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Research Article

The Association Between Self-Reported and Performance-Based Physical Function With Activities of Daily Living Disability in the Canadian Longitudinal Study on Aging

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Abstract

Background: Physical function limitations precede disability and are a target to prevent or delay disability in aging adults. The objective of this article was to assess the relationship between self-report and performance-based measures of physical function with disability.

Methods: Baseline data (2012–2015) from the Canadian Longitudinal Study on Aging (n = 51,338) was used. Disability was defined as having a limitation for at least one of 14 activities of daily living. Physical function was measured using 14 questions across three domains (upper body, lower body, and dexterity) and five performance-based tests (gait speed, timed up and go, single leg stance, chair rise, and grip strength). Logistic regression was used to assess the relationship between physical function operationalized as (i) at least one limitation, (ii) presence or absence of limitations in each individual domain/test, and (iii) number of domains/tests with limitations, with disability.

Results: In the 21,241 participants with self-reported function data, the odds of disability were 1.87 (95% CI: 1.56–2.24), 6.78 (5.68–8.08), and 14.43 (11.50–18.1) for one, two, and three limited domains, respectively. In the 30,097 participants with performance-based measures of function, the odds of disability ranged from 1.53 (1.33–1.76) for one test limited to 14.91 (11.56–19.26) for all five tests limited.

Conclusions: Both performance-based and self-report measures of physical function were associated with disability. Each domain and performance test remained associated with disability after adjustment for the other domains and tests. Disability risk was higher when the number of self-report domains and performance-based limitations increased.

Keywords: Activities of daily living, Performance tests, Gait speed, Grip strength, CLSA.

Age-related disabilities have considerable personal and public health implications including increased demand for health care (1), reduced quality of life (2), and higher mortality (3). Within the literature on aging, disability is most commonly operationalized using activities of daily living (ADL) and/or instrumental activities of daily living (IADL) where ADL items reflect basic self-care, such as bathing and feeding, and IADL items focus on more complex tasks, such as shopping and managing money (4). Though the prevalence of ADL/IADL disability varies widely based on the population and operationalization of the variables, it was estimated that more than 6% of community-dwelling seniors needed help to carry out ADLs, whereas more than 15% reported difficulty with IADLs; numbers that increase rapidly with advancing age and that are higher in females than males (5–8). Given the importance of maintaining independence in older adults, investigating the disablement process remains a priority for gerontology research.

On the basis of Nagi's conceptualization of the disablement process, the distinction between functional limitation and disability is that functional limitations are restrictions in physical and mental activities which become disabilities when they interfere with activities of daily life (9,10). The literature supports this causal pathway with studies showing that declines in functional performance precede disability (9–11). Consequently, physical function is a frequent target for interventions designed to prevent or mitigate late-life disability.

Physical function can be measured using either self-reported measures or physical performance tests. Both types of outcomes have been shown to predict ADL and IADL disability in older adults (12,13). However, there are gaps in the literature which limit our understanding of the relationship between function and disability. There are only a small number of studies that include both self-reported physical function and performance-based tests in the context of disability and it is unclear if the association between function and disability differs by how function is measured. There is also a paucity of adequately powered studies assessing if the association between function and disability for each domain and test remains statistically significant after adjustment for the others domains or tests. Better understanding if and how different performance domains and tests can be used together in cross-sectional data will inform model building for future longitudinal studies assessing the ability of function to predict future disability. This data will be key for the effective screening of individuals requiring interventions to delay the onset of disability and loss of independence.

The objectives of this study were to (i) describe the prevalence of ADL/IADL disability and self-reported physical function limitations in Canadian men and women; (ii) determine the association between both self-reported and performance-based physical function with ADL/IADL disability; and (iii) determine if each domain of self-reported physical function and each performance-based functional test is associated with ADL/IADL disability after adjustment for the other domains and performance tests.

Methods

Study Design and Sample

Baseline data (2011–2015) including 51,338 participants from the Canadian Longitudinal Study on Aging (CLSA) was used. There were 21,241 participants from all 10 provinces who completed questionnaires about social, physical, and mental health by telephone. There were 30,097 participants selected based on their geographic proximity to 11 CLSA Data Collection Sites across Canada that were seen in their homes as well as the Data Collection Site which allowed for the collection of additional physical, cognitive, and biological measures that could not be collected by telephone A maintaining contact questionnaire was administered by phone approximately 18 months after baseline data collection. Details on the study design have been described elsewhere (14).

