research priority.

Keywords: Anxiety; Depression; Cross-sectional; Chronic conditions

☆ The funders, detailed in the Acknowledgements section, funded the survey data collection and in some cases have funded the ongoing work of research groups. The funders have had no role in influencing the analysis or interpretation of data, the writing of this report or the decision to submit it for publication.

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0165-0327/$ - see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.jad.2007.01.015

1. Introduction

It is now well established that there is significant comorbidity (co-occurrence) of mental disorders, particularly mood disorders, with chronic physical conditions (Wells et al., 1989a,b; Dew, 1998; Katon and Ciechanowski, 2002; Harter et al., 2003; McWilliams et al., 2003; Buist-Bouwman et al., 2005; Simon et al., 2006; Ortega et al., 2006). These associations have considerable individual and public health significance in their impact on role impairment (Sullivan et al., 1997; Kessler et al., 2003), treatment costs and adherence (Simon et al., 1995; Ciechanowski et al., 2000) and premature mortality risk (Harris and Barraclough, 1998; van Melle et al., 2004; Zhang et al., 2005). However, prior research on the strength of the association between mental disorders and physical conditions has been limited by a preponderance of clinical relative to general population studies, a restricted range of mental or physical conditions explored and an absence of information from developing countries.

There is a further limitation to the earlier research on this topic. Anxiety and depressive disorders often co-occur. Population surveys have found that about half those with a current mood disorder also have a comorbid anxiety disorder (Kessler et al., 1996; Scott et al., 2006). Since prior research has not usually taken this depression–anxiety comorbidity into account, it is not known whether the association of anxiety disorders with chronic physical conditions might be due to comorbid mood disorder, or conversely, whether the association of mood disorders with chronic physical conditions might be due to comorbid anxiety disorder. Additionally, comorbid depression–anxiety is believed to be a more severe and chronic form of psychological disorder than non-comorbid depressive or anxiety disorders (Angst, 1997), so it is of interest to determine if comorbid depressive–anxiety disorder is associated with increased risks of chronic physical conditions. Lastly, since prior research has typically studied single or small numbers of chronic physical conditions, it is not clear whether there are substantial differences in mental–physical comorbidity patterns across different chronic physical conditions.

This paper addresses these issues by using data from 18 surveys participating in the World Mental Health Surveys to investigate the association of 10 chronic physical conditions with depressive and anxiety disorders, taking the comorbidity between depressive and anxiety disorders into account. The objectives of this paper are: 1) to determine whether non-comorbid depressive disorder and/or non-comorbid anxiety disorder are associated with specific physical conditions; 2) to determine whether comorbid depressive–anxiety disorder is more strongly associated than is non-comorbid depressive or anxiety disorder with physical conditions; and 3) to contrast the strength of association of different chronic physical conditions with depressive and anxiety disorders.

2. Methods

The methods employed in the World Mental Health surveys relevant to this report have been described in detail in prior reports (Kessler et al., 2004). Here we provide a brief overview of the key methodologic features.

2.1. Samples

Eighteen surveys were carried out in 17 countries in the Americas (Colombia, Mexico, United States), Europe (Belgium, France, Germany, Italy, Netherlands,

Spain, Ukraine), the Middle East (Israel, Lebanon), Africa (Nigeria, South Africa), Asia (Japan, People's Republic of China: Beijing, Shanghai), and New Zealand. An effort was made to recruit as many countries as possible in the initiative. The final set of countries was determined by availability of collaborators in the country who were able to obtain funding for the survey. All surveys were based on multi-stage, clustered area probability household samples. All interviews were carried out face-to-face by trained lay interviewers. The combined total sample size was 85,052. Survey response rate varied, with a weighted average response rate across surveys of 71%.

