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Associations between DSM-IV mental disorders and subsequent onset of arthritis

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Abstract

Objective: We investigated the associations between DSM-IV mental disorders and subsequent arthritis onset, with and without mental disorder comorbidity adjustment. We aimed to determine whether specific types of mental disorders and increasing numbers of mental disorders were associated with the onset of arthritis later in life.

Method: Data were collected using face-to-face household surveys, conducted in 19 countries from different regions of the world (n = 52,095). Lifetime prevalence and age at onset of 16 DSM-IV mental disorders were assessed retrospectively with the World Health Organization (WHO) Composite International Diagnostic Interview (WHO-CIDI). Arthritis was assessed by self-report of lifetime history of arthritis and age at onset. Survival analyses estimated the association of initial onset of mental disorders with subsequent onset of arthritis.

Results: After adjusting for comorbidity, the number of mood, anxiety, impulse-control, and substance disorders remained significantly associated with arthritis onset showing odds ratios (ORs) ranging from 1.2 to 1.4. Additionally, the risk of developing arthritis increased as the number of mental disorders increased from one to five or more disorders.

Conclusion: This study suggests links between mental disorders and subsequent arthritis onset using a large, multi-country dataset. These associations lend support to the idea that it may be possible to reduce the severity of mental disorder-arthritis comorbidity through early identification and effective treatment of mental disorders.

Keywords: arthritis, comorbidity, mental disorders, substance abuse

Researchers have long recognized the consequences of mental and physical comorbidity [1-3]. The research to date has shown that individuals with arthritis are at a greater risk of developing mental disorders, which is likely a result of the diminished work and social roles that accompany arthritis [4-7]. However, the link between mental disorders and arthritis may be bidirectional and little research has investigated the possibility that mental disorders are a precursor to the development of arthritis. As such, an examination into whether the occurrence of mental disorders is associated with the subsequent onset of arthritis is warranted.

Evidence suggests that the prevalence of arthritis increases with age [3] with the highest prevalence among 30 to 65 year olds [8]. In developed countries, more than half of older adults report arthritis or chronic pain [9-10]. The effects of arthritis on the daily activities of adults over the age of 65 can be particularly debilitating [11, 3]. Arthritis is also known to be associated with disability and economic burden that eventually leads to diminished productivity and social roles. Previous work in this area suggests that such impairments and social isolation is strongly associated with experiencing a mental disorder [4-7].

A number of researchers have examined the association between mental disorders and arthritis with cross-sectional designs [5, 9, 3]. Using data from a nationally representative survey in the United States (i.e., the National Comorbidity Survey Replication [NCS-R]), Stang et al. found that individuals with arthritis, based on self-reports of having “arthritis or rheumatism”, were significantly more likely to report depression and a range of anxiety disorders after controlling for age and other demographic variables. However, the analyses conducted by Stang et al. did not reveal significant associations between arthritis and alcohol or drug abuse disorders. To date, few studies [9, 3, 12, 13] investigated the concurrent association of mental disorders among persons with arthritis using the World Mental Health

Survey (WMHS), which collect cross-national data on the prevalence of mental, substance, and behavioral disorders. He, Zhang and colleagues investigated the prevalence of specific mental disorders among persons with arthritis in 17 countries. When the results were pooled across all countries and adjusted for age and gender, arthritis was significantly associated with depressive and anxiety disorders. It should be noted, however, that the findings were not statistically significant in every country and the findings from some countries indicated that individuals with arthritis were slightly less likely to exhibit certain mental disorders.

The importance of mental-physical comorbidity research examining the bidirectional link between physical disorders, such as arthritis, and mental disorders is supported by the World Health Organization (WHO) and empirical studies [9, 3, 14]. Moving beyond cross-sectional studies, researchers have examined the temporal direction of the association between physical and mental disorders. Researchers reviewed the research on the linkage between chronic pain and depression [15]. According to Fishbain's antecedent hypothesis, mental disorders precede the onset of physical disorders. Conversely, the consequence hypothesis suggests that mental disorders result from physical disorders. Fishbain et al.'s review that examined the temporal association between chronic pain and depression found much more support for the consequence hypothesis than the antecedent hypothesis. However, a small number of studies in Fishbain et al.'s review showed that depression preceded chronic pain.