Assessment of ADL/IADL Disability

ADL/IADL disability was assessed in both the telephone and in-person cohorts using a questionnaire adapted from the Older Americans Resources and Services Multidimensional Assessment Questionnaire (15). The questionnaire consisted of seven items assessing basic ADL and seven items assessing IADL (16). Using the same methods as the Canadian Community Health Survey (17), for each question, participants were considered to have a limitation if they responded that they needed assistance to complete a task or could not complete the task with assistance. For the item "trouble making it to the bathroom in time," participants unable to make it to the bathroom in time at least one or twice a week were considered limited. Participants were considered to have an ADL disability if they required assistance with at least one ADL, an IADL disability if they required assistance with at least one IADL, or overall ADL/IADL disability if they required assistance with at least one ADL or IADL.

Assessment of Physical Function

Self-reported

In the phone-only cohort, self-reported function was measured using 14 questions adapted from the Framingham Disability Study, Established Populations for Epidemiologic Studies of the Elderly study, the Disabilities of the Arm, Shoulder, and Hand questionnaire, as well as items from questionnaires developed by Nagi, and Rosow and Breslau (16,18). For each physical function question, participants were considered to have a limitation if they completed the task with difficulty, were unable to do the task, or did not do the task on doctor's orders. An exploratory factor analysis was used to determine the underlying domains of physical function within the self-reported function questionnaire. The resulting domains included upper body, lower body, and dexterity-related tasks.

Performance-based functional limitations

In the in-person cohort, physical function was measured using the 4-m walk test, timed up and go, single leg stance test, chair rise test, and grip strength test (19). The total time taken to complete the gait speed test was divided by four to derive speed in meter per second. The better of the two times for the single leg stance test and the highest value of the three grip strength tests were used for analyses. Participants in the lowest age and sex-specific quintile for gait speed, single leg stance test, and grip strength and participants in the highest age and sex-specific quintile for timed up and go and the chair rise test were considered to have low performance as well as those contraindicated for the task. Between 0.4% and 4.8% of participants were contraindicated for each performance task.

Statistical Analyses

The CLSA provides inflation weights and analytical weights, which were used for prevalence estimates and regression modeling, respectively, that allow the results to reflect the population of Canada. Separate inflation and analytical weights are calculated for the 21,241 participants with questionnaire-based physical function data and the 30,097 participants with performance-based tests (20). All statistical analyses were completed using SAS (version 12.3). Multiple imputation (10 imputations) using the predictive mean matching technique was used for missing data (21). In both cohorts, the percentage of missing data for any variable was less than 12%. All prevalence estimates were calculated using inflation weights and stratified by age group (45–54, 55–64, 65–74, and 75 years and older) and sex.

Relationship between self-reported physical function and disability

In the 21,241 participants with self-reported physical function data, the relationship between physical function (independent variable) and disability (dependent variable) was investigated. Disability was defined as (i) any ADL or IADL disability, (ii) any ADL disability, (iii) any IADL disability. Three methods were used to categorize physical function. Method 1: Participants were dichotomized as having at least one limitation in any of the three domains (upper body, lower body, and dexterity), or no functional limitations. Method 2: For each of the three function domains (upper body, lower body, and dexterity), participants were dichotomized as having a limitation or not having a limitation. Each domain was included as a separate variable in the model. Method 3: Participants were classified into four categories based on the number of domains (upper body, lower body, and dexterity) they had a limitation in (0, 1, 2, or 3). The

association between physical function and disability was examined separately using each of the three methods for categorizing physical function and for each of the following disability outcomes (i) ADL and IADL disability combined, (ii) ADL disability, and (iii) IADL disability.

Relationship between performance-based physical function and disability

For the 30,097 participants who completed the performance tests, the relationship between physical function (independent variable) and disability (dependent variable) was investigated. Three methods were used to categorize the functional status of participants. Method 1: Participants with performance in the lowest quintile for at least one of the performance tests. Method 2: Participants in the lowest quintile versus not in the lowest quintile for each of the five performance tests included as separate variables in the same model. Method 3: Number of performance tests in the lowest quintile. The association between physical function and disability was examined separately using each of the three methods for categorizing physical function and for each of the following disability outcomes (i) ADL and IADL disability combined, (ii) ADL disability, and (iii) IADL disability.

