Health Status, Arthritis Risk Factors, and Medical Care Use Among Respondents with Joint Symptoms or Physician Diagnosed Arthritis: Findings from the 2001 Behavioral Risk Factor Surveillance System

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ABSTRACT. ***Objective***. The Behavioral Risk Factor Surveillance System (BRFSS) telephone interview study provides estimates indicating that approximately one-third of US adults meet the Centers for Disease Control and Prevention (CDC) case definition for arthritis. However, this population includes very diverse groups with major differences in health status, risk factors and disability.

Methods. BRFSS data for 2001 were compared for 4 roughly equal size groups of respondents reporting joint symptoms or a physician's diagnosis of arthritis: those with transient joint symptoms (TJS), chronic joint symptoms (CJS), a physician diagnosis of arthritis (PDA), and those with both PDA and CJS.

Results. By far the greatest burden of arthritis related disability is concentrated among individuals reporting both CJS and PDA. After controlling for age, sex, race, ethnicity, and education, this group had over 7 times the likelihood of fair to poor health status compared to the general adult population without arthritis. About one-third of those with undiagnosed CJS reported activity limitations, one-quarter were without health insurance at some point during the previous year, and this group had over 3 times the likelihood of reporting fair to poor health compared to the general population. Obesity was an even more prevalent arthritis risk factor than physical inactivity.

Conclusion. The results support the validity of the CDC case definition of arthritis, which excludes TJS. However, a previous PDA in the absence of current symptoms was in itself a poor predictor of activity limitations due to arthritis. Findings will be useful in evaluating subsequent revisions of the CDC arthritis case definition and monitoring the burden of arthritis. (J Rheumatol 2005;32:130–6)

Key Indexing Terms:
ARTHRITIS
EPIDEMIOLOGICAL SURVEILLANCE
JOINT SYMPTOMS
ACTIVITY LIMITATION

Arthritis affects over 70 million American adults, is the most important cause of disability for older Americans[1,2], and accounts for $120 billion in costs annually[3]. Despite its importance, arthritis public health surveillance, secondary prevention, and community health interventions are in their infancy. This is in large part because arthritis consists of such a diverse array of chronic conditions affecting the joints and surrounding tissues, which has made it difficult for population based surveys to accurately measure prevalence, severity, and associated effects on health status.

Several recent national health surveys have found that arthritis is an even greater public health concern than once thought, with nearly one in every 3 American adults reporting chronic joint symptoms or physician diagnosed arthritis[4]. In particular, the Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System (BRFSS), the world's largest telephone interview study, conducted in every US state and territory, has documented significant deficits in health related quality of life, morbidity, and physical activity[5,6] among respondents with CDC-defined arthritis or chronic joint symptoms (CJS). However, it is known that the CDC arthritis case definition, which is based on 3 questions in the 6 question arthritis module, includes a very diverse group of respondents with and without current joint symptoms. In particular, there is significant variation among adults with CDC-defined arthri-

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tis or CJS in reports of activity limitation due to joint symptoms and current arthritis treatment.

To describe the epidemiology of arthritis and its associated risk factors, we examined 2001 BRFSS data for several distinct, mutually exclusive groups of respondents with either self-reported joint symptoms or a previous physician diagnosis of arthritis (PDA). The purpose of our study was to compare health status, activity limitation, and arthritis care and treatment across these 5 groups. Public health campaigns promoting weight loss and physical activity have gained momentum in recent years and these efforts are central to arthritis prevention, and for those who already have joint symptoms, to reduce pain and improve functioning[7-9]. Because of their key role as risk factors for arthritis disease progression, physical activity and obesity rates are also compared between the study populations. Comparisons of health status, obesity, and physical activity levels are presented, controlled for differences among subgroups in age, sex, educational attainment, and race and ethnic composition. Findings provide estimates of the real range of arthritis disease burden, while highlighting differences among subgroups in sociodemographic characteristics, health status, arthritis treatment, and prevalence of risk factors.

