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ORIGINAL ARTICLE

Mental disorders among persons with arthritis: results from the World Mental Health Surveys

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Background. Prior studies in the USA have reported higher rates of mental disorders among persons with arthritis but no cross-national studies have been conducted. In this study the prevalence of specific mental disorders among persons with arthritis was estimated and their association with arthritis across diverse countries assessed.

Method. The study was a series of cross-sectional population sample surveys. Eighteen population surveys of household-residing adults were carried out in 17 countries in different regions of the world. Most were carried out between 2001 and 2002, but others were completed as late as 2007. Mental disorders were assessed with the World Health Organization (WHO) World Mental Health–Composite International Diagnostic Interview (WMH-CIDI). Arthritis was ascertained by self-report. The association of anxiety disorders, mood disorders and alcohol use disorders with arthritis was assessed, controlling for age and sex. Prevalence rates for specific mental disorders among persons with and without arthritis were calculated and odds ratios (ORs) with 95% confidence intervals (CIs) were used to estimate the association.

Results. After adjusting for age and sex, specific mood and anxiety disorders occurred among persons with arthritis at higher rates than among persons without arthritis. Alcohol abuse/dependence showed a weaker and less consistent association with arthritis. The pooled estimates of the age- and sex-adjusted ORs were about 1.9 for mood disorders and for anxiety disorders and about 1.5 for alcohol abuse/dependence among persons with *versus* without arthritis. The pattern of association between specific mood and anxiety disorders and arthritis was similar across countries.

Conclusions. Mood and anxiety disorders occur with greater frequency among persons with arthritis than those without arthritis across diverse countries. The strength of association of specific mood and anxiety disorders with arthritis was generally consistent across disorders and across countries.

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Introduction

Studies conducted in many countries worldwide have found arthritis to be common in the general population, especially among older adults (Carmona *et al.* 2001; CDC, 2001; Zhang *et al.* 2001; Reginster, 2002; PRC, 2003; Stang *et al.* 2006). Among the elderly, about one-third to more than half report arthritis or chronic joint symptoms (Helmick *et al.* 1995; CDC, 2001; Mili *et al.* 2002; Mannoni *et al.* 2003; Stang *et al.* 2006). Arthritis is found to be more common among women than men in most of these studies, and the prevalence of arthritis increases with age in both male and female patients (Mikkelsen *et al.* 1967; Cunningham & Kelsey, 1984; Felson *et al.* 1987; van TQ1 Saase *et al.* 1989; Reginster, 2002). In a community-based survey, the incidence and prevalence of disease increased 2- to 10-fold from 30 to 65 years of age (Oliveria *et al.* 1995). Arthritis is also known to be associated with significant disability and economic burden. Arthritis accounts for one-eighth of all restricted activity days in the US adult population, causes large health-care and work disability costs, and leads to notable decrements in social role performance (Guccione *et al.* 1994; Yelin, 1995; Lawrence *et al.* 1998; Dunlop *et al.* 2004; Stang *et al.* 2006).

Studies have found a relationship between pain and depression (Gureje *et al.* 1998, 2007; Demyttenaere *et al.* 2006). Prior research in developed countries has also found that persons with arthritis, mainly osteoarthritis and rheumatoid arthritis, are more likely to experience depressive illness (Dickens *et al.* 2003; John *et al.* 2003; Lowe *et al.* 2004; Ang *et al.* 2005). Such co-morbidity is found to be associated with increased disability, use of health services and mortality risk (Vali & Walkup, 1998; Khongsaengdao *et al.* 2000; Oslin *et al.* 2002; Dickens *et al.* 2003; Kessler *et al.* 2003; Lowe *et al.* 2004; Ang *et al.* 2005). Until recently, the association of arthritis with other mental disorders, including anxiety disorders and substance use disorders, has received only limited attention. Stang *et al.* (2006) analyzed data from the U.S. National Comorbidity Survey Replication and found that arthritis was associated with increased prevalence of both mood and anxiety disorders.

Using data from 18 surveys participating in the World Mental Health (WMH) Surveys, information regarding the occurrence of a number of mental disorders among persons reporting arthritis was explored for the first time. The objectives of this study were: (1) to estimate the prevalence of specific mood disorders, anxiety disorders and alcohol use disorders among persons with arthritis in diverse countries; (2) to determine which kinds of mental disorder are most strongly associated with arthritis after controlling for age and sex; and (3) to assess whether the associations of specific mental disorders with arthritis are consistent across adult populations in different countries in Europe, the Americas, Asia, the Middle East, Africa and the South Pacific. This study assessed whether the association between chronic pain and mental disorders is also observed for arthritis, and whether arthritis is also associated with a range of anxiety disorders and alcohol use disorders. It provides the first cross-national comparison from a global perspective of the occurrence of mood, anxiety and alcohol use disorders among persons with arthritis in general population samples.

Method

Samples

Eighteen surveys were carried out in 17 countries in the Americas (Colombia, Mexico, the USA), Europe (Belgium, France, Germany, Italy, The Netherlands, Spain, Ukraine), the Middle East (Israel, Lebanon), Africa (Nigeria, South Africa), Asia (Japan, separate surveys in Beijing and Shanghai in the People's Republic of China), and the South Pacific (New Zealand). Most of the 18 surveys were carried out between 2001 and 2002, but others were completed as late as 2007. Field work duration ranged from 3 to 33 months, with about half of the studies being completed in the 12-month range. An effort was made to recruit as many countries as possible into the initiative. The final set of countries was determined by the availability of collaborators 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 six Western European surveys were carried out jointly (ESEMeD/MHEDEA 2000 Investigators, 2004). Sample sizes ranged from 2372 (The Netherlands) to 12 992 (New Zealand), with a total of 85 088 participating adults. Response rates range from 46% (France) to 88% (Columbia), with a weighted average of 71%.

