

# Associations of Arthritis-Attributable Interference with Routine Life Activities: A Modifiable Source of Compromised Quality-of-Life

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**Objective.** Arthritis patients experience the impact of disease beyond routinely assessed clinical measures. We characterized arthritis-attributable interference in four important routine life domains: 1) recreation/leisure/hobbies; 2) household chores; 3) errands/shopping; and 4) social activities.

**Methods.** Participants were from the Arthritis Conditions Health Effects Survey (2005–2006), a cross-sectional survey of noninstitutionalized US adults 45 years or older with doctor-diagnosed arthritis ( $n = 1793$ ). We estimated the prevalence of “a lot” of arthritis-attributable interference and quantified the associations between sociodemographic, clinical, and psychological characteristics and “a lot” of arthritis-attributable interference (vs “a little” or “none”) in each domain using prevalence ratios (PRs) in multivariable (MV)-adjusted logistic regression models.

**Results.** An estimated 1 in 5 to 1 in 4 adults with arthritis reported “a lot” of arthritis-attributable interference in recreation/leisure/hobbies (27%), household chores (25%), errands/shopping (22%), and social activities (18%). The highest prevalence of “a lot” of arthritis-attributable interference was for those unable to work/disabled or reporting severe arthritis symptoms (pain, stiffness, fatigue), anxiety, depression, or no/low confidence in ability to manage arthritis, across domains. In MV-adjusted models, those unable to work/disabled, currently seeing a doctor, or reporting fair/poor self-rated health, severe joint pain, anxiety, or no/low confidence in ability to manage arthritis were more likely to report arthritis-attributable interference than their respective counterparts. Magnitudes varied by domain but were consistently strongest for those unable to work/disabled (MV PR range = 1.8–2.5) and with fair/poor health (MV PR range = 1.7–2.7).

**Conclusion.** Many characteristics associated with arthritis-attributable interference in routine life activities are potentially modifiable, suggesting unmet need for use of existing evidence-based interventions that address these characteristics and reduce interferences to improve quality of life.

## INTRODUCTION

“The operation was success, but the patient is dead” is a well-known dark joke in medical circles. Possibly less well known is that it is a recasting of a line from *The Tiger King*, a short story by an Indian author writing under the name Kalki Krishnamurthy. Interpretations of the original line abound—from an adept literary use of irony, to revenge, to prophecy fulfillment, to a straightforward, blatant disconnect between the goals of the surgeons and the goals of the patient. Whatever the original intention, this quip neatly sums up an ongoing tension today between the needs

and desires important to people with health conditions and those charged to care for them, who may be focused on other, often more medical, aspects of the health condition.

A growing body of research identifies roles and activities important to people with chronic conditions and examines their effects on health and health outcomes (1–5). A study among people with chronic conditions (including arthritis) with disability in valued life activities found that, even in the absence of improving disease symptoms, self-rated health, well-being, and quality of life can be improved by reducing the effects of disease on valued life activities. For example, accommodation through behavioral strat-

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egies or assistive devices can minimize interference in valued or routine life activities and improve individuals' assessments of their health (1–4,6–8). And the 2012 Institute of Medicine (IOM) report, *Living well with chronic disease: Public health action to reduce disability and improve functioning and quality-of-life*, recommends greater emphasis on quality-of-life measures among people with chronic conditions because “people are increasingly focused not simply on living longer, but on maintaining or even improving their capacity to live well over their entire lives” (9).

Previous studies have established that arthritis-attributable activity limitation (AAAL), a broad measure of limitation in one's usual activities (“Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?”), is highly prevalent, affecting 44% of adults with arthritis (23.7 million people), which translates to at least 9.8% of all US adults 18 years or older (10). As a leading cause of disability and work disability among US adults (11,12), arthritis has considerable and more specific compromising impacts and negative consequences on quality of life (eg, work limitations (13,14), severe joint pain (15), serious psychological distress (16,17), anxiety, depression (18,19), and restrictions in community (20), social (17), and volunteer participation (21)). Furner et al compared five quality-of-life measures of physical and mental health among individuals with and without arthritis and found that, across all measures, health-related quality of life was two to three times worse among those with arthritis (22). Additionally, this and other studies have shown that people with arthritis report fair/poor self-rated health much more often (eg, 29% vs 8%) (23) than those without arthritis (13,22).

Although general arthritis activity limitation data are useful, understanding arthritis impacts on specific domains of activity can help both further characterize effects of arthritis and identify those in need of more concentrated, potentially coordinated, multifaceted care approaches. Also, describing the effect of arthritis on specific activities may lead to better tailoring of interventions and improve peoples' capacity to live well with arthritis (2).

Population-based data on specific routine life activity limitations are rare (13,17,21), but an arthritis-specific survey, the Arthritis Conditions Health Effects Survey (ACHES) asked a series of questions assessing arthritis-attributable interference in routine life activities, including household chores, recreational and leisure activities, social activities, and shopping. Quantitatively, these activities are common and routine; the American Time Use Survey indicates that between 46% and 96% of US adults are engaged in shopping, household, social, and leisure activities every day, depending on activity (24). These have also been identified in the literature as routine and valued activities for large proportions of US adults with chronic health conditions, including arthritis. Interference with and disability in valued life activities that is due to arthritis has been shown to be associated with anger, frustration, isolation (25), adverse changes in self-image and sexual identity (26),

increased fair/poor health status (1), and onset of new depressive symptoms (1,3).

