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Received 7 January 2010; accepted in revised form 10 June 2010

Age and Ageing 2010; **39:** 738–745
doi: 10.1093/ageing/afq105
Published electronically 1 September 2010

Population attributable risk for functional disability associated with chronic conditions in Canadian older adults

Lauren Griffith[1], Parminder Raina[1], Hongmei Wu[2], Bin Zhu[3], Liza Stathokostas[4]

[1]Department of Clinical Epidemiology and Biostatistics, McMaster University, DTC-314, 1280 Main Street West, Hamilton, ON, Canada, L8S 4L8
[2]Department of Gerontology, Si Chuan University, West China Hospital, Clincial Medical School, Chengdu, Sichuan, People's Republic of China
[3]Division of Clinical Epidemiology, McGill University Health Centre, Montreal, Quebec, Canada
[4]School of Kinesiology, University of Western Ontario, London, ON, Canada

Address correspondence to: L. Griffith. Tel: (+1) 905 525 9140x22393; Fax: (+1) 905 522 7681. Email: griffith@mcmaster.ca

Abstract

Objectives: to investigate the population impact on functional disability of chronic conditions individually and in combination.
Methods: data from 9,008 community-dwelling individuals aged 65 and older from the Canadian Study of Health and Aging (CSHA) were used to estimate the population attributable risk (PAR) for chronic conditions after adjusting for confounding variables. Functional disability was measured using activity of daily living (ADL) and instrumental activity of daily living (IADL).
Results: five chronic conditions (foot problems, arthritis, cognitive impairment, heart problems and vision) made the largest contribution to ADL- and IADL-related functional disabilities. There was variation in magnitude and ranking of population attributable risk (PAR) by age, sex and definition of disability. All chronic conditions taken simultaneously accounted for about 66% of the ADL-related disability and almost 50% of the IADL-related disability.
Conclusions: in community-dwelling older adults, foot problems, arthritis, cognitive impairment, heart problems and vision were the major determinants of disability. Attempts to reduce disability burden in older Canadians should target these chronic conditions; however, preventive interventions will be most efficient if they recognize the differences in the drivers of PAR by sex, age group and type of functional disability being targeted.

Keywords: *chronic disease, functional disability, activities of daily living, risk factors, ageing, elderly*

Introduction

Functional disability has numerous implications for public health, including increased demand for health care [1], reduced quality of life [2], increased cost of care [3] and higher mortality [4]. The reported prevalence of functional disability varies due to the number and type of disabilities included in a study, the classification of these disabilities, the characteristics of the sample (e.g. age) and the manner in which data are collected [5]. In the Health and Activity Limitation Surveys (HALS), over 40% of Canadians 65 years and older reported having at least one disability, with approximately one-quarter of these seniors categorized as severely disabled [6].

Research in older adult populations has also demonstrated that chronic conditions are highly prevalent and, in fact, the most important determinants of disability [1, 7]. The impact of individual chronic conditions on disability in the elderly has long been studied [7–15]. Individually, musculoskeletal diseases (including arthritis), cognitive deficits, stroke, fractures, coronary heart disease and visual problems are strongly related to various functional disabilities in the elderly. However, multi-morbidity frequently occurs in older adults [16], and an increase in the number of diseases has been shown to be associated with an increase in the risk of disability for activities of daily living (ADLs) [17]. These relationships are becoming increasingly relevant to health-care policy and decision-making as the demographics of our population change. The implications of this demographic change have been recognized by governments resulting in a paradigm shift from a health-care system that is primarily focused on cure to the one focusing on health promotion and disease prevention [18].

To devise and implement strategies for preventing or delaying the onset of disability in the elderly, the first step is to understand the factors that lead to disability. Researchers, however, seldom examine the population impact of combinations of chronic conditions on disability in older adults, which can help guide policy. The purpose of this study was (i) to identify a set of chronic conditions that are independently associated with overall functional disability in (I) ADLs in community-dwelling older adults and (ii) to investigate the impact of chronic conditions (individually and in combination) on the total burden of functional disability in the study population using multi-factorial, model-based estimation of population attributable risk (PAR).