The prior cross-sectional studies assessing the association between arthritis and mental disorders as well as the longitudinal investigations examining the link between chronic pain and depression led us to the question of whether arthritis precedes or follows the development of mental disorders. Recent research found that, after adjusting for sociodemographic control variables, individuals from the Netherlands with arthritis had a significantly elevated risk of developing a mood disorder over a three-year period [13]. In

contrast, mood, anxiety, and psychiatric disorders did not predict the onset of arthritis over a two-year period. Although these findings do not support the antecedent hypothesis (i.e., mental disorders lead to arthritis), further research is needed given the short time-frame of this study and the limited research on the antecedent hypothesis

This study uses a retrospective cross-sectional cohort design, using a large multi-national database. First, we investigated the association of the first onset of mood, anxiety, impulse control, and substance use disorders with the subsequent onset of arthritis, with and without adjustment for mental disorder comorbidity. Second, we assessed whether increasing numbers of mental disorders were associated with an increased risk of developing arthritis in an exposure-response manner.

Sample and Methods

The present study uses the cross-national WMHS dataset to examine associations among a wide range of DSM-IV mental disorders and subsequent arthritis onset. The WMHS are general population surveys that retrospectively assessed lifetime prevalence of DSM-IV mental disorders and also obtained self-report of physician's diagnosis of selected chronic physical conditions including arthritis. While the surveys are cross-sectional in design, data on the onset of mental disorders and physical conditions allowed the use of survival analysis to examine associations between temporally prior mental disorders and subsequent onset of arthritis.

Samples

In this study, we employed data from 19 countries participating in the WMHS. The 19 countries included in the analyses reported in this study were those that collected data relating to the onset of mental disorders and arthritis. These 19 countries (and the WHO regions to

which they belong) included: the Americas (Colombia, Mexico, Peru, and the United States), Asia (PRC Shen Zhen, and Japan), Europe (Belgium, France, Germany, Italy, the Netherlands, Romania, Spain, Portugal, Northern Ireland, and Poland), the Middle East (Israel and Iraq), and the South Pacific (New Zealand). A stratified multi-stage clustered area probability sampling strategy was used to select adult respondents (18 years+) in most WMHS countries. Most of the surveys were based on nationally representative household samples while Colombia, Mexico, and PRC Shen Zhen were based on nationally representative household samples in urbanized areas. Sample sizes ranged from 2,419 (Belgium) to 12,790 (New Zealand), with a total of 98,714 participants. Response rates ranged from 45.9% (France) to 95.2% (Iraq), with a weighted average of 67.4% (see Table 1).

Data collection procedures

In most countries, internal subsampling was used to reduce respondent burden and average interview time by dividing the interview into two parts. All respondents completed Part 1, which included the core diagnostic assessment of the major mental disorders in DSM-IV that were of interest to the researchers. All Part 1 respondents who met lifetime criteria for any mental disorder and a probability sample of other respondents were administered Part 2, which assessed physical conditions and collected a range of other information related to survey aims. 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 paper are based on the weighted Part 2 subsample (n = 52,095). Additional weights were used to adjust for differential probabilities of selection within households, to adjust for non-response, and to match the samples to population sociodemographic distributions. Measures taken to ensure interviewer and data accuracy and cross-national consistency are described in detail elsewhere [16, 17]. All respondents provided informed consent and procedures for protecting

respondents were approved and monitored for compliance by the Institutional Review Boards in each country (see Kessler & Üstün, 2004 for details).

