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Arthritis Disability and Heart Disease Disability

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Objective. **Arthritis is the most common health condition in midlife and late life, and heart disease is the leading cause of death. This article compares disability impacts of these 2 preeminent health problems.**

Methods. **Using data from the National Health Interview Survey Disability Supplement, we studied specific limitations and disabilities, accommodations used (buffers), and accommodations needed (barriers) for US population groups of adults with arthritis disability, heart disease disability, both arthritis and heart disease disability, and disability due to other conditions. Weights and complex SE adjusted for sample design. We hypothesized that arthritis disability is more extensive and troublesome than heart disease disability.**

Results. **People with arthritis disability had more numerous, longer, and more bothersome disabilities than people with heart disease disability. People with arthritis disability used more equipment and rehabilitation, whereas people with heart disease disability emphasized personal assistance, medications, and medical services. People with arthritis disability experienced more barriers and needs in activities and services. People with disabilities from both arthritis and heart disease were especially disadvantaged, with high levels of limitations and accommodations. People with disability from other conditions had the highest social participation, fewest disabilities, and most tailored accommodations of all groups.**

Conclusion. **Arthritis had higher and more extensive disability impact than heart disease. Both groups had more difficulty, buffers, and barriers in their lives than people disabled by other conditions. Therefore, arthritis and heart disease are premier conditions for disability attention and alleviation in the US population.**

INTRODUCTION

Disease impact is often rated by mortality. By this measure, heart disease ranks at the top; it is the leading cause of death for the US population and has been so for decades (1–3). Measuring impact instead by disease prevalence or disability, arthritis is at the top for the middle-aged and older US population (3–6). Increasingly, disability is viewed as equally important to mortality for public health policy and programs. We provide an in-depth comparison of arthritis disability and heart disease disability for the US population. We compare social, health, specific limitations/disabilities, and accommodations features of adults with arthritis disability and those with heart disease disability. Our hypothesis is that arthritis disability is greater than heart disease disability; specifically, that adults with arthritis disability have more limitations/disabilities of many types, use more accommodations, and have more accommodation needs.

Arthritis has top prevalence in the US middle-aged (for women; just below the top rank for men) and older (for both sexes) population (3–10). Heart disease has much lower prevalence, but still ranks high among all chronic conditions, especially for men (1,3,5,6,10–12). Having both conditions is quite common compared with other comorbidities (13–15). Heart disease is the leading cause of death, but arthritis is rarely listed as the underlying cause of death because most specific types are nonfatal. Arthritis increases mortality risk (consistent results for rheumatoid arthritis, not for osteoarthritis) (16–21). Comorbidity of arthritis and heart disease also increases mortality risk (22). Disability impact is measured by aggregate rates (population with disability due to a condition) and by multivariate risk coefficients (individual-level effect of condition presence on disability). Population-based rates show that arthritis is the top reason for disability in middle-aged and older US men and women (3,4,7–10,23–26). Heart disease disability rates are much lower, but still rank high among all conditions (approximate rank 2–3 for men, slightly lower for women). Multivariate analyses show that compared with other chronic conditions, arthritis and heart disease have significant positive effects on disability,

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Table 1. Rates of arthritis disability and heart disease disability in US community-dwelling adults*

	Adults, % prevalence rate (SE)	Adults with disability, % distribution (SE)
Total with target disability†	19.0 (0.18)	
Arthritis disability		
A&RDisab	3.1 (0.05)	16.5 (0.25)
ArthDisab	2.6 (0.05)	13.6 (0.24)
HDDisab	0.9 (0.03)	4.8 (0.14)
Disability due to both conditions		
A&RDisab and HDDisab	0.06 (0.01)	0.3 (0.03)
ArthDisab and HDDisab	0.05 (0.01)	0.3 (0.03)
Disability due to other conditions	14.9 (0.15)	78.4 (0.28)

* Source: National Health Interview Survey Disability Supplement Phase One. Adults are age ≥18 years. Virtually all (99%) of the arthritis and heart disease conditions reported are chronic, using National Health Interview Survey definitions of acute and chronic (45). See Materials and Methods for disability definitions. A&RDisab = arthritis and other rheumatic diseases disability; ArthDisab = arthritis disability; HDDisab = heart disease disability.
† Raw sample sizes for Phase One: 28,152 total with target disability, 4,688 A&RDisab, 3,864 ArthDisab, 1,372 HDDisab, 91 Both (A&RDisab and HDDisab) disabilities, 80 Both (ArthDisab and HDDisab) disabilities, 22,001 Other conditions disability. Raw sample sizes for Phase Two: 2,868 A&RDisab, 2,405 ArthDisab, 949 HDDisab, 69 Both (A&RDisab and HDDisab) disabilities, 64 Both (ArthDisab and HDDisab) disabilities, 13,643 Other conditions disability.

with arthritis typically having stronger effects (14,15,27–37). Societal costs of arthritis and heart disease are measured by population health services use, health expenditures, lost wages, reduced life expectancy, increased years of life with illness and disability, and reduced quality of life. Heart disease generates much higher health expenditures than arthritis, but arthritis has a greater impact on years spent unhealthy and with disability (9,10,38–44).

MATERIALS AND METHODS

Data source. The National Health Interview Survey Disability Supplement (NHIS-D) was conducted by the National Center for Health Statistics (NCHS) in 2 phases. Phase One was conducted concurrently with the 1994 and 1995 National Health Interview Surveys, providing disability information for US community dwellers (civilian noninstitutional population) of all ages. Phase Two was a followup for people who had any evident or possible disability at Phase One (>200 items about conditions, limitations, disabilities, and services were reviewed). Phase Two provided detailed information about disabilities and accommodations. Public use data for the NHIS-D were released in 1996–1999. NHIS-D questionnaires are available at the NCHS Web site (www.cdc.gov/nchs/about/major/nhis_dis/nhis_dis.htm).

Analysis groups. We studied groups of adults (age ≥18 years) with disability due to arthritis, heart disease, both arthritis and heart disease, and other conditions. The groups were formed through attributed conditions for limitations/disabilities as follows: in Phase One, adult respondents were asked about the main conditions that cause 17 limitation/disability items. The items covered health-related difficulties doing personal care (activities of daily living [ADL]) and household management (instrumental activities of daily living [IADL]) tasks; physical limitations (PLIM), sensory, communication, cognitive, and emotional limitations; and reasons for physical and occupational therapy in the past year (Table 1). Specifically, the main cause of disability was asked about for all ADL combined (1 item), all IADL combined (1 item), all PLIM combined (1 item), serious difficulty seeing, trouble hearing, and communication/understanding trouble (3 items), specific cognitive/emotional limitations (all low prevalence; 9 items), physical therapy in the past year, and occupational therapy in the past year (2 items). They were the only Phase One items with condition information for adults. We call them target disabilities. We selected respondents with ≥1 target disability. They were then divided into condition groups by scanning attributed conditions to find those who named arthritis, heart disease, or both as the main cause of ≥1 target disability.