Methods

Study population

The Canadian Study of Health and Aging (CSHA) is a national, population-based study of dementia in Canadian adults aged 65 or older [19]. In the first wave of the CSHA in 1991, face-to-face interviews were conducted with 10,263 older adults across Canada: 9,008 were living in the community and 1,255 were living in institutions. The 10,263 comprised representative random samples of people aged 65 or over drawn in 39 urban centres and nearby rural areas in the 10 Canadian provinces [19]. The present analysis includes participants from the community-dwelling sample ($n = 9,008$) of the first wave of the CSHA.

Functional disability

Functional status was measured by trained staff using the Older Americans Resources and Services (OARS) Multidimensional Functional Assessment Questionnaire [20]. The OARS contains 14 items pertaining to functional disability in both basic ADLs and instrumental ADLs (IADLs). Functional disability was defined as needing help with, or an inability to perform, one or more of the seven basic ADL/IADL activities. Only participants with no missing ADL and IADL items were included in the analyses.

Thomas *et al.* [21] have proposed an alternative scoring of ADL and IADL items which results in three scales reflecting basic self-care, intermediate self-care and complex self-management (CSM). Functional disability for CSM was defined as needing help with or the inability to handle money, use the phone or self-medicate. Because we were particularly interested in understanding factors related to cognition in the older adults, we further examined the relationship between chronic disease and CSM.

Chronic conditions

Twelve chronic medical conditions were identified *a priori* as putative risk factors for functional decline: cognitive impairment, Parkinson's disease, hypertension, heart problems, stroke, diabetes, respiratory problems, hearing problems, vision problems, arthritis, foot problems and fracture. The conditions were self-reported, and caregivers provided proxy information when participants could not answer for themselves.

Cognitive status was assessed with the Modified Mini-Mental State examination [22]; a score ≤77 was used to define cognitive impairment. Heart problems included a history of hardening of the arteries, heart troubles or other blood diseases. Respiratory problems included asthma, pneumonia, tuberculosis, emphysema, bronchitis and breathing problems. Vision problems included eye troubles that could not be relieved by glasses. Foot problems included any kind of foot or ankle problem. Fracture was used as a generic term to include any kind of fracture.

Sociodemographic factors

Sociodemographic factors included age, gender, marital status, level of education and living situation. Age was categorized into three groups: 65–74 years, 75–84 years and ≥85 years. Marital status was also categorized into married, never married and widowed/separated/divorced. Level of education was divided into two categories: 0–9 years and

≥10 years. Living situation was categorized as living alone or living with someone.

Statistical analysis

We reasoned that chronic conditions that were both prevalent and independently associated with both ADL and IADL would be the most relevant from a public health perspective (i.e. associated with a higher PAR). We chose chronic conditions that were present in at least 10% of the population and had a statistically significant relationship with both types of functional disability (ADL and IADL) using multivariable logistic regression. These included cognitive impairment, heart problems, diabetes, arthritis, hearing problems, vision problems, respiratory problems and foot problems. The remaining chronic conditions (hypertension, stroke, Parkinson's disease and fractures) were combined into one covariate named 'comorbidity'. Comorbidity was dichotomized into the presence of at least one of the remaining chronic conditions.

Model-based, adjusted estimations of PAR were computed to explore the population impact of selected chronic conditions on functional disability while adjusting for relevant covariates [23]. The PAR and 95% confidence intervals were estimated based on a series of unconditional multivariable logistic regression models using interactive risk attributable program software (US National Cancer Institute, 2002). PARs were calculated for individual conditions and combinations of conditions. PARs were ranked and compared qualitatively.

Results

Study population

Of the 9,008 community-dwelling CSHA-1 participants, 8,858 (98.3%) completed the screening questionnaire and had complete ADL and IADL data. The amount of missing data for any ADL or IADL item did not exceed 0.5%. Although most demographic and chronic condition characteristics were similar, those not included in the analysis tended to be older, were more likely to have never been married and more likely to have cognitive impairment or Parkinson's disease ($P < 0.05$).