Measures

Mental disorder status

All surveys used the WMH survey version of the WHO Composite International Diagnostic Interview (currently CIDI 3.0), a fully structured interview, to assess lifetime prevalence of mental disorders. Disorders were assessed using the definitions and criteria of the DSM-IV [18]. The mental disorders adjusted for in this paper include *anxiety disorders* (panic disorder, generalized anxiety disorder, social phobia, specific phobia, agoraphobia without panic, post-traumatic stress disorder, and obsessive compulsive disorder); *mood disorders* (major depressive episode/dysthymia, bipolar I, II and sub-threshold [broad]); *substance use disorders* (alcohol abuse and dependence, drug abuse and dependence); and *impulse control disorders* (intermittent explosive disorder, bulimia nervosa, and binge eating disorder). These disorders were deemed core diagnoses and considered important by the WHO [16]. CIDI organic exclusion rules were applied in making diagnoses. In other words, a diagnosis was not made if the respondent indicated that the episode of depressive or anxiety symptoms was due to physical illness or injury or use of medication, drugs or alcohol. Clinical reappraisal studies, conducted in four of the 19 WMH countries (France, Italy, Spain, and the United States), indicate that lifetime diagnoses of anxiety, mood, and substance use disorders based on the CIDI have generally good concordance with diagnoses based on blinded clinical interviews [19].

Arthritis status

In a series of questions adapted from the U.S. Health Interview Survey, respondents were asked about the lifetime presence of selected chronic conditions. Respondents were asked if they had ever had 'arthritis or rheumatism.' If respondents endorsed this question they were

classified as having a history of arthritis for these analyses. Respondents were also asked how old they were when the arthritis first began.

Statistical analyses

Discrete-time survival analyses [20] with person-year as the unit of analysis were used to test sequential associations between first onset of mental disorders and the subsequent onset of arthritis. For these analyses a person-year dataset was created in which each year in the life of each respondent, up to and including the age of onset of arthritis or their age at interview (whichever came first), was treated as a separate observational record, with the year of arthritis onset coded '1', and earlier years coded '0' on a dichotomous outcome variable. People who reported arthritis onset before age 21 were excluded from analysis (17.1% of total arthritis cases), because such early onset arthritis is atypical and likely to be related to some strong congenital predisposition, and therefore unlikely to be influenced by mental disorders. Mental disorder predictors were recorded using the same dichotomous values. This time lag of 1 year in the coding of the predictors ensured that in cases where the first onset of a mental disorder and of arthritis occurred in the same year, the mental disorder would not count as a predictor. Only person-years up to the diagnosis of arthritis were analyzed so that only mental disorder episodes occurring prior to the onset of arthritis were included in the predictor set.

Logistic regression analyses were used to analyze these data with the survival coefficients presented as odds ratios, indicating the relative odds of arthritis onset in a given year for a person with a prior history of mental disorder compared to a person without that mental disorder (including people without any history of mental disorder).

A series of bivariate and multivariate models were developed including the predictor mental disorder plus control variables. Models control for person-years, country, gender, current age, and in the multivariate model, other mental disorders. Bivariate models

investigated association of specific mental disorders with subsequent arthritis onset. The multivariate model estimated the associations of each mental disorder with arthritis onset adjusting for mental disorder comorbidity (that is, for other mental disorders occurring at any stage prior to the onset of arthritis). The multivariate number model included a series of predictor variables for number of mental disorders (e.g., one such variable for respondents who experienced exactly one mental disorder, another for respondents who experienced exactly two mental disorders, and so on), as well as the control variables. Other more complex non-additive multivariate models were also run, for example, including both type and number of mental disorders, but model fit statistics (i.e., Akaike Information Criterion [AIC] and Bayesian Information Criterion [BIC] tests to assess the adequacy of a model and its fit to the data when compared to other models under consideration) did not indicate these provided a better fit for the data, so the simpler models are reported here.

We chose not to control for covariates that could be on the causal pathway between mental disorders and subsequent arthritis. However, we recognize that these variables (i.e., smoking) may also confound associations so we re-estimated the multivariate model with adjustment for history of smoking (ever/never) and educational attainment. This made virtually no difference to associations (all previously significant associations remained significant and none reduced in magnitude – data available on request) so we report the results from the model unadjusted for smoking and education in this paper.

Our earlier studies of concurrent mental-physical comorbidity in the WMH surveys found that these associations were generally consistent cross-nationally [14], despite varying prevalence of mental disorder and physical conditions. All analyses for this paper were therefore run on the pooled cross-national dataset. As the WMH data are both clustered and weighted, the design-based Taylor series linearization [21] implemented in version 10 of the

SUDAAN software system [22] was used to estimate standard errors and evaluate the statistical significance of coefficients.