Although not an exhaustive list of valued activities, ACHES provides the only opportunity to examine these unique indicators in a population-based sample of US adults with arthritis. The purpose of this study is to characterize associations between arthritis-attributable interference in four routine life activity domains—1) recreation/leisure/hobbies; 2) household chores; 3) errands/shopping; and 4) social activities—with selected characteristics among US adults with arthritis who are 45 years or older.

## METHODS

**Participants and data source.** Data were obtained from ACHES ( $n = 1793$ ), a cross-sectional, random-digit-dialed national telephone survey designed to be representative of civilian, noninstitutionalized US adults aged 45 years or older with self-reported doctor-diagnosed arthritis and/or chronic joint symptoms. ACHES was funded and designed by the Centers for Disease Control and Prevention (CDC) and conducted by Battelle in 2005–2006 (27). It is the first, and currently only, population-based US survey dedicated entirely to arthritis and/or chronic joint symptoms. Hispanics and non-Hispanic blacks were oversampled. At least two weeks prior to the first call attempt, letters were mailed to addresses associated with potential residential phone numbers in an effort to maximize response rates among the target population. Trained interviewers called each number to identify 1) residential numbers and 2) survey eligibility, ie, household members 45 years or older with doctor-diagnosed arthritis. Because of the study design, the requirement for signed, written consent was waived. After obtaining oral consent by reading a standardized consent statement to participants, trained interviewers collected data in English (Spanish, as needed) using a standardized questionnaire. To enhance comparability with other studies, ACHES used questions from other health surveys (eg, Behavioral Risk Factor Surveillance System; National Health Interview Survey); each ACHES question, source, and modifications are available in the data set documentation (27). The overall person-level response rate was 28%; among eligible respondents, the interview completion rate was 75%–80% across strata (27). The CDC Human Subjects Review Board and Battelle Centers for Public Health Research and Evaluation Institutional Review Board reviewed and approved the ACHES protocol, which complied, as applicable, to the 1975 Declaration of Helsinki. Additional survey details are provided elsewhere (19,21,27).

**Definitions.** We used the case-finding definition for self-reported, doctor-diagnosed arthritis that has been used by the Centers for Disease Control and Prevention since 2002 in national and state surveillance and to track Healthy People objectives (28), “yes” to “Have you ever been told by a doctor or other health pro-

fessional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?"

**Arthritis-attributable interference in four routine life activity domains.** Interference with three of the life activity domains was queried beginning with: "The next questions refer to how arthritis or joint symptoms may affect your life. During the past 7 days, how much did your arthritis or joint symptoms interfere with the following activities?" followed by three activity domains: recreation, leisure, or hobbies; household chores; and errands or shopping. Interference with the fourth life activity domain (social activities) was defined by the question: "During the past 30 days, to what extent did your arthritis or joint symptoms interfere with your normal social activities with family, friends, neighbors, or groups?" Responses for each of the four questions were: a lot, a little, or not at all. These questions are variants of the Lorig Social/Role Activities Limitations questions, which are routinely used in self-management education intervention evaluations. The Lorig questions were, in turn, adapted from the Medical Outcomes Study to measure illness interference with role activity (29).

We examined three sets of characteristics: demographics, clinical status, and psychological factors. Six demographics were examined: age, sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic other), education (less than high school, high school graduate, more than high school), employment status (employed for pay, unable to work/disabled; others [unemployed, homemakers, students, retired]), and body mass index (BMI; [weight in kg/height in m<sup>2</sup>] calculated from self-reported weight and height (under/normal weight  $\leq 24.9$ , overweight 25.0-29.9, obese  $\geq 30.0$ )). Next, five clinical measures were examined: self-rated health, currently seeing a doctor for arthritis, and the following three measures of arthritis symptoms: severe joint pain, severe joint stiffness, and severe arthritis fatigue. Arthritis symptoms were each measured on a 10-point scale and dichotomized as "severe" at a cut point of 7 or more (30,31). Finally, three psychological factors were considered. Anxiety and depression were assessed separately using the Arthritis Impact Measurement Scales subscales and scored with a threshold of 4 or more (19,32,33). Level of confidence in ability to manage arthritis symptoms was assessed on a 10-point scale and categorized into three levels of confidence: very (7 or more), moderate (4 to 6), and no/low (0 to 3).

**Statistical analysis.** All analyses were weighted to generate estimates matching the target population, US adults 45 years or older with doctor-diagnosed arthritis. Variance using Taylor Series Linearization was estimated with 95% confidence intervals (CIs) using statistical software (SAS v.9.2) that accounted for the complex sample design (34).

To describe the population, we estimated weighted distributions of survey respondents for sociodemographic characteristics and level of arthritis-attributable interference in each of the four domains.