Internal sub-sampling was used to reduce respondent burden by dividing the interview into two parts. Part 1 included the core diagnostic assessment of mental disorders. Part 2 included additional information relevant to a wide range of survey aims, including assessment of chronic physical conditions. All respondents completed Part 1. All Part-1 respondents who met criteria for any mental disorder and a probability sample of other respondents were administered Part 2. Part-2 respondents were weighted by the inverse of their probability of selection for Part 2 of the interview to adjust for differential sampling. Analyses in this article were based on the weighted Part-2 sample (N=42,249). Additional weights were used to adjust for differential probabilities of selection within households and to match the samples to population socio-demographic distributions.

2.2. Training and field procedures

The central World Mental Health (WMH) staff trained bilingual supervisors in each country. Consistent interviewer training documents and standardized translation protocols were used across surveys. The institutional review board of the organization that coordinated the survey in each country approved and monitored compliance with procedures for obtaining informed consent and protecting human subjects.

2.3. Mental disorder status

All surveys assessed mental disorders with the World Mental Health version of the WHO Composite International Diagnostic Interview (WMH-CIDI, now CIDI 3.0) (Kessler and Ustun, 2004), a fully structured diagnostic interview. Disorders considered in this paper include 12-month anxiety disorders (generalized anxiety disorder, panic disorder and/or agoraphobia, posttraumatic stress disorder, and/or social phobia) and 12-month depressive disorders (dysthymia and/or major depressive disorder). Disorders were assessed using the definitions and criteria of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*) (APA, 1994). CIDI organic exclusion rules were imposed in making all diagnoses. Methodological evidence collected in the WHO-CIDI Field Trials and later clinical calibration studies showed that all the disorders considered herein were assessed with acceptable reliability and validity in the WMH-CIDI (Kessler et al., 2004).

2.4. Mental disorder comorbidity status

The analyses in this paper consider persons in three mutually exclusive groups, those with: 1) a depressive disorder in the absence of comorbid anxiety disorder; 2) an anxiety disorder in the absence of comorbid depressive disorder; and 3) comorbid depressive and anxiety disorder.

2.5. Chronic physical conditions

Physical conditions were assessed with a standard chronic disorder checklist, of the kind commonly used in national health surveys (NCHS, 1994). For the conditions reported here respondents were asked if they had ever had arthritis, chronic back or neck problems, frequent or severe headaches (referred to here as 'chronic headaches'), other chronic pain, stroke, heart attack, or whether they had ever been told by a doctor they had heart disease, high blood pressure, asthma, diabetes or ulcer. The category 'multiple pains' includes two or more of arthritis, chronic back or neck problems, chronic headaches, or other chronic pain. Prior research has demonstrated reasonable correspondence between self-reported chronic conditions such as diabetes, heart disease and asthma, and general practitioner records (Kriegsman et al., 1996). Obesity was defined as a body mass index (BMI) of 30 kg/m^2 or greater. Height and weight were self-reported.

2.6. Analytic methods

Analyses were run for all ten physical conditions on a country-by-country basis (data available on request). Odds ratios for the association of the three mental disorder groups with each of the physical conditions were estimated for each survey adjusting for age and sex. Associations were not further adjusted for socio-economic status as this may be part of the vulnerability for mental–physical comorbidity and the purpose of this paper was descriptive rather than explanatory. Countries were included in a particular analysis if they had at least 25 respondents with the physical condition. Some countries did not collect obesity data. Ninety-five percent confidence intervals for the odds ratios were estimated using the Taylor Series method (Wolter, 1985) with SUDAAN software (SUDAAN, 2002) to adjust for clustering and weighting.

Using meta-analytic methods to summarise results across surveys, pooled estimates of the odds ratios were developed describing the association of each of the mental disorder groups with the specific physical condition across surveys. The pooled estimate of the odds ratio was weighted by the inverse of the variance of the estimate for each survey (DerSimonian and Laird, 1986). Tests were carried out to assess whether heterogeneity among the country-specific odds of association between each of the mental disorder status groups and a given physical condition was greater than that expected by chance (DerSimonian and Laird, 1986), using a conservative alpha value of $p<0.05$.

