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Associations of functional disability and behavioural risk factors with social participation of older adults: a cross-sectional analysis from the Canadian Longitudinal Study on Aging

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ABSTRACT

Objectives To examine: (1) the associations of functional disability and behavioural risk factors with social participation; and (2) whether the association between functional disability and social participation is modified by co-occurrence of behavioural risk factors.

Design A cross-sectional analysis of data from the Canadian Longitudinal Study on Aging.

Setting A national stratified sample of 51 388 individuals living in the 10 Canadian provinces at the time of baseline data collection (2011–2015).

Participants Participants included men and women aged 45–85 years and residing in the communities in the 10 Canadian provinces.

Outcome measures Social participation was assessed using frequency of participant involvement in eight different social activities in the past 12 months. Responses for each category were converted into number of days per month. Total social participation score (range: 0–180) was based on summing frequencies over all eight activities representing number of social activities per month.

Results Functional disability was associated with participating in fewer social activities (difference in mean total social participation score, b=−1.1, 95% CI −1.5 to −0.7). In comparison to no behavioural risk factors, presence of any one (b=−2.7, 95% CI −3.1 to −2.3), any two (b=−4.6, 95% CI −5.0 to −4.2), any three (b=−6.3, 95% CI −6.8 to −5.9) and all four (b=−7.8, 95% CI −9.0 to −6.6) behavioural risk factors was associated with lower social participation. The association between functional disability and social participation was modified by the presence of behavioural risk factors with the lowest social participation observed for adults with disability and all four behavioural risk factors (b=−4.3, 95% CI −7.5 to −1.2).

Conclusions Individuals with functional disabilities and behavioural risk factors are more likely to experience restrictions in social participation. Public health interventions that encourage healthy lifestyle behaviours may help mitigate the impact of functional disabilities on social participation in the ageing population.

Strengths and limitations of this study

- This study addresses the gap for empirical research by examining the associations of functional disability and co-occurrence of behavioural risk factors with social participation in older adults.
- This study included a large, population-based sample to examine the associations of functional disability and behavioural risk factors with social participation of older adults.
- The analyses were based on the baseline cross-sectional data; therefore, the associations between functional disability, behavioural risk factors and social participation may be subject to reverse causality.
- The study sample did not include individuals residing in long-term care institutions, which may have underestimated the association between functional disability and social participation and limit the generalisability of our findings to community-dwelling populations.

INTRODUCTION

Social participation is viewed as an important factor impacting the health and well-being of older individuals.[1–4] Epidemiological evidence suggests that participation in meaningful social activities is associated with lower risk of physical and mental health problems, loneliness, frailty, disability, and mortality, and better health-related behaviours, quality of life, life satisfaction and self-rated health.[5–7] The WHO has recognised the direct impact of social participation on health and well-being and has thus integrated it into research and policy frameworks of ageing.[8] For instance, the Decade of Health Ageing 2021–2030, an initiative led by the WHO to foster healthy ageing, recognises the need to create a wide

range of affordable and accessible opportunities for social participation as part of their action strategy to enable older adults to live independently and age in place of choice by building age-friendly cities and communities.[8]

Despite the strong positive association of social participation with health and well-being, opportunities for social participation tend to decline with age, particularly among those with diminished physical capacity.[9] According to the Canadian Study on Health and Aging, 15.4% of Canadians aged 65 years and older reported having at least one disability in basic activity of daily living (ADL) and 33.4% reported having at least one disability in instrumental activities of daily living (IADL).[10] Many older individuals also live with multiple chronic mental and physical health conditions, which has a significant impact on their ability to perform ADL, and as a result experience reduced opportunities to participate in formal and informal social activities.[11] Additionally, external factors such as cost and availability of social activities, accessibility and the physical built environment may also act as barriers for social participation among adults with functional disabilities.[11 12] Findings from meta-analyses and systematic reviews also indicate that functional disabilities may be associated with behavioural risk factors including physical inactivity and smoking.[12 13] The evidence for the association of physical inactivity, sedentary behaviour, obesity, nutritional behaviour and smoking with functional disability is compelling; however, the association between alcohol consumption and functional disability in older adults is less clear.[12–16] Some studies found alcohol consumption to be associated with greater risk of functional disability, whereas other studies reported light to moderate alcohol consumption to be associated with maintenance of mobility compared with non-drinkers,[13 17 18] but only in older adults in good health. In addition to functional disabilities, research indicates that health behaviours may also be associated with social participation among older adults. Some studies have shown higher levels of social engagement to be positively associated with participation in moderate to vigorous level of physical activity and a daily intake of at least five servings of fruits and vegetables,[19 20] and negatively associated with smoking,[20 21] while other studies reported no associations or inconsistent findings.[22–24]

To develop and implement strategies for increasing social participation as individuals age, it is critical to understand the factors that contribute to lower social participation. To date, there is little empirical research about whether functional disability impacts social participation in an ageing population. Further, studies have examined the independent effects of behavioural risk factors on functional disabilities and social participation, but to our knowledge no study has examined whether co-occurrence of behavioural risk factors influences the association between functional disability and social participation in the adult population. Therefore, the purpose of this study was to investigate the associations between functional disability, behavioural risk factors including smoking, physical inactivity, low nutritional intake, and high-risk alcohol consumption, and social participation, and to examine whether the association between functional disability and social participation is modified by co-occurrence of behavioural risk factors.

