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Mental and Physical Comorbid Conditions and Days in Role Among Persons with Arthritis

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Abstract

Objective—To estimate the prevalence of comorbidity among people with arthritis in the US adult population and to determine the role of comorbidity in accounting for the association of arthritis with days out of role.

Methods—Data come from the National Comorbidity Survey Replication (NCS-R), a nationally representative household survey of 9282 respondents ages 18 and older carried out in 2001–3. Arthritis was assessed by self-report in a chronic conditions checklist along with a wide range of other physical conditions. Mental and substance use disorders were ascertained with the WHO Composite International Diagnostic Interview (CIDI). Number of days out of role was assessed for the 30 days before the interview.

Results—Arthritis was reported by 27.3% of respondents, 80.9% of whom also reported at least one other physical or mental disorder, including 45.6% with another chronic pain condition, 62.3% with another chronic physical condition, and 24.3% with a 12-month mental disorder. Arthritis was significantly associated with days out of role, but comorbidity explained more than half of this association. No significant interactions were found between arthritis and the other conditions in predicting days out of role.

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Conclusions—Comorbidity is the rule rather than the exception among people with arthritis. Comorbidity accounts for most of the days out of role associated with arthritis. The societal burden of arthritis needs to be understood and managed within the context of these comorbid conditions.

Keywords

Chronic Pain; Arthritis; Mental Disorders; Chronic Disease; Disability; Prevalence

More than half of all people in the U.S. over the age of 65 report having either arthritis (typically osteoarthritis) or chronic joint symptoms (1–3). Arthritis accounts for one-eighth of all restricted activity days in the US adult population, \$15 billion in annual direct treatment costs, and \$50 billion in annual indirect costs (4–7). A number of other chronic physical conditions are known to be highly comorbid both with rheumatoid arthritis (8–13) and with osteoarthritis (14–23). Mental disorders are also frequently comorbid with rheumatoid arthritis (24–27) and osteoarthritis (17,19,20,22,28).

These comorbidities have been linked to a variety of adverse outcomes, including decreased quality of life (15,16,22,29–32), sleep disturbance (33), increased health care costs (13,30,34,35), increased disability (13,21,26,28,30), and increased mortality (36). When coupled with the dramatic rise in arthritis prevalence as the population ages (1,37,38), these effects are likely to increase. As a result, there is growing interest in how comorbid conditions should be addressed among patients with arthritis to reduce adverse effects (19,22,23,27,30,37,39).

Prior research suggests that some comorbid conditions are stronger predictors of adverse outcomes in arthritis patients than others (17,32,40). It has recently been hypothesized that some comorbid conditions have interactive effects with arthritis, for example, by decreasing locomotor capacity or endurance when they co-occur with arthritis (40). Consistent with this suggestion, Wilson et al. (12) have reported that comorbidity between arthritis and anemia had an interactive effect on role impairment. We examine whether co-occurrence of arthritis and other chronic conditions have interactive effects on disability as a number of studies have examined additive effects of comorbid conditions in predicting functional outcomes among arthritis patients. These studies are fairly consistent in documenting that comorbid mental disorders (21,23,25) osteoporosis (8,41–43), diabetes (40), and cardiovascular disorders (10,11,17,32,44) predict adverse outcomes among patients with arthritis. The evidence is less consistent for effects of other comorbid conditions (11,32,40). However, population-based estimates of the unique contribution of arthritis to disability, after accounting for a wide range of physical and mental comorbidity, are not available.

The objective of this report is to estimate the prevalence of comorbidity among people with arthritis in the US adult population. A second aim is to estimate the additive and interactive effects of a wide range of comorbid conditions in explaining the association of arthritis with percent of days in role, a key disability measure. The data come from a national survey of respondents ages 18 and older in the US, the National Comorbidity Survey Replications (45). These data allow us to specifically assess the impact of comorbid mental disorders on disability among persons with arthritis, based on prior research indicating that mental disorders play a major role in disability among persons with a range of chronic physical conditions (46–48).