MATERIALS AND METHODS

The BRFSS. The BRFSS is a continuing, state based, random-digit dialed telephone survey conducted by state health departments and coordinated by the CDC in conjunction with state health departments. The BRFSS collects self-reported health status, demographic, behavioral risk factor, and other information from a representative sample of the civilian, noninstitutionalized population aged ≥ 18 years in each US state and territory. The 2001 median state response rate was 51%[10]. In 2001, the BRFSS arthritis module questions were included on the core survey for the first time and thus were asked of 212,510 respondents in all 50 states, the District of Columbia, Guam, Puerto Rico, and the US Virgin Islands.

Joint symptom chronicity and prior diagnosis of arthritis. The 2001 CDC arthritis case definition was designed to reflect chronicity of joint symptoms as well as physician diagnosis. These survey questions allow for an interesting division of respondents with joint symptoms or self-reported arthritis into 4 large, roughly equal size populations. These groups can then each be compared to a fifth group of "normal" respondents, who do not have current joint symptoms and have never been told by a physician they have arthritis. These 5 groups are defined in Table 1 and consist of (1) undiagnosed individuals who report acute, short term or transient joint symptoms (TJS) not included in the CDC arthritis or CJS case definition; (2) those with chronic, but still undiagnosed joint symptoms (CJS); (3) those who report a previous diagnosis of arthritis by a physician but report that they do not have chronic joint symptoms (PDA); (4) respondents with both CJS and a PDA (PDA+CJS); and finally, (5) the large reference group of all "normal" adults who indicate they are without either joint symptoms or self-reported arthritis.

Definitions of respondent groups were based on 2001 BRFSS arthritis module items. Specifically, CJS were defined by the CDC to include respondents who answered affirmatively the 2 questions: "During the past 12 months, have you had pain, aching, stiffness or swelling in or around a joint?" and "Were these symptoms present on most days for at least one month?" Although the CDC case definition excludes those who report current, but not chronic joint symptoms, it was of interest to further define a group of those with only acute, short duration, or transient joint symptoms (TJS) as well. The CDC also included in its arthritis definition any respondent who answered affirmatively, "Have you ever been told by a doctor that you have arthritis?".

Based on these items, 5 groups were defined (Table 1) as (1) chronic (CJS) or (2) transient joint symptoms (TJS) without a previous physician diagnosis of arthritis; (3) physician diagnosed arthritis without chronic joint symptoms (PDA), including a small number of respondents (13%) with current, but not chronic joint symptoms; (4) respondents with both a physician diagnosis of arthritis and chronic joint symptoms (PDA+CJS); and (5) no joint symptoms or physician arthritis diagnosis, the "normal" or reference population.

Demographic and socioeconomic characteristics. Demographic variables in the BRFSS include age, sex, and race and ethnicity (non-Hispanic Whites, non-Hispanic Blacks, Hispanics, or other race, which includes 1.1% of respondents with missing data). Educational attainment was dichotomized to indicate high school education or less, versus more than high school. Although not included as covariates in primary analyses due to significant missing data, annual household income < US $35,000 and lack of health insurance at any time in the previous year were utilized in secondary analyses to determine the sensitivity of findings about arthritis groups.

Health status, physical activity, and obesity. The association of arthritis with key health characteristics was estimated by comparing each subgroup to "normal" respondents without current joint symptoms or a PDA. Health status measures were dichotomized to reflect the proportion reporting fair or poor general health, as well as those reporting the maximum value of "30 days" in response to 2 questions, "How many days during the past 30 days was your physical health [or mental health] 'not good'." Height and weight were classified into 3 body mass index (BMI) groups, obese (BMI ≥ 30 kg/m^2), overweight (BMI 25–25.9 kg/m^2), and normal weight (BMI < 25 kg/m^2). Finally, the BRFSS uses 6 questions to classify the frequency and duration of reported physical activity into 3 groups, inactive (< 10 minutes of daily moderate or vigorous activity), insufficient (moderate physical

Table 1. Arthritis prevalence subgroups by BRFSS survey item responses.

	During the past 12 months, have you had pain, aching, stiffness or swelling in or around a joint?	Were these symptoms present on most days for at least one month?	Have you ever been told by a doctor that you have arthritis?
Transient joint symptoms, TJS	Yes	No	No
Chronic joint symptoms, CJS	Yes	Yes	No
Physician diagnosed arthritis without chronic joint symptoms, PDA	Yes or No	No	Yes
Physician diagnosed arthritis and chronic joint symptoms, PDA + CJS	Yes	Yes	Yes
No joint symptoms or arthritis	No	No	No

activity for < 30 minutes a day, or for < 3 days a week, or < 20 minutes of vigorous activity, or for < 3 days a week) or meets recommended level (at least 30 minutes of moderate activity ≥ 5 or more days a week or at least 20 minutes of vigorous activity at least 3 days a week).