For arthritis, we used 2 International Classification of Diseases, Ninth Revision (ICD-9) codespans, one with wide coverage of arthritis and other rheumatic diseases (A&RDisab) and the other covering just arthropathies (ArthDisab; subset of A&RDisab). ICD-9 codes for arthritis and other rheumatic diseases are 95.6, 95.7, 98.5, 99.3, 136.1, 274, 277.2, 287.0, 344.6, 353.0, 354.0, 355.5, 357.1, 390, 391, 437.4, 443.0, 446, 447.6, 696.0, 710–716, 719.0, 719.2–719.9, 720–721, 725–727, 728.0–728.3, 728.6–728.9, 729.0–729.1, 729.4. Arthritis codes are 711.b,0,9, 712.b,8,9, 714–716, 720.0, 721. Three-digit numbers include fourth digits .0–.9, and b means blank. The first approach (A&RDisab) was developed by a national workgroup and gives a broad view of arthritis prevalence and impact. It encompasses arthropathies (osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, other axial forms, infectious and crystal arthropathies), other rheumatic and connective tissue conditions (e.g., lupus, bunions), fibromyalgia and nonspecific rheumatism, and other system diseases with prominent joint or connective tissue mani-

Table 2. Variables for the analysis of the National Health Interview Survey Disability Supplement, Phase One (P1) and Phase Two (P2)*

	Social and health (Table 3)	Limitations/disabilities (Table 4)	Buffers used (Table 5)	Barriers experienced (Table 6)
Sociodemographic	P1			
Health	P1			
Disability identity and autonomy	P1, P2			
Social activities	P2			
ADL/IADL		P1, P2	P1, P2	P2
Physical limitations		P1, P2		
Other functional limitations		P1		
Work and productive activity	P1, P2	P1, P2	P2	P2
Home and housing		P2		P2
Transportation/away from home	P2	P2	P2	P2
Aids and medications			P1, P2	
Medical and other services			P1, P2	P2
Overall scope		P2	P2	P2

* ADL = activities of daily living; IADL = instrumental activities of daily living.

festations (e.g., gout, carpal tunnel syndrome) (45). The second approach (ArthDisab) was developed by NCHS and gives information for a distinct set of conditions: the arthropathies (46). For heart disease (HDDisab), we used the NCHS codespan (46). ICD-9 codes for heart disease are 410–417, 420.b,9, 421.b,0,9, 422.b,9, 423–424, 425.b,0–5,9, 426, 427.b,0–6,8,9, 428, 429.b,0–6,8,9, 745–746, 785.0–785.2. It encompasses ischemic heart disease, heart rhythm disorders, and other selected heart diseases, excluding hypertension. For both arthritis and heart disease (BothDisab), we found people who attributed target disabilities to both conditions. We again used 2 arthritis codespans: one BothDisab group was A&RDisab and HDDisab, and the other was ArthDisab and HDDisab. Once the arthritis and heart disease groups were identified, remaining people were grouped together (OthDisab). By definition, they attributed all of their target disabilities to conditions other than arthritis and heart disease.

A person's group status was determined at Phase One and maintained in Phase Two analyses. Groups could not be established anew at Phase Two because 1) only 2 disability items queried people about attributed conditions and 2) they had different wording than in Phase One; attributed conditions were coded into categories rather than ICD-9 codes. Thus, each condition group was a cohort with initial and followup reports about their disability experience. A&RDisab, HDDisab, BothDisab, and OthDisab groups were mutually exclusive; a person belonged to only one group. Raw sample sizes are shown in Table 1.

Of the Phase One respondents who screened in for Phase Two, 62% had a followup interview. Besides typical nonresponse reasons (death, not located, institutionalized, refused), some of Phase Two was not conducted due to budget constraints. Followup respondents were older, more often women, and had poorer health and less employment, but were similar for race, education, and number of target disabilities at Phase One than the whole initial sample. Sample weights designed for NHIS-D adjusted for nonresponse, so Phase Two selectivity had negligible or no impact on estimated rates.

Variables. We compared the groups for social and health characteristics, specific limitations and disabilities, accommodations used (buffers), and accommodations needed (barriers). Table 2 shows the organization of variables.

Procedures. NHIS-D had a multistage, cluster probability sample of US households (47). We used NCHS-prepared weights to generate point estimates representative of the civilian noninstitutional population age ≥18 years. SUDAAN statistical software was used to estimate complex variances (48). Item missing data were scant and coded to item modes.

Means and percentages of outcome variables were estimated for 6 analysis groups: A&RDisab, ArthDisab, HDDisab, Both A&RDisab and HDDisab, Both ArthDisab and HDDisab, and OthDisab. Pairwise tests were performed to assess statistically significant differences ($P \leq 0.05$, $P \leq 0.01$, $P \leq 0.001$) between the arthritis, heart disease, and Both disability groups, and then between those groups and the Other disability group. The entire analysis was performed again with age-sex standardized values. A worktable with all point estimates and pairwise tests was prepared and comparisons summarized. This article summarizes all comparisons. Only comparisons of arthritis disability with heart disease disability are shown in the tables. Values for the OthDisab group are available upon request from the corresponding author.

RESULTS

Stated differences are statistically significant at $P \leq 0.05$. Highly consistent differences are sometimes noted as $P > 0.05$. Occasionally, a strong difference occurs for one phase only, indicated by Phase One or Phase Two. The term arthritis disability encompasses A&RDisab and ArthDisab because their comparisons with other analysis groups are virtually identical.

Differences in disability experience for population

groups are identified. We also identify features that distinguish groups consistently and with statistical significance. Our aim is an overall substantive story about differences among groups, and little attention goes to numerical values (all are national estimates). Phase One and Phase Two values should not be compared for longitudinal changes because items differed so much for the 2 interviews. We compare 1) the arthritis disability and heart disease disability groups, 2) people with Both arthritis and heart disease disability with the arthritis (only) and heart disease (only) groups, and 3) people with Other disabling conditions with the arthritis and heart disease disability groups.

Disability prevalence. Overall, 19.0% of US community-dwelling adults had disability, defined as ≥1 target disability (Table 1). A total of 3.1% of US adults had disability due to arthritis (A&RDisab; 2.6% ArthDisab), 0.9% due to heart disease, <0.1% due to both arthritis and heart disease, and 14.9% due to other conditions. Disability prevalence rose with age for all groups. Among persons age ≥85 years, 15.2% had disability due to arthritis (A&RDisab; 14.3% ArthDisab), 5.0% due to heart disease, 0.4% due to both arthritis and heart disease, and 52.2% due to other conditions. These rates were genuine prevalence because the numerator was population with disability due to the condition and the denominator was total US population.

Among all adults with disability, 16.5% had arthritis disability, 4.8% had heart disease disability, 0.3% had both disabilities, and 78.4% had other disability (Table 1). The distribution was the same for Phase Two respondents: 16.2%, 5.3%, 0.4%, and 78.1%, respectively.

Social and health characteristics. People with arthritis disability (A&RDisab or ArthDisab) were younger and more often women than those with heart disease disability (Table 3; A&RDisab versus HDDisab and ArthDisab versus HDDisab). There were no race/ethnicity differences. People with arthritis disability had more education, higher levels of current and past-year employment, current schooling and job training, volunteer work, better self-rated health, fewer chronic or disabling conditions, and less disability self-identity than people with heart disease disability. The arthritis and heart disease groups were similar in trips and days outside the home, and were also similar in social activities (arthritis often higher; $P > 0.05$). People with both arthritis and heart disease disability differed notably from people with arthritis (only) and heart disease (only) disability (Table 3; A&RDisab versus BothDisab and HDDisab versus BothDisab). The BothDisab group was older than those groups and less often women than people with arthritis. They had less education, less employment (than arthritis), poorer self-rated health, more chronic and disabling conditions, and higher disability self-identity. People with both disabilities had fewer trips and days outside the home (consistent; $P > 0.05$) than the arthritis and heart disease groups, but were similar for social activities. People with Other disability were the youngest (mean age 54 years) and most often men (47%) of all groups. They had the highest education (mean 12 years) and work participation (38% major activity, 45% current employment), best self-rated health (37% fair/poor), fewest chronic or disabling conditions (mean 2.2 and 1.3, respectively), and lowest disability self-identity (38%). They had the most transportation and away-from-home behavior of all groups, but were not distinctive for social activities.