The models were adjusted for other factors associated with physical function and disability based on the literature (13): age (45–54, 55–64, 65–74, and 75 years and older); sex; presence or absence of the following chronic health conditions: (i) osteoarthritis, (ii) osteoporosis, (iii) chronic obstructive pulmonary disease, (iv) heart disease (including angina and myocardial infarction), (v) hypertension, (vi) peripheral vascular disease, (vii) diabetes, (viii) cerebrovascular disease (stroke/cerebral vascular event, transient ischemic attack), (ix) neurological (Parkinson's disease, multiple sclerosis, epilepsy, and migraine headaches), (x) ophthalmolgical (cataracts, glaucoma, macular degeneration), (xi) kidney disease; (xii) cancer (all cancers other than non-melanoma), (xiii) depression (a score of 10 or more on the Center for Epidemiologic Studies Short Depression Scale (22)); cognitive status (a standardized score of <35 on the mental alternation test, mean of 50, and *SD* of 10) (23,24); self-rated pain or discomfort (participants with mild, moderate, or severe pain); annual household income (<$20,000, $20,000–$50,000, $50,000–<$100,000, $100,000–$150,000, or >$150,000); body mass index (underweight, normal weight, overweight, or obese as classified by the World Health Organization); physical activity (using the Physical Activity Scale for the Elderly scale dichotomized as meeting the World Health Organization's guidelines for physical activity of at least 150 minutes of moderate-intensity physical activity through the week or at least 75 minutes of vigorous-intensity physical activity per week (25)); and social support availability (measured using the Medical Outcomes Study Social Support Survey with participants in the lowest quintile of scores considered to have limited social support (26). All models were adjusted for all of the listed covariates.

To test for multicollinearity in the performance test-based data, variance inflation factors were assessed using the linear regression technique suggested by Allison, and all values (<2.0) were below the recommended value of 10 indicating that collinearity was not present (27,28). The analytical weights for the 21,241 participants were used for self-reported physical function and the analytical weights for the 30,097 participants with performance-based measures were used. To correctly apply the analytical weights in the regression models, a stratified analysis was run using a variable indicating the sampling strata (province, low vs not low education level, and if participants conducted interviews in person or over the phone). Using weighted data allows the results from the self-reported physical function to be more generalizable to the Canadian population.

Results

Participant Characteristics

Table 1 displays the participant characteristics for the 21,241 participants with self-reported physical performance data, and 30,097 with performance testing. In the self-report cohort, 48.5% (n = 10,406) participants were male and 49.1% (n = 14,777) were male in the performance testing cohort (unweighted values).

Disability Prevalence

The prevalence of disability defined by having at least one ADL or IADL limitation was 9.7% in both the self-report function cohort and the performance testing cohort (Table 2). The prevalence of disability increased with age, and women experienced a higher prevalence of disability than men across all age groups (Supplementary Table 1). A similar percentage of participants had at least one ADL limitation (5.6%) and at least one IADL limitation (6.5%) in the self-report cohort, whereas the prevalence of ADL limitations were modestly higher (6.8%) in the performance test cohort compared to IADL limitations (5.4%).

Self-reported Functional Limitation Prevalence

The prevalence of a functional limitation defined by difficulty in at least one physical function task was 49.0% (Table 2). The prevalence of a lower body limitation (41.6%) was higher compared to an upper limitation (25.4%) or dexterity limitation (7.0%). The prevalence of functional limitations increased across age groups and for each of the four age categories, and women experienced more limitations than men with 52.9% of women versus 44.8% of men having at least one functional limitation (Supplementary Table 2).

Performance-Based Physical Function Limitations

The mean (standard error) performance for the gait speed, the timed up and go, single leg stance, and chair rise test were 1.00 (0.002) m/s, 9.32 (0.01) seconds, 42.75 (0.14) seconds, and 13.03 (0.03) seconds, respectively. The mean grip strength (standard error) was 45.68 (0.10) kg for males and 27.39 (0.06) kg for females (Table 2). Age and sex stratified values are available in Supplementary Table 3).