Results

Sample characteristics and history of arthritis

The survey characteristics are presented in Table 1 along with information about the number of survey respondents reporting a history of arthritis (n = 7,853). Self-reported arthritis was common in all of the participating countries, with rates ranging from 5.0% in Peru to 29.7% in Romania (see Table 1). Of the 19 countries, European countries showed higher arthritis rates, followed by the United States, and the South Pacific (New Zealand).

Table 1 about here

Number of Years Between First Onset of Mental Disorder and Arthritis

Table 2 shows that the median number of years elapsing between mental disorder first onset and arthritis onset (within the 50th percentile) ranged between 13.5 years for major depressive episode/dysthymia and 32.9 years for specific phobia.

Table 2 about here

Type and number of mental disorders as predictors of arthritis onset

Bivariate Model Results

To investigate the association between individual mental disorders and subsequent arthritis onset, a series of bivariate models (i.e., only one mental disorder considered at a time) were estimated. As shown in Table 3, all types of mental disorders were found to be significantly associated with arthritis onset with odds ratios (ORs) ranging between 1.7 (depression) and 2.8 (drug dependence with abuse).

Multivariate Type Model Results

The results from a multivariate model that considered only the type of mental disorder (Table 3), after adjusting for mental disorder comorbidity, revealed decreases in all ORs and a loss of significance in many. Mental disorders with remaining significant associations (ORs ranging from 1.2-1.4) included: (1) major depressive episode/dysthymia, (2) three of the anxiety disorders (i.e., generalized anxiety disorder, specific phobia, and post-traumatic stress disorder), and (3) alcohol abuse. The chi square test of the global null hypothesis was significant (χ_{16}^2= 449.3,P< .001). However, the test for variation in ORs was not significant (χ_{15}^2= 22.9, -P = 0.089). Based on this latter test result, we can conclude that there is a generalized association between several mental disorders (or psychopathology in general) and arthritis, but no specific mental disorders stand out as having significantly stronger associations with arthritis than others. This means that we cannot exclude the possibility that the association between mental disorders and the onset of arthritis are generalized rather than specific.

Multivariate Number Model Results – Number of Mental Disorders

The results from the multivariate model that considered only the number of mental disorders (i.e., not including information about type) are presented in the final column of Table 3. The odds of developing arthritis increases linearly with increasing numbers of mental disorders, with ORs ranging from 1.5 for one mental disorder to 3.1 for 5+ mental disorders. This model was a better fit for the data than either our multivariate type model or a

more complex model that included information about number and type of mental disorders (model fitting results available on request). This reinforces the results from the multivariate type model that it appears to be mental disorders in general, rather than any specific type of mental disorder, that are associated with increased odds risk of arthritis onset.

Table 3 about here

Discussion

This study utilized an epidemiological approach to determine whether mental disorders are associated with arthritis onset. The findings indicated that a range of mood, anxiety, impulse-control, and substance disorders were significantly associated with an elevated risk of developing arthritis, even after controlling for lifetime comorbidity of mental disorders. Additionally, the odds of developing arthritis increased as the number of mental disorders experienced over the lifetime increased from one to five or more disorders.

The bivariate models showed that all mood, anxiety, impulse-control, and substance disorders were significantly associated with the onset of arthritis. The odds ratios ranged from 1.5 to 2.8 and indicated that the odds of developing arthritis among individuals with these disorders are 50% to 180% higher. The multivariate models included all of the mental disorders as simultaneous predictors of the onset of arthritis and revealed that major depressive episode/dysthymia, three of the anxiety disorders (i.e., generalized anxiety, specific phobia, and post-traumatic stress), and alcohol abuse were significant predictors of arthritis after accounting for the other mental disorders. The significant odds ratios based on the multivariate models were smaller and ranged from 1.2 to 1.4, revealing that the odds of developing arthritis among individuals with each of these mental disorders are 20% to 40% higher after accounting for the other mental disorders.

