Social participation restriction among U.S. adults with arthritis: A population-based study using the International Classification of Functioning, Disability, and Health (ICF)

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Abstract

Objective—To examine arthritis impact among U.S. adults with self-reported, doctor-diagnosed arthritis using the International Classification of Functioning, Disability, and Health (ICF) framework (domains=Impairments, Activity Limitations, Environmental, and Personal factors; outcome=social participation restriction (SPR)) 1) overall and among those with SPR, and 2) to identify correlates of SPR.

Methods—Cross-sectional 2009 National Health Interview Survey data were analyzed to examine the distribution of ICF domain components. Unadjusted and multivariable-adjusted prevalence ratios (PR) and 95% confidence intervals (CI) were estimated to identify correlates of SPR. Analyses in SAS v9.2 survey procedures accounted for the complex sample design.

Results—SPR prevalence was 11% (5.7 million) of adults with arthritis. After initial multivariable adjustment by ICF domain, Serious Psychological Distress (Impairments) (PR=2.5, 95% CI=2.0-3.2, 5 medical office visits (Environmental) (PR=3.4, 95% CI=2.5-4.4) , and physical inactivity (Personal) (PR=4.8, 95% CI=3.6=6.4) were most strongly associated with SPR. A combined measure, Key Limitations (walking, standing, or carrying) (PR=31.2 (22.3-43.5) represented the Activity Limitations domain. After final multivariable adjustment incorporating all ICF domains simultaneously, the strongest associations with SPR were Key Limitations (PR= 24.3 (16.8-35.1), 9 hours sleep (PR=1.6, 95% CI=1.3-2.0), and income-to-poverty ratio <2.00 and severe joint pain (PR=1.4, 95% CI=1.2-1.6 for both).

Conclusion—SPR affects 1-in-9 adults with arthritis. This work is the first to use the ICF framework in a population-based sample to identify specific functional activities, pain, sleep, and other areas for priority intervention to reduce negative arthritis impacts, including SPR. Increased use of existing clinical and public health interventions is warranted.

Arthritis is common, affecting 50 million adults in the United States (1), costly, at an annual total exceeding $128 billion (USD) (2), and has been the most common cause of disability among U.S. adults for more than fifteen years (3). Despite this staggering impact, the

complex process through which arthritis leads to disability is not fully understood (4). The International Classification of Functioning, Disability, and Health (ICF) is a system developed by the World Health Organization (WHO) to "provide a unified and standard language and framework for the description of health and health-related states" (5). This approach considers the anatomical/physiological (impairment), individual (activity limitation), and societal (participation restriction) consequences of health conditions in the context of personal and environmental factors and reflects a continuum between positive (functional and structural integrity) and negative functioning (impairments, activity limitations, and participation restriction), with negative aspects indicating disability. At the societal level, *participation* is "involvement in a life situation," while *participation restriction* (PR) is "problems an individual may experience in involvement in life situations" and reflects difficulties in activities such as getting out and about, visiting friends, and leisure activities (5). WHO has proposed that the ICF be used to investigate consequences of health conditions; the comprehensive scope makes it ideal for studying arthritis (5, 6).

Although the ICF has been mapped to different clinical outcome measures for arthritis (7-9), and ICF core sets have been developed for osteoarthritis, rheumatoid arthritis, and other chronic musculoskeletal conditions (10), no population-based studies have applied an inclusive view of all ICF domains to assess PR in adults with arthritis (11). While population-based and clinical studies have often focused on disease impacts considered activity limitations or impairments in the ICF, examining PR using all of the ICF domains, including the contextual personal and environmental factors, provides an opportunity to explore a more comprehensive approach to assessing and describing one aspect of disability among adults with arthritis.

Recently there has been a growing interest in PR (12-17)—in part due to the recognition that the social consequences of musculoskeletal conditions (e.g., difficulty shopping or visiting relatives) may be of greater concern to individuals than impairments (e.g., pain) or specific activity limitations (e.g., walking more than half a mile). Participation is an important outcome for examining the effectiveness of clinical (e.g., joint replacements) and public health (e.g., psychoeducational courses) interventions even when it may not be the target; the secondary benefits of these interventions may be improvements in the ability to go on errands, look after friends and family, work, and be a part of the community. Importantly, even in the presence of ongoing signs (radiographic change), symptoms (pain), and activity limitation (walking limitation), participation can be maintained (14).

Despite increased attention to participation, to our knowledge, there are no ICF-based studies of PR among the U.S. adult population with arthritis (11). Furthermore, in most existing studies, the conceptualization of participation has been limited (e.g., measurement specification (17), hypothesis testing (16), psychosocial aspects of role value and performance (15)). The purpose of this study is to examine arthritis impact among U.S. adults with self-reported, doctor-diagnosed arthritis using the entire ICF framework 1) overall and among those with and without SPR, and 2) to identify correlates of SPR.

Materials and Methods

Study sample

The National Health Interview Survey (NHIS) is an annual health survey of people of all ages. It uses a complex sample design to select a sample representing the U.S. civilian, noninstitutionalized population (18). Data are collected through in-home interview by trained interviewers. We studied adults (18 years) who, in 2009 (the most recent year with all relevant variables), had records in the sample adult core, family, household, and person files (n=27,731); conditional and final response rates in the sample adult core were 80.1% and 65.4%, respectively (18).

Definitions

Doctor-diagnosed arthritis—The sample was limited to people with self-reported, doctor-diagnosed arthritis (hereafter "arthritis") (n=6,696), identified by "yes" to: "Have you ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus or fibromyalgia?"

<u>**Social Participation Restriction:**</u> Respondents who answered "very difficult" or "can't do at all" to either of the following were classified as having **social participation restriction (SPR)**: "By yourself, and without using any special equipment, how difficult is it for you to…" 1) "Go out to things like shopping, movies, or sporting events?" and 2) "Participate in social activities such as visiting friends, attending clubs and meetings, going to parties?"

Prior to analysis, we reviewed the NHIS documentation to identify all variables that could be coded to ICF domains. We used three criteria to select variables for analysis: 1) conceptual relevance, 2) sufficient sample size (50 cases), and/or 3) meaningful prevalence in the population (5%). Several variables (e.g., housing density, excess alcohol consumption, US Census region) were initially considered but failed to meet these criteria. All variables analyzed are presented in Figure 1. Detailed ICF codes for each measure are provided in Appendix A, with the exception of variables representing personal factors (e.g., age, race/ethnicity) because, per WHO, personal factors are not assigned codes (5).