Table 1
Sample characteristics

Country	Part-2 subsample (N)	Mean age[a]	% (60 years or older)	% (women)	Education (secondary or greater)
Americas					
Colombia	2381	36.6	5.3	54.5	46.4
Mexico	2362	35.2	5.2	52.3	31.4
United States	5692	45.0	21.2	53.0	83.2
Asia and South Pacific					
Japan	887	51.4	34.9	53.7	70.0
PRC — Beijing	914	39.8	15.6	47.5	61.4
PRC — Shanghai	714	42.9	18.7	48.1	46.8
New Zealand	7312	44.6	20.7	52.2	60.4
Europe					
Belgium	1043	46.9	27.3	51.7	69.7
France	1436	46.3	26.5	52.2	NA
Germany	1323	48.2	30.6	51.7	96.4
Italy	1779	47.7	29.2	52.0	39.5
Netherlands	1094	45.0	22.7	50.9	69.7
Spain	2121	45.5	25.5	51.4	41.7
Ukraine	1720	46.1	27.3	55.1	79.5
Middle East and Africa					
Lebanon	602	40.3	15.3	48.1	40.5
Nigeria	2143	35.8	9.7	51.0	35.6
Israel	4859	44.4	20.3	51.9	78.3
South Africa	4315	37.1	8.8	53.6	38.9

[a] Age range ≥18, except for Colombia, Mexico (18–65), Japan (≥20) and Israel (≥21).

Table 2
Association of mental disorders with chronic physical conditions—odds ratios pooled across 17 countries, adjusted for age and sex (95% confidence intervals)

Type of physical condition	Type of mental disorder		
	Non-comorbid depressive disorder	Non-comorbid anxiety disorder	Comorbid depression–anxiety
Obesity	1.1 (0.9, 1.2)	1.2 (1.1, 1.4)*	1.2 (1.0, 1.4)*
Diabetes	1.3 (1.1, 1.6)*	1.3 (1.1, 1.5)*	1.4 (1.1, 1.8)*
Asthma	1.7 (1.4, 2.0)*	1.6 (1.4, 1.8)*	1.6 (1.4, 1.9)*
Hypertension	1.5 (1.4, 1.8)*	1.7 (1.5, 1.9)*	1.8 (1.5, 2.1)*
Arthritis	1.6 (1.4, 1.8)*	1.7 (1.5, 1.9)*	2.5 (2.2, 2.9)*
Ulcer	1.8 (1.6, 2.2)*	1.9 (1.7, 2.3)*	2.7 (2.3, 3.2)*
Heart disease	2.0 (1.7, 2.3)*	1.9 (1.6, 2.3)*	2.8 (2.3, 3.4)*
Back/neck problems	2.2 (1.9, 2.4)*	2.0 (1.8, 2.3)*	2.9 (2.5, 3.3)*
Chronic Headache	2.5 (2.2, 2.8)*	2.3 (2.1, 2.5)*	4.0 (3.5, 4.7)*
Multiple pains	2.5 (2.2, 2.9)*	2.3 (2.1, 2.6)*	4.5 (4.0, 5.1)*

Reference group: persons with neither a depressive nor an anxiety disorder.
* $p<0.05$.

The first set of analyses (shown in Table 2) determined the association of physical conditions with non-comorbid depressive or anxiety disorder and with comorbid depressive–anxiety disorder, where the reference group was those with neither a depressive nor an anxiety disorder. The second set of analyses (shown in Table 3) determined the association of physical conditions with comorbid depressive–anxiety disorder, and also with no mental disorder, where the reference group was persons with a non-comorbid depressive or anxiety disorder. This second set of analyses established whether the association between physical conditions and comorbid depressive–anxiety disorder was significantly greater than the association between physical conditions and non-comorbid depressive or anxiety disorder.