The model that used the number of mental disorders as the predictors of the onset of arthritis revealed that the odds of an individual developing arthritis increased in a linear fashion as the number of mental disorders increased from one to five or more disorders. An individual with one disorder had a 50% increase in odds of developing arthritis compared to an individual with no disorders (i.e., an odds ratio of 1.5) while an individual with five or more mental disorders had over a 200% increase in odds of developing arthritis (i.e., an odds ratio of 3.1). These results are consistent with the differences between the bivariate and multivariate models and indicate that some of the association between each mental disorder and later arthritis is explained by the fact that many individuals with a mental disorder have multiple mental disorders and the risk of arthritis is increased with multiple mental disorders.

Although this study is limited by the cross-sectional design and retrospective data collection, our results are consistent with the antecedent hypothesis [15] and suggest that a range of mental disorders precede and are associated with the onset of arthritis. The current results examining sequential associations extend the prior research that found concurrent associations between mental disorders and arthritis [9, 3, 23, 24]. Our findings showed that mood, anxiety, and psychiatric disorders did not predict the onset of arthritis over a two-year period. The average lapse of time between the first onset of mental disorder and the subsequent onset of arthritis in the current study is several decades (data not shown), so the findings may be a result of the different time frames under study. The fact that the current study is based on retrospective data means that these results await confirmation in prospective designs.

Although our results cannot be used to draw causal conclusions about the link between mental disorders and the onset of arthritis, the findings suggest that mental disorders could lead to the development or exacerbation of later arthritis. Prior research indicated that depression and other mental disorders may contribute to adverse health outcomes in people

with a chronic health condition [23, 25, 26]. Research on accelerated cellular aging due to psychological stress [27], suggests a possible mechanism of action. That is, maladaptive behaviors (e.g., poor nutrition, lack of physical activity, substance use, among others) combined with stressful conditions that interact with lifestyle and other high-risk factors can result in mental disorder-arthritis comorbidity. Early exposure to chronic maladaptive conditions early in life may contribute to a pathway leading to mental disorders and arthritis. However, it is worth noting that it is possible that other underlying factors such as general chronic illnesses [9], may also explain the association between mental disorders and arthritis). One cannot discount the potential causal role of adverse life events that impact both physical and mental health. Childhood physical abuse for example, is a risk factor for both osteoarthritis and mental disorders such as depression [28]. That is, increasing early detection and proper treatment may reduce mental disorder-arthritis comorbidity. Early intervention directed toward adolescents, individuals and families of relatively low-intensity intervention is appropriate to improve mental disorder-arthritis comorbidity very early in its manifestation. We also cannot rule out the obesity-depression relationship [29] as another potential underlying factor associated with arthritis, or other health risk behaviors such as lack of physical activity. It is important to note that physical activity and obesity may mediate these associations. In other words, increasing physical activity can reduce obesity and minimize mental disorder comorbidity. Additional research is needed to further refine our understanding of these possible relationships.

Strengths and Limitations

The present study had some important strengths and limitations. Among its strengths are a large sample size and diversity of the sample, the standardized nature and overall quality of the data set, and the advanced methods used to diagnose mental disorders in a community survey [9]. The study did, however, have several limitations. The most notable

limitation is the self-report ascertainment of both conditions of interest, including recalling the age or year of onset of arthritis [12] and the age of onset for mental disorders [30]. The use of self-reported arthritis status is a weakness, in that it may not accurately pinpoint symptom onset. It is possible that the retrospectively reported onset of arthritis post-dates the beginning of the illness by many years. Another measurement limitation was the cursory and nonspecific method of assessment for arthritis, with the possibility that respondents in accurately self-ascribe other health concerns to arthritis. This limitation also prevented us from examining the association between mental disorders and specific types of arthritis (i.e., osteoarthritis and rheumatoid arthritis). While both osteoarthritis and rheumatoid arthritis share similar characteristics, their symptoms and treatment are different. Finally, it is important to note that these data are over a decade old and is based on DSM-IV criteria.

Conclusion

The large WMH survey dataset allowed for an evaluation of the temporal association between mental disorders and the likelihood of subsequent arthritis. Our findings indicated that a number of mood, anxiety, and substance disorders and a greater number of comorbid mental disorders were significantly associated with an elevated risk of developing arthritis. These findings suggest that mental disorders may be associated with increased risk of the development of arthritis and future research should investigate the mechanisms that explain this association. Future research should also validate our findings in a prospective design and determine whether there are differences among types of arthritis (rheumatoid versus osteoarthritis). This work may have clinical implications for the prevention of arthritis through early detection and optimal treatment of mental disorders.