Activity limitation and medical care for respondents with CJS or PDA. A number of additional items in the BRFSS were compared, including the proportion in each subgroup who reported "being limited in any way in any activities because of joint symptoms" (asked only to those reporting symptoms); the proportion "currently being treated by a doctor" for their joint symptoms (asked only of those with PDA); the proportion reporting having "ever seen a doctor, nurse or other health professional" for their joint symptoms; and the proportion reporting that they needed special equipment "such as a cane, wheelchair, a special bed, or a special telephone" for a disability (a generic question asked of all respondents, not specifically part of the arthritis module).

Finally, an optional BRFSS module administered in 12 states was analyzed to compare joint symptom and arthritis subgroups to those without arthritis who responded affirmatively to the generic question (asked of all respondents), "Are you limited in any way in any activities because of physical, mental or emotional problems?". The proportion of those reporting activity limitation in each subgroup was then compared to determine (1) respondents whose "major impairment" was either "arthritis/rheumatism," "back or neck problem," or "fractures, bone/joint injury"; (2) the proportion of respondents reporting needing help with personal care or routine needs; and (3) the proportion reporting "30 days" to questions about whether, over the previous month, pain made it hard to perform usual activities.

Statistical analysis. All statistical procedures were conducted with population weighted data using the complex survey design software included in Stata version 7.0 to adjust confidence intervals for multistage sampling. Weighting methods account for the probability of telephone number selection, individual respondent selection within households, and post-stratification weighting. Bivariate and multiple logistic regressions were used to compare subgroups to respondents without joint symptoms or a PDA; linear regression was used for comparisons of age. Because most bivariate tests were highly significant, our data in tables indicate nonsignificant comparisons at $p < 0.001$ level. All standard errors were < 0.7, and therefore are not presented in the tables. Multiple logistic regression results present odds ratios controlled for age, sex, race or ethnicity, and educational attainment, allowing examination of the direct effects of these measures on health status and arthritis risk factors.

RESULTS

Prevalence of joint symptoms and physician diagnosed arthritis. Figure 1 presents the weighted point estimates for proportions of the US adult population reporting joint symptoms or an arthritis diagnosis. Data on key arthritis items were missing for 2.5% of respondents. Those reporting either chronic joint symptoms or PDA, the CDC case definition, accounted for an estimated 32.3% of the 215 million US adults age > 17 years. A large group (12.4% or an estimated 26.7 million adults) reported transient but not chronic joint symptoms, and thus did not meet the standard for CDC-defined arthritis or CJS. Those reporting CJS and PDA (PDA+CJS) accounted for 12.2%, or an estimated 26.2 million adults, a somewhat larger population than PDA and CJS.

Figure 2 presents population estimates by 5-year age intervals for combined CDC-defined arthritis or CJS, in comparison to all other adults without CDC-defined arthritis, including the TJS group. This figure illustrates the rapidly increasing prevalence of arthritis from ages 45 to 60 years. The number of respondents without joint symptoms declines from over 90% in the youngest ages to less than 50% after age 60.

Table 2 presents sociodemographic comparisons among the 5 defined populations. Those reporting an arthritis diagnosis (PDA and PDA+CJS) were significantly older (> 15 years) and had a correspondingly much higher (> 10%) proportion of women. Those reporting undiagnosed chronic or transient joint symptoms were only marginally older than the "normal" population without joint symptoms or a PDA. The older PDA and PDA+CJS groups had less education and lower income; however, due to the effect of Medicare universal coverage, older Americans in general report less uninsurance. Almost one-quarter of those with undiagnosed CJS reported being uninsured at some point during the previous year, including 17% reporting being uninsured at the time of the survey.