Specific limitations and disabilities. People with arthritis disability had more ADL and PLIM disabilities than those with heart disease disability; the IADL results were inconsistent (Table 4). The arthritis groups often had longer durations of ADL, IADL, and PLIM problems, yet disability severity was similar or less than the heart disease group. People with arthritis disability were more likely to have pain doing ADL and IADL, and also fatigue and long time ($P > 0.05$) for IADL (but less for ADL). People with heart disease disability more often had all-at-once disability onsets (ADL, IADL, PLIM) and had disability hierarchy (49). The people with arthritis disability had fewer sensory/communication problems; the groups were similar for cognitive/emotional problems. People with arthritis disability had more trouble getting/keeping jobs and more limitations in kind/amount of work, whereas people with heart disease disability were more likely to stop working and say that their health prevented work. The people with arthritis had more home access problems, but the groups were similar for transportation problems. Overall, the arthritis groups had greater disability scope (limitations/disability in more activity domains). People with both arthritis and heart disease disability had notably more ADL, IADL, PLIM, and sensory/communication difficulties than the arthritis and heart disease groups. Their disabilities were usually more severe ($P > 0.05$) and of similar or longer durations ($P > 0.05$), but all-at-once onsets and hierarchy were less common. The BothDisab group cited the most problems in home access and transportation, and they were most often retired due to health/disability and most often said they could not work (Phase One) of all groups. Their scope of disability was the most extensive. People with Other disability had the fewest ADL, IADL, and PLIM difficulties of all of the groups. Their ADL/IADL disabilities were often the longest and disabilities started all at once (ADL, IADL, PLIM) more often than for other groups; they were not distinctive for severity. The OthDisab group was least troubled by fatigue, long time, and pain. People with Other disability conditions had the most cognitive/emotional limitations and more sensory/communication limitations than the arthritis group (but less than the BothDisab group). They cited the most trouble getting/keeping jobs, yet fewest home access and transportation problems. Overall, the OthDisab group had the smallest disability scope (fewest activities affected by limitations/disabilities) of all groups.

Buffers used. People with arthritis disability used more equipment assistance for ADL/IADL disabilities and less personal assistance ($P > 0.05$ for some) than people with heart disease disability (Table 5). People with arthritis also

Table 3. Social and health characteristics of adults with arthritis disability and heart disease disability*

	A&R Disab	Arth Disab	HD Disab	Both Disab†	Comparisons, *P*‡: A&R Disab vs. HD Disab	Arth Disab vs. HD Disab	A&R Disab vs. Both Disab	HD Disab vs. Both Disab†
Sociodemographic (P1)								
Age, mean years	63.7	66.6	67.5	72.2	≤ 0.001	> 0.05	≤ 0.001	≤ 0.001
Age ≥55 years, %	71.8	79.8	83.4	95.5				
Sex, % female	73.1	73.0	52.8	59.8	≤ 0.001	≤ 0.001	≤ 0.05	> 0.05
Age-sex, % female age ≥55 years	52.4	58.5	45.0	56.4	≤ 0.001	≤ 0.001	> 0.05	> 0.05
Race, % white non-Hispanic	80.6	80.4	81.0	85.9	> 0.05	> 0.05	> 0.05	> 0.05
Education, mean completed years	11.2	11.0	10.7	10.4	≤ 0.001	≤ 0.05	> 0.05	> 0.05
High school or more, %	62.3	58.8	52.7	44.0	≤ 0.001	≤ 0.001	≤ 0.001	> 0.05
Health (P1)								
Fair/poor self-rated health, %	45.4	47.9	69.9	78.3	≤ 0.001	≤ 0.001	≤ 0.001	> 0.05
Chronic conditions, mean§	2.8	2.8	3.1	4.4	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001
Target disabling conditions, mean§	1.4	1.4	1.5	2.8	≤ 0.01	≤ 0.05	≤ 0.001	≤ 0.001
Disability identity and autonomy								
Considered disabled by self or others (P1), %	40.6	42.6	52.4	65.6	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.05
Self-direction for medical care (P2), % who give own consent	98.1	98.0	97.3	93.3	> 0.05	> 0.05	> 0.05	> 0.05
Work and other productive activity								
P1								
Employed in past 2 weeks, %	25.2	19.6	12.9	12.9	≤ 0.001	≤ 0.001	≤ 0.001	> 0.05
Major activity in past year was work, %	25.4	19.6	12.8	14.0	≤ 0.001	≤ 0.001	≤ 0.01	> 0.05
P2								
Currently working, %	20.2	15.2	11.7	10.4	≤ 0.001	≤ 0.01	≤ 0.05	> 0.05
Current activities (age <70 years), %								
Competitive employment	32.0	25.5	18.8	17.2	≤ 0.001	≤ 0.01	> 0.05	> 0.05
Job training	0.4	0.4	0.0	0.0	≤ 0.05	> 0.05	≤ 0.05	–
School	1.8	1.4	0.2	0.0	≤ 0.001	≤ 0.01	≤ 0.001	> 0.05
Volunteer work	13.1	11.6	7.1	20.0	≤ 0.001	≤ 0.01	> 0.05	> 0.05
No structured activity	55.8	56.6	60.6	58.2	> 0.05	> 0.05	> 0.05	> 0.05
Volunteer work, mean days/month	1.0	0.9	0.6	0.6	≤ 0.01	≤ 0.05	> 0.05	> 0.05
Transportation and out and about (P2)								
Any vehicular travel past 6 months, %	88.8	88.3	89.9	88.7	> 0.05	> 0.05	> 0.05	> 0.05
Local trips in vehicles past week, mean	6.5	6.0	6.3	6.2	> 0.05	> 0.05	> 0.05	> 0.05
Any trips, %	82.5	81.7	84.6	80.3				
≥8, %	30.4	26.9	26.5	27.2				
Long-distance trips past 6 months, mean	0.5	0.5	0.4	0.2	≤ 0.01	> 0.05	≤ 0.001	> 0.05
Any trips, %	16.9	15.5	13.2	10.2				
Days away from home past 2 weeks, mean¶	9.3	8.9	9.1	8.6	> 0.05	> 0.05	> 0.05	> 0.05
Any days, %	94.9	94.2	96.2	94.6				
1–7 days, %	34.5	37.2	38.5	45.0				
All 14, %	49.8	46.5	49.0	42.6				
Social activities (P2)								
Friend/neighbor/relative contacts past 2 weeks, mean#	20.2	19.9	18.6	22.5	≤ 0.05	> 0.05	> 0.05	> 0.05
>10 contacts, %	66.2	65.7	61.5	69.4				
Variety of contacts (4 types), mean	3.0	3.0	2.9	2.9	≤ 0.05	> 0.05	> 0.05	> 0.05
All 4 types, %	42.4	42.0	39.0	38.3				
Away-from-home events past 2 weeks, mean**	11.4	11.4	11.2	11.5	> 0.05	> 0.05	> 0.05	> 0.05
>10 events, %	41.5	41.1	41.4	36.3				
Variety of events (3 types), mean	1.2	1.2	1.1	1.1	> 0.05	> 0.05	> 0.05	> 0.05
All 3 types, %	10.7	9.6	7.8	8.0				
Satisfaction with social activities, % about enough††	54.0	54.3	49.2	48.2	≤ 0.05	≤ 0.05	> 0.05	> 0.05

