Self-reported arthritis and mortality in aged males and females

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Abstract

We analyze the association between self-reported arthritis and mortality in the U.S. elderly disabled and non-disabled individuals using unique disability-focused data from the large-scale population-based National Long Term Care Survey. Males and females who reported arthritis/rheumatism have about 20% smaller risks of death than those who did not report those conditions. This inverse relationship is even more pronounced in disabled individuals. For females, this effect is age insensitive, while for males it is limited to ages below 85. Demographic and 19 major geriatric conditions have trivial effect on these risks supporting the view that a better survival of diseased individuals can be attributed to the effects of medical treatment. Given the widespread prevalence of arthritis/rheumatism and disability in elderly populations in the world and the increasing population of the elderly, these findings call for comprehensive analyzes of factors driving better survival and medical costs associated with extended lives.

INTRODUCTION

Major musculoskeletal conditions including arthritis represent an increasing burden on individuals and societies in terms of worsening health and increasing health care consumption with associated medical costs [1]. Millions individuals in the world are affected by various types of arthritis with osteoarthritis being the most frequent form among the elderly [2-7]. Projections show that the prevalence of arthritis in American population will likely substantially increase during the next 30 to 40 years, particularly among the elderly (a 2.3-fold increase in the U.S. to the year 2050 compared to 1.3 for adults aged 20 to 65) [6,8]. In the U.S., osteoarthritis is one of the most common causes of disability [9], which is as great as that attributable to cardiovascular disease and is greater than the risk attributable to any other health disorder in the elderly [2,10]. Global trends toward increasing life expectancy can make osteoarthritis the fourth leading cause of disability in the world by the year 2020 [1].

Rheumatoid arthritis is the second common type of arthritis (after osteoarthritis), which is, however, typical for younger individuals [11]. While rheumatoid arthritis has been extensively studied for its association with excessive mortality [12-15], knowledge about the association between mortality and osteoarthritis remains limited [16]. Generally, studies do not support association between increased risk of mortality and osteoarthritis [17,18]. Some studies examined mortality among individuals with self-reported arthritis. For example, no significant increase in mortality during 15 years of follow-up has been found among individuals, who reported arthritis or osteoarthritis as compared with those without these disorders [19]. The Epidemiological Follow-up of the National Health and Nutrition Examination Survey I also has found no significant association between arthritis and mortality excess [20]. The latter study even provides evidence for significant negative relationship between certain types of osteoarthritis and mortality. Some other studies, however, have reported positive associations between particular types of osteoarthritis and mortality [21]. The results are, therefore, controversial and require better understanding of the relationships between arthritis and survival chances, particularly in the elderly individuals.

In this paper, we analyze relationships between arthritis and mortality using unique disability-focused data from the National Long Term Care Survey (NLTCS) linked with Medicare vital statistics files to comprehensively assess the risk of death among individuals who reported and who did not report arthritis or rheumatism. Over-sampling of disabled individuals in the detailed NLTCS instruments provided an opportunity to assess these connections separately for disabled and non-disabled individuals. We also analyzed how major health conditions and demographic factors modulate these associations. Since the NLTCS participants answered a question concerning whether they have rheumatism or arthritis, no distinction was made between these disorders.

METHODS

The data are from the 1982, 1984, 1989, 1994, and 1999 NLTCS and the linked Medicare vital statistics files (from 1982 to August, 2003). The NLTCS is considered to be one of the best designed surveys to assess chronic disability (activity limitations that last 90+ days) in the U.S. elderly (65+) individuals [22,23]. To complete the NLTCS, a two-stage interviewing process was used. A screening interview assessing chronic disability was given to all participants. A detailed interview was given to i) those who reported at least one chronic impairment in (instrumental) activities of daily living, ii) institutionalized individuals, and iii) those who received a detailed interview in a previous survey. For each new wave of the survey, a cohort sample of about 5,000

persons was added to the surviving sample to replace deaths occurring since the previous survey and to ensure that the new sample was representative of the U.S. elderly population. Such a procedure ensures a valid longitudinal and cross-sectional design for the survey. The 1994 and 1999 surveys also explicitly included samples of individuals who were designated for detailed interviews before being give a test on disability (see [24] for details).

We performed sex-specific analyses assessing relative risks of death using Cox regression models adjusted for demographic (age, race, education, marital status) and self-reported health-related (diabetes, cancer, overweight/obesity, heart diseases, hypertension, stroke, paralysis, other permanent numbness/stiffness besides paralysis/rheumatism/arthritis, multiple sclerosis, cerebral palsy, epilepsy, Parkinson's disease, atherosclerosis, pneumonia, bronchitis, flu, emphysema, asthma, and fractures) conditions. In preliminary analyses, we found that the effect of disability is best quantified as presence of any impairment vs. no disability. Consequently, only dichotomous disability indicator is used.