The Association Between Self-reported Physical Functional Limitations and Disability

In the 21,241 participants with self-reported function, after adjusting for covariates and using the analytical weights, having at least one domain with a limitation (Method 1) was associated with a 3.75 (95% CI: 3.20–4.40) greater odds of ADL/IADL disability compared to not having a limitation (Table 3). Including all three domains (upper body, lower body, and dexterity) in the same model revealed an independent association between each domain with ADL/IADL disability (Method 2). Having limitations in more domains was associated with a stronger association with ADL/IADL disability regardless of the combination (Method 3). For all methods of categorizing functional limitations, the association between functional limitations and disability tender to be stronger for IADL limitations only compared to ADL limitations only. Models including odds ratios for

Table 1. Participant Characteristics for the Self-report Physical Function and Performance Test-Based Cohorts

	Self-report Performance Cohort (n = 21,241)		Physical Performance Test-Based Cohort (n = 30,097)	
	Mean* or N	SE or %†	Mean or N	SE or %
Mean age (y), range 45–85	60.57	0.08	62.96	0.06
Men	10,406	48.5	14,777	49.1
Women	10,835	51.5	15,320	50.9
Weight (kg)	78.59	0.14	79.81	0.10
Height (cm)	169.38	0.08	168.34	0.10
Body mass index (kg/m^2)	27.49	0.04	28.08	0.03
Underweight	186	0.9	218	0.7
Normal weight	6,960	32.8	8,905	29.6
Overweight	8,737	41.1	12,132	40.3
Obese	5,358	25.2	8,843	29.4
Chronic conditions (number of people with condition in disease domain)				
Osteoarthritis	5,681	26.8	7,981	26.5
Osteoporosis	2,020	9.5	2,740	9.1
Chronic obstructive pulmonary disease	1,439	6.8	1,743	5.8
Heart disease	2,909	13.7	3,032	13.4
Hypertension	8,115	38.2	11,184	37.2
Peripheral vascular disease	1,524	7.2	1,666	5.5
Stroke	1,016	4.8	1,336	4.4
Neurological	3,228	15.2	4,359	14.5
Ophthalmological	5,706	26.9	9,141	30.4
Kidney disease	595	2.8	873	2.9
Cancer	2,880	13.6	4,120	13.7
Diabetes	3,557	16.7	5,335	17.7
Depression	3,595	16.9	4,780	15.9
Cognition	1,522	6.2	1,414	4.7
Self-rated pain (answered yes to pain)	8,799	41.4	11,195	37.2
Household income				
<$20,000	1,491	7.0	1,726	5.7
$20,000 or more—but < $50,000	6,358	29.9	6,933	23.0
$50,000 or more—but <$100,000	7,688	36.2	10,590	35.2
$100,000 or more—but <$150,000	3,372	15.9	5,833	19.4
$150,000 or more	2,332	11.0	5,016	16.7
Smoking status				
Daily smoker	1,904	9.0	2,102	7.0
Occasional smoker	374	1.8	491	1.6
Former or never smoker	18,963	89.3	27,505	91.4
Physical activity, % not meeting World Health Organization guidelines	17,117	80.6	19,877	66.0
Social support availability score	60.54	0.10	59.08	0.07

Notes: SE = standard error.
*Mean and standard error calculated using analytical weights.
†Percentages are calculated using inflation weights.

covariates are available in Supplementary Tables 4–6. The results of the regression modeling were not meaningfully different from the completers only analyses (Supplementary Table 7).

The Association Between Performance-Based Physical Functional Limitations and Disability

In the 30,097 participants who completed the performance tests, after adjusting for covariates and using the analytical weights, being in the lowest functional performance group defined as contraindicated or in the lowest quintile of age and sex-specific performance (Method 1) was associated with a 2.35 (95% CI: 2.10–2.64) greater odds of ADL/IADL disability (Table 4). Each of the five performance tests were independently associated with ADL/IADL disability when included in the same model (Method 2). A clear dose response was observed as the number of tests in the lowest performance group increased from an odds of 1.53 (95% CI: 1.33–1.76) for having only one test in the lowest performance group to 14.91 (95% CI: 11.56–19.26) when all 5 tests were in the lowest performance group (Method 3). Across all methods of categorizing participants as functionally limited, the association between function limitations with IADL disability than for ADL disability with the exception of gait speed. Models including odds ratios for covariates are available in Supplementary Tables 8–10. The results of the regression modeling were not meaningfully different from the completers only analyses (Supplementary Table 11).