Internal subsampling 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 with two exceptions: in Israel, where all respondents were recruited as one sample and only one long version of the questionnaire,

including both diagnostic assessment and additional relevant information, was used; and in Lebanon, where only a subsample of Part 2 (random 20%) was asked for chronic physical conditions. A total number of 42 697 respondents completed Part 2 and questions about chronic physical condition were included for analysis of arthritis and mental disorder co-morbidity.

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. Additional weights were used to adjust for differential probabilities of selection within households, and post-stratification to adjust weighted sample distributions for the 2000 census table (age, sex and education) was used to ensure that the joint distribution of a set of post-stratifying variables matches the known local population distribution.

Training and field procedures

The central WMH staff trained bilingual supervisors in each country. Consistent interviewer training documents and procedures were used across surveys. The WHO translation protocol 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 Israel, three languages (Hebrew, Russian and Arabic) were used. In Nigeria, interviews were conducted in four languages (Yoruba, Hausa, Igbo and Efik), using the dominant language in the region 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 uses and protection, and the rights of respondents were provided in both written and verbal form to all potentially eligible respondents before obtaining verbal informed consent for participation in the survey. Quality control protocols, described in more detail in Kessler *et al.* (2004), 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.

Mental disorder status

All surveys used the WMH Survey version of the World Health Organization (WHO) Composite International Diagnostic Interview (WMH-CIDI; Kessler & Ustun, 2004), a fully structured diagnostic interview, to assess disorders and treatment. Disorders considered in this study include anxiety disorders [generalized anxiety disorder, panic disorder and/or agoraphobia, post-traumatic stress disorder (PTSD) and social phobia], mood disorders (dysthymia and major depressive disorder) and substance disorders (alcohol and drug abuse and dependence). Disorders were assessed using DSM-IV definitions and criteria (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 here were assessed with acceptable reliability and validity both in the original CIDI (Wittchen, 1994) and in the original version of the WMH-CIDI (Kessler *et al.* 2004). Studies of cross-national comparability in the validity of the WMH-CIDI are under way. Clinical reappraisal in probability subsamples of the WMH surveys in France, Italy, Spain and the USA found moderate to good individual-level CIDI–SCID concordance for lifetime prevalence estimates of most disorders (Haro *et al.* 2006).

Arthritis status

In a series of validated questions about chronic conditions adapted from the US Health Interview Survey (National Center for Health Statistics, 1994), respondents were asked about the presence of selected chronic conditions. The question about arthritis was asked in two different forms depending on the country. In Nigeria, Lebanon, Beijing PRC, Shanghai, South Africa and Ukraine, respondents were asked whether they had experienced 'arthritis or rheumatism' in the prior 12 months. In the remaining surveys, respondents were asked if they had ever had 'arthritis or rheumatism'. The 12-month report of arthritis and the lifetime report of arthritis were compared for the six ESEMeD countries that had both. The lifetime report of arthritis is reported as being present in the past 12 months from 53% to 80% of the time, averaging over 60% of the time. Because of the chronic nature of this disease, these two versions were combined and the lifetime definition was used.

In a study looking at the validity of self-reported arthritis when compared to information from medical records on diagnosis or treatment for arthritis in the prior 3 years, over 90% of cases were confirmed (Lin *et al.* 2003). Again, in the US National Health Interview Survey, arthritis self-report showed moderate agreement with medical records data ($\kappa = 0.40$), with many persons reporting arthritis not receiving medical care for their condition (National Center for Health Statistics, 1994). However, a lower agreement ($\kappa = 0.3$)

between self-report arthritis and general practitioner information among elderly patients in three culturally distinct geographical areas of The Netherlands was reported by Kriegsman *et al.* (1996). The Framingham study delineated the degree of discrepancy between radiographic evidence of osteoarthritis and self-reported symptoms related to the severity of the disease (Felson *et al.* 1987). Neither medical records nor radiographic examinations are considered to be the gold standard for assessing the validity of ascertainment of arthritis in a community survey.

Analytical methods

In this paper we report the prevalence rates for specific mental disorders among persons with and without arthritis. Odds ratios (ORs) for the association of each mental disorder with arthritis were estimated for each survey adjusting for age and sex. Ninety-five per cent confidence intervals (CIs) for the ORs were estimated using the Taylor series method (Wolter, 1985) with SUDAAN (2002) to adjust for clustering and weighting.

A pooled estimate of the ORs and their standard errors was developed to describe the association of each mental disorder with arthritis across the surveys. The pooled estimate of the OR was weighted by the inverse of the variance of the estimate for each survey. The CIs for the pooled estimates of the ORs were estimated. For each association of a specific mental disorder with arthritis, we assessed whether the heterogeneity of the OR estimates across surveys was greater than that expected by chance. Because six out of the seven heterogeneity tests were non-significant, we concluded that pooled estimates of the ORs, and CIs for the pooled estimates, could be appropriately reported. Pooled estimates of mental disorder prevalence rates were not reported because of the large variation in mental disorder prevalence rates across the surveys.

We also calculated adjusted ORs assessing the association of each mood disorder (major depressive disorder or dysthymia) and each anxiety disorder (generalized anxiety disorders, panic/agoraphobia, social phobia or PTSD) with arthritis. A pooled estimate of these ORs across surveys was also estimated. These ORs, and the pooled estimate, are displayed for each survey using a funnel graph (Bird *et al.* 2005), which plots 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. Precision increases as the standard error of the estimate becomes smaller. The 'funnel' in these graphs shows the band that survey-specific estimates fall within if their 95% CIs include the pooled estimate. Each survey's estimate was plotted on the funnel graph, showing whether the pooled estimate fell within the 95% CI of each survey's OR estimate. On this graph, the less precise estimates are to the left (where the funnel is wider), and the more precise estimates are to the right (where the funnel is narrower). These graphs provide a visual summary of the association of any mood disorder and any anxiety disorder with arthritis across the participating surveys.