<u>**Impairments:**</u> Respondents rated their joint pain in the past 30 days on a scale of 0 (none) to 10 ("as bad as it can be"); ratings 7 were classified as **severe joint pain** (19, 20). **Body Mass Index (BMI)** (weight in kg/height in m²) was calculated from self-reported weight and height. Respondents were asked whether they had ever been diagnosed with a series of chronic conditions. We examined: hypertension, heart disease (coronary heart disease, angina, myocardial infarction, other heart disease), stroke, emphysema, asthma, cancer, diabetes, chronic bronchitis, weak/failing kidneys, and liver disease. Responses (yes = 1, no = 0) were summed (range 0-10) and categorized to represent the **number of selected comorbid conditions** (0; 1-2; 3). **Serious psychological distress** was measured with the Kessler 6 (K6), a scale developed to identify and monitor population-level prevalence and trends of non-specific serious psychological distress (21). The K6, consisting of 6 questions rated on a 0 (none of the time) to 4 (all of the time) scale asks how often in the past 30 days the respondent felt each of: sad; worthless; nervous; restless; hopeless; that everything was

an effort. Values were summed for a total score (0-24); scores 13 identified respondents with serious psychological distress (21). In an article examining the relationship of sleep to several health outcomes, Knutson commented on the u-shaped curve observed in self-reported and clinically measured sleep and noted that, across studies, "short sleep" is generally <6 hours per night while "long sleep" is generally >8 hours (22). Therefore, we categorized average number of **sleep** hours in a 24-hour period in this study: 1-5; 6-8; 9 hours.

Activity Limitation: Respondents reported their ability, using a 5 point scale (not at all difficult; only a little difficult; somewhat difficult; very difficult; can't do at all; do not do this activity) to do the following nine specific activities critical to independent functioning: "By yourself, and without using any special equipment, how difficult is it for you to…. 1) Lift or **carry** something as heavy as 10 pounds such as a full bag of groceries, 2) Walk (**climb**) up 10 steps without resting, 3) Use your fingers to **grasp** or handle small objects, 4) **Push** or pull large objects like a living room chair, 5) **Reach** up over your head, 6) **Sit** for about 2 hours, 7) **Stand** or be on your feet for about 2 hours, 8) **Stoop**, bend or kneel, 9) **Walk** ¼ mile or 3 city blocks. Each limitation was coded as a 2-level variable with those indicating "very difficult" or "can't do at all" classified as "yes" and all others as not limited. Very few respondents (range n=14 (0.2%) (grasp) to n=432 (6.5%) (push)) reported "do not do this activity;" because it is not possible to determine whether these individuals choose not to perform these activities or are unable to do them, the most conservative approach was including them in the "not limited" group. For programmatic and surveillance purposes, two summary limitation variables were created reflecting 1 limitation (versus none) and 3 limitations (versus 0-2).

Anticipating high multicollinearity among the above activity limitations, we created a combination variable for the regression analyses. The two authors with clinical backgrounds (RW [physiotherapy]; JMH [sports medicine/athletic training]) nominated each of lower extremity, upper extremity, mobility, and endurance as the most important capacities to include in a combined variable. These capacities were represented by three variables: walk (lower limb mobility); carry (upper limb mobility and strength) and stand (overall endurance). The presence of **key limitations** was defined as a response of "very difficult" or "can't do at all" for any of the three.

Contextual Factors per ICF: The ICF distinguishes contextual factors as environmental (i.e., external) or personal (i.e., internal) factors.[1] Environmental categories include one's immediate inter-personal and physical environment, use of services, and support and relationships. Personal factors include individual characteristics (e.g., age, gender, education, social background, past experience, coping style) (5).

Environmental Factors

Respondents were queried regarding **homeownership**, **household size** (number of people in household), and **marital status**. Participants were also asked a series of questions about

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[1]Not all categories of contextual factors (e.g., attitudes) were available in the NHIS.

their **number of medical office visits** in the past year, if they had **health insurance**, or had **delayed health care due to cost** in the past year. Receipt of **government assistance** was assessed by a "yes" response to receiving ≥1 type of government assistance in the previous calendar year (i.e., welfare; food stamps; other assistance). NHIS provides a calculated variable of family income divided by the relevant poverty threshold (poverty thresholds account for family size and are therefore more informative than income alone) (18, 23). Depth of poverty can be assessed by the income-to-poverty ratio. Although the U.S. Census Bureau does not use this term, ratios of >1.00 – 1.99 are often cited as "near poverty" (23). For this study, the **income-to-poverty ratio** was categorized as: <2.00; ≥2.00. Finally, the **most educated household adult** was classified as: less than high school; GED/high school graduate; some college, no college degree; college degree or more.

Personal Factors

Personal factors identified from the NHIS were 1) sociodemographic characteristics (**age**, **sex**, **race/ethnicity**, respondent's **education** (defined as above), **employment**), 2) health behaviors ((**aerobic-physical activity level** per 2008 criteria (meets physical activity guidelines recommendations; insufficient; inactive) (24), **current smoker**, **retrieve health information from the internet**)), and 3) whether the respondent had ever spent ≥ **24 hours homeless or in jail**. The last three variables were coded as 1= yes; all others = no.

Missing values for the non-dichotomous variables ranged from n=1 (employment) to n=250 (BMI), (0.0% to 3.7% of the sample, respectively), with the exception of the income-to-poverty ratio which had n=712 missing, (10.6% of the sample).

Data Analysis

To address our first aim of describing the profile of people with arthritis using the ICF framework, we calculated distributions of all study variables across U.S. adults with arthritis overall and among those with arthritis with and without SPR. Analyses were conducted using SAS v9.2 survey procedures (25); sampling weights were applied to derive nationally representative estimates and the standard error calculations accounted for the complex sample design. All reported estimates have a relative standard error <20%.

To address our second aim of examining associations with SPR and identifying correlates, regression modeling proceeded in four steps.

First, independent associations between each variable and SPR were estimated with unadjusted prevalence ratios and 95% confidence intervals (CI).

Second, we used the following criteria to identify eligible variables for the multivariable-adjusted models by examining: 1) potential modifiability (possibly amenable to intervention); 2) known relationship with SPR from other studies; 3) statistical significance in the univariable regression stage; and 4) a moderate to strong association (defined as a Spearman's rank correlation coefficient of ≥0.4). For example, if the Spearman's correlation coefficient between two variables was ≥0.4, the variable that was not modifiable or had no known relationship to SPR was excluded. Statistical significance in univariable regression

was defined as having CIs which did not include 1.0; statistically significant differences in PRs was defined as non-overlapping 95% CIs. This is a more conservative approach than significance testing and more appropriate for our study given the large sample size, number of variables, and multiple comparisons (26).