Methods

Sample

The National Comorbidity Survey Replication (NCS-R) was designed to study comorbidities among mental disorders and of mental disorders with physical disorders (45). The survey was carried out in a nationally representative household sample of 9282 respondents ages 18 and

older between February 2001 and December 2002. Respondents were selected from a multistage area probability sample of the non-institutionalized civilian population in the 48 contiguous states. The response rate was 70.9 %. All respondents were administered a Part I psychiatric diagnostic interview as described below, while a probability sub-sample of 5692 Part I respondents also received a Part II interview that included assessment of chronic physical diseases, chronic pain conditions, and disability. The Part II sub-sample consisted of all respondents who screened positive for any mental disorder in Part I plus a probability sample of all other Part I respondents. The Part I sample was weighted to adjust for differential probabilities of selection within households and for differences in intensity of recruitment effort among hard-to-recruit cases. The Part II sub-sample was then weighted to adjust for the lower selection probabilities for Part I respondents without a mental disorder. A final weight adjusted the sample to match the sample to the cross-classification on a number of geographic and socio-demographic variables based on data in the 2000 Census. All analyses reported in the current paper are based on Part II data that use these weights, providing estimates for the adult U.S. population residing in households. A more complete description of the NCS-R sampling design has been reported elsewhere (49).

Measures

Arthritis was ascertained as part of a chronic conditions checklist containing questions about 20 conditions based on the list used in the US National Health Interview Survey. The focus was on chronic conditions present at some time in the 12 months before the interview. Separate questions were asked about whether respondents experienced symptom-based conditions like arthritis or chronic headaches and whether a doctor ever told respondents they had a silent condition like hypertension or diabetes. Methodological research has shown that such checklists predict outpatient health care use, hospitalization, and mortality (50), and that self-reports in such checklists show moderate to high agreement with medical records (51). An advantage of self-reports over medical records is that symptom-based conditions that are often untreated, such as arthritis, are found more often in self-reports than in medical records.

Any respondent who reported having “arthritis or rheumatism” in the checklist is defined here as having arthritis. Four other chronic pain conditions were ascertained in the checklist: chronic back and neck pain, migraine (using component symptoms), other frequent or severe headaches, and a residual category of any other chronic pain. The remaining 15 conditions in the checklist included cardiovascular disorders (stroke, heart disease, heart attack, high blood pressure), respiratory disorders (asthma, tuberculosis, other lung disease), digestive disorders (ulcer, irritable bowel disorder), sensory impairments (vision impairment, hearing impairment), cancer, diabetes, epilepsy, and HIV infection.

Mental disorders were assessed with an expanded version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI) (52), a fully structured instrument designed for use by trained interviewers who do not have clinical experience. Diagnoses are based on DSM-IV criteria (53). Organic exclusions and diagnostic hierarchy rules were both applied in making diagnoses. As with physical disorders, the focus in the current report is on 12-month prevalence. The 13 diagnoses considered here include mood disorders (major depression, dysthymia, bipolar I-II disorder), anxiety disorders (panic disorder, agoraphobia without panic, social anxiety disorder, specific phobia, generalized anxiety disorder, and posttraumatic stress disorder), and substance use disorders (alcohol abuse and dependence, drug abuse and dependence). Previous methodological research has documented acceptable-to-good concordance between the NCS-R CIDI diagnoses and blind clinical diagnoses, with the CIDI generally making diagnoses that are conservative in comparison to blind clinical diagnoses (54).

All Part II respondents were administered the WHO Disability Assessment Schedule (WHO-DAS-II) (55), an inventory that assesses impairments in role functioning during the 30 days before the interview. The WHO-DAS measures days out of role, a widely used measure in studies of the burden of illness (55–59). Using this variable, percent of days in role in the 30 days prior to interview was estimated, and is the disability measure reported in this paper. The validity of self-report of days out of role has been established by studies comparing payroll records of employed people with self-reports of day out of role, which have found strong associations of self-report and records-based estimates (57–61).