Results

Sample characteristics and prevalence of arthritis

The samples showed substantial cross-national differences. As expected, persons tended to be older and better educated in the developed than developing countries (Table 1). Self-reported arthritis was common in all of the participating countries, with prevalence rates ranging from 6.1% in Colombia to 29.2% in France (Table 1). Prevalence rates were generally higher in the European countries, the USA and New Zealand than elsewhere. Consistent with prior epidemiological data, in all of the surveys: women were more likely to report arthritis than men; less educated persons were more likely to report arthritis than those with higher levels of education; and prevalence increased with age (data not shown).

Mood disorders and arthritis

Major depression was common among persons with arthritis (Table 2). Prevalence estimates fell in the 5–10% range in two-thirds of the countries. The prevalence rates of dysthymia were lower than major depression. Comparison of the prevalence rates of major depression and dysthymia among persons with *versus* without arthritis showed small absolute differences in many countries, with eight countries showing slightly lower prevalence rates of either major depression or dysthymia among persons with arthritis. Prevalence of mood disorders and arthritis varies according to age and gender. Age and sex were adjusted in assessing the association of arthritis and mood disorders.

As shown in Table 2, age- and sex-adjusted ORs and their 95% CIs measuring the association of major depression with arthritis were greater than one for 16 of the 18 surveys and significantly greater than one for nine of the 18 surveys at a 0.05 significance level. As the 18 surveys differed in sample size and number of cases of arthritis and depression identified, it is not surprising that ORs for many of the individual surveys were not significantly greater than one. This may be explained by both limitations of statistical

Table 1. *Sample characteristics and arthritis prevalence (n = 42697)*

Country	National sample (*n*)	Mean age[a] (years)	% ⩾60 years	% women	Education: secondary or greater	Arthritis prevalence[b]	
						n	Weighted %
Americas							
Colombia	2381	36.6	5.3	54.5	46.4	184	6.1
Mexico	2362	35.2	5.2	52.3	31.4	229	7.5
USA	5692	45.0	21.2	53.0	83.2	1588	27.3
Asia and South Pacific							
Japan	887	51.4	34.9	53.7	70.0	117	10.2
Beijing, PRC	914	39.8	15.6	47.5	61.4	111	8.6
Shanghai, PRC	714	42.9	18.7	48.1	46.8	114	15.3
New Zealand	7312	44.6	20.7	52.2	60.4	1474	19.6
Europe							
Belgium	1043	46.9	27.3	51.7	69.7	227	20.3
France	1436	46.3	26.5	52.2	N.A.	432	29.2
Germany	1323	48.2	30.6	51.7	96.4	151	11.9
Italy	1779	47.7	29.2	52.0	39.5	510	26.9
Netherlands	1094	45.0	22.7	50.9	69.7	134	10.7
Spain	2121	45.5	25.5	51.4	41.7	617	21.4
Ukraine	1720	46.1	27.3	55.1	79.5	479	20.3
Middle East and Africa							
Lebanon	602[c]	40.3	15.3	48.1	40.5	57	6.9
Nigeria	2143	35.8	9.7	51.0	35.6	469	16.9
Israel	4859	44.4	20.3	51.9	78.3	496	9.7
South Africa	4315	37.1	8.8	53.6	38.9	453	10.1

[a] Age range ⩾18 years, except for Colombia and Mexico (18–65 years), Japan (⩾20 years) and Israel (⩾21 years).
[b] Lifetime prevalence reported, except for Beijing, Shanghai, Lebanon, Nigeria, Ukraine and South Africa (12-month prevalence). There is no consistent difference in prevalence rates between the countries reporting 12-month and lifetime rates.
[c] Random 20% of Part 2 sample.

power of single surveys and random variation in the OR estimates across the single surveys. The OR estimates for dysthymia showed a similar pattern. We assessed whether the variability in the OR estimates across the different surveys was greater than that expected by chance. The test of heterogeneity was non-significant for both major depression ($p = 0.20$) and dysthymia ($p = 0.35$), making it appropriate to report a pooled estimate. The pooled estimate of the ORs of major depression among persons with *versus* without arthritis was 1.9 (95% CI 1.7–2.1), while the pooled estimate of the ORs of dysthymia among persons with arthritis was 2.4 (95% CI 2.0–2.7), indicating a significant overall association of arthritis with both major depression and dysthymia, after adjusting for age and sex. Given the limitations of statistical power and the random variation of estimates across the single surveys, the fact that only about half of the surveys found ORs that were significantly greater than one does not support an inference that arthritis and depression (or dysthymia) were associated in some surveys but not in others. Rather, it suggests that the individual surveys may not have been adequately powered to detect an OR for this association in the moderate range.

Fig. 1 shows the funnel graph of the age- and sex-adjusted ORs for mood disorder (major depression and dysthymia combined) in all 18 countries. In this graph, the OR was plotted on a log scale. The funnel lines show the band indicating the limit of the 95% CI of a survey estimate in relation to the pooled estimates, given the precision of the survey estimate. Most of the OR estimates clustered close to the pooled estimate of 1.9. All of the pooled estimates fell within the 95% CIs of the individual survey estimates, with those at the end of the left side of the funnel tending to have the lowest precision. These results support the conclusion that persons with arthritis are more likely to experience mood disorders than otherwise comparable persons without arthritis.