Third, once the candidate variables for each ICF domain were identified, the entire group of variables in each domain was analyzed simultaneously. We ran a series of multivariable models for each domain and tested for potential collinearity using the Condition Index (SAS *proc reg*). For each model, we identified the variable with the largest individual condition index ≥30.0 (27). Then, the model was re-run excluding this variable with the final model including variables with a condition index of <30 only.

Fourth, once the multivariable model for each ICF domain was finalized, a multivariable "meta" model incorporating all ICF domains was created using the same process described in step three. This multivariable meta-model was created to identify the strongest statistically significant independent associations with SPR when variables across all ICF domains were examined simultaneously.

Results

Study Population (Table 1)

Detailed characteristics of the population (U.S. adults ≥18 years with arthritis) are presented in Table 1 and Appendix B.

The prevalence of SPR was 11% (5.7 million) of adults with arthritis. Compared with those without SPR, adults with SPR reported greater than five times the prevalence of serious psychological distress (22.6% vs. 4.1%) and three to ten times the prevalence of activity limitations. Nearly all (96.9%) respondents with SPR reported ≥1 limitation, and 85.5% reported ≥3 limitations, compared with 35.8% and 15.7%, respectively, for those without SPR. Those with SPR also reported double the prevalence of an income-to-poverty ratio <2.00 (56.3% vs. 27.5%). Most respondents with SPR were non-Hispanic whites (70.5%) and women (68.2%); 46.1% were ≥65 years. Respondents with SPR tended to have low education (34.2% less than a high school; 31.3% GED or high school graduate). Employment was the same across groups.

Prevalence ratios, unadjusted (Table 2)

A detailed discussion of the unadjusted associations is presented in Appendix B.

Correlates of SPR, Domain-Specific Multivariable Models (Table 2)

Impairments—After multivariable adjustment, serious psychological distress continued to be the impairment most strongly associated with SPR (PR=2.5). There was ≥50% increased probability of SPR among those with severe joint pain, ≥3 selected comorbid conditions, and ≥9 hours of sleep.

Limitations—Those with key limitations were 31 times more likely to report SPR compared with those without key limitations (PR = 31.2, CI=22.3-43.5).

Environmental Factors—The highest frequency of office visits in the past year (5) and <2.00 income-to-poverty ratio were the strongest correlates of SPR in the multivariate environmental model; each was associated with a more than double increase in the likelihood of SPR (PR = 3.4 and 2.5, respectively).

Personal Factors—There were small increases in the likelihood of SPR for women and smokers (PR=1.3 for both). Non-Hispanic Others and those with less than a high school education had at least a 70% greater likelihood of SPR. The strongest associations with SPR were for low physical activity (insufficient and inactive, PR=2.0 and 4.8, respectively).

Multivariable correlates of SPR, Meta-Model(Table 2)

No personal domain variables remained significant in the meta-model. Also, the strength of association between SPR and key limitations was attenuated in the meta-model, dropping to PR=24.3 (16.8-35.1). Nevertheless, key limitations remained the single strongest correlate of SPR after adjustment, with the remaining significant PRs demonstrating associations between 30 and 40% higher likelihood of SPR.

Discussion

By identifying the characteristics of adults with arthritis who are most likely to have SPR, researchers can further refine the development and targeting of interventions that enhance quality-of-life and decrease disability and healthcare costs. Our results provide the first population-based examination of arthritis disability in U.S. adults using all ICF domains. Our approach extends the literature by presenting both ICF domain-specific multivariate models and a meta-model to demonstrate associations with SPR. The domain-specific models present numerous potentially modifiable characteristics, while the meta-model results can be viewed as identifying priority areas with the strongest and possibly most important relationships requiring immediate resolution.

Findings from the domain-specific impairment multivariate model were consistent with existing literature. For example, using the same measure of serious psychological distress as in our study, Okoro et al. found that adults with disability and serious psychological distress were worse off than those with just self-reported disability (28). In our study, domain-specific multivariate association of serious psychological distress with SPR was quite strong (PR=2.5), and, coupled with existing evidence (28-31), suggests that people with arthritis could benefit from more aggressive and targeted control of mental health symptoms. Although the negative impacts of mental health effects and physical disability appear to be cyclical (32), it is reasonable to attempt to "break the cycle" through existing, effective but underused interventions—such as pharmacological- and cognitive behavioral therapy, self-management education, and aerobic exercise—for the depression and anxiety components of serious psychological distress among those with arthritis (30).

Among the variables that remained statistically significant in the meta-model, key limitations was by far the most strongly associated with SPR (PR= 24.3). This finding reiterates the importance of targeting the component activities (walking ¼ mile, standing for about 2 hours, carrying something weighing about 10 pounds) for improved performance

among people with arthritis. Both aerobic and muscle strengthening exercise programs have been shown to improve pain, functional performance measures (6 minute walk, timed up-and-go, chair stands, etc.), self-reported physical function (e.g., Health Assessment Questionnaire score), cardiorespiratory fitness (endurance), strength, and balance in randomized controlled and comparative effectiveness trials among adults with arthritis (33-36). Improvements in impairments and limitations via exercise may delay or reduce risk of disability. For example, the Fitness Arthritis and Seniors Trial reported an approximately 43% reduced risk of incident activity of daily living disability 18 months after a structured aerobic and muscle strengthening intervention among older adults with osteoarthritis (37).

The persistent association of severe joint pain with SPR after all adjustments in the meta-model (PR=1.4) was expected and is consistent with existing literature regarding joint pain in people with arthritis. For example, Wilkie et al. found that the highest level of knee pain severity was strongly associated with restricted mobility outside of the home (adjusted OR=2.4) (13). Hawker et al. determined that unpredictable, intense, emotionally draining pain "resulted in significant avoidance of social and recreational activities" (38). Osteoarthritis pain impact on sleep onset and continuation was also associated with greater disability, fatigue, and mood disturbances (38). These findings call into question whether the participants in our study reporting   9 hours of sleep per 24 hours are actually sleeping that entire time and what the quality of their sleep is; a low quality of sleep may explain the association between high number of sleeping hours and SPR. Unfortunately, quality of sleep was not assessed in the NHIS.