Descriptive analysis

The mean age of included participants was 75.7 ± 7.1 years and 59.5% were female. The majority of participants were either married (51.3%) or separated, widowed or divorced (41.7%); 36% lived alone. The mean number of years of formal education was 10.1 ± 3.9 years.

The distribution of the 12 chronic conditions and functional disability (ADL, IADL and CSM) are presented in Table 1. The most prevalent chronic condition was arthritis (56.5%) and the least prevalent was Parkinson's disease (1.3%). The rates for most chronic conditions differed by age, although arthritis was the most prevalent condition in all age groups.

Overall, the prevalence of functional disability in ADL was 15.4%. There was a greater overall prevalence of IADL disability in this population (33.4%), and 11.4% of the study population had difficulty with CSM tasks. There was a statistically significant ($P < 0.05$) increase in the prevalence of all functional disabilities (ADL, IADL and CSM) with increasing age.

Identifying chronic conditions with public health relevance

The associations between all 12 chronic conditions were statistically significant for each category of functional disability except for the association between hypertension and ADL. Eight of the remaining 11 chronic conditions (cognitive impairment, heart problems, diabetes, arthritis, hearing problems, vision problems, respiratory problems and foot problems) also had a prevalence of 10% or greater and thus were included in the PAR analyses.

Model-based estimation of PAR

PARs associated with single chronic conditions

The presence of foot problems, arthritis, cognitive impairment, heart problems and vision contributed the most to PAR in ADL-related disability (Table 2). Foot problems and arthritis tended to be the strongest drivers of ADL-related disability in the youngest age groups, whereas cognitive impairment had the highest PAR in those aged 85 or older. There were differences in the relative ranking of PARs among male and female participants, especially in those aged 75–84.

In general, the PARs for IADL tended to be lower than those for ADL. In the youngest age group, individually heart problems and respiration yielded the highest PARs for IADL-related disability in females and males, respectively. Cognitive impairment was associated with higher PARs for IADL-related disability only in the older age groups.

In our subanalysis of CSM items, cognitive impairment consistently contributed the most to PARs for females and males across all age groups (data not shown; see Supplementary data available in *Age and Ageing* online). Along with foot problems, hearing and vision also emerged as chronic conditions contributing to the top ranking of PARs related to CSM-related disability.

PARs associated with multiple chronic conditions

The two highest ranking PARs for functional disabilities in ADL, IADL based on combinations of two and three chronic conditions are presented in Table 3. Again, PARs for IADL for two and three conditions were lower compared with the PARs for ADL. Of the eight chronic conditions included in the analysis, five chronic conditions (foot

Table 1. The distribution of chronic conditions and functional disability in the study population, stratified by age

	Total population ($n = 8,858$)	Age 65–74 ($n = 3,911$)	Age 75–84 ($n = 3,673$)	Age ≥ 85 ($n = 1,274$)
Chronic conditions, *n* (%)				
No chronic conditions	812 (9.2)	528 (13.5)	243 (6.6)	41 (3.2)
One chronic condition	1,684 (19.0)	954 (24.4)	588 (16.0)	142 (11.2)
Two or more chronic conditions	6,362 (71.8)	2,429 (62.1)	2,842 (77.4)	1,091 (85.6)
Cognitive impairment	1,576 (17.8)	330 (8.4)	716 (19.5)	530 (41.6)
Hypertension	2,987 (33.9)	1,313 (33.6)	1,266 (34.6)	408 (32.4)
Heart problems	2,676 (30.3)	1,036 (26.5)	1,211 (33.0)	429 (34.0)
Stroke	428 (4.9)	153 (3.9)	203 (5.5)	72 (5.7)
Parkinson's disease	118 (1.3)	36 (0.9)	63 (1.7)	19 (1.5)
Diabetes	857 (9.7)	400 (10.2)	357 (9.8)	100 (7.9)
Arthritis	4,991 (56.5)	2,072 (53.1)	2,150 (58.6)	769 (60.7)
Hearing problems	2,563 (29.0)	804 (20.6)	1,185 (32.3)	574 (45.3)
Vision problems	2,705 (30.6)	777 (19.9)	1,317 (35.9)	611 (48.2)
Respiratory problems	1,544 (17.3)	639 (16.4)	684 (18.7)	205 (16.2)
Foot problems	2,935 (32.9)	1,088 (27.9)	1,307 (35.6)	512 (40.4)
Fracture	529 (5.9)	217 (5.6)	211 (5.8)	96 (7.6)
Functional disability, *n* (%)				
ADL	1,364 (15.4)	249 (6.4)	629 (17.1)	486 (38.2)
IADL	3,397 (33.4)	822 (21.0)	1,620 (44.1)	955 (75.0)
CSM	1,012 (11.4)	172 (4.4)	440 (12.0)	400 (31.4)