We estimated associations between each independent variable and each of the four domains of arthritis-attributable interference using prevalence ratios (PRs) and 95% CIs from unadjusted and multivariable-adjusted logistic regression models. For each domain, the dependent variable for modeling was dichotomized as "a lot" of arthritis-attributable interference versus all other choices combined ("a little" or "none"). Multivariable model specification proceeded in three steps. First, to avoid multicollinearity, we examined correlations across all independent variables prior to modeling to identify any variables that were highly correlated (ie,  $r \geq 0.4$ ). Second, we selected representative candidate variables. Joint pain, stiffness, and fatigue were highly correlated; so, we chose to represent arthritis symptoms with joint pain in the multivariable models because it is the most commonly assessed symptom in clinical and public health efforts. Anxiety and depression were also highly correlated. We selected anxiety, which is more common among people with arthritis than depression (18,19) and has stronger unadjusted associations for some domains, to represent psychological factors. Age, sex, race/ethnicity, and education were forced into all multivariable models. Third, for each domain, we started with an initial model containing all candidate variables and reduced this model through a series of regressions using manual backward stepwise deletion with the Wald chi-square statistic at  $\alpha \leq 0.10$  as the cut point for inclusion in the final model (35). Despite independent construction, multivariable models for all four domains resulted in the same correlates; only BMI did not meet model-specified model criteria.

## RESULTS

**Characteristics of the Population (Table 1).** Median age was 62 years (SD 11.1). The weighted population distributions were mostly women (61%) and non-Hispanic whites (81%) with more than a high school education (52%). Greater than 50% reported "a little" or "a lot" of arthritis-attributable interference in each of the four domains. "A lot" of arthritis-attributable interference was most common for the recreation/leisure/hobbies domain (27%) and least common for social activities (18%).

**Arthritis-Attributable Interference by Domain and Subgroup.** Weighted prevalence of "a lot" of arthritis-attributable interference in each of the four domains for all subgroups (eg, among those in each age group, among men and women, etc) is reported in Table 2. For demographic characteristics, prevalence of interference generally did not differ substantially. However, arthritis-attributable interference was higher for women compared with men for two domains: household chores (30% vs 17%) and errands or shopping (27% vs 14%). Non-Hispanic whites reported lower prevalence of arthritis-attributable interference compared with Hispanics and non-Hispanic blacks for errands and shopping and social activities. Those with obesity had the highest prevalence of arthritis-attributable interference compared with those

**Table 1.** Unweighted sample size (n),<sup>a</sup> weighted distributions (%),<sup>b</sup> and 95% confidence intervals (CIs) of selected characteristics and arthritis-attributable interference in four routine life activities among US adults 45 years or older with arthritis, Arthritis Conditions Health Effects Survey (ACHES) (n = 1793)

	Unweighted n	Weighted %	95% CI
Demographics			
Age group (in years)			
45-54	468	25.1	(22.8-27.5)
55-64	538	29.0	(26.5-31.4)
≥65	763	45.9	(43.1-48.7)
Sex			
Men	550	39.0	(36.6-41.4)
Women	1243	61.0	(58.6-63.4)
Body Mass Index (BMI)			
Underweight/normal	537	29.8	(27.4-32.2)
Overweight	601	37.1	(34.6-39.7)
Obese	606	33.1	(30.6-35.5)
Race/Ethnicity			
Non-Hispanic white	1363	80.5	(78.5-82.5)
Non-Hispanic black	206	9.6	(8.3-11.0)
Hispanic	114	6.3	(4.9-7.6)
Non-Hispanic other	67	3.6	(2.6-4.5)
Education			
Less than high school	286	15.6	(13.7-17.5)
High school graduate	558	32.1	(29.6-34.6)
More than high school	945	52.3	(49.6-55.0)
Employment Status			
Employed	597	33.3	(30.7-35.9)
Unable to work/disabled	279	14.6	(12.7-16.4)
Other <sup>c</sup>	915	52.2	(49.4-54.9)
Clinical measures			
Self-Rated health			
Excellent/very good	584	34.0	(31.4-36.6)
Good	580	32.0	(29.5-34.4)
Fair/poor	624	34.1	(31.6-36.6)
Currently seeing doctor/health care provider			
No	920	52.7	(50.1-55.3)
Yes	873	47.3	(44.7-49.9)
Severe joint pain			
No	1247	70.7	(68.3-73.0)
Yes	546	29.3	(27.0-31.7)
Severe joint stiffness			
No	1264	71.6	(69.4-73.9)
Yes	529	28.4	(26.1-30.6)
Severe fatigue			
No	1286	73.0	(70.8-75.3)
Yes	507	27.0	(24.7-29.2)

(Continued)

**Table 1.** (Cont'd)

	Unweighted n	Weighted %	95% CI
Psychological factors			
Anxiety			
No	1230	69.5	(67.0-71.9)
Yes	561	30.5	(28.1-33.0)
Depression			
No	1461	82.5	(80.5-84.4)
Yes	332	17.5	(15.6-19.5)
Confidence in ability to manage arthritis symptoms (0-10 point scale)			
Very confident, 7-10	1106	62.8	(60.3-65.4)
Neutral, 4-6	494	27.8	(25.4-30.1)
No/Low confidence, 0-3	160	9.4	(7.9-10.9)
Arthritis-Attributable interference with:			
Recreation, leisure, and hobbies			
A lot	503	27.0	(24.8-29.3)
A little	656	37.4	(34.9-39.9)
Not at all	634	35.6	(33.1-38.1)
Household chores			
A lot	479	25.1	(22.9-27.2)
A little	734	41.5	(39.0-44.0)
Not at all	580	33.4	(30.9-35.9)
Errands or shopping			
A lot	421	21.7	(19.6-23.7)
A little	602	34.5	(32.0-37.0)
Not at all	770	43.8	(41.2-46.5)
Social activities			
A lot	329	17.6	(15.7-19.5)
A little	623	34.4	(32.0-36.9)
Not at all	841	48.0	(45.4-50.6)