Arthritis pain, while complex, is treatable. Over-the-counter medications (acetaminophen and non-steroidal anti-inflammatory medications), topical preparations (Capsaicin), thermal modalities (heat and cold packs), aerobic, aquatic, and muscle strengthening exercise, weight loss, assistive devices (e.g., cane or crutch), orthotics/braces, and self-management education have all been shown to reduce osteoarthritis pain (39, 40). In cases where pain is not controlled with these first line treatments, intra-articular corticosteroid injections, hyaluronate injections, duloxetine, and opioids can be used (39, 40). In review of this evidence, it seems clear that uncontrolled pain among people with arthritis is substantially damaging to their function and quality-of-life and that better control of joint pain could have positive cascading effects on sleep, mental health, and disability.

The literature has demonstrated that poor socioeconomic status is associated with poor health outcomes in general (41, 42) and for specific condition groups, including arthritis (43, 44). Our study shows univariate (PR=2.9), domain-specific multivariate (PR=2.5), and meta-model (PR=1.4) associations between <2.00 income-to-poverty ratio and SPR. In addition to income-to-poverty ratio, two other measures, delayed healthcare due to cost (PR=1.5) and received government assistance (PR=3.0), had strong univariate associations with SPR, suggesting that financial resources may have a key role in the process of arthritis disability. These findings may have important policy implications both from the perspectives of reducing and addressing disability among adults with arthritis (45).

This study has at least four limitations. First, doctor-diagnosed arthritis was self-reported and may be subject to recall bias. This case-finding question, however, is considered valid

for public health surveillance (46, 47). Second, cross-sectional study data cannot be used to infer causation. Third, there were conceptual limitations in variables available to measure some elements; e.g., marital status and household size were also proxies for the broader concept of a social network. Similarly, as described in the introduction, social participation can be conceptualized in many ways, so our measure of SPR assesses only those aspects captured in the NHIS questions, which represent the "capacity" aspect of participation. The ICF defines "capacity" as what an individual can do in a standard environment without barriers or facilitators to participation and "performance" as what an individual can do in their usual environment including barriers (e.g., no sidewalks) and facilitators (e.g., walking aids). If the NHIS measured the performance of social participation, the proportion with SPR may have been lower (48). Fourth, the NHIS does not measure all ICF elements, so some important concepts were not included. In particular, there were no available variables on specific environmental characteristic (e.g., built environment features such as sidewalks, curbs, transportation access) whose modification, especially in conjunction with assistive mobility technologies, could be expected to influence SPR (49).

This study has several strengths. First, the NHIS is a unique and rich data source for examining ICF-based correlates of disability, represented by SPR, including personal and environmental factors frequently absent from clinical studies. Next, the study had a sufficiently large sample to estimate precise moderate associations in the meta-model. Third, this is also the first nationally representative application of the ICF among adults with arthritis, and the findings are generalizable to U.S. adults with arthritis. This study has addressed a gap by providing an inclusive, descriptive application of the ICF to arthritis in the U.S. Fourth, our findings can be used to develop applied research questions to explore arthritis impacts and relationships to improve our understanding of and ability to modify adverse arthritis outcomes, including SPR.

Social participation represents an important life domain for many people. Social activity has longitudinal associations of decreased risk of incident disability among community-dwelling older adults (50), and a growing number of studies demonstrate the potentially protective effects of "having and retaining favorite pastimes" (32). Our study findings empirically demonstrate some of the complex relationships across ICF domains and provide priority areas for clinical and public health interventions to decrease pain, address mental health impacts, control arthritis symptoms, and create environments in which people with limitations or impairments are still able to participate.

Appendix B

Population Characteristics (Table 1)

The majority of adults with arthritis were non-Hispanic white (77.8%), and women (60.1%); a plurality were 45 to 64 years of age (45.8%). Respondents tended to be fairly well educated, with 31.1% having at least a college degree. Nearly a third of respondents (30.6%) reported an income-to-poverty ratio <2.00. Most respondents were either overweight (34.4%) or obese (38.3%). Nearly one in six respondents reported serious psychological distress. Prevalence of the nine specific activity limitations ranged from 5.5% (grasp) to

27.2% (stoop, bend, or kneel), and >12% of adults with arthritis had six limitations. More than four in ten (42.5%) reported 1 limitation, and almost a quarter (23.4%) reported 3 limitations.

Prevalence ratios, unadjusted (Table 2)

Impairments

There was a strong association between SPR and reporting serious psychological distress (PR=4.5), having 3 comorbid conditions (PR= 4.2), and severe joint pain (PR= 3.4). People who reported 1-5 or 9 hours of sleep were moderately more likely to have SPR (PR = 2.3 and 2.6, respectively).

Activity Limitations

All limitations were significantly and strongly associated with SPR. PRs ranged from 5.2 (grasp) to 14.0 (stand), and five limitations (climb, push, carry, walk, stand) had a PR 10.0. Respondents with key limitations had the strongest association with PR = 31.2 (95% CI= 22.3-43.5).

Environmental Factors

Eight of the nine examined environmental factors had significant univariate associations with SPR. Living in a multiple person household (PR = 0.7) and a college-educated most educated adult in the household (PR =0.6) were protective for SPR. All remaining variables had at least one category that was associated with 50% greater likelihood of SPR. The strongest univarate associations were for an income-to-poverty ratio <2.00 (PR =2.9), receiving government assistance in the past year (PR =3.0), and 5 office visits in the past year (PR =3.3). Having health insurance did not have a significant relationship with SPR (PR= 1.0; 95% CI = 0.7-1.3).

Personal Factors

With the exception of employment, all examined personal factors were significantly associated with SPR. A college degree (PR= 0.6) and retrieving health information from the internet (PR=0.4) were protective. Less than a high school education (PR= 2.1) and insufficient physical activity (PR=2.3) or being inactive (PR=6.1) were most strongly associated with SPR.

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Significance and Innovations

2-4 bullet points highlighting the significance and/or innovative findings from your article

- This is the first nationally representative application of the ICF among U.S. adults with arthritis.

- 5.7 million U.S. adults with arthritis report social participation restriction

- We observed a novel association between social participation restriction and sleep among adults with arthritis.