* Source: National Health Interview Survey Disability Supplement, Phase One (P1) and Phase Two (P2). A&RDisab = arthritis and other rheumatic diseases disability; ArthDisab = arthritis disability; HDDisab = heart disease disability; BothDisab = A&RDisab and HDDisab.
† Results using ArthDisab rather than A&RDisab are similar (not shown).
‡ Pairwise significance tests. Some indicators have no significant *P* values; they are aspects of an initial indicator with descriptive interest, but not tested statistically for group differences. The value 0.0 means <0.05.
§ Chronic conditions are International Classification of Diseases, Ninth Revision coded conditions elicited in the National Health Interview Survey core interview. Target disabling conditions are named as main causes of 17 target disabilities in P1.
¶ Days left one's home for any reason.
# Contacts are in person with friends/neighbors, phone with friends/neighbors, in person with relatives, and phone with relatives.
** Events are going to a religious place for worship/other activities; going to a movie, sports event, club, class, or other group event; and going out to eat at a restaurant.
†† Includes social contacts and events; self-responses only.

Table 4. Specific limitations and disabilities of adults with arthritis disability and heart disease disability*

					Comparisons, *P*‡			
	A&R Disab	Arth Disab	HD Disab	Both Disab†	A&R Disab vs. HD Disab	Arth Disab vs. HD Disab	A&R Disab vs. Both Disab	HD Disab vs. Both Disab†
Personal care (ADL) disabilities§								
P1								
ADL disabilities (0–6), mean	0.4	0.4	0.3	1.0	> 0.05	≤ 0.01	≤ 0.001	≤ 0.001
Any ADL disability, %	16.8	18.4	14.4	40.1				
Among people with ADL disability								
Severity of ADL (1–3), mean¶	1.7	1.7	1.7	1.8	> 0.05	> 0.05	> 0.05	> 0.05
Duration of ADL, mean years#	6.6	6.7	4.3	5.5	≤ 0.001	≤ 0.001	> 0.05	> 0.05
Duration of longest ADL, mean years	7.4	7.4	4.9	6.7	≤ 0.001	≤ 0.001	≤ 0.05	> 0.05
All-at-once onset of ADL, %**	70.1	70.2	75.3	39.0				
Perfect hierarchy ADL, %††	45.4	46.2	65.0	25.9	≤ 0.001	≤ 0.001	≤ 0.05	≤ 0.001
P2								
ADL disabilities (0–7), mean	1.5	1.7	1.2	2.3	≤ 0.001	≤ 0.001	≤ 0.01	≤ 0.001
Any ADL disability, %	55.2	59.0	46.1	71.0				
≥5, %	11.2	12.5	6.8	20.2				
Among people with ADL disability								
Severity of ADL (1–3), mean¶	1.5	1.5	1.5	1.6	> 0.05	> 0.05	> 0.05	> 0.05
Duration of ADL, mean years#	2.1	2.2	1.7	2.4	> 0.05	> 0.05	> 0.05	> 0.05
Any tiring ADL, %‡‡	64.8	64.7	74.2	68.0	≤ 0.001	≤ 0.001	> 0.05	> 0.05
Any long-time ADL, %	65.9	65.9	72.6	67.1	≤ 0.05	≤ 0.05	> 0.05	> 0.05
Any painful ADL, %	63.9	62.9	47.1	57.3	≤ 0.001	≤ 0.001	> 0.05	> 0.05
Any tire/time/pain ADL, %	79.7	79.3	84.2	74.8	≤ 0.05	≤ 0.05	> 0.05	> 0.05
Household management (IADL) disabilities§§								
P1								
IADL disabilities (0–6), mean	0.8	0.9	1.2	1.8	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001
Any IADL disability, %	44.1	46.6	65.1	87.4				
Among people with IADL disability								
Severity of IADL (1–3), mean¶	2.4	2.4	2.6	2.5	≤ 0.001	≤ 0.001	≤ 0.05	> 0.05
Duration of IADL, mean years#	7.4	7.6	6.8	6.7	> 0.05	≤ 0.05	> 0.05	> 0.05
Duration of longest IADL, mean years	8.1	8.3	7.4	7.7	≤ 0.05	≤ 0.05	> 0.05	> 0.05
All-at-once onset of IADL, %**	59.6	59.2	65.1	52.5				
Perfect hierarchy IADL, %††	81.9	82.7	82.9	78.7	> 0.05	> 0.05	> 0.05	> 0.05
P2								
IADL disabilities (0–8), mean	1.4	1.4	1.4	2.1	> 0.05	> 0.05	≤ 0.01	≤ 0.05
Any IADL disability, %	55.5	57.5	56.9	66.8				
≥5, %	8.6	9.3	10.0	19.3				
Among people with IADL disability								
Severity of IADL (1–3), mean¶	2.1	2.1	2.2	2.3	≤ 0.01	≤ 0.05	> 0.05	> 0.05
Duration of IADL, mean years#	4.6	4.7	4.9	4.8	> 0.05	> 0.05	> 0.05	> 0.05
Any tiring IADL, %‡‡	52.2	51.8	45.5	50.9	≤ 0.05	≤ 0.05	> 0.05	> 0.05
Any long-time IADL, %	52.4	51.8	46.8	52.0	> 0.05	> 0.05	> 0.05	> 0.05
Any painful IADL, %	48.1	45.6	25.7	48.3	≤ 0.001	≤ 0.001	> 0.05	≤ 0.01
Any tire/time/pain IADL, %	60.4	58.6	50.5	52.0	≤ 0.001	≤ 0.01	> 0.05	> 0.05
PLIM¶¶								
P1								
PLIM (0–8), mean	2.7	2.9	2.5	3.9	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001
Any PLIM, %	92.2	93.5	84.9	100.0				
Among people with PLIM								
Severity of PLIM (1–3), mean¶	1.5	1.6	1.7	1.8	≤ 0.001	≤ 0.001	≤ 0.001	> 0.05
Duration of PLIM, mean years#	7.4	7.6	6.8	8.0	≤ 0.05	≤ 0.01	> 0.05	> 0.05
Duration of longest PLIM, mean years	9.1	9.5	8.2	11.4	≤ 0.01	≤ 0.001	> 0.05	≤ 0.05
All-at-once onset of PLIM, %**	53.7	52.5	63.4	41.1				
Perfect hierarchy PLIM, %††	23.5	25.3	32.1	37.3	≤ 0.001	≤ 0.001	≤ 0.01	> 0.05
P2								
PLIM (0–10), mean	4.3	4.6	4.0	5.5	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001
Any PLIM, %	88.2	90.9	84.8	98.6				
≥5, %	50.3	54.1	44.5	70.8				

(continued)

Table 4. Specific limitations and disabilities of adults with arthritis disability and heart disease disability* *(Continued)*