Table 2. *Prevalence (%) of mood disorders among persons with* versus *without arthritis*[a]

	Major depression			Dysthymia			AQ5
Country	No arthritis	Arthritis	OR (95% CI) adjusted	No arthritis	Arthritis	OR (95% CI) adjusted	
Colombia	6.0	9.3	1.7 (0.8–3.4)	1.0	1.6	1.3 (0.4–4.4)	
Mexico	3.7	10.2	2.9 (1.8–4.7)*	0.8	2.0	2.2 (0.7–7.0)	
USA	7.9	9.3	1.8 (1.4–2.2)*	1.8	3.6	2.4 (1.9–3.1)*	
Japan	2.3	2.2	1.3 (0.4–3.5)	0.8	0.1	0.2 (0.0–1.5)	
Beijing, PRC	2.2	3.9	2.1 (0.5–8.8)	0.3	1.1	3.0 (0.7–12.7)	
Shanghai, PRC	1.0	5.7	6.4 (1.8–22.4)*	0.4	0.3	1.0 (0.1–7.7)	
New Zealand	6.7	6.2	1.6 (1.2–2.1)*	1.7	2.4	1.9 (1.3–2.9)*	
Belgium	5.8	4.7	0.9 (0.4–1.9)	1.1	2.1	1.4 (0.5–4.1)	
France	6.2	5.9	1.5 (0.9–2.7)	1.2	2.7	1.6 (0.6–4.6)	
Germany	3.0	3.8	1.9 (0.8–4.7)	0.7	2.2	3.3 (0.6–17.6)	
Italy	2.4	5.1	2.0 (1.4–2.7)*	0.7	2.1	2.0 (1.0–3.9)*	
Netherlands	5.3	5.0	1.2 (0.5–2.8)	1.8	1.6	1.4 (0.4–4.5)	
Spain	3.3	6.8	2.3 (1.7–3.0)*	0.9	3.2	3.1 (1.7–5.9)*	
Ukraine	7.0	19.2	2.3 (1.6–3.3)*	2.5	10.6	2.9 (1.9–4.3)*	
Lebanon	1.9	1.4	0.7 (0.2–3.0)	0.7	1.1	1.3 (0.2–9.7)	
Nigeria	0.9	2.2	2.9 (1.2–7.0)*	0.1	0.6	8.6 (1.2–64.5)*	
Israel	5.6	10.5	2.0 (1.4–2.8)*	1.0	3.9	3.8 (2.0–7.0)*	
South Africa	4.5	7.6	1.6 (1.0–2.6)	0.1	0.0	N.E.	
Pooled OR	–	–	1.9 (1.7–2.1)*	–	–	2.4 (2.0–2.7)*	

OR, Odds ratio (adjusted for age and sex); CI, confidence interval; N.E., non-estimable; –, information not available.
[a] Country not included if less than 25 respondents have the physical condition.

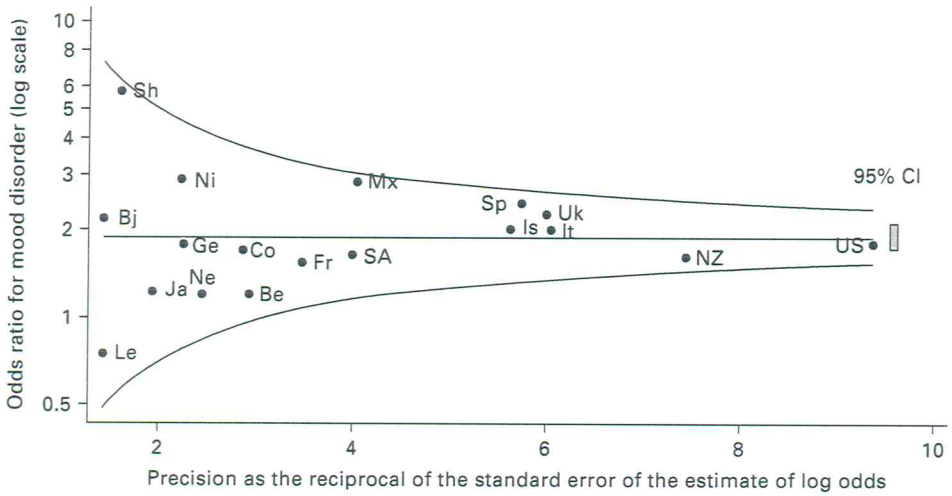

Fig. 1. Odds ratios (age- and sex-adjusted) for mood disorder for persons with *versus* without arthritis. Be, Belgium; Bj, Beijing; Co, Colombia; Fr, France; G, Germany; Is, Israel; It, Italy; Ja, Japan; Le, Lebanon; Mx, Mexico; Ne, Netherlands; Ni, Nigeria; NZ, New Zealand; SA, South Africa; Sh, Shanghai; Sp, Spain; Uk, Ukraine; US, United States.

Anxiety disorders and arthritis

Across the surveys, the specific anxiety disorders (generalized anxiety disorder, panic/agoraphobia, social phobia and PTSD) were less prevalent among persons with arthritis than major depression (Table 3), reflecting the lower prevalence of these disorders in general. Because social phobia and PTSD were relatively less common, it was not possible to estimate ORs for their association with arthritis for several countries. Given the relatively small sample sizes of these specific anxiety disorders, it is not surprising

Table 3. *Prevalence (%) of anxiety disorders among persons with* versus *without arthritis*[a]