- An income-to-poverty ratio of <2.00 and other measures of assets and public assistance suggest financial resources may have a key role in the process of arthritis disability.
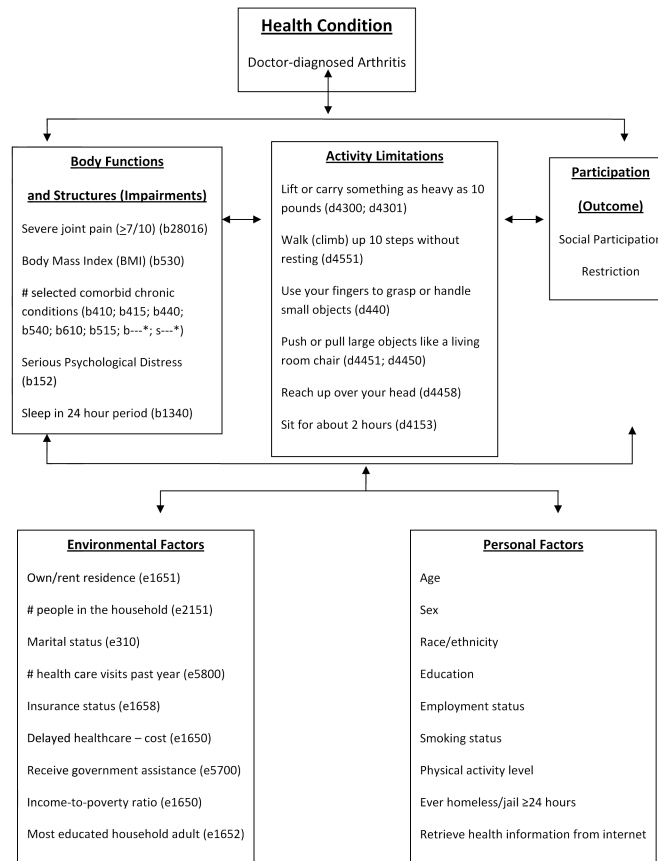
Figure 1.
International Classification of Functioning, Disability, and Health (ICF) domains with codes and National Health Interview Survey (NHIS) variables used in analysis, adapted from the WHO ICF figure (5).

Table 1

Distribution of International Classification of Functioning, Disability, and Health (ICF) characteristics, by domain, among U.S. adults 18 years with self-reported doctor-diagnosed arthritis overall and with and without social participation restriction (SPR) (weighted number, percent and 95% confidence intervals (CI)), National Health Interview Survey, 2009.

	All adults with arthritis N= 52,106,717		Adults with arthritis but not SPR N=46,382,370		Adults with arthritis and SPR N=5,724,347	
	N in 1,000s	% (95% CI)	N in 1,000s	% (95% CI)	N in 1,000s	% (95% CI)
Social participation restriction	5,724	11.0 (10.0-12.0)	0	0.0	5,724	100.0
Impairments						
Severe joint pain (7/10)	14,116	27.1 (25.6-28.6)	10,940	23.6 (22.1-25.1)	3,176	55.5 (51.9-59.1)
Body Mass Index (BMI)						
Under or normal weight (<25.0)	13,715	27.4 (26.0-28.7)	12,128	27.1 (25.7-28.5)	1,588	29.4 (25.9-33.0)
Overweight (25.0-29.9)	17,247	34.4 (33.0-35.8)	15,696	35.1 (33.5-36.6)	1,551	28.8 (25.4-32.1)
Obese (30.0)	19,183	38.3 (36.8-39.8)	16,928	37.8 (36.2-39.4)	2,255	41.8 (38.1-45.6)
Number of selected comorbid conditions						
0	12,412	23.8 (22.5-25.1)	11,820	25.5 (24.1-26.9)	592	10.3 (8.5-12.1)
1-2	27,569	52.9 (51.4-54.4)	24,891	53.7 (52.9-55.3)	2,678	46.8 (43.1-50.5)
3-10	12,126	23.3 (21.9-24.6)	9,671	20.9 (19.4-22.3)	2,454	42.9 (39.0-46.8)
Serious Psychological Distress	8,501	16.3 (15.1-17.5)	1,900	4.1 (3.4-4.8)	1,292	22.6 (19.2-25.9)
Sleep in 24 hour period (hours)						
1-5	6,518	12.7 (11.7-13.7)	5,343	11.6 (10.6-12.7)	1,174	21.5 (18.2-24.7)
6-8	38,787	75.4 (74.1-76.7)	35,752	77.8 (76.4-79.2)	3,035	55.4 (51.5-59.4)
9	6,139	11.9 (10.9-13.0)	4,874	10.6 (9.5-11.7)	1,265	23.1 (20.2-26.0)
Activity Limitations (defined as "very difficult" or "cannot do")						
Carry/lift something as heavy as 10 pounds	6,465	12.4 (11.5-13.4)	2,999	6.5 (5.7-7.2)	3,466	60.6 (57.0-64.1)
Climb up 10 steps without resting	7,985	15.3 (14.3-16.3)	4,298	9.3 (8.4-10.2)	3,687	64.4 (61.1-67.7)
Grasp/handle small objects with your fingers	2,848	5.5 (4.8-6.1)	1,530	3.3 (2.8-3.8)	1,317	23.0 (19.6-26.4)
Push/pull large objects (living room chair)	9,489	18.2 (17.0-19.5)	5,519	11.9 (10.8-13.0)	3,970	69.4 (66.0-72.7)
Reach up over your head	3,667	7.0 (6.3-7.8)	1,928	4.2 (3.5-4.8)	1,739	30.4 (27.0-33.8)
Sit for about 2 hours	5,115	9.8 (8.9-10.8)	3,228	7.0 (6.1-7.8)	1,887	33.0 (29.6-36.3)
Stand or be on your feet for about 2 hours	14,226	27.3 (25.8-28.8)	9,416	20.3 (18.8-21.8)	4,809	84.0 (81.5-86.5)
Stoop, bend, or kneel	14,150	27.2 (25.7-28.6)	9,755	21.0 (19.7-22.4)	4,395	76.8 (73.6-79.9)
Walk ¼ mile or 3 city blocks	10,933	21.0 (19.7-22.3)	6,441	13.9 (12.7-15.1)	4,492	78.5 (75.5-81.5)