Table 3 provides striking evidence of (1) the validity of the CDC case definition with respect to the evident health status burden of arthritis across the 3 included subgroups; and (2) the much lower health status of the older respondents in the PDA+CJS group, even compared to all other respondents with CDC-defined arthritis or CJS. A large proportion of PDA+CJS respondents reported fair to poor general health (41.8%) as well as poor physical and mental health for the entire previous 30 days. PDA+CJS respondents also had by far the largest proportion of physically inactive (26.3%) and obese (33.8%) respondents. While the health status differences between the TJS group and the "normal" reference group without joint symptoms were relatively small, the CJS and PDA groups clearly report an intermediate, but significantly elevated burden of poor health status.

To illustrate the extent to which health status and risk factor differences among groups are due solely to differences in sociodemographic factors, Table 4 presents multiple logistic regression results for fair to poor general health, physical inactivity, and obesity. The adjusted odds ratios for the 4 subgroups reflect comparisons to respondents not reporting joint symptoms or a PDA. These findings confirm that the PDA+CJS group was by far the most likely to have fair to poor health (OR 7.3), or be physically inactive (OR 1.8) or obese (OR 2.9). In general, compared to the "normal" US adult population, differences in the likelihood of sedentary behavior were relatively small for the other subgroups (the TJS group was actually more likely to be active than the "normal" reference population). Obesity, however, was significantly elevated for all 4 groups, indicating the close relationship between joint symptoms and being overweight. These results were independent of the age, education, and non-White race and ethnicity gradient in all 3 measures, and were not affected by inclusion of low household income in the model.

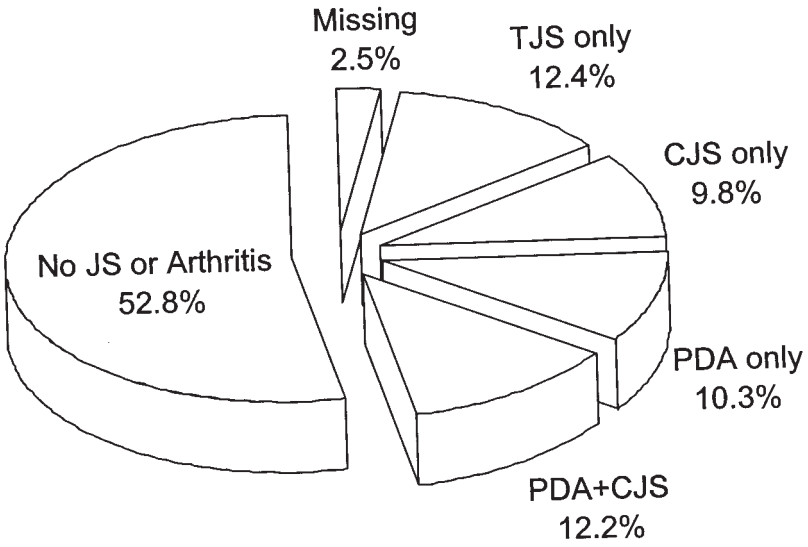

Figure 1. Prevalence of joint symptoms or a physician diagnosis of arthritis in the adult US population. Population estimates: Chronic joint symptoms only (CJS, 21.1 million adults), physician diagnosed arthritis without CJS (PDA, 22.0 million adults), CJS and PDA (PDA+CJS, 26.2 million adults), transient joint symptoms (TJS, 26.7 million adults), no arthritis or joint symptoms (No JS, estimate 113 million adults). Missing category refers to those responding "not known," "not sure," or "refused" to any of the 3 BRFSS arthritis questions used in the case definition (5.4 million adults).