<sup>a</sup>Unweighted sample size = number of survey respondents. <sup>b</sup>Weighted distribution % = percentage of survey respondents mathematically adjusted to match target population (US adults ages 45 or older with doctor-diagnosed arthritis); columns may not add to 100.0 because of rounding. <sup>c</sup>Unemployed, homemakers, students, retired.

reporting overweight or underweight/normal weight BMI in all four domains. Similarly, those with the lowest level of education reported the highest prevalence of arthritis-attributable interference in all domains (range 31%-40%) compared with higher education levels.

Within the household chores and errands/shopping domains, respectively, 8% and 5% of respondents with excellent/very good self-rated health reported "a lot" of arthritis interference. Within the errands and shopping domain, 9% of employed respondents reported "a lot" of arthritis-attributable interference. Otherwise, the only reports with 10% or less of "a lot" of arthritis-attributable interference were in the social activities domain. These reports were among those: not currently seeing a health care provider (10%); without: anxiety (10%), severe joint stiffness (9%), or severe joint

pain (9%); with good self-rated health (9%); without severe fatigue (8%); employed respondents (7%); and those with excellent/very good self-rated health (5%).

The highest prevalence of "a lot" of arthritis-attributable limitations were reported by those unable to work/disabled, ranging from 53% (social activities) to 65% (both recreation/leisure/hobbies and household chores). Reports of "a lot" of arthritis-attributable limitations were also high, ranging from more than 1 in 3 to more than 1 in 2 for those with each of the arthritis symptoms measured, severe joint pain, severe joint stiffness, and severe fatigue. In addition, those with anxiety and depression reported "a lot" of arthritis-attributable limitations frequently, ranging from 35%-47% and 45%-55% across domains, respectively. Finally, those with low confidence rat-

**Table 2.** Weighted prevalence<sup>a</sup> (%) and 95% confidence intervals (CIs) of “a lot” of arthritis-attributable interference in four routine life activity domains among US adults ages 45 years or older with arthritis, by domain and selected characteristics, Arthritis Conditions Health Effects Survey (ACHES) (n = 1793)

Selected characteristics	Routine life domains							
	Recreation, leisure, and hobbies (n = 503) <sup>b</sup>		Household chores (n = 479) <sup>b</sup>		Errands and shopping (n = 421) <sup>b</sup>		Social activities (n = 329) <sup>b</sup>	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Demographics								
Age group (in years)								
45-54	30.2	(25.6-34.9)	25.5	(21.2-29.8)	20.7	(16.8-24.6)	18.8	(14.8-22.7)
55-64	26.6	(22.3-30.8)	25.7	(21.5-30.0)	22.9	(18.7-27.1)	19.9	(16.1-23.8)
≥65	25.7	(22.4-29.1)	24.6	(21.4-27.7)	21.3	(18.4-24.3)	15.3	(12.6-17.9)
Sex								
Men	24.2	(20.3-28.1)	17.3	(13.9-20.7)	14.1	(10.9-17.2)	16.0	(12.7-19.3)
Women	28.8	(26.1-31.6)	30.0	(27.3-32.8)	26.5	(23.8-29.2)	18.6	(16.2-20.9)
Race/Ethnicity								
Hispanic	29.7	(19.6-39.8)	31.3	(21.4-41.1)	34.9	(24.0-45.8)	32.1	(21.8-42.3)
Non-Hispanic black	31.2	(24.0-38.3)	27.7	(21.2-34.2)	28.1	(21.6-34.6)	23.8	(17.7-30.0)
Non-Hispanic other	35.5	(24.0-47.1)	35.6	(23.0-48.2)	29.4	(18.3-40.4)	23.0	(12.8-33.2)
Non-Hispanic white	25.4	(22.9-28.0)	23.5	(21.1-25.9)	19.3	(17.1-21.5)	15.1	(13.0-17.1)
Body mass index (BMI)								
Underweight/Normal	23.8	(19.8-27.8)	22.7	(18.9-26.6)	19.3	(15.7-22.8)	14.4	(11.3-17.6)
Overweight	23.6	(19.9-27.3)	20.3	(16.9-23.8)	16.4	(13.3-19.5)	14.5	(11.4-17.6)
Obese	33.2	(29.1-37.2)	32.2	(28.2-36.2)	29.1	(25.1-33.0)	23.1	(19.5-26.8)
Education								
Less than high school	40.3	(33.8-46.8)	35.9	(29.7-42.1)	36.4	(30.2-42.6)	30.5	(24.4-36.6)
High school graduate	28.9	(24.8-33.0)	28.8	(24.8-32.7)	23.9	(20.2-27.6)	18.5	(15.2-21.9)
More than high school	21.7	(18.9-24.6)	19.4	(16.7-22.1)	15.7	(13.3-18.1)	12.9	(10.6-15.2)
Employment status								
Employed	16.6	(13.3-19.8)	11.3	(8.6-14.0)	9.4	(6.9-11.9)	7.3	(5.1-9.6)
Unable to work/disabled	64.7	(58.3-71.1)	64.6	(58.5-70.6)	57.4	(50.9-63.9)	53.4	(46.8-60.0)
Other <sup>c</sup>	23.3	(20.3-26.2)	22.9	(20.1-25.8)	19.6	(16.9-22.3)	14.1	(11.8-16.5)
Clinical measures								
Self-rated health								
Excellent/very good	13.0	(10.0-16.1)	8.4	(6.1-10.8)	5.4	(3.6-7.2)	4.9	(3.1-6.7)
Good	18.5	(15.1-21.8)	18.4	(15.0-21.7)	14.7	(11.6-17.8)	8.7	(6.2-11.1)
Fair/poor	49.0	(44.6-53.4)	47.9	(43.7-52.2)	44.3	(40.0-48.6)	38.2	(34.1-42.2)
Currently seeing doctor/health care provider								
No	16.6	(13.9-19.3)	15.3	(12.7-17.9)	13.2	(10.8-15.6)	9.8	(7.6-12.0)
Yes	38.6	(35.1-42.2)	36.0	(32.5-39.4)	31.1	(27.8-34.3)	26.2	(23.1-29.3)
Severe joint pain								
No	15.9	(13.7-18.1)	14.6	(12.5-16.7)	11.5	(9.6-13.3)	8.7	(7.0-10.4)
Yes	53.8	(49.1-58.5)	50.4	(45.8-54.9)	46.2	(41.7-50.8)	39.0	(34.5-43.4)
Severe joint stiffness								
No	16.5	(14.3-18.7)	15.9	(13.7-18.0)	12.4	(10.5-14.3)	9.4	(7.6-11.2)
Yes	53.7	(48.8-58.5)	48.4	(43.7-53.0)	45.1	(40.5-49.8)	38.1	(33.6-42.7)