Respondents were asked the numbers of days in the past 30 they were “totally unable to work or carry out normal activities” because of health problems. Responses were transformed to percent score in which a score of 0 percent represents being out of role every day and a score of 100 percent represents never being out of role. A standard battery of questions concerning socio-demographic variables was administered to all respondents. The variables of this type used here include age, sex, years of completed education, race-ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, Other), and employment status (working, student, homemaker, retired, other).

Analysis methods

Logistic regression analysis (62) was used to estimate the association of arthritis with each other condition after adjusting for socio-demographic variables. The logistic regression coefficients were transformed to odds-ratios (ORs) with 95% confidence intervals for ease of interpretation. The association of arthritis with days in role was assessed using linear regression. Mean differences in the standardized measure of percent of days in role associated with arthritis are reported after adjusting for socio-demographic variables with and without controls for particular sets of comorbid conditions. Because uncontrolled within-category variance in age and education might bias results, the relevant analyses were also run with the addition of linear and quadratic measures of age and similar measures of education. Interactive effects were evaluated in expanded linear regression equations that included main effects and two-way interactions between arthritis and each of the other conditions.

Because of the weighting and clustering of the NCS-R sample, significance tests were carried out using the Taylor series linearization method implemented in the SUDAAN software package (63). Multivariate significance tests were calculated using Wald F tests based on coefficient variance-covariance matrices adjusted for design effects using the Taylor series method. Statistical significance was evaluated using two-sided design-based tests evaluated at the .05 level of significance.

Results

Arthritis prevalence

The prevalence of self-reported arthritis among U.S. household-residing adults was estimated to be 27.3% (Table 1). This is equivalent to roughly 57 million people in the US. Prevalence was higher among females than males, increased with age, was inversely related to education, and was lower among Hispanics than other race-ethnic groups.

Comorbidity

Disaggregated analyses showed considerable variation in the strength of the associations between arthritis and other chronic physical conditions after adjusting for the effects of age, sex, race-ethnicity, and education (Table 2). The strongest and most consistently significant ORs were with other chronic pain conditions (2.1–3.9). The latter conditions were also quite common, resulting in close to half of all people with arthritis (45.6%) having at least one other

chronic pain condition. Nearly three-fourths of the ORs with other physical conditions were greater than 1.0 (11 of 15) and nearly half were statistically significant (7 of 15). The strongest relationships were observed for ulcers (an odds ratio of 2.8), vision impairment (2.2), and asthma (2.1). Other significantly comorbid conditions included heart disease, high blood pressure, other lung disease, and diabetes, with ORs in the range 1.5–1.9. Nearly two-thirds of respondents with arthritis (62.3%) had at least one other comorbid chronic physical condition, or an estimated 35.6 million U.S. adults with arthritis and at least one other comorbid physical condition.

In multivariate analyses that control for age and other socio-demographics, arthritis was consistently associated with increased rates of mood and anxiety disorders (Table 3) whereas the unadjusted estimates were not significant. The ORs for mood and anxiety disorders were in the range 1.5–2.2, and were all significantly greater than 1.0 except for agoraphobia. In comparison, none of the associations between arthritis and substance use disorders were significant at the .05 level even after controlling for socio-demographics, with ORs in the range 0.8–1.6. Nearly one-quarter of respondents with arthritis (24.3%) had at least one comorbid mental or substance use disorder, or an estimated 13.9 million U.S. adults.

Associations of arthritis and comorbid conditions with days out of role

The mean score on the measure of percent of days in role was 82.1 among respondents with arthritis compared to a significantly higher 92.2 among other respondents ($z = 9.1$, $p < .001$). The estimated effect of arthritis, before adjusting for covariates, was a difference of 10.1% of days in role (Table 4), or roughly equivalent to a difference of 3 days out of role over the course of a month for persons with versus without arthritis. When adjusted for socio-demographics, this regression coefficient was reduced to a difference of 7.8 percent, which is still statistically significant (Table 4). Equations that controlled for mental and substance use disorders reduced the difference in percent of days in role associated with arthritis to 6.4%. Adjusting for both physical and mental comorbidity (the last line of Table 4) reduced the difference in percent of days in role associated with arthritis to 2.9%, which remained statistically significant, but was substantially reduced from the unadjusted estimate. This coefficient represented a reduction of 71% compared to the coefficient in the equation that controls only for socio-demographics, indicating the substantial contribution of physical and mental comorbidity to disability among persons with arthritis.