The sums of the strata do not add up to the total number of participants because of missing values.

problems, arthritis, cognition, heart and vision) consistently appeared in the top two ranking for both ADL- and IADL-related disabilities. For IADL-related disability, respiration also emerged as an important driver of PAR in combination with other chronic conditions. The drivers of PAR differed by both age and sex. The incremental gain in PAR when considering combinations of four or more conditions was marginal (results not shown). The combination of cognition and vision yielded the highest PARs in CSM-related disability for most age groups for both females and males (data not shown; see Supplementary data available in *Age and Ageing* online). Cognition and vision were most frequently a part of the three chronic-condition combinations.

Discussion

When considering each chronic condition separately, we found foot problems, arthritis and heart problems had the most consistently high PARs for disability (ADL and IADL) in both sexes and all age groups. Like other researchers [14, 15], we found that arthritis had its largest relative impact on the PAR for functional disability based on performing both ADL and IADL items in the age groups <85 years. Cognitive impairment and vision problems were also related to increased functional disability in the older age groups, especially when disability was defined as difficulty with CSM. Although a small number of chronic conditions were identified as the primary drivers of PAR (i.e. foot problems, arthritis, heart problems, cognition and vision), there was variation in PAR by age, sex and definition of disability.

The heterogeneity in PAR we found by sex, age and definition of functional ability may partially explain the discrepancies among studies that have investigated the contribution of individual chronic conditions to the total burden of disability in a population [7–9, 11–15]. For example, one study from the USA demonstrated that knee osteoarthritis contributed to functional limitations in at least four IADL tasks performed by the elderly [11]. However, another study from the Netherlands [9] showed no such association when looking at functional limitation based on a six-metre walk test. One of the main differences between these two studies is that over 80% of the US study population was less than 80 years old, whereas the Dutch study included only participants over 85 years of age.

We also found higher PARs for cognitive impairment in the older age groups and for men for disability in terms of ADL and IADL. Other studies showed similar results for the population impact of cognitive impairment on functional disability. In a Dutch study [4], cognitive impairment (MMSE ≤1 8) was found to account for 24% of walking disability in the oldest group of elderly and two studies from Hong Kong [12] and Sweden [10] indicated that dementia had a PAR of 23.2 and 49.2% for functional disability in the elderly based on ADL. Dodge *et al.* [13] also reported PARs ranging from 18.7 to 36.3% for different components of ADL among community-dwelling Japanese elders. However, in the Framingham Study, much lower estimates of PAR were reported ranging from 3.4 for difficulties with housekeeping to 8.5 for difficulties carrying bundles [10]; for three of the IADL items (stair climbing, walking a mile and heavy home chores), they found no association between cognitive impairment and functional disability. Of the four positive studies, one included only participants 85 years and over [4], one included participants 75 years and over [12] and one included participants 70 years and older, although over 40% of the population was

Table 2. PAR of ADL- and IADL-related functional disabilities for each chronic condition individually and for all chronic conditions combined stratified by age and sex