3. Results

Information on sample characteristics is provided in Table 1. The sample size numbers refer to the Part-2 subsample that completed the section of the interview containing the physical condition checklist. The proportion of the sample that was age 60 or greater was higher in the developed countries than the developing countries, and the percent with 12 or more years of education was also generally higher in the developed countries.

The majority of heterogeneity tests assessing whether the variability in odds ratio estimates across surveys was

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greater than chance were non-significant (data available on request). Where they were significant this was due to obviously outlying estimates from one or two countries with very small numbers with the comorbid conditions. Such extreme estimates do not make a significant contribution to the pooled estimate as this is weighted by the inverse of the variance of the estimate for each survey. The pooled results across countries for the association between the mental disorder groups (non-comorbid depression or anxiety and comorbid depressive–anxiety disorder) and the ten physical conditions are presented in Table 2.

Considerable variability in the strength of association between specific physical conditions and mental disorders is apparent. The chronic pain conditions (back/neck problems, chronic headache and multiple pains) show the strongest associations with depressive and anxiety disorders. Non-comorbid depressive and anxiety disorders are remarkably similar to each other in their strength of association with the ten physical conditions examined. They are both independently related to each physical disorder, with the one exception that non-comorbid depressive disorder was not significantly associated with obesity. For the physical conditions with generally weaker associations with mental disorder (e.g., obesity, diabetes, asthma), the association with comorbid depressive–anxiety disorder is roughly equal to the strength of association of the physical condition with non-comorbid depression or anxiety. For those physical conditions with stronger overall relationships with mental disorder (e.g., chronic pain conditions, ulcer, heart disease), their relationship with comorbid depressive–anxiety disorder appears stronger than with depression or anxiety alone, though the formal test for that is presented in Table 3.

Table 3
Association of no depressive or anxiety disorder, and of comorbid depressive–anxiety disorder, with physical conditions— odds ratios pooled across 17 countries, adjusted for age and sex (95% confidence intervals)

Type of physical condition	Type of mental disorder	
	Neither depression nor anxiety	Both depression and anxiety
Obesity	0.9 (0.8, 1.0)*	1.0 (0.8, 1.2)
Diabetes	0.8 (0.7, 0.9)*	1.1 (0.9, 1.4)
Asthma	0.6 (0.5, 0.7)*	1.1 (0.9, 1.4)
Hypertension	0.6 (0.6, 0.7)*	1.0 (0.9, 1.2)
Arthritis	0.6 (0.6, 0.7)*	1.6 (1.3, 1.8)*
Ulcer	0.5 (0.5, 0.6)*	1.4 (1.1, 1.7)*
Heart disease	0.5 (0.5, 0.6)*	1.5 (1.2, 1.8)*
Back/neck problems	0.5 (0.4, 0.5)*	1.4 (1.2, 1.6)*
Chronic headache	0.4 (0.4, 0.5)*	1.7 (1.5, 2.0)*
Multiple pains	0.4 (0.4, 0.4)*	1.9 (1.6, 2.1)*

Reference group: persons with non-comorbid depressive or anxiety disorder
* $p<0.05$.

The results in Table 3 confirm that for six of the ten physical conditions (arthritis, ulcer, heart disease, back/neck problems, chronic headache and multiple pains), their association with comorbid depressive–anxiety disorder is significantly stronger than with depression or anxiety alone. This table also confirms that having neither a depressive nor an anxiety disorder is protective in terms of the likelihood of experiencing any of the ten physical conditions, relative to those with a single mental disorder.