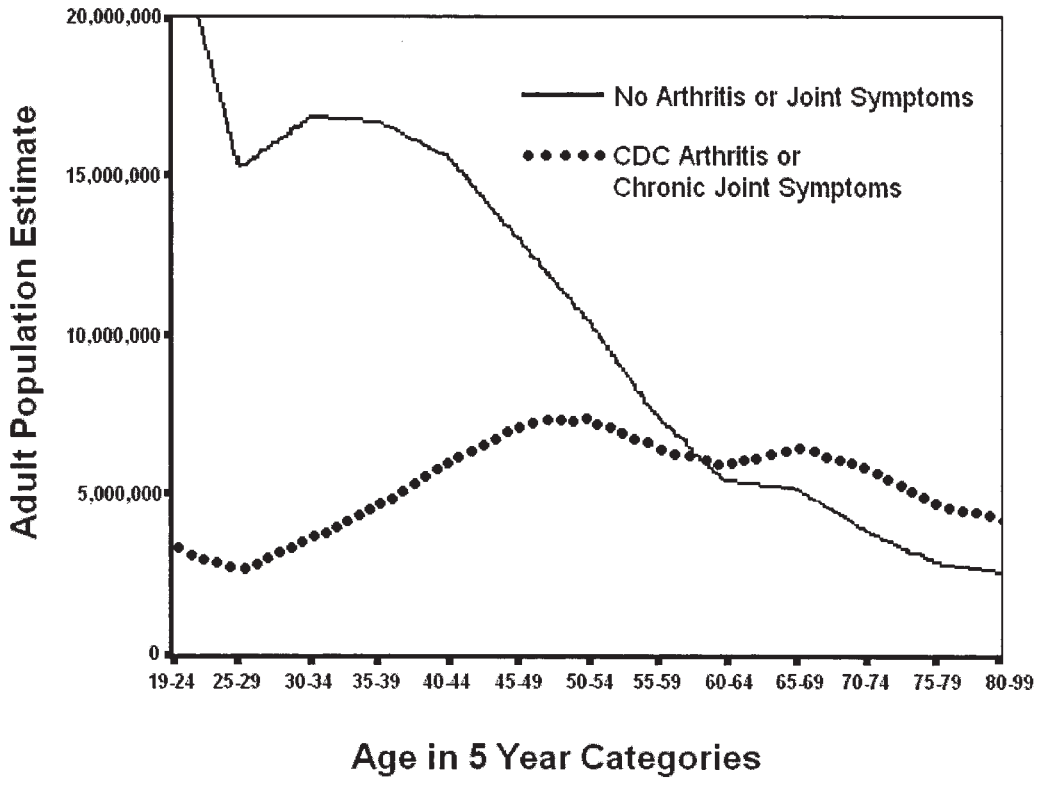

Figure 2. Population estimates of arthritis or chronic joint symptoms by age. CDC: Centers for Disease Control and Prevention.

Table 2. Sociodemographic differences among respondents with joint symptoms or physician diagnosed arthritis: 2001 BRFSS population weighted estimates from 215,510 respondents age > 17 years.

Characteristics of Respondents	No JS or Arthritis	TJS	CJS	PDA	PDA + CJS
Mean age, yrs	40.5	41.9	43.8	58.2	58.2
Female, %	48.9	47.2*	51.2	60.1	63.6
White (non-hispanic), %	66.1	75.3	72.4	75.8	77.3
African American (non-hispanic), %	10.0	7.8	8.0	9.9*	8.6
Hispanic/Latino, %	16.0	9.2	12.3	8.5	7.9
Other or ethnicity unknown†	7.9	7.6*	7.3*	5.9	6.2
High school graduate or less, %	42.0	36.1	46.5	50.5	53.1
Annual household income < $35,000 per year††, %	42.0	35.2	46.6	52.3	56.8
Uninsured currently or any time during the previous year, %	21.6	19.6	24.7	12.4	13.4

* Not significant at $p < 0.001$ for comparisons to "No JS or Arthritis" group. † Other race or ethnicity group includes 1.1% of respondents with missing data. †† 14.9% of respondents missing; all other variables < 1.0% missing.

Table 3. Health status, physical activity, and obesity by subgroups with joint symptoms or physician diagnosed arthritis: 2001 BRFSS population weighted estimates from 215,510 respondents age > 17 years.

	No JS or Arthritis	TJS	CJS	PDA	PDA + CJS
Fair or poor general health, %	8.8	9.4	23.7	20.6	41.8
Poor physical health prior 30 days, %	2.1	2.1	11.9	6.8	21.1
Poor mental health prior 30 days, %	4.7	5.8*	17.8	10.1	26.6
Meets recommended physical activity level**, %	47.6	49.5	43.9	40.7	36.2
Insufficient physical activity level***, %	38.6	40.2*	38.5*	39.0*	37.1
Inactive†	13.8	10.2	17.6	20.3	26.6
Obese††	16.8	22.4	26.5	26.3	33.8

* Not significant at $p < 0.001$ for comparisons to "No JS or Arthritis" group. ** At least 30 minutes of moderate activity 5 or more days a week or at least 20 minutes of vigorous activity at least 3 days a week. *** Moderate physical activity for less than 30 minutes a day for at least 5 days a week, or less than 20 minutes of vigorous activity for less than 3 days a week. † Less than 10 minutes of daily moderate or vigorous activity. †† Body mass index ≥ 30 kg/m^2.