Discussion

This is the first population-based study of older Canadians which provides comprehensive data on both self-report and

Table 2. Prevalence of Activities of Daily Living and Instrumental Activities of Daily Living Limitations and Functional Status Limitations

	Males		Females		Overall	
Participants with self-report physical function data (n = 21,241)—prevalence of activities of daily living limitations						
	N	%*	*N*	%*	*N*	%*
≥1 ADL or IADL limitation	766	5.7	1,684	13.6	2,450	9.7
≥1 ADL limitation	422	3.0	1,009	8.1	1,431	5.6
≥1 IADL limitation	520	4.0	1,093	8.9	1,613	6.5
Participant with physical performance test-based data (n = 30,097)—prevalence of activities of daily living limitations						
	N	%*	*N*	%*	*N*	%*
≥1 ADL or IADL limitation	853	5.8	2,057	13.5	2,910	9.7
≥1 ADL limitation	557	3.8	1,483	9.7	2,041	6.8
≥1 IADL limitation	516	3.5	1,102	7.2	1,618	5.4
Participants with self-reported physical function data (n = 21,241)—prevalence of functional status limitations						
	N	%*	*N*	%*	*N*	%*
≥1 functional limitation	5,105	44.8	6,158	52.9	11,262	49.0
≥1 upper body functional limitation	2,539	21.7	3,405	28.9	5,944	25.4
≥1 lower body functional limitation	4,304	37.3	5,327	45.6	9,631	41.6
≥1 dexterity-related functional limitation	668	5.6	1,024	8.3	1,692	7.0
Participant with physical performance test-based data—mean and standard error of performance						
	Mean†	*SE*	Mean	*SE*	Mean	*SE*
Gait speed (m/s), n = 14,712 males, 15,252 females	1.01	0.002	0.99	0.002	1.00	0.001
Timed up and go (s), n = 14,685 males, 15,207 females	9.35	0.02	9.30	0.02	9.32	0.01
Single leg stance test (s), n = 14,320 males, 14,729 females	44.26	0.20	41.28	0.20	42.75	0.14
Chair rise test (s), n = 14,442 males, 14,895 females	12.82	0.05	13.22	0.04	13.03	0.03
Grip strength (kg), n = 14,326 males, 14,311 females	45.68	0.10	27.39	0.06	36.55	0.09

Notes: ADL = basic activities of daily living; IADL = instrumental activities of daily living.
*Inflation weight.
†Analytic weight.

Table 3. The Association Between Self-reported Physical Function Categorized Using Four Methods With Combined Any ADL and IADL Disability, Any ADL Disability, and Any IADL Disability†, n = 21,241

Method of Categorizing Participants as Functionally Limited	Prevalence (%)	Outcome: ADL or IADL Disability		Outcome: ADL Disability		Outcome: IADL Disability	
		Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Method 1—limitation in at least one domain (upper body, lower body, dexterity)‡							
At least one domain limited	49.0	3.75*	3.20–4.40	2.82*	2.33–3.40	7.67*	5.80–9.89
Method 2—adjusted for presence or absence of limitation in each individual domain							
Upper body vs no upper body limitation	25.4	3.45*	3.07–3.88	2.61*	2.27–3.01	5.61*	4.77–6.59
Lower body vs no lower body limitation	41.6	2.36*	2.04–2.72	2.07*	1.75–2.45	3.40*	2.73–4.24
Dexterity vs no dexterity limitation	7.00	1.94*	1.66–2.26	2.00*	1.69–2.37	1.88*	1.58–2.25
Method 3—number of domains (upper body, lower body, dexterity) with at least one limitation‡							
Three	28.3	14.43*	11.50–18.09	9.92*	7.64–12.89	30.57*	22.22–42.08
Two	16.4	6.78*	5.68–8.08	4.54*	3.68–5.59	15.03*	11.34–19.93
One	4.30	1.87*	1.56–2.24	1.57*	1.26–1.95	2.80*	2.08–3.76

Notes: ADL = activities of daily living; CI = confidence interval; IADL = instrumental activities of daily living.
†Adjusted for age, sex, chronic conditions, cognition, self-rated pain, household income, body mass index, smoking status, physical activity, social support availability, and province.
‡Reference group: no domains limited.
*Significant $p < .05$.

performance-based physical function and their association with disability. To the best of our knowledge, this is the first large study that has shown that each physical function domain and performance test remains significantly associated with disability after adjustment for the other domains or tests.