	A&R Disab	Arth Disab	HD Disab	Both Disab†	Comparisons, *P*‡: A&R Disab vs. HD Disab	Arth Disab vs. HD Disab	A&R Disab vs. Both Disab	HD Disab vs. Both Disab†
Among people with PLIM limitation								
Severity of PLIM (1–3), mean¶	1.8	1.9	1.9	2.0	> 0.05	> 0.05	> 0.05	> 0.05
Duration of PLIM, mean years#	5.1	5.2	4.3	5.4	≤ 0.01	≤ 0.001	> 0.05	> 0.05
Other functional limitations (P1)								
Sensory/communication limitations (0–10), mean##	0.7	0.7	0.9	1.4	≤ 0.001	≤ 0.01	≤ 0.001	≤ 0.001
Any sensory/communication limitation, %	39.7	40.9	45.2	71.4				
Cognitive/emotional limitations (0–7), mean***	0.5	0.5	0.6	0.6	> 0.05	> 0.05	> 0.05	> 0.05
Any cognitive/emotional limitation, %	27.9	27.9	29.2	35.3				
Work, home, and transportation disabilities								
P1								
Unable now to do major activity of past year, %†††	21.6	22.0	34.2	37.0	≤ 0.001	≤ 0.001	≤ 0.01	≤ 0.05
Unable to work (age <70 years), %	37.0	41.0	61.5	75.6	≤ 0.001	≤ 0.001	≤ 0.05	> 0.05
P2								
Work limitations due to health, %								
Health prevents work	23.0	25.8	20.3	13.9	> 0.05	≤ 0.01	> 0.05	> 0.05
Health limits work	22.0	19.0	14.3	13.6	≤ 0.001	≤ 0.05	> 0.05	> 0.05
Retired on disability or due to health	31.8	35.0	50.2	57.9	≤ 0.001	≤ 0.001	≤ 0.001	> 0.05
Among people with work limitation								
Could not work even with accommodations	55.0	62.4	72.4	70.2	≤ 0.001	≤ 0.001	> 0.05	> 0.05
Could or does work with accommodations	17.6	16.2	10.2	8.1	≤ 0.001	≤ 0.001	> 0.05	> 0.05
Problems getting/keeping job due to health (10 types), mean‡‡‡	0.3	0.2	0.2	0.2	≤ 0.05	> 0.05	> 0.05	> 0.05
Any job problem, %	12.3	9.0	8.2	5.8	≤ 0.001	> 0.05	≤ 0.05	> 0.05
Home access problems due to health (5 types), mean§§§	0.6	0.7	0.5	1.0	≤ 0.001	≤ 0.001	≤ 0.05	≤ 0.01
Any home problem, %	35.2	37.4	27.7	46.8	≤ 0.001	≤ 0.001	> 0.05	≤ 0.01
Transportation problems due to health (3 types), mean¶¶¶	0.5	0.6	0.5	0.8	> 0.05	> 0.05	≤ 0.05	≤ 0.05
Any transportation problem, %	34.0	36.4	35.6	52.6	> 0.05	> 0.05	≤ 0.01	≤ 0.01
Scope of disabilities (P2)###								
Activity domains with limitations/disability (0–5), mean	2.4	2.5	2.3	3.0	> 0.05	≤ 0.01	≤ 0.01	≤ 0.001
Any domain, %	84.4	86.3	86.1	90.7				
≥3, %	48.0	50.4	43.8	67.8				

* Source: National Health Interview Survey Disability Supplement, Phase One (P1) and Phase Two (P2). ADL = activities of daily living; IADL = instrumental activities of daily living; PLIM = physical limitations. See Table 3 for additional definitions.
† Results using ArthDisab rather than A&RDisab are similar (not shown).
‡ Pairwise significance tests. Some indicators have no significant *P* values; they are aspects of an initial indicator with descriptive interest, but not tested statistically for group differences. The value 0.0 means <0.05.
§ P1 ADL tasks (6) are bathing/showering, dressing, eating, getting in/out of bed/chairs, using toilet (including getting to toilet), and getting around inside home. P2 ADL tasks (7) exclude getting around inside home and include walking and getting outside.
¶ Severity is the degree of difficulty doing activities on one's own (without personal or special equipment assistance; 1 = some, 2 = a lot, 3 = unable). The average severity of ADL, IADL, and PLIM was computed for each person.
# Duration is years since first onset of ADL, IADL, or PLIM. Mean duration was computed for each person.
** Ages of ADL, IADL, and PLIM onset were computed. For people with ≥2 disabilities: all-at-once onset is if all disabilities started within 1 year (e.g., age 44–45 or 70–71 years).
†† Perfect hierarchy is when a person's disabilities scale by prevalence (for a given disability, all disabilities with higher population prevalence exist as well).
‡‡ Doing activity without assistance is very tiring, takes a long time, or is very painful. Any tire/time/pain is the percentage of people that experiences any of these disability symptoms.
§§ P1 IADL tasks (6) are preparing own meals, shopping for personal items, managing money, using the telephone, doing heavy housework, and doing light housework. P2 IADL tasks (8) include getting to places outside of walking distance and managing own medication. P2 wording changes include shopping for groceries and personal items and managing own money.
¶¶ P1 PLIM (8) are lifting 10 pounds, walking up 10 steps without rest, walking a quarter mile, standing for 20 minutes, bending down from upright to pick up an object, reaching up over head or reaching outward, using fingers to grasp or handle, holding a pen or pencil. P2 PLIM (10) has only 3 identical tasks (walking up 10 steps without rest, walking a quarter mile, using fingers to grasp or handle). The other tasks are standing for 2 hours, sitting for 2 hours, stooping/crouching/kneeling, reaching up over head, reaching outward, lifting/carrying 25 pounds, lifting/carrying 20 pounds.
See, hear, communicate, understand, learn, dizzy, balance, ringing ears, smell, and taste problems.
*** Frequently depressed/anxious, trouble making/keeping friendships, trouble getting along with others socially, trouble concentrating for daily tasks, serious difficulty coping with stresses, frequently confused/disoriented/forgetful, phobias or strong fears.
††† Working at a job or business, keeping house, going to school, or something else.
‡‡‡ Health-related problems such as past job change due to health, current difficulty to change job, difficulty to advance in job, fired or refused job due to health.
§§§ Health-related difficulties to enter/exit house, open/close doors of home, reach/open cabinets, use bathroom, and live with others now due to health.
¶¶¶ Health-related difficulties to use local public transportation, get around outside home, never driven a car.
Activity domains (ADL, IADL, transportation, housing, work) in which a person reports limitations/disabilities.