These analyses were extended to test if any interactions between arthritis and other physical or mental disorders made a significant contribution to percent of days in role. Significance tests were calculated for sets of interactions involving all comorbid conditions in a given class as well as for individual conditions. None of these interaction terms was significant at the .05 level. This was also true when the equation was simplified to include only one interaction at a time.

Discussion

In interpreting these results, an important limitation is that chronic physical conditions were assessed with self-report. As noted earlier, methodological research has shown generally good concordance of self-reported chronic condition with independent medical records (51). This is especially true for conditions where the patient's knowledge of the condition hinges almost entirely on being informed of its presence by a health care professional (e.g. diabetes). Self-reports of symptom-based conditions, like arthritis, generally show lower concordance with medical records, but this can be due to the fact that many cases are not documented in the medical record. Even so, a recent study using self-reported arthritis found that 91.4% of respondents who described themselves as having arthritis (receiving a diagnosis or treatment for arthritis in the past 3 years) were confirmed as cases by independent medical records

examinations (64). Our ascertainment of arthritis was also based on a single question and those considered to have arthritis would have included people reporting arthritis regardless of whether or not they had sought medical care. As such, we may have included those with milder symptoms.

Within the context of this limitation, the NCS-R results are consistent with prior research in finding that arthritis is significantly comorbid with a wide range of other physical and mental conditions. However, our results refine those in previous studies in three respects. First, we found that comorbidities with other chronic pain conditions were more consistently significant and generally stronger in magnitude than those with other comorbid conditions. Second, we found that significant comorbidities with mental disorders only emerged when we adjusted for age which probably reflects the underlying age distribution of the sample, the higher prevalence of arthritis among older respondents, the prevalence of psychiatric disorders among younger respondents, and the strong association among respondents who are younger than most patients with clinically significant arthritis. Third, we found no evidence that arthritis was comorbid with substance use disorders.

We also replicate previous research in showing that arthritis is significantly associated with disability, as assessed by percent of days in role. The gross individual-level effect is equivalent to approximately 3 days out of role each month. On a base of approximately 57 million people in the US with arthritis, this is equivalent to approximately 2 billion days out of role per year, a number that is consistent with previous suggestions that arthritis, along with other musculoskeletal conditions, are associated with more days out of role than any other class of health problems (65–67).

As noted in the introduction, previous research has shown that the gross effects of arthritis on role functioning can be partly explained by comorbid conditions. The latter have typically been studied one at a time, with cardiovascular disorders the most widely studied and consistently documented to play an important role in accounting for disability among persons with arthritis (10,11,17,32,44). Our more comprehensive investigation found that other chronic pain conditions appeared to explain the largest part of the overall association between arthritis and percent of days in role. Indeed, nearly half (47%) of the adjusted gross effect of arthritis (i.e., the effect controlling for socio-demographics, but not for comorbid conditions) was explained by other chronic pain conditions. All other chronic physical conditions combined explained less than half as much of the adjusted gross effect of arthritis (20%). Consistent with previous research (21,23,25), comorbid mental disorders were also found to be important, accounting for roughly the same proportion of the adjusted gross effect of arthritis (17%) as all chronic physical conditions exclusive of pain conditions. Taken together, all the comorbid conditions considered in the NCS-R accounted for considerably more than half of the adjusted gross effects of arthritis on days out of role.