The prevalence of having at least one ADL/IADL limitation was 9.7% in the self-report cohort and 9.7% in the performance test cohort. When stratified by age this value is similar to the findings of the Canadian Community Health Survey which estimated that 6% of Canadians aged 65 and older required assistance with ADLs and 15% required support with IADLs (6). Though the prevalence estimates of ADL/IADL disability varied, our results are also consistent with previous population-based cohorts which have found that ADL/IADL disability is more common in women than in men (5,7,8), a finding that has been attributed to the rate of mortality being higher in men than in women for most major causes of death which leaves women more likely to survive with multiple chronic conditions that leading to disability (29).

Table 4. The Association Between Limitations on Performance Tests Categorized Using Four Methods With Combined Any ADL and IADL Disability, Any ADL Disability, and Any IADL Disability†, *n* = 30,097

Method of Categorizing Participants as Functionally Limited	Outcome: ADL or IADL Limitation		Outcome: ADL Limitation Only		Outcome: IADL Limitation Only	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Method 1—at least one test (grip strength, timed up and go, balance, chair rise, grip strength) in lowest performance group‡						
≥one test in lowest performance group	2.35*	2.10–2.64	2.24*	1.96–2.56	3.34*	2.82–3.98
Method 2—adjusted for presence or absence of lowest performance group in each individual test						
Low gait speed vs normal gait speed	1.62*	1.44–1.84	1.80*	1.57–2.06	1.80*	1.57–2.06
Low TUG vs normal TUG	1.70*	1.50–1.94	1.69*	1.47–1.94	1.69*	1.47–1.94
Low balance vs normal balance	1.87*	1.67–2.09	1.86*	1.64–2.11	1.86*	1.64–2.11
Low chair rise test vs normal chair rise	1.53*	1.37–1.71	1.51*	1.35–1.72	1.51*	1.35–1.72
Low grip strength vs normal grip strength	1.40*	1.26–1.56	1.32*	1.17–1.50	1.32*	1.17–1.50
Method 3—number of tests (grip strength, timed up and go, balance, chair rise, grip strength) with lowest performance group‡						
Five	14.91*	11.56–19.26	15.28*	11.86–19.72	23.96*	17.92–32.06
Four	7.15*	5.92–8.63	6.72*	5.50–8.22	10.78*	8.49–13.71
Three	2.85*	2.38–3.42	2.72*	2.21–3.37	4.05*	3.19–5.16
Two	2.06*	1.76–2.42	1.77*	1.48–2.14	2.88*	2.30–3.61
One	1.53*	1.33–1.76	1.46*	1.24–1.72	1.71*	1.39–2.12

Notes: ADL = activities of daily living; CI = confidence interval; IADL = instrumental activities of daily living; TUG = timed up and go.

†Adjusted for age, sex, chronic conditions, cognition, self-rated pain, household income, body mass index, smoking status, physical activity, social support availability, and province.

‡Reference group: no performance tests in lowest performance group (lowest performance quintile or contraindicated).

*Statistically significant ($p < .05$).

The prevalence of self-reported physical function limitations was 49%. Although other studies have used different questionnaires yielding different prevalence estimates (30), the higher prevalence of functional limitations compared to ADL/IADL disability is consistent with Nagi's Disablement Model which outlines that functional limitations precede disability (9,31). The way self-report physical function and disability are operationalized in the CLSA reflects Nagi's model, but also many affect prevalence. The CLSA asks about difficulty completing tasks for the physical function questions and ability to complete tasks independently for disability. Participants may have a functional limitation in which they find completing a task difficult but have not yet transitioned to disability as they are still able to complete the task without assistance. These findings along with the strong associations between self-reported function and ADL/IADL disability support the construct validity of the CLSA function questionnaire. For both self-reported physical function and ADL/IADL disability, the prevalence of limitations was higher in women than in men and increased across the four age groups. The prevalence of physical function limitations based on performance test data could not be estimated. Cut points for these tests vary based on the participant characteristics, such as age, the study protocols for the tests, and which health-related outcome was used to derive the cut points. In the absence of appropriate cut points, the lowest age and sex-specific quintile of participants as well contraindicated participants were identified as having low performance for each test. This technique identified participants with low performance relative to their peers. Although the cut points used in this study may not be generalizable to other studies, this techniques improved our ability to compare the association between performance and disability across tests as the severity of limitation for each test was the same.