Table 5. Buffers used by adults with arthritis disability and heart disease disability*

	A&R Disab	Arth Disab	HD Disab	Both Disab†	Comparisons, *P*‡: A&R Disab vs. HD Disab	Arth Disab vs. HD Disab	A&R Disab vs. Both Disab	HD Disab vs. Both Disab†
Assistance for ADL§								
Among people with ADL disability (P1)								
Help from another person, mean ADL	1.1	1.2	1.5	1.0	≤ 0.01	≤ 0.01	> 0.05	≤ 0.05
Any help from another person, %	48.8	50.1	68.5	50.7				
Remind/nearby help, mean	0.4	0.4	0.6	0.5	> 0.05	> 0.05	> 0.05	> 0.05
Any remind/nearby help, %	15.8	16.3	22.9	21.1				
Equipment assistance, mean	0.8	0.8	0.7	0.7	≤ 0.05	≤ 0.05	> 0.05	> 0.05
Any equipment assistance, %	50.1	50.8	44.8	46.5				
Any assistance at all for ADL, %	80.1	80.9	90.1	75.2	≤ 0.001	≤ 0.01	> 0.05	> 0.05
Among people with ADL disability (P2)								
Help from another person, mean ADL	0.9	0.9	1.0	1.0	> 0.05	> 0.05	> 0.05	> 0.05
Any help from another person, %	34.8	35.8	38.5	38.6	> 0.05	> 0.05	> 0.05	> 0.05
Hands-on help, mean	0.8	0.9	0.9	1.0	> 0.05	> 0.05	> 0.05	> 0.05
Any hands-on help, %	33.0	34.1	35.6	38.6	> 0.05	> 0.05	> 0.05	> 0.05
Supervise/nearby help, mean	0.3	0.3	0.3	0.3	> 0.05	> 0.05	> 0.05	> 0.05
Any supervise/nearby help, %	14.1	14.6	18.4	17.0	> 0.05	> 0.05	> 0.05	> 0.05
Equipment assistance, mean	1.6	1.7	1.2	1.8	≤ 0.001	≤ 0.001	> 0.05	> 0.05
Any equipment assistance, %	60.8	63.2	52.3	65.4	≤ 0.01	≤ 0.001	> 0.05	> 0.05
Any assistance at all for ADL, %	70.3	72.3	64.6	75.9	≤ 0.05	≤ 0.01	> 0.05	> 0.05
Assistance for IADL¶								
Among people with IADL disability (P1)								
Help or supervision from another person, mean IADL	1.6	1.6	1.6	1.7	> 0.05	> 0.05	> 0.05	> 0.05
Any help/supervision, %	84.7	85.8	86.4	87.4				
Among people with IADL disability (P2)								
Help from another person, mean IADL	2.2	2.3	2.4	2.8	≤ 0.05	> 0.05	> 0.05	> 0.05
Any help from another person, %	81.8	82.6	85.8	87.0	≤ 0.05	> 0.05	> 0.05	> 0.05
Hands-on help, mean	1.9	1.9	2.0	2.4	> 0.05	> 0.05	> 0.05	> 0.05
Any hands-on help, %	71.8	72.9	72.5	82.8	> 0.05	> 0.05	> 0.05	> 0.05
Supervise/nearby help, mean	0.1	0.1	0.1	0.1	> 0.05	> 0.05	> 0.05	> 0.05
Any supervise/nearby help, %	7.0	7.4	9.3	6.0	> 0.05	> 0.05	> 0.05	> 0.05
Any assistance at all for IADL, %	73.5	74.6	75.7	83.9	> 0.05	> 0.05	> 0.05	> 0.05
Work accommodations (P2)								
Among currently employed people#								
Special features at work, % any	8.5	8.5	3.3	15.2	≤ 0.05	≤ 0.05	> 0.05	> 0.05
Special equipment or arrangements at work, % any	2.6	3.0	0.8	0.8	> 0.05	> 0.05	≤ 0.001	> 0.05
Vocational rehabilitation ever received (age ≥18 years, 15 types), mean	0.4	0.3	0.2	0.2	≤ 0.001	≤ 0.01	> 0.05	> 0.05
Any vocational rehabilitation, %	18.0	16.6	13.8	15.6	≤ 0.01	> 0.05	> 0.05	> 0.05
Transportation accommodations (P2)								
Special equipment on car or other motor vehicle, % any	1.1	1.2	0.6	1.2	≤ 0.05	≤ 0.05	> 0.05	> 0.05
Aids and medications used								
P1								
Sensory equipment aids (15 types), mean	0.1	0.1	0.1	0.2	> 0.05	> 0.05	> 0.05	> 0.05
Any sensory aids, %	8.2	9.0	9.1	16.8				
Mobility equipment aids (16 types), mean	0.4	0.5	0.2	0.6	≤ 0.001	≤ 0.001	≤ 0.05	≤ 0.001
Any mobility aids, %	32.1	33.9	18.9	41.7				
P2								
Medical devices past 12 months (15 types), mean	1.0	1.1	1.1	1.4	> 0.05	> 0.05	≤ 0.05	> 0.05
Any devices, %	50.8	54.1	52.4	66.8	> 0.05	> 0.05	≤ 0.05	≤ 0.05
Medical implants now (11 types), mean	0.3	0.4	0.4	0.5	> 0.05	> 0.05	≤ 0.05	≤ 0.05
Any implants, %	26.2	28.8	28.6	43.5	> 0.05	> 0.05	≤ 0.01	≤ 0.05
Prescription medicines now, % any**	85.8	87.9	95.9	97.0	≤ 0.001	≤ 0.001	≤ 0.001	> 0.05
≥6 medications, %	19.1	20.2	38.6	40.0				

(continued)

Table 5. Buffers used by adults with arthritis disability and heart disease disability* *(Continued)*

	A&R Disab	Arth Disab	HD Disab	Both Disab†	Comparisons, *P*‡: A&R Disab vs. HD Disab	Arth Disab vs. HD Disab	A&R Disab vs. Both Disab	HD Disab vs. Both Disab†
Medical and other services used								
P1								
Rehabilitation services past year (9 types), mean	0.2	0.2	0.2	0.3	≤ 0.001	≤ 0.01	> 0.05	> 0.05
Any rehabilitation services, %	20.7	18.0	14.7	27.0				
Mental health services past year (2 types), mean	0.1	0.1	0.1	0.1	> 0.05	≤ 0.05	> 0.05	> 0.05
Any mental health services, %	8.8	8.0	10.1	12.8				
P2								
Visits to regular physician past 3 months, mean	1.6	1.6	2.0	1.9	≤ 0.01	≤ 0.01	> 0.05	> 0.05
Visits to specialists past 3 months, mean	0.9	0.9	1.0	0.9	> 0.05	> 0.05	> 0.05	> 0.05
Allied health services past 12 months, % any	23.6	23.3	23.6	29.8	> 0.05	> 0.05	> 0.05	> 0.05
Center-based services past 12 months, % any	8.8	8.9	10.3	13.0	> 0.05	> 0.05	> 0.05	> 0.05
Mental health services past 12 months, % any	5.5	4.7	3.4	1.3	≤ 0.01	> 0.05	≤ 0.01	> 0.05
Medical treatments received at home past 3 months, % any	7.2	8.0	12.0	11.8	≤ 0.001	≤ 0.01	> 0.05	> 0.05
Coordinator for medical care, % have	51.9	52.5	59.5	68.9	≤ 0.001	≤ 0.01	≤ 0.01	> 0.05
Coordinator for nonmedical services, % have	6.1	6.6	8.0	16.6	> 0.05	> 0.05	≤ 0.05	> 0.05
Scope of disability buffers (P2)††								
Activity domains with buffers (0–4), mean	0.9	1.0	0.8	1.2	≤ 0.01	≤ 0.001	≤ 0.001	≤ 0.001
Any domain, %	59.9	63.1	54.2	77.4				
≥2 domains, %	30.2	32.8	26.5	47.9				
Service domains with buffers (0–11), mean	3.8	3.9	4.2	4.8	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.05
Any domain, %	95.4	96.0	97.9	100.0				
≥5 domains, %	34.6	36.1	40.7	52.3				