Time of follow up measured was used as the time scale in the Cox regressions. We calculated relative risks of death which occurred during different periods of follow up. Representative results are given for short- (4 years) and long- (up to 22 years, depending on the wave) term periods. To test robustness of the estimates, we analyzed each of the five NLTCS waves and the entire pooled sample.

RESULTS

Table 1 shows descriptive characteristics for participants of each of the five NLTCS waves and for the pooled sample. The proportion of deaths that occurred within the 22-year observation period decreases as the length of this period decreases for the later waves. The sharp decrease of the percentage of disabled individuals in 1994 and 1999 NLTCSs is due to the change of the survey design when the "healthy" supplements were added (individuals who were designated to receive community detail interview before screening on disability). Given over-sampling of disabled individuals, the arthritis prevalence is consistent with the CDC estimates for self-reported arthritis in the U.S. for year 2001, which is about 60% among the elderly 65+ (both sexes), and higher among females [25].

Table 1 about here

Univariate regression analysis (Table 2, M0) shows that both males and females in the pooled sample who reported on arthritis/rheumatism have lower risks of death than those who did not report those conditions. These estimates are highly significant for females while for males they can be non-significant for long follow-ups. Survey-specific analysis shows that the relative risks of death are significantly lower for males and females with arthritis/rheumatism from the early NLTCS irrespective of the follow-up period. For the later NLTCS waves, these risks are less convincing. Given that the number of disabled individuals decreases in the later surveys, it is reasonable to expect that disability might affect the estimated risks. If so, then adjustment for disability might provide more convincing numbers for the later waves. Indeed, Table 2 (M1) shows that relative risks of death for females become significant irrespective of the NLTCS wave and follow-up period. For males who reported arthritis conditions, the risks of death are either significantly lower or the same as for those who did not report those conditions. Adjusting models for other possible confounders (demographic and health-related factors; see Section "Analysis") does not substantially change the estimates. For shorter follow-up periods, the relative risks of death for individuals with arthritis/rheumatism tend to be lower than those for longer periods.

Table 2 about here

Multivariate analysis applying the full model (M2) to the pooled sample for each sex stratified according to the disability status shows significantly lower risks of death for disabled males and females with arthritis/rheumatism compared to disabled individuals without arthritis (Table 3, Disability). For non-disabled males, the risks do not significantly differ between diseased and non-diseased groups; they, however, tend to be lower for diseased individuals. For non-disabled females, the risks of death are significantly lower for longer follow-up periods for those who reported arthritis conditions. Stratification for more homogeneous age groups shows that age is not an essential factor for females, while better survival for diseased males is limited to 85 years (Table 3, Age).

Table 3 about here

Stratification by disability and age (Table 4) shows that younger (65-84) males with arthritis and disability have significantly lower risks of death than disabled individuals without arthritis. For older males who are disabled and for non-disabled males irrespective of age, these risks do not significantly differ between diseased and non-diseased individuals irrespective of follow-up period. However, for the oldest-old non-disabled males (85+), the relative risks tend to be well below unity. Disabling conditions increase the chances of death of diseased oldest-old males making them the same irrespective of arthritis/rheumatism and follow-up period.

Table 4 about here

For non-disabled females (Table 4) for short-term follow-up periods, the risks of death do not significantly differ from unity. For longer follow-up periods, younger diseased females (65-74) have lower chances of death than non-diseased females. Contrarily to males, the oldest-old (85+) diseased and non-disabled females tend to have larger chances of death than non-diseased and non-disabled counterparts. For disabled females, the relative risks are highly significant being lower for females with arthritis or rheumatism.

DISCUSSION AND CONCLUSIONS

This study uses unique data from the large-scale, population-based NLTCS, which focuses on disabled individuals. The study shows very intriguing effect of arthritis/rheumatism and disability on survival. We found that both males and females having arthritis or rheumatism (self-reports; "Do you have arthritis or rheumatism?") tend to have significantly ***lower*** chances to die than those who do not suffer of those disorders. Disability is found to be a strong modulating factor which ***decreases*** the chances of death for diseased males and females. The estimates for disabled individuals are robust and highly significant, indicating, for instance, that diseased females and males have 24% (Relative Risk [RR]=0.76; 95% Confidence Interval [CI]: 0.71-0.82) and 19% (RR=0.81; CI: 0.75-0.88), respectively, lower chances for short-term deaths than non-diseased counterparts. For long-term deaths, the risks become practically identical for both sexes (RR=0.83; CI: 0.79-0.87 for females and RR=0.82; CI: 0.78-0.87 for males). For females, this effect is practically age insensitive. For males, however, this effect is limited basically to ages below 85. The risks of death for diseased individuals are lower both for deaths occurred during short- and long-term periods, i.e., this effect is long-standing. Other factors besides disability (i.e., demographic characteristics and 19 health-related conditions) do not alter the revealed relationships contributing little to their explanation.