	All adults with arthritis N= 52,106,717		Adults with arthritis but not SPR N=46,382,370		Adults with arthritis and SPR N=5,724,347	
	N in 1,000s	% (95% CI)	N in 1,000s	% (95% CI)	N in 1,000s	% (95% CI)
Summary limitation variables						
1 limitation	22,160	42.5 (40.9-44.1)	16,614	35.8 (34.2-37.5)	5,546	96.9 (95.4-98.3)
3 limitations	12,190	23.4 (22.0-24.8)	7,297	15.7 (14.5-17.0)	4,893	85.5 (82.8-88.2)
Key limitations (walk/stand/carry)	17,020	32.7 (31.1-34.2)	11,650	25.1 (23.6-26.7)	5,369	93.8 (92.1-95.5)
Environmental Factors						
Homeownership						
Own/being bought	39,587	76.0 (74.6-77.5)	35,934	77.5 (76.0-79.0)	3,653	63.9 (60.8-67.1)
Rent/other	12,485	24.0 (22.5-25.4)	10,422	22.5 (21.0-24.0)	2,063	36.1 (32.9-39.2)
Household size (# of people in household)						
Single	12,308	23.6 (22.5-24.8)	10,541	22.7 (21.5-23.9)	1,767	30.9 (28.0-33.7)
2	22,732	43.6 (42.1-45.2)	20,563	44.3 (42.7-46.0)	2,169	37.9 (34.5-41.3)
3	17,066	32.7 (31.1-34.4)	15,278	32.9 (31.2-34.7)	1,788	31.2 (27.6-34.9)
Marital status						
Married/living with partner	32,837	63.1 (61.6-64.6)	30,117	65.0 (63.5-66.5)	2,720	47.5 (43.6-51.4)
Divorced/separated/widowed	14,878	28.6 (27.2-29.9)	12,429	26.8 (25.5-28.2)	2,449	42.8 (39.3-46.3)
Never married	4,336	8.3 (7.5-9.1)	3,781	8.2 (7.3-9.0)	555	9.7 (7.8-11.6)
Medical office visits in the past year						
0-1 visits	7,459	14.5 (13.4-15.6)	7,055	15.4 (14.2-16.6)	404	7.2 (5.6-8.9)
2-4 visits	26,684	51.9 (50.4-53.5)	24,592	53.7 (52.0-55.4)	2,092	37.5 (34.6-40.5)
5 visits	17,252	33.6 (32.0-35.1)	14,175	30.9 (29.3-32.6)	3,077	55.2 (51.9-58.6)
Health insurance (no)	4,498	8.6 (7.7-9.6)	4,007	8.7 (7.7-9.7)	490	8.6 (6.7-10.5)
Delayed healthcare due to cost in past year (yes)	8,074	15.5 (14.5-16.5)	6,815	14.7 (13.6-15.8)	1,259	22.0 (19.0-25.0)
Received government assistance last calendar year (yes)	4,531	8.7 (7.9-9.5)	3,268	7.0 (6.2-7.9)	1,263	22.1 (19.0-25.2)
Income-to-poverty ratio						
< 2.00 (Below or near poverty)	14,358	30.6 (29.1-32.2)	11,476	27.5 (25.9-29.1)	2,882	56.3 (52.9-59.7)
2.00	32,504	69.3 (67.8-70.9)	30,266	72.5 (70.9-74.1)	2,238	43.7 (40.3-47.1)
Most educated household adult						
Less than high school	5,189	10.0 (9.1-10.8)	4,030	8.7 (7.9-9.5)	1,159	20.3 (17.4-23.2)
GED or high school graduate	13,302	25.6 (24.2-27.0)	11,574	25.0 (23.6-26.4)	1,728	30.3 (27.2-33.4)
Some college, no degree	10,893	20.9 (19.6-22.3)	9,708	21.0 (19.6-22.4)	1,186	20.8 (17.9-23.7)
College degree or more	22,637	43.5 (41.9-45.1)	20,999	45.3 (43.7-47.0)	1,637	28.7 (25.6-31.8)
Personal factors						
Age (years)						
18-44	8,963	17.2 (15.9-18.5)	8,164	17.6 (16.2-19.0)	799	14.0 (11.4-16.6)

	All adults with arthritis N= 52,106,717		Adults with arthritis but not SPR N=46,382,370		Adults with arthritis and SPR N=5,724,347	
	N in 1,000s	% (95% CI)	N in 1,000s	% (95% CI)	N in 1,000s	% (95% CI)
45-64	23,844	45.8 (44.0-47.5)	21,559	46.5 (44.6-48.4)	2,286	39.9 (36.3-43.5)
65+	19,299	37.0 (35.3-38.7)	16,660	35.9 (34.1-37.7)	2,639	46.1 (43.0-49.2)
Sex						
Male	20,775	39.9 (38.5-41.3)	18,957	40.9 (39.4-42.4)	1,818	31.8 (28.4-35.1)
Female	31,332	60.1 (58.7-61.5)	27,425	59.1 (57.6-60.6)	3,907	68.2 (64.9-71.6)
Race/ethnicity						
Non-Hispanic White	40,549	77.8 (76.4-79.2)	36,513	78.7 (77.3-80.2)	4,036	70.5 (67.5-73.5)
Non-Hispanic Black	5,728	11.0 (9.9-12.0)	4,865	10.5 (9.4-11.5)	863	15.1 (12.8-17.3)
Hispanic	3,793	7.3 (6.5-8.0)	3,306	7.1 (6.3-8.0)	487	8.5 (6.9-10.1)
Non-Hispanic Other	2,037	3.9 (3.3-4.5)	1,698	3.7 (3.0-4.3)	340	5.9 (4.1-7.7)
Education						
Less than high school	8,720	16.8 (15.7-18.0)	6,775	14.7 (13.5-15.8)	1,945	34.2 (31.2-37.3)
GED or high school graduate	16,376	31.6 (30.1-33.0)	14,594	31.6 (30.1-33.1)	1,782	31.3 (28.3-34.4)
Some college, no degree	10,530	20.3 (19.0-21.6)	9,591	20.8 (19.4-22.2)	938	16.5 (13.7-19.3)
College degree or more	16,227	31.3 (29.7-32.9)	15,206	32.9 (31.3-34.6)	1,022	18.0 (15.1-20.8)
Employment status						
Working	27,802	53.4 (51.7-55.0)	24,748	53.4 (51.6-55.2)	3,054	53.4 (49.8-56.9)
Not working	24,300	46.6 (45.0-48.3)	21,631	46.6 (44.8-48.4)	2,670	46.6 (43.1-50.2)
Current smoker (yes)	10,868	20.9 (19.5-22.2)	9,301	20.1 (18.6-21.5)	1,567	27.4 (23.6-31.2)
Aerobic Physical activity level						
Meets Recommended	18,451	36.2 (34.5-38.0)	17,855	39.4 (37.6-41.3)	596	10.6 (8.5-12.7)
Insufficient	11,261	22.1 (20.7-23.5)	10,420	23.0 (21.5-24.5)	841	15.0 (12.4-17.5)
Inactive	21,195	41.6 (39.9-43.4)	17,022	37.6 (35.8-39.4)	4,174	74.4 (71.0-77.8)
2 hours homeless or in jail (yes)	3,529	6.8 (5.9-7.6)	2,845	6.1 (5.3-7.0)	684	12.0 (9.1-14.8)
Retrieve health information from internet (yes)	24,588	47.2 (45.6-48.8)	23,153	49.9 (48.2-51.6)	1,434	25.1 (21.9-28.2)

NOTE: Numbers may not sum to 100.0 due to rounding

Table 2

Unadjusted and adjusted associations (prevalence ratios (PR) and 95% confidence intervals (CIs)) of International Classification of Functioning, Disability, and Health (ICF) characteristics, by domain, with Social Participation Restriction (SPR) among U.S. adults 18 years with self-reported doctor-diagnosed arthritis, National Health Interview Survey, 2009.