Table 4. Multiple logistic regression results for models of health status, physical activity and obesity. Comparisons to BRFSS respondents without joint symptoms or a physician arthritis diagnosis. Odds ratios adjusted for age, sex, education level, race, and ethnicity.

	Fair to Poor General Health		Physically Inactive*		Obese**	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
TJS	1.3	(1.2–1.4)	0.8	(0.7–0.8)	1.5	(1.4–1.6)
CJS	3.5	(3.3–3.8)	1.3	(1.2–1.4)	1.8	(1.7–2.0)
PDA	2.3	(2.2–2.5)	1.2	(1.1–1.3)	2.0	(1.9–2.1)
PDA + CJS	7.3	(6.9–7.8)	1.8	(1.7–1.9)	2.9	(2.7–3.0)
Age > 64 yrs	1.9	(1.8–2.0)	2.2	(2.1–2.3)	0.7	(0.6–0.7)
Male sex	0.9	(0.9–1.0)	0.9	(0.9–1.0)	1.1	(1.0–1.1)
High school education or less	2.4	(2.3–2.5)	2.0	(2.0–2.2)	1.3	(1.3–1.4)
Non-Hispanic African American	1.7	(1.6–1.8)	2.0	(2.0–2.2)	1.9	(1.8–2.0)
Hispanic	3.0	(2.8–3.3)	1.8	(1.7–2.0)	1.3	(1.2–1.4)
Other Race***	1.6	(1.4–1.7)	1.5	(1.4–1.7)	0.8	(0.7–0.9)

* Less than 10 minutes of nonoccupational daily moderate or vigorous activity in a usual week. ** Body mass index ≥ 30 kg/m^2. *** Other race or ethnicity group includes 1.1% of respondents with missing data. Race/ethnicity comparisons are to non-Hispanic Whites.

As presented in Table 5, over half the PDA+CJS respondents and one-third of the CJS respondents reported activity limitations due to joint symptoms, with almost one-quarter of the PDA+CJS respondents reporting needing special equipment to deal with functional limitation. While 63% of CJS respondents and 38% of TJS respondents had seen a health professional for joint symptoms, they nevertheless reported never having been told they had arthritis. Of particular interest is that 87% of PDA respondents reported not having joint "pain, aching, swelling or stiffness" during the previous 12 months.

Data from the optional, 12-state BRFSS quality of life and caregiving module (43,464 respondents) further supported these findings. Almost 40% of the PDA+CJS group reported that pain had interfered with their activities for the whole previous month, while this was the case for only 28% of those with CJS and less than 10% of those without joint symptoms. When followup questions were asked of activity-limited PDA+CJS and CJS respondents, arthritis/rheumatism, back and neck problem, or fracture, bone and joint problems were given as the most frequent causes of their activity limitations. However, these causes were rarely cited by a majority of respondents; even among the PDA+CJS group only 35% reported arthritis, 15% back and neck problems, and 8% bone and joint problems as the main causes of their limitation.

DISCUSSION

The wide variety of joint symptoms and medical care use patterns among people with arthritis has made it difficult for surveys to reliably identify arthritis prevalence or a continuum of disease progression. While some ambiguity in community surveys would be expected given evolving questionnaire wording and methods, any arthritis case definition will reflect the inherent complexity of briefly assessing the diverse array of several hundred conditions potentially affecting joints and surrounding tissues[11]. Specifically, the 2002 and later BRFSS surveys have changed the wording of the joint symptoms items to "*During the past 30 days,* have you had any symptoms of pain, aching or stiffness in and around a joint, *excluding the back or neck?*" and "Did your symptoms *first begin more than three months ago?*". The physician diagnosis item has been changed to "have you ever been told by a doctor *or other health professional that you have some form of arthritis, gout, lupus, or fibromyalgia?*". It remains to be seen the extent to which the new item wordings, and the decision to limit the case definition to medical diagnosis, in the 2002 and later versions of the BRFSS will influence the prevalence of arthritis[12,13].