4. Discussion

Despite great diversity in demographic, socioeconomic and health patterns among the 17 countries surveyed, the pooled cross-national results consistently showed that depressive and anxiety disorders were independently and comparably related to a wide range of chronic physical conditions. Comorbid depressive–anxiety disorder was more strongly associated with several physical conditions than was non-comorbid depression and anxiety. There was considerable variability between physical conditions in their strength of association with mental disorders. The findings observed here that heart disease and the chronic pain conditions, among the physical conditions studied, showed the strongest associations with depressive and anxiety disorders is consistent with research highlighting the robust links between these physical conditions and major depressive disorder (Evans et al., 2005). The particular contributions of this report are two-fold. First, it confirms that both anxiety and depressive disorders are independently associated with chronic physical conditions: comorbidity research has often focused on one (Harter et al., 2003) or the other (Evans et al., 2005). Second, this research produces the novel finding that having both depression and anxiety further increases the risk of a number of physical conditions co-occurring.

A limitation of this study is that physical conditions were ascertained by a standard checklist, rather than physician's examination. A distinction may be drawn between those conditions which were ascertained via self-report of symptoms (the pain conditions) and those ascertained via self-report of a physician's diagnosis (asthma, heart disease, high blood pressure, diabetes, ulcer). Self-report of chronic pain conditions has reasonable validity given that these are largely self-defined. For the other conditions, while acknowledging the limitation of self-report, methods research indicates that self-report of diagnosis generally shows good agreement with medical records data (Kehoe et al., 1994; NCHS, 1994; Kriegsman et al., 1996), and importantly, the presence of depressive or anxiety symptoms has not been found to bias or inflate the self-report of diagnosed physical conditions (Kolk et al., 2002). A further limitation is that there were no measures of the severity of the chronic conditions. The associations reported are therefore averaged across the full spectrum of physical condition severity.

A strength of this study is that the estimates are pooled across a large number of consistently conducted surveys. For a given physical condition, whether or not the country-specific odds ratios were statistically significant varied (data available on request), largely as a function of variation in sample or cell size. But the heterogeneity tests indicated that the majority of the country-specific odds ratios did not differ significantly from each other, allowing confidence in the pooled estimates. This reflects the usefulness of a meta-analytical approach when investigating the co-occurrence of mental and physical problems (where the smaller number of people with both disorders reduces power in an individual survey).

The cross-sectional nature of this study limits conclusions about the direction or causal nature of the relationships between mental disorder and physical conditions. Other research suggests that for many of the physical conditions studied here the relationship with mental disorder may be bi-directional, involving a combination of biological and psychosocial mechanisms (Cohen and Rodriguez, 1995; Dew, 1998; Kiecolt-Glaser et al., 2002). However, with regard to our finding that the association between mental disorder and many physical conditions is strengthened in the presence of both anxiety and depression relative to either alone, the following observation may be made. This finding seems more comprehensible within a framework of mental disorder leading to physical condition (whereby the odds of a physical condition are increased with the experience of more mental disorders), than within a framework of physical condition leading to mental disorder (which would imply that a physical condition is more likely to result in both depression and anxiety than either alone). Another possible interpretation is that the combination of factors (both internal and external to the individual) that is conducive to the experience of multiple mental disorders is also conducive to the occurrence of a number of physical conditions. Further research is required to test these possibilities.

What is clear is that mental–physical comorbidity is clinically consequential: it has been shown to complicate treatment, alter disease course, contribute to disability and increase mortality risks (Harris and Barraclough, 1998; Cassano and Fava, 2002; Evans et al., 2005). From this clinical standpoint, the concurrent presentation of mental with physical disorder may be the critical issue, rather than the question of which disorder came first. However, many countries manage the delivery of mental health services separately from that of general medical services, which is not optimal for the adequate recognition and treatment of mental–physical comorbidity (Kathol and Clarke, 2005). Even where depressive and anxiety disorders are predominantly treated within general practice settings, they are typically under-detected there (Ormel et al., 1991; Cassano and Fava, 2002). Moreover, while many primary care clinicians may be aware of the associations between depression and physical conditions, they may be less aware of the connections observed in this study between anxiety disorders and physical conditions, despite the greater prevalence of anxiety disorders relative to depressive disorders (Demyttenaere et al. 2004). Given the increasing prevalence of chronic conditions (Popkin, 1998) and possibly also of anxiety and depressive disorders (Kessler et al., 2005), improved understanding of the determinants, consequences and management of their comorbidity remains a research priority.