	Unadjusted associations with SPR PR (95% CI)	Multivariate ICF domain-specific models PR (95% CI)	Meta Multivariate model (includes <u>all</u> ICF domains)[*] PR (95% CI)
Impairments			
Severe joint pain (7/10) (ref = no)	3.4 (2.9-4.0)	1.7 (1.4-2.0)	1.4 (1.2-1.6)
Body Mass Index (BMI)			
Underweight/normal (<25.0)	1.0	-	-
Overweight (25.0-29.9)	0.8 (0.6-1.0)	-	-
Obese (30.0)	1.0 (0.8-1.2)	-	-
Number of selected comorbid conditions			
0	1.0	1.0	-
1 to 2	2.0 (1.6-2.7)	1.4 (1.1-1.7)	-
3	4.2 (3.2-5.6)	1.5 (1.2-1.9)	-
Serious Psychological Distress (ref = no)	4.5 (3.7-5.4)	2.5 (2.0-3.2)	-
Sleep in 24 hour period (hours)			
1-5	2.3 (1.9-2.9)	1.3 (1.0-1.6)	1.3 (1.1-1.6)
6-8	1.0	1.0	1.0
9	2.6 (2.1-3.2)	1.5 (1.3-1.9)	1.6 (1.3-2.0)
Limitations (defined as "very difficult" or "cannot do") (ref = not limited)			
Carry or lift something as heavy as 10 pounds	10.8 (9.2-12.7)	-	-
Climb up 10 step without resting	10.0 (8.5-11.8)	-	-
Grasp or handle small objects with your fingers	5.2 (4.4-6.1)	-	-
Push or pull large objects (e.g., living room chair)	10.2 (8.5-12.2)	-	-
Reach up over your head	5.8 (4.9-6.8)	-	-
Sit for about 2 hours	4.5 (3.9-5.3)	-	-
Stand for about 2 hours	14.0 (11.1-17.7)	-	-
Stoop, bend, or kneel	8.9 (7.3-10.8)	-	-
Walk 1/4 mile or 3 city blocks	13.7 (11.1-17.0)	-	-
Summary limitation variables			
1 limitation (ref = no)	41.9 (25.5-68.8)	-	-
3 limitations (ref = no)	19.3 (15.0-24.9)	-	-
Key limitation (walk/stand/carry) (ref = no)	31.2 (22.3-43.5)	31.2 (22.3-43.5)	24.3 (16.8-35.1)
Environmental Factors			
Homeownership			

	Unadjusted associations with SPR PR (95% CI)	Multivariate ICF domain-specific models PR (95% CI)	Meta Multivariate model (includes <u>all</u> ICF domains)[*] PR (95% CI)
Own/being bought	1.0	-	-
Rent/other	1.8 (1.5-2.1)	-	-
Household size (# of people in household)			
Single	1.0	-	-
2	0.7 (0.6-0.8)	-	-
3	0.7 (0.6-0.9)	-	-
Marital Status			
Married/living with partner	1.0	1.0	1.0
Divorced/separated/widowed	2.0 (1.7-2.4)	1.4 (1.2-1.7)	1.1 (0.9-1.3)
Never married	1.6 (1.2-2.0)	1.2 (0.9-1.5)	1.3 (1.0-1.6)
Medical office visits in past year			
0-1 visits	1.0	1.0	-
2-4 visits	1.5 (1.1-2.0)	1.6 (1.2-2.2)	-
5 visits	3.3 (2.4-4.5)	3.4 (2.5-4.4)	-
Health insurance status			
Have health insurance	1.0 (0.7-1.3)	-	-
No health insurance	1.0	-	-
Delayed healthcare due to cost (ref = no)	1.5 (1.3-1.9)	-	-
Received government assistance last calendar year (ref = no)	3.0 (2.5-3.6)	-	-
Income-to-poverty ratio (10.6% missing)			
(Below or near poverty) < 2.00	2.9 (2.5-3.4)	2.5 (2.1-3.0)	1.4 (1.2-1.6)
2.00	1.0	1.0	1.0
Most educated household adult			
Less than high school	1.7 (1.4-2.1)	-	-
GED or high school graduate	1.0	-	-
Some college, no degree	0.8 (0.7-1.0)	-	-
College degree or more	0.6 (0.5-0.7)	-	-
Personal Factors			
Age (years)			
18-44	1.0	1.0)	-
45-64	1.1 (0.8-1.4)	1.0 (0.8-1.3)	-
65+	1.5 (1.2-2.0)	1.2 (1.0-1.6)	-
Sex			
Male	1.0	1.0	1.0
Female	1.4 (1.2-1.7)	1.3 (1.1-1.6)	1.1 (1.0-1.3)
Race/Ethnicity			

	Unadjusted associations with SPR PR (95% CI)	Multivariate ICF domain-specific models PR (95% CI)	Meta Multivariate model (includes <u>all</u> ICF domains)[*] PR (95% CI)
Non-Hispanic White	1.0	1.0	1.0
Non-Hispanic Black	1.5 (1.2-1.8)	1.2 (1.0-1.5)	0.9 (0.7-1.1)
Hispanic	1.3 (1.0-1.7)	1.0 (0.7-1.3)	1.1 (0.9-1.4)
Non-Hispanic Other	1.7 (1.2-2.4)	1.7 (1.2-2.4)	1.4 (1.0-1.9)
Education			
Less than high school	2.1 (1.7-2.5)	1.8 (1.5-2.1)	-
GED or high school graduate	1.0	1.0	-
Some college, no degree	0.8 (0.6-1.1)	1.0 (0.8-1.3)	-
College degree or more	0.6 (0.5-0.8)	0.9 (0.7-1.1)	-
Employment status			
Working	1.0	-	-
Not working	1.0 (0.9-1.2)	-	-
Current smoker (ref = no)	1.4 (1.2-1.7)	1.3 (1.1-1.6)	1.2 (1.0-1.4)
Physical activity level-aerobic			
Recommended	1.0	1.0	-
Insufficient	2.3 (1.6-3.3)	2.0 (1.5-2.9)	-
Inactive	6.1 (4.6-8.1)	4.8 (3.6-6.4)	-
24 hours homeless or in jail (ref = no)	1.9 (1.5-2.4)	-	-
Retrieve health information from the internet (ref = no)	0.4 (0.3-0.5)	-	-

[*] NOTE: The Multivariate ICF domain-specific models column presents associations for each domain examined independently. The Meta Multivariate model column presents associations for all ICF domains examined simultaneously in the same model.