* Source: National Health Interview Survey Disability Supplement, Phase One (P1) and Phase Two (P2). ADL = activities of daily living; IADL = instrumental activities of daily living. See Table 3 for additional definitions.
† Results using ArthDisab rather than A&RDisab are similar (not shown).
‡ Pairwise significance tests. Some indicators have no significant *P* values; they are aspects of an initial indicator with descriptive interest, but not tested statistically for group differences. The value 0.0 means <0.05.
§ P1 had separate questions about help from another person, remind/nearby help (need to be reminded or need someone close by), and equipment (special equipment). P2 was more complex: people were asked if they had help from another person, and if yes, whether it was hands on. Only those saying no to hands-on help were asked about supervise/nearby help (supervise or stay nearby in case help is needed). Equipment (special equipment or aids) was asked about separately. Means are number of ADL with the assistance type.
¶ P1 had a combined question about getting help or supervision from another person. P2 was more complex (same structure as ADL; see above). Equipment was not asked about for IADL. Means are the number of IADL with the assistance type.
# Special features are installed items (e.g., handrails, regular or adapted elevator, adapted work station; 7 types). Special equipment or arrangements were highly specialized disability aids (e.g., voice synthesizer, job coach for work tasks, sign language interpreter; 10 types).
** Number was coded in categories, so mean cannot be computed.
†† Activity domains (ADL, IADL, transportation, work) in which a person reports buffers. Service domains used (11 types in just-prior section).

used more equipment aids (vehicle, workplace, mobility), more rehabilitation services, and (Phase Two) more mental health services. By contrast, people with heart disease had more medications, general medical visits, medical treatments at home, and medical care coordination. Overall, the arthritis group had buffers in more activity domains, whereas the heart disease group had more service buffers. Compared with the arthritis and heart disease groups, the BothDisab group used more assistance for ADL (Phase Two) and IADL (consistent; $P > 0.05$ for most). The BothDisab group used more mobility aids, prescription drugs, and care coordination services. Other aids and services (sensory aids, medical devices, medical implants, rehabilitation/allied health services, center-based services, coordinator for nonmedical services) were also higher for them ($P > 0.05$). Overall, people with both arthritis and heart disease disability had the highest scopes of activity and service buffers. People with disability from other conditions had the highest levels of ADL/IADL personal assistance, vocational rehabilitation, and mental health services of all of the groups. By contrast, they had the lowest use of many other services, including equipment for ADL (Phase Two), work, and mobility, medical devices and implants, prescription drugs, general medical services, and medical care coordination. Overall, the OthDisab group had the least extensive activity and service buffers.

Barriers experienced. People with arthritis disability had more needs for personal assistance in daily tasks, work and transportation accommodations, vocational rehabilitation, and allied health services than people with heart disease disability (results consistent; $P > 0.05$ for most) (Table 6). Overall, the arthritis disability group experienced notably more activity and service barriers. People with disability due to both arthritis and heart disease

Table 6. Barriers experienced by adults with arthritis disability and heart disease disability*

	A&R Disab	Arth Disab	HD Disab	Both Disab†	Comparisons, *P*‡: A&R Disab vs. HD Disab	Arth Disab vs. HD Disab	A&R Disab vs. Both Disab	HD Disab vs. Both Disab†
Assistance needs for ADL/IADL (P2)								
Among people with ADL disability§								
Need (more) hands-on help for ADL, %	8.4	8.5	7.2	12.2	> 0.05	> 0.05	> 0.05	> 0.05
Need (more) supervise/nearby help for ADL, %	3.6	3.6	2.9	6.3	> 0.05	> 0.05	> 0.05	> 0.05
Among people with IADL disability								
Need (more) hands-on help for IADL, %	19.2	18.9	15.2	13.2	≤ 0.05	> 0.05	> 0.05	> 0.05
Need (more) supervise/nearby help for IADL, %	4.7	4.8	3.8	2.6	> 0.05	> 0.05	> 0.05	> 0.05
Work barriers (P2)								
Among currently employed people¶								
Need and do not have special features at work, %	13.3	14.7	12.0	15.2	> 0.05	> 0.05	> 0.05	> 0.05
Need and do not have special equipment or arrangements at work, %	0.3	0.4	0.0	0.0	> 0.05	> 0.05	> 0.05	-
Need (more) vocational rehabilitation (age ≥18 years), %	5.4	4.0	2.7	1.8	≤ 0.001	> 0.05	> 0.05	> 0.05
Housing barriers (P2)								
Home has elevated features (3 types), mean#	1.2	1.2	1.2	1.4	> 0.05	> 0.05	> 0.05	> 0.05
Any elevated features, %	76.2	75.1	75.0	75.4	> 0.05	> 0.05	> 0.05	> 0.05
On waiting list for long-term care facility, % yes	0.6	0.5	0.9	0.5	> 0.05	> 0.05	> 0.05	> 0.05
Transportation and away-from-home barriers (P2)								
Need special equipment for car or other motor vehicle, %	1.4	1.3	0.3	0.5	≤ 0.001	≤ 0.001	> 0.05	> 0.05
Barriers to using community special transportation services, % any barrier	5.4	5.5	6.1	7.2	> 0.05	> 0.05	> 0.05	> 0.05
Barriers to using local public transportation, % any barrier	13.0	14.2	11.0	23.5	> 0.05	≤ 0.05	> 0.05	≤ 0.05
Barriers to getting around outside home due to health, % any barrier	28.5	31.0	27.9	41.6	> 0.05	> 0.05	≤ 0.05	≤ 0.05
Medical and other services barriers (P2)								
Needed and did not receive in past 12 months, %								
Allied health services	3.8	3.8	2.2	4.2	≤ 0.05	≤ 0.05	> 0.05	> 0.05
Center-based services	1.8	1.8	1.8	3.0	> 0.05	> 0.05	> 0.05	> 0.05
Mental health services	1.8	1.6	1.5	0.0	> 0.05	> 0.05	≤ 0.001	≤ 0.001
Need and do not have coordinator for nonmedical services, %	1.1	1.0	0.8	0.0	> 0.05	> 0.05	≤ 0.001	≤ 0.05
Scope of disability barriers (P2)**								
Activity domains with barriers (0–6), mean	1.4	1.5	1.4	1.7	≤ 0.05	≤ 0.01	> 0.05	≤ 0.05
Any domain, %	86.9	86.6	84.5	91.4				
≥3 domains, %	14.1	15.0	11.7	18.3				
Service domains with barriers (0–5), mean	0.1	0.1	0.1	0.1	≤ 0.01	> 0.05	> 0.05	> 0.05
Any domain, %	10.8	9.6	7.5	7.2				

* Source: National Health Interview Survey Disability Supplement, Phase One (P1) and Phase Two (P2). P1 had only a few items about barriers (low rates, not shown). ADL = activities of daily living; IADL = instrumental activities of daily living. See Table 3 for additional definitions.
† Results using ArthDisab rather than A&RDisab are similar (not shown).
‡ Pairwise significance tests. Some indicators have no significant *P* values; they are aspects of an initial indicator with descriptive interest, but not tested statistically for group differences. The value 0.0 means <0.05.
§ Equipment needs were not asked about.
¶ Special features are installed items (e.g., handrails, regular or adapted elevator, adapted work station; 7 types). Special equipment or arrangements were highly specialized disability aids (e.g., voice synthesizer, job coach for work tasks, sign language interpreter; 10 types).
# Outside steps, several floors, bathroom/bedroom/kitchen on different floors.
** Activity domains (ADL, IADL, transportation, getting about outside the house, housing, work) in which a person reports barriers. Service domains (vocational, allied health, center-based, mental health, coordinator) in which a person reports barriers.

had still more barriers in activities. Compared with the arthritis (only) and heart disease (only) groups, they needed more ADL personal assistance and work accommodations and had more transportation and away-from-home troubles (results consistent; $P > 0.05$ for most); however, for services, they stated minimal needs (vocational rehabilitation, mental health, coordinator). Overall, the BothDisab group reported the most activity barriers but fewest service barriers of all groups. In sharp contrast to this, the OthDisab group had the fewest activity barriers

but most service barriers of all groups. Specifically, they had the fewest transportation and away-from-home troubles and fewest work accommodation needs, but had the highest vocational rehabilitation and mental health services needs.