In comparison to the evidence of pervasive comorbidity and additive effects of comorbidity on the gross association between arthritis and days out of role, we failed to find any statistically significant interactions between arthritis and comorbid conditions. This result is inconsistent with at least one report (40). However, it is important to note that this earlier study examined a number of interactions and found only one to be significant, which suggests that this one interaction might well have been due to chance variation. It is also relevant that this earlier report had a different outcome – self-reported decline in physical functioning – rather than percent of days in role. It might be that significant interactions exist in predicting decline in physical functioning or other outcomes even though they do not exist in predicting days out of role.

Assuming that the effects are additive, comorbid conditions can be thought of as cumulative adversities. Improved functioning in the face of cumulative adversities can be achieved by treating any one or more of the component conditions effectively, but these improvements would be expected to have effects independent of the symptoms of arthritis, assuming that these conditions play a causal role. Randomized intervention studies that treat comorbid conditions among patients with arthritis would be required to confirm that this is the case. The number of such studies that have been carried out up to now is quite small and limited largely to studies of anemia in rheumatoid arthritis (12). The latter might more reasonably be thought of as studies of a complex single disorder than of comorbidity. Successful resolution of anemia is typically shown in these studies to be associated with reduction in a wide range of rheumatoid arthritis symptoms.

The only replicated experimental studies of treating a comorbid condition among patients with arthritis that we found in the published literature deal with depression. Parker et al. (68) showed that successful depression treatment among patients with rheumatoid arthritis resulted in a significant improvement in overall quality of life. Lin et al. (2003) (64) found that treatment of comorbid depression among elderly patients with arthritis resulted in significant reductions in arthritis pain and improved functioning.

Given the large and growing prevalence of arthritis in the aging population and the pervasiveness of comorbidity, these results argue that the medical care of patients with arthritis should be managed with recognition that comorbidity is a typical feature of arthritis, accounting for a substantial part of the disability associated with this condition.

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Acronyms used in the text

NCS-R

National Comorbidity Survey Replication

WHO

World Health Organization

CIDI

WHO Composite International Diagnostic Interview

WHO-DAS

WHO Disability Assessment Schedule

Table 1

The prevalence of arthritis in the total sample and in socio-demographic sub-samples

	Prevalence		
	%	(se)	(n)
Total Sample	27.3	(0.9)	(5692)
Sex			
Female	30.9	(1.2)	(3310)
Male	23.3	(1.2)	(2382)
Age			
18–29	6.0	(0.8)	(1373)
30–44	14.1	(1.1)	(1826)
45–59	37.3	(1.7)	(1522)
60+	56.4	(2.2)	(971)
Education			
0–11	40.3	(2.3)	(849)
12	28.8	(1.0)	(1712)
13–15	24.9	(1.6)	(1709)
16+	18.5	(1.4)	(1422)
Race/ethnicity			
Non-Hispanic Black	25.5	(2.3)	(717)
Non-Hispanic White	28.9	(1.2)	(4180)
Hispanic	19.6	(2.8)	(527)
Other	24.7	(4.2)	(268)
Employment status			
Working	20.4	(1.0)	(3913)
Student	4.6	(1.4)	(143)
Homemaker	29.2	(2.9)	(340)
Retired	58.7	(2.4)	(679)
Other	33.3	(2.8)	(607)

Table 2

The prevalence of comorbid physical conditions among respondents with arthritis and adjusted odds-ratios of arthritis with these conditions