Appendix A

National Health Interview Survey (NHIS) measures used in analysis with detailed International Classification of Functioning, Disability, and Health (ICF) codes and definitions, NHIS 2009

NHIS measure used in analysis	ICF Chapter Heading (sub-chapter)	First branching level	ICF code	Remaining branching levels→ ICF definition
Social participation restriction	Activities and Participation (9)	Community, social, and civic life	d910; d920	Community, social, and civic life→ Community Life; Recreation and Leisure
Impairments				
Severe joint pain (7/10)	Body Functions (2)	Sensory functions and pain	b28016	Pain→ Sensation of pain→ Pain in joints
Body Mass Index (BMI)	Body Functions (5)	Functions of the digestive, metabolic and endocrine systems	b530	Functions related to the digestive system→ Weight maintenance functions
Number of selected comorbid conditions (max 10)				
Hypertension	Body Functions (4)	Functions of the cardiovascular, haematological, immuniological, and respiratory systems	b 415	Functions of the cardiovascular system→ Blood vessel functions
Heart disease (coronary heart disease, angina, myocardial infarction, other heart disease)	Body Functions (4)	Functions of the cardiovascular, haematological, immuniological, and respiratory systems	b 410	Functions of the cardiovascular system→ Heart functions
Stroke	Body Functions (4)	Functions of the cardiovascular, haematological, immuniological, and respiratory systems	b 415	Functions of the cardiovascular system→ Blood vessel functions
Emphysema	Body Functions (4)	Functions of the respiratory system	b 440	Respiratory functions
Asthma	Body Functions (4)	Functions of the respiratory system	b 440	Respiratory functions
Cancer		All Body Functions and Body Structures	b---; s---	Because cancer can affect virtually any body structure and influence function and because we queried regarding any type of cancer, this item cannot be further classified
Diabetes	Body Functions (5)	Functions of the digestive, metabolic, and endocrine systems	b 540	Functions related to metabolism and the endocrine system→ General metabolic function
Chronic bronchitis	Body Functions (4)	Functions of the respiratory system	b 440	Respiratory functions
Weak/failing kidneys	Body Functions (6)	Genitourinary and reproductive functions	b 610; b6100	Urinary excretory functions→ Filtration of urine by the kidneys

NHIS measure used in analysis	ICF Chapter Heading (sub-chapter)	First branching level	ICF code	Remaining branching levels→ ICF definition
Liver disease	Body Functions (5)	Functions of the digestive, metabolic, and endocrine systems	b 515	Functions related to the digestive system→ Digestive functions
Serious Psychological Distress	Body Functions (1)	Mental functions	b 152	Specific mental functions→ Emotional functions
Sleep in 24 hour period	Body Functions (1)	Mental functions	b1340	Global mental functions→ Sleep functions→ Amount of sleep
Limitations (defined as "very difficult" or "cannot do")				
Carry/lift something as heavy as 10 pounds	Activities and Participation (4)	Mobility	d4300; d4301; d4302	Carrying, moving and handling objects→ Lifting and carrying objects→ Lifting; Carrying in the hands; Carrying in the arms
Climb up 10 steps without resting	Activities and Participation (4)	Mobility	d4551	Carrying, moving, and handling objects→ Walking and moving → Moving around→ Climbing (e.g., climbing steps or stairs)
Grasp/handle small objects with your fingers	Activities and Participation (4)	Mobility	d440; d4401; d4402	Carrying, moving, and handling objects→ Fine hand use→ Grasping; Manipulating
Push/pull large objects (living room chair)	Activities and Participation (4)	Mobility	d4451; d4450	Carrying, moving, and handling objects→ Hand and arm use→ Pushing; Pulling
Reach up over your head	Activities and Participation (4)	Mobility	d4458	Carrying, moving, and handling objects→ Hand and arm use→ Hand and arm use, other specified
Sit for about 2 hours	Activities and Participation (4)	Mobility	d4153	Changing and maintaining body position→ Maintaining a body position→ Maintaining a sitting position
Stand or be on your feet for about 2 hours	Activities and Participation (4)	Mobility	d4154	Changing and maintaining body position→ Maintaining a body position→ Maintaining a standing position
Stoop, bend, or kneel	Activities and Participation (4)	Mobility	d4106; d4105; d4102	Changing and maintaining body position→ Changing basic body position→ Shifting the body's centre of gravity; Bending; Kneeling
Walk ¼ mile or 3 city blocks	Activities and Participation (4)	Mobility	d4500	Walking and moving→ Walking→ Walking short distances
Environmental Factors				
Homeownership	Environmental (1)	Products and technology	e1651	Assets→ Tangible assets (e.g., houses and land)
Household size (# people in household)	Environmental (2)	Natural environment and human-made changes to environment	e2151	Population→ Population density
Marital status	Environmental (3)	Support and relationships	e310	Immediate family (e.g., related by marriage; spouse)

NHIS measure used in analysis	ICF Chapter Heading (sub-chapter)	First branching level	ICF code	Remaining branching levels→ ICF definition
Medical office visits in the past year	Environmental (5)	Services, systems, and policies	e5800	Health services, systems, and policies→ Health services (e.g., primary care services, acute care, rehabilitation, and long-term care services)
Health insurance	Environmental (1)	Products and technology	e1658	Assets→ Assets, other specified
Delayed healthcare due to cost (yes)	Environmental (1)	Products and technology	e1650	Assets→ Financial assets
Received government assistance last calendar year (yes)	Environmental (5)	Services, systems, and policies	e5700	Social security services, systems, and policies→ Social security services (e.g., public assistance)
Income-to-poverty ratio	Environmental (1)	Products and technology	e1650	Assets→ Financial assets
Most educated household adult	Environmental (1)	Products and technology	e1652	Assets→ Intangible assets (e.g., knowledge and skills)
Personal factors-not classified due to substantial social and cultural variance associated with them; "Contextual factors that relate to the individual such as age, gender, social status, life experiences and so on, which are not currently classified in ICF but which users may incorporate in their applications of the classification (5)."				
Age (years)				
Sex				
Race/ethnicity				
Education				
Employment status				
Current smoker				
Physical activity level-aerobic				
>2 hours homeless or in jail				
Retrieve health information from internet				