Acknowledgements

The surveys included in this report were carried out in conjunction with the World Health Organization World Mental Health (WMH) Survey Initiative. We thank the WMH staff for assistance with instrumentation, fieldwork, and data analysis. These activities were supported by the United States National Institute of Mental Health (R01MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (R13-MH066849, R01-MH069864, and R01 DA016558), the Fogarty International Center (FIRCA R01-TW006481), the Pan American Health Organization, Eli Lilly and Company, Ortho-McNeil Pharmaceutical, Inc., GlaxoSmithKline, and Bristol-Myers Squibb. A complete list of WMH publications can be found at http://www.hcp.med.harvard.edu/wmh/. The Mexican National Comorbidity Survey (MNCS) is supported by The National Institute of Psychiatry Ramon de la Fuente (INPRFMDIES 4280) and by the National Council on Science and Technology (CONACyT-G30544- H), with supplemental support from the PanAmerican Health Organization (PAHO). The Lebanese survey is supported by the Lebanese Ministry of Public Health, the WHO (Lebanon) and unrestricted grants from Janssen Cilag, Eli Lilly, GlaxoSmithKline, Roche, Novartis and anonymous donations. The ESEMeD project was

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funded by the European Commission (Contracts QLG5–1999–01042; SANCO 2004123), the Piedmont Region (Italy), Fondo de Investigación Sanitaria, Instituto de Salud Carlos III, Spain (FIS 00/0028), Ministerio de Ciencia y Tecnología, Spain (SAF 2000–158-CE), Departament de Salut, Generalitat de Catalunya, Spain, and other local agencies and by an unrestricted educational grant from GlaxoSmithKline. The Chinese World Mental Health Survey Initiative is supported by the Pfizer Foundation. The Colombian National Study of Mental Health (NSMH) is supported by the Ministry of Social Protection, with supplemental support from the Saldarriaga Concha Foundation. The Israel National Health Survey is funded by the Ministry of Health with support from the Israel National Institute for Health Policy and Health Services Research and the National Insurance Institute of Israel. The World Mental Health Japan (WMHJ) Survey is supported by the Grant for Research on Psychiatric and Neurological Diseases and Mental Health (H13-SHOGAI-023, H14-TOKUBETSU-026, H16-KOKORO-013) from the Japan Ministry of Health, Labour and Welfare. The New Zealand Mental Health Survey (NZMHS) is supported by the New Zealand Ministry of Health, Alcohol Advisory Council, and the Health Research Council. The Nigerian Survey of Mental Health and Wellbeing (NSMHW) is supported by the WHO (Geneva), the WHO (Nigeria), and the Federal Ministry of Health, Abuja, Nigeria. The South Africa Stress and Health Study (SASH) is supported by the US National Institute of Mental Health (R01-MH059575) and National Institute of Drug Abuse with supplemental funding from the South African Department of Health and the University of Michigan. The Ukraine Comorbid Mental Disorders during Periods of Social Disruption (CMDPSD) study is funded by the US National Institute of Mental Health (RO1-MH61905). The US National Comorbidity Survey Replication (NCS-R) is supported by the National Institute of Mental Health (NIMH; U01-MH60220) with supplemental support from the National Institute of Drug Abuse (NIDA), the Substance Abuse and Mental Health Services Administration (SAMHSA), the Robert Wood Johnson Foundation (RWJF; Grant 044708), and the John W. Alden Trust.

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Please cite this article as: Scott, K.M. et al. Depression-anxiety relationships with chronic physical conditions: Results from the World Mental Health surveys. J. Affect. Disord. (2007), doi: 10.1016/j.jad.2007.01.015