Chronic condition	ADL						IADL					
	Age 65–74		Age 75–84		Age ≥85		Age 65–74		Age 75–84		Age ≥85	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Foot problems	**33.8 (21.1, 46.4)**	**29.7 (14.3, 45.1)**	**24.8 (17.1, 32.4)**	10.5 (0.3, 20.6)	*15.7 (8.7, 22.8)*	*19.4 (5.9, 32.9)*	***13.0 (7.3, 18.7)***	9.4 (2.6, 16.2)	*9.5 (6.0, 13.1)*	0.6 (−3.8, 5.0)	**4.2 (1.4, 7.1)**	*8.1 (2.8, 13.5)*
Arthritis	***18.9 (−2.1, 40.0)***	*24.4 (1.4, 47.4)*	*21.3 (9.5, 33.1)*	***10.8 (−3.4, 25.0)***	7.9 (−2.5, 18.3)	10.8 (−9.0, 30.6)	*18.2 (9.0, 27.4)*	***10.4 (−0.25, 21.0)***	**10.8 (5.2, 16.3)**	2.7 (−4.1, 9.5)	***3.4 (−1.2, 7.9)***	***7.8 (−0.3, 15.9)***
Cognitive impairment	10.9 (4.6, 17.3)	12.6 (3.0, 22.3)	9.9 (5.6, 14.2)	**25.2 (16.0, 34.3)**	**21.3 (15.1, 27.5)**	**27.4 (11.3, 43.6)**	5.4 (2.8, 7.9)	7.3 (2.9, 11.6)	7.7 (5.6, 9.7)	**12.4 (8.3, 16.5)**	*3.5 (0.7, 6.2)*	**15.5 (7.7, 23.3)**
Heart problems	*24.1 (12.8, 35.4)*	***18.9 (0.02, 37.8)***	7.9 (1.1, 14.8)	3.8 (−7.0, 14.6)	***7.8 (1.9, 13.9)***	9.5 (−3.0, 22.0)	**18.7 (13.8, 23.7)**	**14.0 (5.6, 22.4)**	***9.3 (6.3, 12.4)***	***8.1 (3.2, 13.1)***	3.2 (0.9, 5.6)	1.2 (−3.4, 5.8)
Vision problems	4.9 (−5.0, 14.9)	17.2 (4.4, 30.0)	***14.7 (7.4, 22.0)***	*18.8 (8.7, 29.0)*	1.0 (−7.0, 9.1)	***15.0 (−0.4, 30.4)***	5.9 (1.6, 10.2)	9.6 (3.9, 15.4)	9.0 (5.7, 12.3)	*9.3 (4.6, 14.0)*	2.6 (−0.8, 5.9)	4.5 (−2.2, 11.1)
Respiration	11.3 (3.2, 19.4)	17.9 (3.0, 32.7)	6.1 (1.9, 10.4)	0 (−8.5, 7.8)	1.1 (−2.5, 4.7)	3.9 (−5.8, 13.5)	8.3 (4.7, 11.8)	*12.2 (5.8, 18.6)*	4.6 (2.7, 6.5)	7.8 (4.0, 11.6)	0.5 (−0.6, 1.7)	2.1 (−1.7, 5.9)
Hearing	3.3 (−5.0, 11.5)	8.1 (−6.6, 22.9)	3.0 (−2.7, 8.6)	7.2 (−4.2, 18.6)	6.9 (0.3, 13.5)	0 (−32.7, 7.5)	1.9 (−1.7, 5.5)	6.1 (−0.7, 13.0)	3.3 (0.8, 5.8)	3.2 (−2.2, 8.5)	1.6 (−1.1, 4.3)	0.8 (−7.5, 9.2)
Diabetes	7.8 (1.9, 13.8)	7.3 (−2.5, 17.0)	5.2 (2.1, 8.3)	0 (−6.3, 4.5)	0.4 (−1.7, 2.4)	0 (−9.4, 6.5)	2.6 (0.02, 5.2)	5.5 (1.0, 9.9)	1.7 (0.5, 3.0)	1.6 (−0.8, 4.1)	0.3 (−0.6, 1.1)	1.8 (−0.8, 4.3)
All chronic conditions	74.4 (65.5, 83.3)	79.1 (69.3, 89.0)	68.2 (60.7, 75.7)	59.3 (46.0, 72.6)	57.3 (45.8, 68.8)	60.4 (40.4, 80.3)	61.8 (55.0, 68.6)	58.0 (49.3, 66.7)	56.3 (50.0, 62.6)	43.4 (33.9, 52.8)	25.6 (15.5, 35.6)	45.3 (29.2, 61.4)