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Disclosure Statement: In the past three years, Ronald C. Kessler has been a consultant for Hoffman-La Roche, Inc., Johnson & Johnson Wellness and Prevention, and Sonofi-Aventis Groupe. Dr. Kessler has served on advisory boards for Mensante Corporation, Plus One Health Management, Lake Nona Institute, and U.S. Preventive Medicine. Dr. Kessler owns 25% share in DataStat, Inc.

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Table 1. Characteristics of WMH samples and percent (and number) with history of arthritis.

Country	Field Dates	Age Range	Sample Size		Response Rate (%)	History of Arthritis				
			Part 1 sample	Part 2 sample		n	%	SE	Mean age of onset	SE
Americas										
Colombia	2003	18-65	4426	2381	87.7	161	**6.1**	0.8	40.2	1.1
Mexico	2001-2	18-65	5782	2362	76.6	159	**5.9**	0.7	42.4	1.0
United States	2002-3	18+	9282	5692	70.9	1406	**27.4**	0.9	47.5	0.5
Peru	2005-6	18-65	3930	1801	90.2	105	**5.0**	0.8	41.6	1.5
Asia and South Pacific										
Japan	2002-6	20+	4129	1682	55.1	147	**7.4**	0.8	50.4	1.6
PRC Shen Zhen[a]	2006-7	18+	7132	2475	80.0	238	**7.0**	0.7	33.6	0.6
New Zealand	2003-4	18+	12790	7312	73.3	1244	**18.8**	0.9	49.6	0.7
Europe										
Belgium	2001-2	18+	2419	1043	50.6	192	**18.2**	1.8	44.3	1.3
France	2001-2	18+	2894	1436	45.9	347	**27.8**	2.2	42.7	1.0
Germany	2002-3	18+	3555	1323	57.8	136	**11.2**	1.3	50.2	1.2
Italy	2001-2	18+	4712	1779	71.3	416	**24.7**	1.7	44.0	0.8
The Netherlands	2002-3	18+	2372	1094	56.4	119	**10.8**	1.3	47.8	2.1
Spain	2001-2	18+	5473	2121	78.6	546	**21.0**	1.1	48.7	0.7
Northern Ireland	2004-7	18+	4340	1986	68.4	339	**16.7**	1.4	48.7	1.0
Portugal	2008-9	18+	3849	2060	57.3	349	**16.4**	1.1	43.6	1.1
Romania	2005-6	18+	2357	2357	70.9	750	**29.7**	1.0	40.7	0.5
Poland	2010-11	18-64	10081	4000	50.4	317	**7.7**	0.5	40.8	0.7
Middle East										
Israel	2002-4	21+	4859	4859	72.6	350	**6.8**	0.4	43.1	0.7
Iraq	2006-7	18+	4332	4332	95.2	532	**14.5**	0.9	43.4	1.0
Weighted average response rate (%)					**67.4**					
Total sample size			**98714**	**52095**		**7853**				
All countries combined							**15.3**	**0.3**	**45.5**	**0.2**

[a]People's Republic of China

Table 2. Median number of years elapsing between reported year of first onset of DSM-IV mental disorders and reported year of subsequent arthritis onset[1].

Type of mental disorders	Median number of years between mental disorder first onset and arthritis onset	
	50th percentile	SE
I. Mood disorders		
Major Depressive Episode/ Dysthymia	**13.5**	0.7
Bipolar Disorder (Broad)	**15.5**	1.3
II. Anxiety disorders		
Panic Disorder	**14.7**	1.7
Generalized Anxiety Disorder	**15.9**	0.8
Social Phobia	**29.2**	0.7
Specific Phobia	**32.9**	0.9
Agoraphobia without Panic	**25.4**	2.0
Post-Traumatic Stress Disorder	**17.8**	1.2
Obsessive Compulsive Disorder	**18.4**	1.8
III. Impulse-control disorders		
Intermittent Explosive Disorder	**22.3**	1.6
Binge Eating Disorder	**17.1**	2.6
Bulimia Nervosa	**17.9**	2.9
IV. Substance disorders		
Alcohol Abuse	**15.5**	0.9
Alcohol Dependence with Abuse	**13.6**	1.1
Drug Abuse	**16.5**	1.4
Drug Dependence with Abuse	**14.6**	1.5

[1]Cases are restricted to those whose arthritis onset occurred at the age of 21 years and above.