Country	No arthritis	Arthritis	OR (95% CI) adjusted	No arthritis	Arthritis	OR (95% CI) adjusted
	Generalized anxiety			Agoraphobia or panic disorder		
Colombia	1.0	1.0	1.2 (0.4–3.8)	2.1	3.2	1.3 (0.5–3.5)
Mexico	0.5	1.4	3.1 (1.0–9.3)*	1.2	2.9	2.4 (1.2–4.8)*
USA	3.4	5.9	2.3 (1.7–3.1)*	3.1	5.0	2.4 (1.7–3.3)*
Japan	1.5	2.5	1.9 (0.6–5.9)	0.6	0.9	1.7 (0.2–13.4)
Beijing, PRC	1.0	2.3	1.9 (0.9–4.0)	0.4	0.3	0.7 (0.1–10.7)
Shanghai, PRC	0.2	3.6	9.5 (1.6–55.9)*	0.1	0.0	N.E.
New Zealand	2.8	3.9	2.1 (1.6–2.9)*	2.1	2.6	2.1 (1.5–3.0)*
Belgium	1.0	1.4	1.9 (0.3–12.2)	1.3	2.2	3.5 (1.0–12.7)
France	1.6	3.2	4.1 (1.9–9.0)*	1.3	1.6	1.8 (0.8–4.5)
Germany	0.5	0.2	0.6 (0.1–5.0)	1.1	0.6	0.8 (0.2–3.8)
Italy	0.4	0.8	1.7 (0.5–6.2)	0.8	1.5	1.6 (0.7–3.7)
Netherlands	1.0	1.3	2.0 (0.5–8.2)	1.7	1.7	1.3 (0.4–4.3)
Spain	0.7	2.0	3.1 (1.2–7.9)*	0.6	1.7	3.5 (1.9–6.7)*
Ukraine	1.4	6.0	3.4 (2.0–5.8)*	1.3	4.0	2.5 (1.3–4.7)*
Lebanon	0.2	0.2	0.5 (0.1–4.3)	0.2	0.4	2.2 (0.2–28.4)
Nigeria	0.0	0.2	N.E.	0.1	1.1	7.0 (1.6–30.2)*
Israel	2.4	4.5	1.8 (1.0–3.0)*	0.7	2.9	3.6 (1.9–6.7)*
South Africa	1.7	3.5	1.5 (0.7–3.2)	5.2	8.5	1.6 (1.1–2.3)*
Pooled OR	–	–	2.3 (1.9–2.6)*	–	–	2.2 (1.9–2.5)*
	Social phobia			PTSD		
Colombia	2.8	3.7	1.7 (0.7–4.0)	0.6	0.6	0.9 (0.2–4.2)
Mexico	1.7	5.3	3.8 (1.9–7.3)*	0.6	0.3	0.5 (0.1–3.3)
USA	6.6	7.5	1.8 (1.4–2.2)*	2.9	5.2	2.6 (2.0–3.4)*
Japan	0.6	0.0	N.E.	0.4	0.1	0.4 (0.0–4.1)
Beijing, PRC	0.4	0.0	N.E.	0.3	0.0	N.E.
Shanghai, PRC	0.0	0.0	N.E.	0.0	0.8	N.E.
New Zealand	5.1	4.7	1.5 (1.1–2.0)*	2.8	4.0	1.9 (1.3–2.8)*
Belgium	0.8	2.2	7.0 (1.3–37.1)*	0.5	1.2	2.2 (0.7–6.6)
France	2.8	2.2	1.1 (0.5–2.7)	2.0	3.1	2.1 (1.1–4.1)*
Germany	1.9	0.4	0.3 (0.1–1.6)	0.7	0.6	1.4 (0.5–3.6)
Italy	1.0	1.2	1.2 (0.4–3.2)	0.6	1.0	1.4 (0.5–3.9)
Netherlands	1.2	2.2	3.4 (0.8–15.3)	2.4	3.1	0.8 (0.2–3.2)
Spain	0.6	1.0	4.5 (1.4–14.5)*	0.4	0.9	2.3 (0.8–6.8)
Ukraine	1.8	3.2	3.7 (1.5–9.4)*	2.3	4.5	1.3 (0.7–2.3)
Lebanon	0.6	0.0	N.E.	1.8	0.7	0.4 (0.1–2.2)
Nigeria	0.3	0.2	0.8 (0.0–15.3)	0.0	0.0	N.E.
Israel	–	–	N.E.	0.5	1.1	2.1 (0.8–5.5)
South Africa	1.7	3.8	2.7 (1.2–5.8)*	0.6	0.5	0.7 (0.2–2.5)
Pooled OR	–	–	1.8 (1.6–2.1)*	–	–	1.9 (1.6–2.3)*

OR, Odds ratio (adjusted for age and sex); CI, confidence interval; PTSD, post-traumatic stress disorder; N.E., non-estimable; –, information not available.

[a] Country not included if less than 25 respondents have the physical condition.

that the OR estimates were significantly greater than one for some surveys but not for others, even when the OR estimates were consistent with the pooled estimate. The heterogeneity tests for the ORs were non-significant for generalized anxiety disorder ($p=0.44$), agoraphobia/panic ($p=0.44$) and PTSD ($p=0.11$), but the heterogeneity test for social phobia was significant ($p=0.03$). Given the limited number of cases available in each survey, the pooled estimate of the ORs provides a more precise estimate of the association of each of the anxiety disorders with arthritis. Across the four anxiety disorders, the pooled

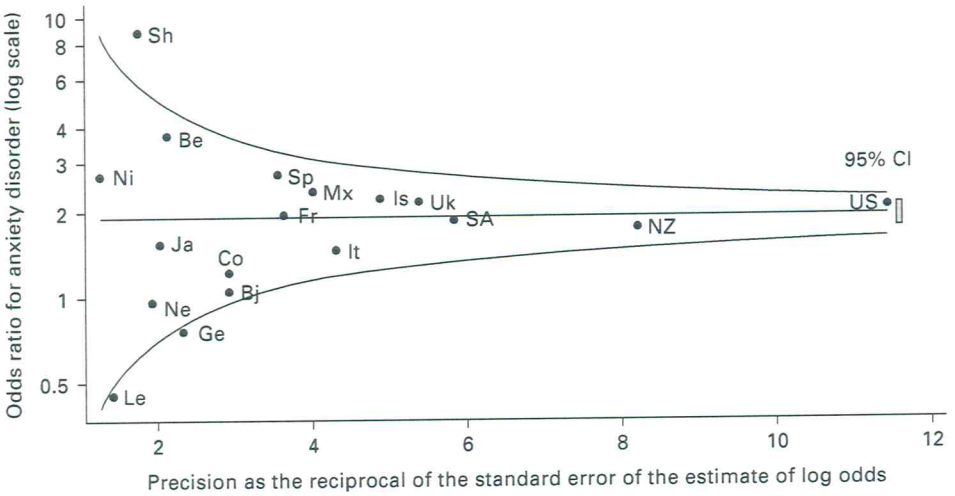

Fig. 2. Odds ratios (age- and sex-adjusted) for anxiety disorder for persons with *versus* without arthritis. For abbreviations see Fig. 1 legend.