Age-sex standardized comparisons. If all groups had similar age and sex, how would their disabilities and accommodations compare? Using the A&RDisab age-sex distribution (Phase One) as the standard population, we recalculated all group means/percentages and pairwise comparisons. For the arthritis and heart disease groups, no important changes occurred with standardization, and differences between them were substantively and statistically the same. With standardization, the BothDisab group shifted toward more disability. Although they were older and there were fewer women than in the A&RDisab group, standardized changes were small and significance levels of comparisons persisted. The OthDisab group altered most with standardization, and their disability rates rose. The group's relative youth and male presence masked difficult circumstances embedded in age-sex specific risks for specific outcomes. Nevertheless, directions and significance levels of comparisons stayed the same.

DISCUSSION

Combining all results, we found several succinct profiles. People with arthritis disability had more social and health advantages than people with heart disease disability. However, their disabilities were more numerous, longer, more bothersome, and occurred in more activity domains. For the heart disease group, disabilities started all at once more often. These findings reflect the insidious and symptomatic course of arthritis in contrast with often abrupt occurrences of heart events and swift multiple limitations. People with arthritis were more often employed, albeit with work limitations, whereas people with heart disease more often stopped working entirely. For buffers, people with arthritis were oriented to equipment and rehabilitation, whereas people with heart disease had more personal assistance and medical services, a difference of self-management versus reliance on others. The people with arthritis made disability accommodations in more life domains, yet still reported more activity and service barriers than the people with heart disease. Overall, this is a picture of high effort to relieve disability. People with disability from both arthritis and heart disease were disadvantaged by lower socioeconomic status and poorer health than the arthritis (only) and heart disease (only) groups. They had the highest numbers, severity, and scope of disabilities of all groups, highest levels of assistance and services used, and most activity barriers. Remarkably, with already high levels of service use, they seldom cited needs for more. People with disability from other conditions had the fewest disabilities, but often had the longest-duration disabilities of all groups, suggesting at-birth or childhood/youth conditions for some. The OthDisab group had tailored buffers, concentrating on personal assistance, rehabilitation, and mental health services. Despite the highest social participation, they reported the most service barriers, especially work-related barriers. Our prior analyses comparing people with arthritis disability with people with disability from other conditions had compatible results (50,51). The OthDisab group here was smaller (94%) because persons with heart disease disability were taken into analysis groups.

These profiles persisted with age-sex standardization. Therefore, they are a robust view of disability and accommodations that reflected distinctive impacts of arthritis and heart disease compared with other conditions.

The NHIS-D had extensive questions on disability, buffers, and barriers for a large national sample. Rates for numerous disability outcomes, even if uncommon, can be estimated. The NHIS-D is the only recent survey that permits comprehensive comparison of disability among condition groups. Other major surveys have less disability and accommodations content, smaller samples, or different question structure (condition and disability items are not linked by attribution). They have produced many fine multivariate analyses about the disabling impacts of conditions measured by coefficients (11,12,25–30). The fact that NHIS-D data were collected over a decade ago is not problematic, because differentials (group comparisons) tend to be very sturdy over time even if point estimates change.

Our analyses concerned real-world population groups. Each group had a key similarity (the disabling condition) and heterogeneity. People with arthritis disability had some target disabilities due to other conditions, and similarly for the HDDisab and BothDisab groups. The OthDisab group was especially heterogeneous, with plenty of variety in attributed conditions. Despite such heterogeneity, significant group differences emerged. This was a strong signal of distinctive impacts for arthritis and heart disease that would likely be more visible and robust in pure clinical groups (e.g., arthritis and no other condition, heart disease and no other condition).

The fact that only the main-cause condition was asked about for the target disabilities was fine, because analyses then concerned strongly-linked conditions and disabilities. We also took great care to use well-accepted ICD-9 codespans for arthritis and heart disease.

The main limitation of the NHIS-D is complex questionnaire structure. Analyses of condition-specific disability occurred only via attributed conditions for selected disabilities (17 for adult ages). The scope of those disability items is fortunately quite broad (ADL and IADL; PLIM, sensory, communication, cognitive, and emotional limitations; reasons for rehabilitation). The disability item set can look varied to readers, but it was purposely designed by the NCHS and discussed in NHIS-D documentation. The big difference between Phase One and Phase Two questionnaires can also confuse readers. Overall, the questionnaire structure requires painstaking description in analyses (50,51).

This analysis compared the leading chronic condition of midlife and late life (arthritis) and the leading cause of death (heart disease) for their population disability impact. Our hypothesis that arthritis disability is more extensive and bothersome than heart disease disability was

confirmed. People with arthritis disability endeavored to relieve disability with more accommodations, focusing more on self-management (equipment and rehabilitation) than on personal assistance and medical services. These differences stem partly from disease nature (arthritis is usually symptomatic and heart disease is often asymptomatic) and disease-modifying therapies (few now for arthritis, but an ample portfolio of drugs and surgery for heart disease).

People who had disabilities due to both arthritis and heart disease had the most limitations/disabilities of all groups studied. They blended the arthritis and heart disease accommodation strategies, using wide arrays of equipment and personal assistance and medical and other professional services. As population aging continues in the US, the percentage of people with both arthritis and heart disease and associated disability will likely rise.

Research studies of arthritis disability and heart disease disability are often separate, conducted by specialists of each condition. Although some data compendiums have information about numerous conditions, including arthritis and heart disease, comparisons are largely left to readers. To our knowledge, this is the first comprehensive comparison of disabilities and accommodations for US adults with disability due to arthritis and to heart disease. The disability impact of arthritis exceeded that of heart disease in all respects: number and scope of disabilities, accommodations used (buffers), and accommodations needed (barriers). With these results, arthritis specialists have further impetus for advocating basic, engineering, and rehabilitation research. Heart disease specialists now have a view of impacts for people living with heart disease measured on the same playing field.

Arthritis and heart disease do have an important similarity. People with arthritis disability and people with heart disease disability both have markedly more difficulties than people with disabilities from other conditions. Therefore, arthritis and heart disease are both premier conditions for medical and rehabilitation professionals to address in clienteles and for disability policy to place at the forefront.

AUTHOR CONTRIBUTIONS

Dr. Verbrugge had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study design. Verbrugge.
Acquisition of data. Verbrugge.
Analysis and interpretation of data. Verbrugge, Juarez.
Manuscript preparation. Verbrugge.
Statistical analysis. Verbrugge, Juarez.

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