Table 3. Bivariate and multivariate associations (odds ratios) between DSM-IV mental disorders and the subsequent onset of arthritis.

Type of mental disorders	Bivariate Models[1]		Multivariate Type Model[2]		Multivariate Number Model[3]	
	OR	(95% C.I.)	OR	(95% C.I.)	OR	(95% C.I.)
I. Mood disorders						
Major Depressive Episode/ Dysthymia	1.7**	(1.5-1.8)	1.3**	(1.2-1.5)	-	-
Bipolar Disorder (Broad)	1.9**	(1.6-2.3)	1.1	(0.9-1.3)	-	-
II. Anxiety disorders						
Panic Disorder	1.8**	(1.5-2.1)	1.2*	(1.0-1.4)	-	-
Generalized Anxiety Disorder	1.9**	(1.7-2.2)	1.3**	(1.2-1.5)	-	-
Social Phobia	1.6**	(1.4-1.8)	1.1	(1.0-1.2)	-	-
Specific Phobia	1.6**	(1.4-1.8)	1.3**	(1.2-1.5)	-	-
Agoraphobia without Panic	1.5**	(1.2-1.9)	1.0	(0.8-1.3)	-	-
Post-Traumatic Stress Disorder	1.9**	(1.7-2.2)	1.4**	(1.2-1.6)	-	-
Obsessive Compulsive Disorder	1.5**	(1.1-2.0)	1.2	(0.9-1.6)	-	-
III. Impulse-control disorders						
Intermittent Explosive Disorder	1.8**	(1.5-2.1)	1.2*	(1.0-1.5)	-	-
Binge Eating Disorder	2.0**	(1.5-2.7)	1.4*	(1.0-1.8)	-	-
Bulimia Nervosa	1.8**	(1.2-2.6)	1.0	(0.7-1.5)	-	-
IV. Substance disorders						
Alcohol Abuse	1.8**	(1.6-2.0)	1.4**	(1.2-1.6)	-	-
Alcohol Dependence with Abuse	2.1**	(1.7-2.5)	1.1	(0.9-1.4)	-	-
Drug Abuse	2.2**	(1.9-2.6)	1.3*	(1.0-1.6)	-	-
Drug Dependence with Abuse	2.8**	(2.2-3.6)	1.1	(0.8-1.6)	-	-
Joint effect of all types of disorders, χ^2_{16}				449.3**		
Difference between types of disorders, χ^2_{15}				22.9		
V. Number of disorders						
Exactly 1 disorder	-	-	-	-	1.5**	(1.4-1.6)
Exactly 2 disorders	-	-	-	-	1.7**	(1.5-1.9)
Exactly 3 disorders	-	-	-	-	2.2**	(1.9-2.6)
Exactly 4 disorders	-	-	-	-	2.6**	(2.2-3.1)
5+ disorders	-	-	-	-	3.1**	(2.6-3.8)
Joint effect of number of disorders, χ^2_5						323.3**

*/** Significant at the 0.05/0.01 level, two-tailed test.

[1]Bivariate models: each mental disorder type was estimated as a predictor of the physical condition onset in a separate discrete time survival model controlling for age cohorts, gender, person-year and country.

[2]Multivariate Type model: the model was estimated with dummy variables for all mental disorders entered simultaneously, including the controls specified above.

[3]Multivariate Number model: the model was estimated with dummy predictors for number of mental disorders without any information about type of mental disorders, including the controls specified above.

Research Highlights

- We examine associations among DSM-IV mental disorders and subsequent arthritis onset.
- Mood, anxiety, impulse-control, and substance disorders were associated with arthritis onset.
- We found the risk of developing arthritis increased as the number of mental disorders increased.