OR estimates were all significantly greater than one, and all fell in the range 1.8–2.3.

The association of any anxiety disorder with arthritis (Fig. 2) showed a pattern similar to that observed for any mood disorder (Fig. 1). The pooled estimate of the ORs was 1.9. Of the 18 survey-specific estimates, the 95% CIs for all but three surveys included the pooled estimate of the ORs. As was the case for mood disorder, the estimates that diverged from the pooled estimate tended to have low precision. These results indicate that the strength of the association of anxiety disorders, as a class, with arthritis is comparable to that observed for mood disorders.

Alcohol abuse/dependence

In 10 of the 18 countries, less than 1% of those with arthritis had co-morbid alcohol abuse or dependence. In the remaining surveys, the prevalence of alcohol abuse or dependence ranged from 1.9% (Belgium) to 5.2% (Columbia). ORs adjusted for age and sex for the association of alcohol abuse or dependence with arthritis were estimated for 14 surveys, of which three were significantly greater than one. These OR estimates were not found to be heterogeneous across surveys ($p=0.24$). The pooled estimate of the ORs for the association of alcohol abuse or dependence and arthritis was 1.5, with a 95% CI that did not include one. These results suggest that alcohol abuse may occur with somewhat greater frequency among persons with arthritis. However, in many countries the prevalence of alcohol abuse or dependence among persons with arthritis was fairly low.

The results of drug abuse/dependence and arthritis are not reported here because the number of cases was too small to generate reliable conclusions.

Discussion

This report provides the first large-scale, population-based assessment of the frequency and association of both mood and anxiety disorders with arthritis. As the participating surveys included countries that differed markedly in culture, language and level of socio-economic development, the consistency in findings across countries is remarkable. The key finding of the study that different mood and anxiety disorders have similar associations with arthritis has implications for clinical practice. It suggests that clinicians need to be aware of a spectrum of mood and anxiety disorders occurring with increased frequency among persons with arthritis. This suggests that clinicians should evaluate depression and anxiety status of patients with arthritis, particularly among those with significant activity limitations, in light of evidence from a large randomized controlled trial that treating depression among persons with arthritis who are depressed improves functional outcomes (Lin *et al.* 2003). These results point to the need for additional research, particularly randomized controlled trials evaluating the benefits of treating co-morbid depression and anxiety among person with arthritis, and prospective studies that clarify understanding of the extent to which depressive and anxiety disorders are risk factors and/or consequences of arthritis pain and associated activity limitations.

The observed associations have limited implications for understanding causal relationships. However, the

fact that both mood and anxiety disorders show a similar level of association with arthritis suggests that any effects of arthritis on psychological functioning may influence anxiety states as well as mood. Similarly, if psychological disorder increases risks of arthritis, the role of anxiety disorder should be considered as well as mood disorder. Co-morbidity of depression and anxiety is common. It has been determined that non-co-morbid depressive and anxiety disorders are associated in equal degree with diverse physical conditions including arthritis. Co-morbid depressive-anxiety disorder was reported to be more strongly associated with arthritis than were single mental disorders (Scott *et al.* 2007).

The survey results for alcohol use disorders were limited by their relatively low frequency among persons with arthritis. Although the pooled estimate indicated that alcohol abuse or dependence tended to be more common among persons with arthritis than those without, the rates of alcohol abuse/dependence among persons with arthritis were low in most countries.

Of interest, the individual surveys seem to yield disparate results if examined individually. For example, for the estimated association between major depression and arthritis, half of the surveys indicated a significant association. The reason for this apparent discordance is not clear. It could be due to the small number of cases in some surveys, differences in the accuracy of self-report across different countries, or true differences. However, when the survey specific estimates were examined in the context of the pooled estimate, a more consistent and informative picture emerged. For both mood and anxiety disorders, the odds of having a mental disorder was about 2 to 1 for persons with *versus* without arthritis. Moreover, the pooled estimate of the ORs generally fell within the 95% CIs of the estimates from the individual surveys. This suggests that future research on the association of mood and anxiety disorders with arthritis should consider larger survey samples or multiple surveys. In addition, it may be more useful to examine different mood and anxiety disorders and investigate their relationship as a broad category with arthritis rather than looking at specific disorders that occur with lower frequency, particularly in sample surveys of limited size. Tests of significance for the association of specific mental disorders with arthritis from a single survey may be unreliable for lower prevalence mental disorders.

Limitations

The most notable limitation of this research is the ascertainment and recall bias of arthritis based on self-report. As the WMH Surveys were multi-faceted and conducted in large populations worldwide, it was not feasible to examine medical records or to conduct a standardized medical assessment to determine whether arthritis was present or absent. Limited evidence of the agreement of self-report and medical record data was from prior research among special populations in developed countries. A study of the reporting of chronic conditions in the National Health Interview Survey among persons with recent medical contact reported moderate validity ($\kappa = 0.406$) (National Center for Health Statistics, 1994). Lin *et al.* (2003) confirmed 91.4% of self-report among older adults reporting diagnosis or treatment for arthritis from a health-care provider in the past 3 years. Moreover, the prevalence pattern of arthritis in the WMH Surveys seems to be consistent with the expected epidemiological patterns (higher prevalence among females and increasing prevalence with age), adding to the validity of the data.

The large variations in arthritis prevalence rates found in our study are difficult to account for by differences in the age and educational level of the samples. Our research was not able to explain these differences.

As pooled estimates were based on the inverse variance weighting method, more weight is given to estimates from the larger samples (e.g. New Zealand, the USA) that have smaller variances.

It is possible that the association of mood and anxiety disorders with arthritis can be explained by non-specific factors associated with the report of chronic illness in general, rather than an association specific to arthritis. Mood and anxiety disorders are associated with many different chronic physical conditions, especially chronic pain conditions. In prior research, it was found that 48% of patients with persistent pain reported back pain and 42% reported joint pain (Gureje *et al.* 1998). Further research is needed to determine whether there are factors that contribute to the association of arthritis and psychological illness shared with other chronic conditions (Berkanovic & Hurwicz, 1990; John *et al.* 2003; Foley *et al.* 2004).