(Continued)



**Table 2.** (Cont'd)

Selected characteristics	Routine life domains							
	Recreation, leisure, and hobbies (n = 503) <sup>b</sup>		Household chores (n = 479) <sup>b</sup>		Errands and shopping (n = 421) <sup>b</sup>		Social activities (n = 329) <sup>b</sup>	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Severe fatigue								
No	16.3	(14.1-18.6)	14.1	(12.0-16.1)	10.8	(9.0-12.5)	8.0	(6.3-9.6)
Yes	55.9	(51.1-60.7)	54.9	(50.1-59.7)	51.1	(46.3-55.9)	43.5	(38.8-48.2)
Psychological factors								
Anxiety								
No	18.4	(16.1-20.8)	16.1	(14.0-18.3)	15.4	(13.4-17.5)	10.1	(8.4-11.9)
Yes	46.6	(42.0-51.3)	45.4	(41.0-49.8)	35.8	(31.4-40.2)	34.5	(30.2-38.9)
Depression								
No	21.2	(18.9-23.5)	18.8	(16.7-20.9)	16.7	(14.7-18.7)	11.8	(10.0-13.6)
Yes	54.3	(48.5-60.1)	54.5	(48.8-60.3)	44.9	(39.2-50.7)	44.7	(38.9-50.4)
Confidence in ability to manage arthritis symptoms (0-10 point scale)								
Very confident, 7-10	19.9	(17.3-22.5)	17.0	(14.6-19.3)	14.4	(12.3-16.6)	12.2	(10.0-14.3)
Neutral, 4-6	32.4	(28.0-36.8)	32.5	(28.1-36.9)	28.5	(24.2-32.8)	21.7	(17.9-25.5)
No/low confidence, 0-3	53.4	(45.0-61.8)	52.5	(44.1-60.9)	45.7	(37.4-54.1)	38.7	(30.6-46.8)

<sup>a</sup>Weighted prevalence % = percentage of survey respondents mathematically adjusted to match target population (US adults ages  $\geq 45$  or older with doctor-diagnosed arthritis); percentages are among those with each characteristic by row per domain and *do not* sum to 100.0. E.G., among those 45-54 years, 30.2% reported "a lot" of arthritis-attributable interference in recreation, leisure, hobbies. <sup>b</sup>Number of survey respondents who reported "a lot" of arthritis-attributable interference. <sup>c</sup>Unemployed, homemaker, student, retired.

ings reported similarly high prevalence of "a lot" of arthritis-attributable limitations in each domain, ranging from 39%-54%.

**Regression Modeling.** *Univariable prevalence ratios.* See the Appendix for a brief discussion and table of these results.

**Multivariable-Adjusted Prevalence Ratios.** Multivariable PRs are reported in Table 3. There were no significant MV associations for any level of age, race/ethnicity, or education in any domain. Prior to adjustment, associations with age were either not significant or borderline (ie, CI contained 1.0). Following adjustment, the same was true, but magnitude of associations was reduced. For race/ethnicity, adjustment did not affect the direction of associations while attenuating magnitude. Associations by level of education were basically nullified after adjustment. Sex was statistically significant for two domains; relative to men, women had a higher probability of reporting "a lot" of arthritis-attributable interference in the household chores and errands or shopping domains (PR = 1.5, 95% CI = 1.3-1.8 and 1.7, 1.4-2.1, respectively).