For each subgroup, the highest PAR is identified by bold, the second highest in italic and the third highest in bold italic. PARs adjusted for all other chronic conditions, marital status, education, living situation and comorbidity.

80 years or older [16]. Of the positive studies, the Azuchi study had the lowest average age of 74.1 [13]. In the Framingham study [10], over 40% of the population was under 70 years of age. We found that the PAR for cognitive impairment was not ranked in the top three relative to other chronic conditions for ADL or IADL in participants 65–74 years old.

The relative importance of chronic conditions on PAR also depended on the definition used for functional limitation. Perruccio *et al.* [24] found a similar result when examining the relative contribution of 13 chronic conditions to activity limitations, self-rated health and physician consultations. When we focused on disability with respect to ADL, we found much stronger relationships with musculoskeletal and cardiovascular conditions (e.g. foot problems, arthritis and heart problems). In contrast, PARs for CSM was more strongly related to impairment in brain and sensory functions (e.g. cognitive impairment, vision and hearing). This may reflect a different mechanism in which cognitive impairment affects ADL and the non-CSM IADL domains (i.e. relating to balance, falls) compared with CSM (brain function). It may be that people are more able to mobilize an adaptive compensating mechanism to maintain physical functioning than brain functioning until there are a number of concurrent chronic conditions which is more common in the older age groups [25].

We explored the effects of combinations of chronic conditions which more accurately reflect the true picture of ageing [26]. Many studies suggest that interactions among specific diseases are of importance at an individual level. [16, 17, 27, 28]; however, there is little evidence that comorbidity affects disability at the population level. Only one study from the Netherlands reported that six selected chronic conditions (i.e. musculoskeletal diseases, lung diseases, neurological disorders, heart disease, diabetes and cancer) accounted for 33.7% of the total prevalence of mobility disability in the Dutch Population (aged ≥16) [8]. We found that a combination of foot problems, arthritis and heart problems were associated with the most functional disability based on ADL and IADL limitations in older adults. The prevalence of these three conditions can be reduced through interventions. Attempting to reduce the prevalence of other conditions such as cognitive impairment is a much more difficult task and, if successful, may not result in the same dramatic decrease in the total burden of disability.

This study draws upon a large-scale national population-based cohort that has a high participation rate using a multi-causal model-based estimation of PAR. Compared with previous investigations, we were able to estimate PARs associated with various combinations of chronic conditions while controlling for potential confounding factors. The large sample size allowed us to stratify the analysis to assess differences in the relative impact of the seven chronic conditions by sex, age and definition of functional limitation.

Our study also has some limitations. First, there is the issue of the accuracy of self-reported medical conditions in large-scale community surveys. Although we have not been

Table 3. PAR of ADL- And IADL-related functional disabilities for combinations of chronic conditions, stratified by age and sex