One obvious explanation could be that arthritis causes less fatal types of disability compared to other factors (e.g., cardiovascular conditions, cancer). Therefore, disabled individuals with arthritis could be of better health than disabled individuals without arthritis. This

explanation is, however, not entirely convincing since: i) adjustments of the analyses for other potential causes of disability including more fatal diseases (e.g., cardiovascular conditions, cancer) had trivial effects on the estimates (compare Table 2, models 1 and 2), ii) for stratified samples (Tables 3 and 4), the risks were evaluated for model with adjustment for major health-related conditions for the elderly, and iii) this effect holds for individuals (females) having no disabilities (i.e., who are presumably in better health).

Another possible explanation for lower risks of death for individuals with arthritis could be as side-effects of treatment of these conditions. This possibility is supported by the fact that this effect is highly significant among disabled individuals. Given that arthritis/rheumatism are among the leading causes of disability in the elderly [2,9], such individuals can receive more attention from health care providers and, thus, experience better treatment due to their worse conditions than those who do not have disabilities. Typically, current treatment recommendations include the use of various drugs (e.g., acetaminophen, NSAIDs), exercise, education interventions, and joint arthroplasty [7,11]. Moreover, conventional regimes use intensive treatments that combine different types of treatments (e.g., drugs with exercises). Thus, intensive or radical (e.g., surgery) treatments can lead to improving health of such individuals, which increases their chances of surviving. On the other hand, the effects of certain drugs can promote better survival. For instance, treating arthritis with NSAIDs can reduce the risk of death from all causes, although such treatment can increase the risk of cardiovascular diseases [26]. Some anti-inflammatory compounds also appear to be factors positively affecting aging processes [27].

These findings have implications both for understanding perspectives of regular treatment of the elderly patients as a potential anti-aging intervention and for public health, caregivers, and policymakers. Immediate important concerns that should be addressed are which specific factors contribute to life span extension for these individuals and whether the life extension results in a corresponding high load on Medicare spending or not. These concerns, however, deserve separate analyses.

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Table 1. Descriptive characteristics of males (M) and females (F) participating in each of five NLTCS and of pooled sample of participants of all surveys (ALL)

Sample	Sex	N	ND4, %	ND22, %	Disability, yes, %	Arthritis, yes, %
1982	M	2166	43.8	97.1	87.7	63.5
	F	3921	32.7	95.3	93.1	78.6
1984	M	2038	39.9	95.7	83.3	65.1
	F	3891	31.0	92.4	89.1	77.0
1989	M	1470	39.3	89.7	77.2	64.2
	F	2992	29.2	85.1	85.6	76.3
1994	M	1741	36.3	65.9	57.3	58.0
	F	3347	29.3	60.3	68.9	70.7
1999	M	1805	35.3	35.3	56.8	51.7
	F	3341	30.5	30.6	69.5	67.1
ALL	M	9220	39.1	77.6	73.3	60.4
	F	17492	30.7	73.9	81.8	73.9

ND4(ND22)= number of deaths within 4 (up to 22) years of follow up after the respective interview.

Table 2. Cox proportional hazard models of the relative risks (RR) of deaths for males (M) and females (F) reported on arthritis or rheumatism vs. those who did not report those conditions.