Multivariable associations with arthritis-attributable interference were statistically significant and greater compared with their respective referent groups in all four domains for the following characteristics: unable to work/disabled (PR range: 1.8-2.5), fair/poor self-rated health (1.7-2.7), currently seeing a doctor (1.3-1.5), severe joint pain (1.9-2.1), anxiety (1.2-1.7), and no/low

confidence (1.5-1.7). Moderate confidence in managing arthritis symptoms was associated with 30% and 40% greater likelihood of "a lot" of arthritis-attributable interference for the household chores and errands or shopping domains, respectively, compared with those who were very confident. Strengths of association and patterns varied somewhat by characteristic and domain, with no single domain or characteristic dominating the relationships. Overall, however, those identified as unable to work/disabled and those with fair/poor self-rated health had the strongest associations with "a lot" of arthritis-attributable interference in each of the four domains. These associations were strongest (PRs greater than 2) in the household chores, errands or shopping, and social activity domains and smallest for recreation/leisure/hobbies (PR = 1.8, 1.4-2.3 and 1.7, 1.3-2.2, respectively).

## DISCUSSION

Arthritis-attributable interferences in routine life activity domains were very common in middle-aged and older adults with arthritis and associated with a constellation of potentially modifiable characteristics, including severe arthritis symptoms, anxiety, depression, low confidence in ability to manage arthritis symptoms, and obesity. Respondents who were unable to work/disabled and those who reported fair/poor self-rated health consistently reported the highest likelihood of "a lot" of arthritis-at-

tributable interference across all domains of routine life activities in unadjusted and multivariable-adjusted models. Although many of these associations were not unprecedented, this study is the first and only examination of interference in routine life domains

attributed to arthritis from a population-based study designed to be nationally representative. Findings from this study identify characteristics of individuals who can be prioritized quickly and easily in clinical and other settings and may represent important

**Table 3.** Multivariable adjusted<sup>a</sup> prevalence ratios (PRs) with 95% confidence intervals (CI) for associations with “a lot”<sup>b</sup> of arthritis-attributable interference in each of four routine life activity domains among US adults ages 45 years or older with arthritis, by selected characteristics, Arthritis Conditions Health Effects Survey (ACHES) (n = 1793)

Selected characteristics	Routine life activity domains							
	Recreation, leisure, and hobbies		Household chores		Errands or shopping		Social activities	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
Demographics								
Age group (in years)								
45-54	1.0	(0.8-1.2)	0.9	(0.7-1.1)	0.9	(0.7-1.1)	0.9	(0.7-1.2)
55-64	0.8	(0.7-1.0)	0.9	(0.7-1.0)	0.9	(0.7-1.1)	1.0	(0.8-1.2)
≥65	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Sex								
Male	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Women	1.1	(0.9-1.1)	1.5	(1.3-1.8)	1.7	(1.4-2.1)	1.0	(0.8-1.2)
Race/ethnicity								
Hispanic	0.8	(0.5-1.3)	1.0	(0.6-1.4)	1.1	(0.7-1.6)	1.3	(0.8-2.0)
Non-Hispanic white	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Non-Hispanic black	1.2	(0.9-1.5)	1.2	(0.9-1.5)	1.1	(0.8-1.4)	1.0	(0.8-1.3)
Non-Hispanic other	1.4	(0.9-2.0)	1.4	(1.0-2.1)	1.3	(0.9-1.9)	1.2	(0.7-1.9)
Education								
Less than high school	1.0	(0.8-1.2)	0.8	(0.7-1.0)	1.0	(0.8-1.3)	0.9	(0.7-1.2)
High school graduate	0.9	(0.8-1.1)	0.9	(0.8-1.1)	0.9	(0.8-1.1)	0.9	(0.7-1.1)
More than high school	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Employment status								
Employed	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Unable to work/disabled	1.8	(1.4-2.3)	2.3	(1.8-3.1)	2.2	(1.6-2.9)	2.5	(1.8-3.6)
Other <sup>c</sup>	1.1	(0.9-1.3)	1.4	(1.1-1.8)	1.3	(1.0-1.7)	1.5	(1.1-2.1)
Clinical measures								
Self-Rated health								
Excellent/very good	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Good	1.0	(0.8-1.3)	1.4	(1.1-1.8)	1.6	(1.1-2.2)	1.1	(0.7-1.7)
Fair/poor	1.7	(1.3-2.2)	2.2	(1.7-2.9)	2.7	(1.9-3.8)	2.5	(1.7-3.7)
Currently seeing doctor/health care provider								
No	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Yes	1.5	(1.3-1.8)	1.4	(1.2-1.7)	1.3	(1.1-1.6)	1.5	(1.2-1.9)
Severe joint pain								
No	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Yes	1.9	(1.6-2.3)	1.8	(1.5-2.1)	2.1	(1.7-2.5)	1.9	(1.5-2.4)
Psychological factors								
Anxiety								
No	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Yes	1.5	(1.3-1.8)	1.6	(1.3-1.9)	1.2	(1.0-1.4)	1.7	(1.4-2.2)