The results of the logistic regression models for the association between physical function and ADL/IADL disability are consistent with previous work documenting the relationship between deficits in physical function and disability (10,12,13,32). Though we could not directly compare the association of self-reported physical function and performance tests with disability due to different subsets of the CLSA completing these measures, the results of our study indicate that both types of data are strongly associated with ADL/IADL disability. Interestingly, the odds of disability were similar for having one domain limited for the self-report data (odds 1.9) and having one performance tests limited (odds 1.5) for the performance tests. The odds of disability were also similar for having the maximum number of deficits for both the self-reported (odds 14.4) and performance tests (odds 14.9). This indicates that either type of data may be appropriate for disability screening, though more work will be required to establish if the observed trend is similar for incident disability.

A novel finding of this study was that each self-reported function domains and each of the performance-based tests remained significantly associated with ADL/IADL disability when the other domains or tests were included in the same model. This suggests that each of the domains and tests likely reflect unique dimensions of function. Building upon this result was our finding that for each assessment of physical function, a strong dose response was shown for increasing levels of limitations. For both self-report and performance-based measures of function, the association of having one limitation versus having the maximum number of limitations. This better represented the range of odds of disability compared to dichotomizing functional limitations as having at least one domain or at least one functional test limited. In our supplementary analyses (Supplementary Tables 4–6 and 8–10), we found that the odds of disability did not meaningfully change based on the combination of domains or performance tests in the lowest quintile for a given number of domains and tests. Therefore, measuring multiple domains of self-reported physical function or using multiple performance-based tests targeting different aspects of function, regardless of which domains or tests are included, allows for better identification of those with current disability. Future longitudinal studies are required to determine whether this pattern is true for incident disability.

Though physical function limitations are strongly associated with both ADL and IADL disability, the association was stronger with IADL disability compared to ADL disability with the exception of gait speed. The difference in magnitude was most pronounced as the number of functional limitations increased. For example, using the self-report data, having limitations in one domain of physical function was associated with a 1.6 greater odds of ADL disability and a 2.8 greater odds of IADL disability. In participants with limitations in all three domains (upper body, lower body, and dexterity), the odds of ADL disability were 9.9 and the odds of IADL disability were 30.6. Similar observations were made using the performance-based data. These results suggest that regardless of the level of physical limitation, participants are more likely to require assistance with the more complex tasks represented by IADLs rather than basic self-care activities represented by ADLs like eating, bathing, and bathroom activities. Future analyses are required to determine which IADLs are most strongly affected by functional limitations; it is likely that items dependent on mobility, such as housework and shopping, are more strongly associated with physical function than tasks, such as managing money and using the telephone.

Strengths of this study include the use of a large sample size allowing for stratification by age and sex and weighted data which is generalizable to the Canadian population. Though previous studies have investigated similar self-reported function questionnaires and performance-based measures, to the best of our knowledge there are no previous population-based cohort studies which have adjusted for all domains of function and different performance tests within the same model. A limitation of this study is the use of cross-sectional data. At this time, only baseline data are available from the CLSA. However, the development of different domains of physical function based on self-report data and establishing the appropriateness of including multiple performance tests in the same model is essential work to inform future longitudinal analyses of the relationship between physical function and disability in the CLSA. Another limitation is that the number of people endorsing any single ADL or IADL limitation in our community-dwelling sample was low. Those who endorsed items typically responded with requiring some help. Due to the low endorsement of individual items and the low variability in the degree of help required for a task, no analyses could be completed looking at different combinations of ADL and IADL items or severity of disability. As follow-up data from the CLSA is released, the prevalence and severity of ADL/IADL limitations are likely to increase in this cohort. This will allow for longitudinal analyses as well as an investigations into different combinations of ADL/IADL limitations and the severity of disability.

Conclusions

In this analysis of 51,338 participants from the CLSA, the overall prevalence of disability was approximately 10%. For both performance-based and self-report assessments of physical function, there was a strong association with ADL/IADL, ADL only, and IADL only disability including evidence that the strength of the relationship increases if participants have more functional limitations. These analyses have important clinical implications suggesting that using multiple domains of function or a combination of performance-based tests may allow for more accurate identification of individuals at the greatest risk for current ADL/IADL disability. However, prior to making clinical recommendations, these results should be further validated in other populations as well as tested using longitudinal data. Determining which functional limitations are most strongly associated with future rather than current ADL/IADL disability will be the most informative for determining targets for intervention.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences* online.

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Conflict of interest statement

None reported.

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