Our research is not able to provide information on the association of mental disorders with specific types of arthritis (e.g. osteoarthritis, rheumatoid arthritis) or with the severity of arthritis. Although previous research has not established differences in association between mood disorders and specific kinds of arthritis, differences have been reported by arthritis severity, especially for mobility (i.e. people who are depressed have greater problems with mobility) (Dunlop *et al.* 2004; Lowe *et al.* 2004).

Notable strengths of the WMH Surveys include the use of standardized and well-validated methods to diagnose mental disorders in a community survey,

and the size and diversity of the surveys. It was possible to develop population-based estimates for an unprecedented range of mental disorders among community-dwelling adults reporting arthritis.

Conclusions

The WMH Surveys showed that mood and anxiety disorders occurred among persons with arthritis at higher rates than among persons of comparable age and sex without arthritis. This association was observed across different countries with diverse cultures, languages and levels of socio-economic development. The associations of specific mood and anxiety disorders with arthritis appeared similar. Abuse of alcohol was more common among persons with arthritis, but this relationship was observed in only a minority of the surveys. These results should be taken into consideration in clinical practice in light of the burden caused by the co-morbidity of mental disorders with arthritis.

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Declaration of Interest AQ2

None.

References

Ang DC, Choi H, Kroenke K, Wolfe F (2005). Comorbid depression is an independent risk factor for mortality in patients with rheumatoid arthritis. *Journal of Rheumatology* **32**, 1013–1019.

APA (1994). *Diagnostic and Statistical Manual of Mental Disorders*, 4th edn. American Psychiatric Association: Washington, DC.

Berkanovic E, Hurwicz ML (1990). Rheumatoid arthritis and comorbidity. *Journal of Rheumatology* **17**, 888–892.

Bird SM, Cox D, Farewell VT, Goldstein H, Holt T, Smith PC (2005). Performance indicators: good, bad, and ugly. *Journal of the Royal Statistical Society, Series A* **168**, 1–27.

Carmona L, Ballina J, Gabriel R, Laffon A; EPISER Study Group (2001). The burden of musculoskeletal diseases in the general population of Spain: results from a national survey. *Annals of the Rheumatic Diseases* **60**, 1040–1045.

CDC (2001). Prevalence of arthritis – United States, 1997. Centers for Disease Control and Prevention. *Morbidity and Mortality Weekly Report* **50**, 334–336.

Cunningham LS, Kelsey JL (1984). Epidemiology of musculoskeletal impairments and associated disability. *American Journal of Public Health* **74**, 574–579.

Demyttenaere K, Bonnewyn A, Bruffaerts R, Brugha T, Graaf R, Alonso J (2006). Comorbid painful physical symptoms and depression: prevalence, work loss, and help seeking. *Journal of Affective Disorders* **92**, 185–193.

Dickens C, Jackson J, Tomenson B, Hay E, Creed F (2003). Association of depression and rheumatoid arthritis. *Psychosomatics* **44**, 209–215.

Dunlop DD, Lyons JS, Manheim LM, Song J, Chang RW (2004). Arthritis and heart disease as risk factors for major depression: the role of functional limitation. *Medical Care* **42**, 502–511.

ESEMeD/MHEDEA 2000 Investigators (2004). Sampling and methods of the European Study of the Epidemiology of Mental Disorders (ESEMeD) project. *Acta Psychiatrica Scandinavica. Supplementum* **420**, 8–20.

Felson DT, Naimark A, Anderson J, Kazis L, Castelli W, Meenan RF (1987). The prevalence of knee osteoarthritis in the elderly. The Framingham Osteoarthritis Study. *Arthritis and Rheumatism* **30**, 914–918.

Foley D, Ancoli-Israel S, Britz P, Walsh J (2004). Sleep disturbances and chronic disease in older adults: results of the 2003 National Sleep Foundation Sleep in America Survey. *Journal of Psychosomatic Research* **56**, 497–502.

Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y, Wilson PW, Kelly-Yayes M, Wolf PA, Kreger BE, Kannel WB (1994). The effects of specific medical condition on the functional limitations of elders in the Framingham Study. *American Journal of Public Health* **84**, 351–358.

Gureje O, Von Korff M, Kola L, Demyttenaere K, He YL, Posada-Villa J, Lepine JP, Angermeyer MC, Levinson D, Girolamo G, Iwata N, Karam A, Guimaraes Borges GL, Graaf R, Browne MO, Stein DJ, Haro JM, Bromet EJ, Kessler RC, Alonso J (2007). The relation between multiple pains and mental disorders: results from the World Mental Health Surveys. *Pain*. Published online: doi:10.1016/j.pain.2007.05.005.

AQ1

Gureje O, Von Korff M, Simon GE, Grater R (1998). Persistent pain and wellbeing: a World Health Organization study in primary care. *Journal of the American Medical Association* **280**, 147–151.

Haro JM, Arbabzadeh-Bouchez S, Brugha TS, de Girolamo G, Guyer ME, Jin R, Lepine JP, Mazzi F, Reneses B, Vilagut G, Sampson NA, Kessler RC (2006). Concordance of the Composite International Diagnostic Interview Version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO World Mental Health Surveys. *International Journal of Methods in Psychiatric Research* **15**, 167–180.

Helmick CG, Lawrence RC, Pollard RA, Lloyd E, Heyse SP (1995). Arthritis and other rheumatic conditions: who is affected now, who will be affected later? *Arthritis Care and Research* **8**, 203–211.

John R, Kerby DS, Hennessy CH (2003). Patterns and impact of comorbidity and multimorbidity among community-resident American Indian elders. *The Gerontologist* **43**, 649–660.