(Continued)



**Table 3.** (Cont'd)

Selected characteristics	Routine life activity domains							
	Recreation, leisure, and hobbies		Household chores		Errands or shopping		Social activities	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
Confidence in ability to manage arthritis symptoms (0-10 point scale)								
Very confident, 7-10	1.0	ref	1.0	ref	1.0	ref	1.0	ref
Moderate, 4-6	1.1	(0.9-1.4)	1.3	(1.1-1.5)	1.4	(1.1-1.7)	1.1	(0.9-1.3)
No/Low confidence, 0-3	1.6	(1.3-2.0)	1.7	(1.4-2.1)	1.7	(1.3-2.2)	1.5	(1.1-2.0)

<sup>a</sup>Adjusted for age, sex, race/ethnicity, education, employment status, self-rated health, currently seeing a doctor, severe joint pain, anxiety, and confidence in ability to manage arthritis symptoms. <sup>b</sup>Reference group = "A little"/"none" for each life activity domain. <sup>c</sup>Unemployed, homemaker, student, retired.

target groups for gains in quality of life and reductions in population impact of arthritis-attributable interference.

The sex differences found in this study in the pattern of arthritis-attributable interference in routine life activities were as expected. Women reported greater likelihood of "a lot" of arthritis-attributable interference in multivariable-adjusted models for the household chores and errands/shopping domains compared with men. Higher interference in the household chores and errands/shopping domains may partially reflect greater time spent in these activities, on average, for women compared with men. The American Time Use Survey for the same year as ACHES indicated that more women engaged in household activities (83.6% vs 63.7%) and purchasing goods and services (50.3% vs 40.4%) than men and also that, on the days that they did these activities, women spent more time on them than men (2.7 vs 2.1 hours on average) (24).

Our finding of nonsignificant associations between race/ethnicity and arthritis-attributable interference were inconsistent with previous literature reporting that arthritis has greater impact on certain groups, including minorities (36–38); we may have been limited in identifying significant differences because of small cell counts for minorities in ACHES. We did find expected patterns of greater arthritis impact among those with low education (13,17,21,39) in unadjusted PRs, although these relationships did not persist after multivariable adjustment. Finally, although we did empirically establish that those with severe arthritis symptoms are more likely to report arthritis-attributable interference compared with those without severe symptoms, it is noteworthy and actionable that those with anxiety, depression, and low confidence also had significant arthritis-attributable interference associations compared with those without these characteristics. Interventions recommended by the CDC Arthritis Program (<http://www.cdc.gov/arthritis/interventions.htm>) and as described below provide demonstrable improvements in these physical and psychological areas.

Interventions, such as self-management education and physical activity programs are proven to improve function and quality-of-life (40,41), are arthritis-appropriate, widely available, and

underused. Two separate meta-analyses (40,42) have demonstrated small, significant, sustained benefits from evidence-based public health interventions recommended by the CDC Arthritis Program, with absolute values of effect sizes ranging from 0.2-0.5 for improvements in outcomes, including self-efficacy, energy, cognitive symptom management, exercise, and health distress (40). For self-management education programs, such as the Arthritis Self-Management Program (ASMP) and Chronic Disease Self-Management Program (CDSMP), these benefits include reductions in interference in routine life activities (social/role limitation), and many of the characteristics associated with it in this analysis (confidence in ability to manage symptoms, anxiety, depression, pain, and fatigue) (43). For community-delivered physical activity programs, benefits include increased physical function and decreased pain (42). Based on a post-hoc analysis of subgroup data from a randomized controlled trial, Reeves et al. (41) concluded that potential CDSMP participants with low self-efficacy (low confidence) and low health-related quality of life had the largest improvements in health outcomes. Increasing the availability and use of these interventions can help address the large and growing public health problem of arthritis and its quality-of-life impacts. Importantly, the benefits of these programs complement those of clinical management and represent successful community-clinical linkages to address condition management and quality of life.

There were consistent associations between arthritis-attributable interference and the four domains among those who were currently seeing a doctor or other health professional for their arthritis; these individuals had 30-50% greater likelihoods of "a lot" of interference in all domains compared with those not seeing a doctor. These findings correspond with previous studies reporting that people with arthritis tend to minimize or ignore their condition and seek medical attention only when it reaches a point of unacceptable interference (44–46). In fact, challenges in initiating early rheumatoid arthritis treatment include delayed consultation and diagnosis because many people normalize, ignore, and rationalize their symptoms, misunderstand the condition, or are ambivalent about contacting health care providers until symptoms interfere

with daily life activities (47). Simply contacting a health care provider is not enough, however.

In their manuscript, provocatively prefaced, "I'm hurting, I want to kill myself," Hewlett et al reported that rheumatoid arthritis patients and physicians define "flare" and use related terminology differently (48). Patients also reported general dissatisfaction with the commonly used global visual analogue scale and considered it inadequate to capture their experience (48). Similar misapprehensions are reported by patients with other types of arthritis, including osteoarthritis (25,49) and lupus (50). Some specific concerns were providers dismissing symptoms, minimizing symptom inference bothersome to patients (25), overly focusing on pharmaceuticals (49), perceived frustration by physicians when patient symptoms are not "textbook," lack of information (50), and confusion and negative emotional responses to unfamiliar terms (51).