Model	Follow-up, yrs	Sex	ALL		1982		1984		1989		1994		1999	
			RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
M0	4	M	0.91	0.85, 0.97	0.75	0.66, 0.85	0.78	0.67, 0.89	0.84*	0.71, 0.99	1.00†	0.86, 1.18		
		F	0.82	0.77, 0.86	0.68	0.60, 0.77	0.76	0.67, 0.86	0.83*	0.72, 0.97	0.83	0.73, 0.95		
	22	M	0.96†	0.91, 1.00	0.82	0.75, 0.90	0.87	0.80, 0.96	0.94†	0.84, 1.05	1.13†	1.00, 1.27	1.30	1.11, 1.53
		F	0.88	0.84, 0.91	0.82	0.76, 0.88	0.86	0.80, 0.93	0.87	0.79, 0.95	0.93†	0.85, 1.02	0.99†	0.87, 1.13
M1	4	M	0.82	0.77, 0.88	0.76	0.67, 0.87	0.76	0.66, 0.87	0.79	0.67, 0.93	0.84*	0.71, 0.98		
		F	0.74	0.70, 0.79	0.68	0.61, 0.78	0.75	0.66, 0.86	0.80	0.68, 0.92	0.71	0.62, 0.81		
	22	M	0.88	0.84, 0.92	0.82	0.75, 0.90	0.82	0.75, 0.90	0.90†	0.80, 1.01	0.93†	0.83, 1.05	1.01†	0.86, 1.18
		F	0.82	0.79, 0.86	0.82	0.76, 0.88	0.86	0.73, 0.93	0.81	0.74, 0.89	0.77	0.70, 0.85	0.80	0.70, 0.91
M2	4	M	0.81	0.76, 0.87	0.74	0.65, 0.86	0.74	0.63, 0.86	0.84†	0.70, 1.01	0.78	0.66, 0.94		
		F	0.77	0.73, 0.83	0.70	0.61, 0.80	0.80	0.70, 0.92	0.83*	0.70, 0.98	0.77	0.66, 0.89		
	22	M	0.85	0.81, 0.90	0.80	0.73, 0.88	0.79	0.71, 0.87	0.88*	0.78, 1.00	0.88†	0.77, 1.00	1.01†	0.85, 1.21
		F	0.83	0.80, 0.87	0.81	0.74, 0.88	0.88	0.81, 0.96	0.83	0.76, 0.92	0.79	0.71, 0.88	0.81	0.70, 0.93

* $0.01<p<.05$; † $p>0.05$; ALL denotes pooled sample of all five NLTCS waves; CI=Confidence Interval

Note that for 4-year and up to 22-year follow-up periods the relative risks for 1999 NLTCS are the same and, thus, are omitted for the 4-year follow-up

M0: univariate model which includes only arthritis/rheumatism

M1: M0 + age and disability indicator

M2: M1+ demographic factors and self-reported health-related conditions (see Section "Analysis")

Table 3. Multivariate Cox proportional hazard model (model 2 from Table 2) of the relative risks (RR) of deaths for pooled sex-specific samples of individuals reported on arthritis or rheumatism vs. those who did not report those conditions in groups stratified by disability status or age.

Stratification		Males				Females			
		Follow-up period, yrs							
		4		22		4		22	
		RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Disability	No	0.84†	0.69, 1.02	0.97†	0.86, 1.09	0.86†	0.68, 1.08	0.84	0.74, 0.95
	Yes	0.81	0.75, 0.88	0.82	0.78, 0.87	0.76	0.71, 0.82	0.83	0.79, 0.87
Age yrs	65-74	0.79	0.69, 0.90	0.85	0.78, 0.92	0.74	0.64, 0.85	0.79	0.73, 0.86
	75-84	0.77	0.69, 0.85	0.82	0.76, 0.89	0.79	0.71, 0.87	0.85	0.79, 0.91
	85+	0.96†	0.83, 1.11	0.95†	0.83, 1.07	0.79	0.72, 0.88	0.87	0.80, 0.94

† $p>0.05$

Table 4. Multivariate Cox proportional hazard model (model 2 from Table 2) of the relative risks (RR) of deaths for pooled sex-specific samples of individuals reported on arthritis or rheumatism vs. those who did not report those conditions in groups stratified by disability status and age.

Stratification		Males				Females			
		Follow-up period, yrs							
		4		22		4		22	
Disability	Age	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
No	65-74	0.85†	0.59, 1.21	0.98†	0.81, 1.19	0.74†	0.48, 1.13	0.74	0.61, 0.90
	75-84	0.87†	0.66, 1.14	0.98†	0.83, 1.16	0.86†	0.62, 1.20	0.85†	0.71, 1.02
	85+	0.68†	0.38, 1.21	0.65†	0.42, 1.02	1.28†	0.73, 2.26	1.32†	0.93, 1.88
Yes	65-74	0.78	0.67, 0.90	0.81	0.73, 0.89	0.73	0.62, 0.85	0.78	0.71, 0.85
	75-84	0.75	0.67, 0.84	0.79	0.72, 0.86	0.78	0.71, 0.87	0.84	0.78, 0.91
	85+	1.0†	0.85, 1.17	0.97†	0.84, 1.11	0.78	0.70, 0.87	0.85	0.78, 0.92

† $p>0.05$