The most striking difference was found between the 2 older groups of respondents (PDA+CJS versus PDA) who reported a PDA. While about 40% of each group was age 65 or older, the PDA group had much less activity limitation and half the level of current medical treatment for joint symptoms. It is unlikely that much of this difference in disease burden is due to successful treatment; more realistically, the difference may be related to differences in particular joints (e.g., constant knee versus intermittent hand or back problems). Reporting a PDA in the absence of joint symptoms may thus in itself be only modestly associated with poorer health or inferior physical activity status.

Among the younger population with (as yet) undiagnosed joint symptoms, the TJS group (with 56% of its respondents in the age 18–44 range) may simply reflect the prevalence of transient joint injuries, which in turn may be more prevalent among those most physically active. These findings support inclusion of the PDA and CJS groups, but not the TJS group, in the CDC case definition. In contrast, one-third of the CJS group (with 50% of its respondents aged 18–44) reported being activity-limited. Compared to the asymptomatic, undiagnosed population, respondents with CJS had over 3 times the likelihood of reporting fair to poor health. It is thus striking that almost two-thirds of CJS respondents reported having seen a health professional for their joint symptoms, without reporting that they had been told they had arthritis. One 2001 BRFSS study found that among those with CJS who had never seen a "doctor, nurse or other health care professional" for their joint symptoms, over 36% were uninsured and 38% did not have a personal doctor[14]. This group, whose symptoms may or may not be actually caused by arthritis, should probably receive a high priority for arthritis awareness efforts aimed at relevant secondary prevention and pain management.

One well documented method of minimizing the pro-

Table 5. Activity limitation and medical care utilization for respondents with chronic joint symptoms or physician diagnosed arthritis. 2001 BRFSS population weighted estimates from 215,510 respondents age > 17 years*.

Activity Limitation and Medical Care Variables	No JS or Arthritis	TJS	CJS	PDA	PDA + CJS
Limited in any way in any activity due to joint symptoms, %	NA	8.4	33.4	NA	55.8
Have any health problem that "requires use of special equipment, such as a cane, wheelchair, a special bed, or a special telephone," %	1.8	2.5	7.7	9.0	22.0
Currently being treated by a doctor for joint symptoms, %	NA	NA	NA	NA	54.2
Have seen a doctor, nurse, or other healthcare professional for joint symptoms, %	NA	37.7	63.0	38.2	90.6

* Significant at $p < 0.001$ for all comparisons of CJS or PDA to PDA + CJS. NA: Not asked due to skip patterns.

gression of disabling arthritis is through maintenance of regular physical activity. Physical activity is associated with prevention of disability, functional improvement, pain reduction, and lower healthcare costs[7,15]. Despite recently summarized guidelines and recommendations to promote physical activity in the arthritis population[16], the proportion of the population participating in the recommended amount of physical activity is low. In the 2001 BRFSS data analyzed here, about 35% of respondents with CDC-defined arthritis reported not exercising at all outside work, in contrast to less than 25% of other adult Americans. However, perhaps due to the high rate of inactivity among the general population, when adjusted for other factors like age, the physical activity differences described here were not as great as would be expected from differences in other health status measures. As shown by the difference in odds ratios presented in Table 4, obesity appears to be most highly associated with arthritis, with sociodemographic covariates explaining less of the difference between the general population and those with arthritis or CJS.

These data, which differ slightly from previous published estimates[17], document the tremendous burden of arthritis and CJS in terms of the estimated number of Americans affected, associated physical limitations and disability, and the prevalence of risk factors that in turn are associated with other comorbidities. One estimate indicates that the number of older Americans with arthritis will nearly double by 2030, driven by the aging of the population[10]. This provides a strong argument for increasing resources for arthritis self-help programs, such as CDC now coordinates in 36 states, which emphasize widely available self-help education, exercise, and aquatics programs. It is also a call for clinicians to increase their awareness of the efficacy of new arthritis treatments, particularly for patients with undiagnosed joint symptoms, as an integral part of optimizing care for this often neglected condition.

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