	Prevalence		OR ⁺	(95% CI)	(N) ^I
	%	(se)			
Other chronic pain conditions					
Back-neck	35.5	(1.5)	3.9 [*]	(3.2–4.7)	(20.2)
Migraine	6.8	(0.5)	2.7 [*]	(2.0–3.7)	(3.8)
Other chronic headaches	8.5	(0.9)	2.1 [*]	(1.5–2.9)	(4.8)
Other chronic pain	13.7	(1.0)	2.6	(1.9–3.5)	(7.8)
Cardiovascular disease					
Stroke	5.3	(0.7)	1.4	(0.8–2.3)	(3.0)
Heart disease	10.0	(1.0)	1.5 [*]	(1.1–2.3)	(5.7)
Heart attack	6.6	(0.8)	1.0	(0.7–1.4)	(3.8)
High blood pressure	34.7	(1.4)	1.6 [*]	(1.3–1.9)	(19.8)
Respiratory disease					
Asthma	15.7	(1.7)	2.1 [*]	(1.6–2.7)	(9.0)
Other lung disease	5.0	(0.8)	1.9 [*]	(1.1–3.1)	(2.8)
Digestive disorder					
Ulcer	5.0	(0.5)	2.8 [*]	(1.8–4.3)	(2.8)
Irritable bowel syndrome	1.0	(0.2)	1.5	(0.7–2.9)	(0.6)
Sensory impairments					
Hearing impairment	6.6	(0.8)	1.2	(0.7–2.1)	(3.8)
Vision impairment	7.0	(0.9)	2.2 [*]	(1.4–3.5)	(4.0)
Other conditions					
Cancer	1.4	(0.4)	0.9	(0.4–2.0)	(0.8)
Diabetes	11.6	(1.1)	1.5 [*]	(1.1–2.0)	(6.6)
Epilepsy	2.4	(0.3)	1.5	(0.9–2.3)	(1.4)
HIV infection	0.1	(0.1)	0.9	(0.2–4.3)	(0.1)
Any chronic physical condition	62.3	(1.6)	2.1 [*]	(1.7–2.5)	(35.6)

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

⁺ ORs control for demographics

^I Population projection in millions for the US population ages 18+

Table 3

The prevalence of DSM-IV mental and substance use disorders among respondents with arthritis and adjusted odds-ratios of arthritis with these conditions

	Prevalence		OR	(95% CI)	(N) ^I
	%	(se)			
Anxiety disorders					
Panic disorder	3.9	(0.3)	2.2 [*]	(1.5–3.2)	(2.2)
Generalized anxiety disorder	4.6	(0.6)	2.1 [*]	(1.5–3.0)	(2.6)
Agoraphobia	1.1	(0.2)	1.5 [*]	(0.8–3.1)	(0.6)
Social phobia	5.9	(0.6)	1.5 [*]	(1.2–1.9)	(3.4)
Specific phobia	9.9	(0.8)	2.0 [*]	(1.6–2.5)	(5.7)
Post-traumatic stress disorder	5.2	(0.6)	2.2 [*]	(1.6–2.9)	(3.0)
Mood disorders					
Major depressive disorder	7.4	(0.6)	1.6 [*]	(1.2–2.0)	(4.2)
Dysthymia	3.6	(0.4)	2.0 [*]	(1.5–2.7)	(2.0)
Bipolar I or II disorders	2.8	(0.3)	1.7 [*]	(1.2–2.4)	(1.6)
Substance use disorders ²					
Alcohol abuse	2.0	(0.3)	1.3	(0.8–1.9)	(1.1)
Alcohol dependence	1.0	(0.2)	1.5	(0.8–2.9)	(0.6)
Drug abuse	0.8	(0.2)	1.6	(0.9–3.0)	(0.5)
Drug dependence	0.2	(0.1)	0.8	(0.3–2.3)	(0.1)
Any mental or substance use disorder	24.3	(1.2)	1.7 [*]	(1.5–2.1)	(13.8)

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

^I Population projection in millions for the US population ages 18+

² Alcohol and drug abuse are defined without diagnostic hierarchy rules

Table 4

Proportion of days out of role in the past month associated with arthritis in regression models that vary the number of control variables¹

Controls	Proportion (%) of days out of role in past month	
	Proportion (%)	(se)
No controls	10.1	(1.1)
Socio-demographics	7.8	(1.1)
Socio-demographics and mental and substance disorders	6.4	(1.1)
Socio-demographics and other pain conditions	3.9	(1.1)
Socio-demographics and other physical conditions	6.3	(1.1)
Socio-demographics and all comorbid conditions	2.9	(1.1)

¹ Based on multiple linear regression equations with days out of role the outcome and a dummy variable for arthritis the focal predictor variable. The equations varied in the inclusion of control variables.