Combinations of chronic conditions	ADL						IADL					
	Age 65–74		Age 75–84		Age ≥85		Age 65–74		Age 75–84		Age ≥85	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Two conditions												
Foot + arthritis	46.8 (30.3, 63.3)	46.5 (27.1, 65.9)	41.9 (31.5, 52.4)						20.4 (14.4, 26.5)		8.3 (2.8, 13.7)	
Foot + cognition				34.1 (22.7, 45.5)	36.8 (27.8, 45.7)	44.1 (25.6, 62.5)					8.2 (3.6, 12.8)	24.5 (13.9, 35.2)
Foot + heart	50.0 (38.2, 61.8)	43.1 (26.0, 60.1)					30.6 (24.1, 37.1)				8.2 (4.1, 12.3)	
Foot + vision			36.9 (28.3, 45.6)									
Cognition + vision				40.7 (29.3, 52.1)		39.7 (21.0, 58.5)				21.6 (15.5, 27.8)		
Cognition + arthritis				34.1 (19.4, 48.8)								24.0 (11.7, 36.3)
Cognition + heart					29.1 (20.4, 37.8)					20.5 (14.1, 26.9)		
Arthritis + heart							35.3 (26.2, 44.5)	23.5 (11.8, 35.3)	20.4 (13.9, 26.9)			
Heart + respiration								24.8 (15.7, 34.0)				
Three conditions												
Foot + cognition + arthritis			48.9 (38.8, 59.1)		43.6 (32.0, 55.2)	51.3 (30.8, 71.9)					12.6 (5.5, 19.7)	33.4 (19.4, 47.4)
Foot + cognition + heart	56.5 (45.6, 67.5)				43.8 (34.2, 53.4)						12.5 (6.7, 18.4)	
Foot + cognition + vision				48.1 (36.4, 59.7)		54.0 (35.2, 72.9)						29.7 (16.6, 42.8)
Foot + arthritis + heart	60.1 (46.9, 73.3)	56.5 (37.9, 75.0)					45.4 (37.0, 53.8)		30.2 (23.7, 36.8)		12.7 (6.3, 19.1)	
Foot + arthritis + vision		56.0 (37.9, 74.0)	51.7 (42.0, 61.5)						29.6 (23.0, 36.2)			
Cognition + arthritis + vision				47.9 (33.5, 62.3)								
Foot + arthritis + chest		57.1 (41.4, 72.9)										
Arthritis + vision + heart									29.6 (22.7, 36.6)			
Arthritis + heart + respiration							42.3 (33.6, 51.0)	33.4 (22.1, 44.6)				
Cognition + vision + heart										29.5 (22.0, 36.9)		
Cognition + vision + respiration										29.3 (22.3, 36.2)		
Vision + heart + respiration								32.9 (23.7, 42.1)				

For each subgroup, the two highest PARs for a combination of two and three chronic conditions are reported. PARs adjusted for all other chronic conditions, marital status, education, living situation and comorbidity.

able to examine physician-diagnosed conditions, self-reported diagnoses have shown to be reliable and are standard in epidemiologic research [29]. In fact, our study had similar levels of multimorbidity compared with other population-based studies using physicians' records to define morbidity [30]. As well, we restricted our analysis to 12 chronic conditions determined *a priori* to be related to physical functioning. Other mental health conditions, such as depression, were not included in our analysis.

Research concerning the population impact of specific chronic conditions, individually or in combination, on task-specific disabilities in the elderly is informative for public health intervention strategies. Our findings suggest that in community-dwelling older adults, foot problems, arthritis, cognitive impairment, heart problems and vision were the major determinants of disability; however, interventions will be most efficient if they are tailored to recognize the differences in the drivers of PAR by sex, age group and the type of functional disability being targeted.

Key points

- Foot problems, arthritis, heart problems, cognition and vision were identified as the primary drivers of PAR for disability.
- There was, however, variation in PAR by age, sex and definition of disability.
- Effective interventions should be tailored to the drivers of PAR by sex, age group and the type of disability being targeted.

Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

Acknowledgments

We would like to thank all of the investigators at the McMaster Evidence-based Practice Center, Department of Clinical Epidemiology & Biostatistics, McMaster University. We would especially like to thank Rachel Morris for her analytic assistance in this project. Lauren Griffith is a Sun Life Research Fellow, funded by Sun Life Assurance Company of Canada. Parminder Raina is the recipient of a Canadian Institutes of Health Research Investigator award, an Ontario Premier's Research Excellence award and holds a Labarge Chair in Research and Knowledge Application for Optimal Aging at McMaster University.

Conflicts of interest

None declared.

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Received 9 January 2010; accepted in revised form 2 June 2010