Clearly, there continues to be unmet need among the public for trusted sources to communicate accurate information regarding various types and consequences of arthritis (25,47,49–52). Mass media interventions, a cornerstone of public health, are a promising approach to address some of these gaps. As reported by Stack et al, however, public communication campaigns about rheumatology symptoms are more likely to be successful when physicians are consulted regarding their design and messaging (52). Once patients and physicians are face-to-face, recommendation from a health care provider can be the most influential factor for patients to take a self-management education class (53), which presents an important opportunity for providers to address their patients' arthritis-attributable interference in routine life domains.

When indicated, additional referrals to other allied health professional services (eg, occupational or vocational rehabilitation, physical therapy, etc) would also enhance patient care. As more systems become digital and integrated, there may be a role for electronic medical health records to measure and track routine patient reports of arthritis-attributable interference in routine life domains, flag those at risk for adverse outcomes, and trigger intervention recommendations. A recent qualitative study reported patient willingness to participate in electronic data collection, track disease activity to share with providers, and share other patient-reported outcomes if these activities could also support learning about symptom management, provide opportunities for social support, and if providers would act on the data (54).

The findings in this study are subject to at least six limitations. First, doctor-diagnosed arthritis is self-reported; however, a clinic-based validation study has demonstrated that this case-finding question has high positive predictive value for arthritis diagnosis (74.9% for 45–64 years; 91.0% for 65 years or older) and is valid for public health surveillance purposes (27). Second, the overall response rate for ACHES was low, consistent with declining contact rates for national random-digit-dial surveys in general (55). To increase generalizability of results to the target population (US adults 45 years or older with arthritis), ACHES sampling weights

accounted for survey nonresponse and undercoverage and were calculated to match the weighted distributions of age, sex, race/ethnicity, and employment status of US adults 45 years or older with arthritis from the National Health Interview Survey (NHIS), which is used extensively for public health surveillance (27). Third, despite oversampling of Hispanics and non-Hispanic blacks, the small sample sizes reduced the precision of some estimates for these subgroups; small sample sizes also reduced reliability of estimates for the non-Hispanic other group. Fourth, these data are cross sectional and cannot be used to infer causation. Fifth, these four domains do not represent the entirety of life experiences or all regular activities for all people. That said, they are a good representation of areas in which most people, up to 96% of US adults (24), spend a substantial amount of time each day. Sixth, in consideration of faster-than-projected increases in AAALs in recent years (39), our estimates of the proportions of arthritis-attributable interference in routine life activities from ACHES data collected in 2005–2006 may be underestimated. To increase the value of these estimates, we have emphasized statistical associations with unadjusted and multivariable-adjusted prevalence ratios to identify the most persistent associations and most affected subgroups. The high prevalence and likelihood of "a lot" of arthritis-attributable interference from these estimates simply underscores the staggering impact of arthritis on quality-of-life and need for interventions.

Strengths of the study include the use of a relatively large sample designed to be nationally representative and the capacity to examine living well, an IOM-recommended priority, using novel quality-of-life-related questions (arthritis-attributable interference in routine life activity domains) that address items that are important to individuals but often omitted from traditional population-based surveys (6). The most recent American Time Use Survey indicates that nearly identical proportions of US adults (44–96% in 2017) are engaged in shopping, household, social, and leisure activities every day (56) compared with those spending time in those activities when ACHES was collected, which suggests the persistent importance and value of these activities to a majority of people. These domains provide a wide-ranging and relatable set of important and valued activities in which interference may serve as an early indicator of threats to quality-of-life among people with arthritis. Identifying characteristics associated with interference in routine life activity domains can help health care providers and public health practitioners identify those who are most in need of strategies for improving their quality of life. Also, the measures used here specifically ask respondents if they attribute their interference in life activity domains to arthritis, which provides valuable insight into individuals' perception of arthritis impact on their lives.

These findings have implications for three distinct groups: clinicians, public health professionals, and people with arthritis. For clinicians, severe arthritis symptoms distinguish patients with arthritis-attributable interference in routine life activities, but other characteristics (anxiety, depression, low education, and low con-

fidence) may identify additional patients who can benefit from interventions. Increased efforts to control arthritis symptoms therapeutically, in combination with referrals for self-management education and physical activity programs, can enhance patient care. For public health professionals, focusing on quality-of-life issues, such as interference in routine life activities, may identify groups more responsive to public health interventions. Furthermore, there may be great value in expanding the use of existing evidence-based interventions to benefit people with arthritis. Finally, for people with arthritis, participation in currently underused self-management education and physical activity programs may create an opportunity to live well and improve their quality of life.

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## AUTHOR CONTRIBUTIONS

All authors drafted the article or revised it critically for important intellectual content and gave final approval of the version of the article to be published.

**Study conception and design.** Theis, Brady, Helmick, Murphy, Barbour.

**Acquisition of data.** Theis, Murphy.

**Analysis and interpretation of data.** Theis, Brady, Helmick, Murphy, Barbour.

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