Kessler RC, Berglund P, Chiu WT, Demler O, Heeringa S, Hiripi E, Jin R, Pennell B-P, Walters EE, Zaslavsky A, Zheng H (2004). The US National Comorbidity Survey Replication (NCS-R): design and field procedures. *International Journal of Methods in Psychiatric Research* **13**, 69–92.

Kessler RC, Ormel J, Demler O, Stang PE (2003). Comorbid mental disorders account for the role impairment of commonly occurring chronic physical disorders: results from the National Comorbidity Survey. *Journal of Occupational Environment Medicine* **45**, 1257–1266.

Kessler RC, Ustun TB (2004). The World Mental Health (WMH) Survey Initiative Version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research* **13**, 93–121.

Khongsaengdao B, Louthrenoo W, Srisurapanont M (2000). Depression in Thai patients with rheumatoid arthritis. *Arthritis Care and Research* **83**, 743–747.

Kriegsman DMW, Penninx BWJH, van Eijk JThM, Boeke AJP, Deeg DJH (1996). Self-reports and general practitioner information on the presence of chronic diseases in community dwelling elderly. A study on the accuracy of patients' self-reports and on determinants of inaccuracy. *Journal of Clinical Epidemiology* **49**, 1407–1417.

Lawrence RC, Helmick CG, Arnett FC, Deyo RA, Felson DT, Giannini EH, Heyse SP, Hirsch R, Hochberg MC, Hunder GG, Liang MH, Pillemer SR, Steen VD, Wolfe F (1998). Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. *Arthritis and Rheumatism* **41**, 778–799.

Lin EHB, Katon W, Von Korff M, Tang L, Williams JW, Kroenke K, Hunkeler E, Harpole L, Hegel M, Arean P, Hoffing M, Penna RD, Langston C, Unutzer J (2003). Effect of improving depression care on pain and functional outcomes among older adults with arthritis: a randomized controlled trial. *Journal of the American Medical Association* **290**, 2428–2434.

Lowe B, Willand L, Eich W, Zipfel S, Ho AD, Herzog W, Fiehn C (2004). Psychiatric comorbidity and work disability in patients with inflammatory rheumatic diseases. *Psychosomatic Medicine* **66**, 395–402.

Mannoni A, Briganti MP, Di Bari M, Ferrucci L, Costanzo S, Serni U, Masotti G, Marchoinni N (2003). Epidemiological

profile of symptomatic osteoarthritis in older adults: a population based study in Dicomano, Italy. *Annals of the Rheumatic Diseases* **62**, 576–578.

Mikkelsen WM, Dodge HJ, Duff IF, Kato H (1967). Estimates of the prevalence of rheumatic diseases in the population of Tecumseh, Michigan, 1959–60. *Journal of Chronic Disease* **20**, 351–369.

Mili F, Helmick CG, Zack MM (2002). Prevalence of arthritis: analysis of data from the US Behavioral Risk Factor Surveillance System, 1996–1999. *Journal of Rheumatology* **29**, 1981–1988.

National Center for Health Statistics (1994). Evaluation of National Health Interview Survey diagnostic reporting. *Vital and Health Statistics Series 2*. **120**, 1–116.

Oliveria SA, Felson DT, Reed JI, Cirillo PA, Walker AM (1995). Incidence of symptomatic hand, hip, and knee osteoarthritis among patients in a health maintenance organization. *Arthritis and Rheumatism* **38**, 1134–1141.

Oslin DW, Datto CJ, Kallan MJ, Katz IR, Edell WS, TenHave T (2002). Association between medical comorbidity and treatment outcomes in late-life depression. *Journal of the American Geriatrics Society* **50**, 823–828.

PRC (2003). *Morbidity Rate of Chronic Diseases*. Ministry of Health, People's Republic of China (www.moh.gov.cn/statistics/digest05/s61.htm). Accessed 1 February 2006.

Reginster JY (2002). The prevalence and burden of arthritis. *Rheumatology* (Oxford) **41** (Suppl. 1), 3–6.

Scott KM, Bruffaerts R, Tsang A, Ormel J, Alonso J, Angermeyer MC, Benjet C, Bromet E, de Girolamo G, de Graaf R, Gasquet I, Gureje O, Haro JM, He Y, Kessler RC, Levinson D, Mneimneh ZN, Oakley Browne MA, Posada-Villa J, Stein DJ, Takeshima T, Von Korff M (2007). Depression-anxiety relationships with chronic physical conditions: results from the World Mental Health Surveys. *Journal of Affective Disorders* **103**, 113–120.

Stang PE, Brandenburg NA, Lane MC, Merikangas KR, Von Knorff MR, Kessler RC (2006). Mental and physical comorbid conditions and days in role among persons with arthritis. *Psychosomatic Medicine* **68**, 152–158.

SUDAAN (2002). SUDAAN software version 8.0.1. Research Triangle Institute: Research Triangle Park, NC.

Vali FM, Walkup J (1998). Combined medical and psychological symptoms: impact on disability and health care utilization of patients with arthritis. *Medical Care* **36**, 1073–1084.

Wittchen HU (1994). Reliability and validity studies of the WHO Composite International Diagnostic Interview (CIDI): a critical review. *Journal of Psychiatric Research* **28**, 57–84.

Wolter KM (1985). *Introduction to Variance Estimation*. Springer-Verlag: New York.

Yelin EH (1995). Musculoskeletal conditions and employment. *Arthritis Care and Research* **8**, 311–317.

Yelin EH, Callahan LF (1995). The economic cost and social and psychological impact of musculoskeletal conditions. *Arthritis and Rheumatism* **38**, 1351–1362.

Zhang YQ, Xu L, Nevitt MC, Aliabadi P, Yu W, Qin MW, Lui LY, Felson DT (2001). Comparison of the prevalence of knee osteoarthritis between the elderly Chinese population in Beijing and whites in the United States. *Arthritis and Rheumatism* **44**, 2065–2071.

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