METHODS

Data source and participants

The Canadian Longitudinal Study on Aging (CLSA) is a population-based study, which recruited a generalisable, stratified random sample of 51 338 community-dwelling individuals aged 45–85 years at baseline (2011–2015). The CLSA cohort consists of the Tracking cohort of 21 241 participants who were randomly recruited from the 10 Canadian provinces, and the Comprehensive cohort of 30 097 participants who were randomly recruited from one of 11 data collection sites in seven provinces.[25] Residents of the three Canadian territories, individuals living on First Nation reserves or in long-term care institutions, full-time members of the armed forces, those unable to respond in either English or French and those with significant cognitive impairment were excluded from the study. Details on the study design have been described elsewhere.[25] All 51 338 participants were included in the analyses, which was conducted from May to August 2020.

Social participation

Informal social participation generally refers to interactions with personal and close relationships such as with family members, friends, neighbours and coworkers, whereas formal social participation refers to interactions with established organisations such as with religious, sports, education or other community organisations.[26] Social participation was estimated using frequency of participant involvement in eight different social activities in the past 12 months.[26] The social activities included: (1) family or friendship activities outside the household; (2) church or religious activities; (3) sports/physical activities with other people; (4) educational or cultural activities involving other people; (5) service club or fraternal organisation activities; (6) neighbourhood, community or professional association activities; (7) volunteer or charity work; and (8) other recreational activities involving other people (hobbies, gardening, cards). Responses for each category were converted into number of days per month as follows: ‘almost every day’: 20, ‘at least once a week’: 6, ‘at least once a month’: 2, ‘at least once a year’: 1 and ‘never’: 0. Total social participation score is based on summing frequencies over all eight activities representing number of social activities per month, and may range from 0 to 180. The social participation scale based on total score has good internal consistency with Cronbach’s α of 0.85 and a difference of 0.5 activities per person is considered relevant.[27]

Functional disability

Functional disability was assessed using a 14-item questionnaire adapted from the Older Americans Resources and Services Multidimensional Assessment Questionnaire.[28] The questionnaire included seven items pertaining to ADL and seven items pertaining to IADL (online supplemental table 1). Participants who reported requiring assistance with at least one ADL or IADL were considered as having a functional disability.

Behavioural risk factors

Cigarette smoking was categorised as non-smoker (including never smoker and former occasional smoker who smoked 1 or more cigarettes in their lifetime) and smoker (including current occasional smoker who smoked 100 or less cigarettes in their lifetime, current daily smoker, and former daily smoker).[29]

Nutritional risk was assessed using the 'Seniors in the Community: Risk Evaluation for Eating and Nutrition (SCREEN-II)' tool.[30] SCREEN-II is reliable and valid for assessing nutritional risk in community-dwelling older adults. This tool assesses weight loss or gain, frequency of skipping meals, appetite, difficulties in eating, intake of fluids and fruits and vegetables, frequency of eating meals alone, meal preparation, and satisfaction with quality of food prepared by others. Participants who had a total score of less than 32 were identified as having high nutritional risk, and this cut-off is validated and was recommended through personal communication with the developer of SCREEN-II.

Physical activity was measured using the Physical Activity Scale for the Elderly (PASE), which assesses the frequency, intensity, and duration of participantion in leisure, household work, and volunteer activities within the past week.[31] Individuals who participated in at least 75 min per week of vigorous-intensity physical activity or 150 min per week of combined moderate-intensity and vigorous-intensity physical activities were considered to have adequate physical activity, otherwise they were considered to have low physical activity.[32 33]

Alcohol consumption was assessed using Canadian Centre on Substance Use and Addiction guidelines on 'Knowing Your Limits with Alcohol'.[34] Participants were either categorised as low-risk drinkers (never drinker, light drinkers defined as consuming 1–15 drinks a week for men and 1–10 drinks per week for women) or high-risk drinkers (moderate/heavy drinkers defined as consuming more than 15 drinks per week for men and more than 10 drinks per week for women).

Other covariates and confounders

Age (45–54, 55–64, 65–74 and 75+ years); sex; body mass index (BMI; <25, 25–30 and >30 kg/m^2); number of chronic conditions from 13 disease categories including musculoskeletal, respiratory, cardiac, vascular, endocrine, neurological, gastrointestinal, genitourinary, ophthalmological, psychiatric, kidney disease, back problems and cancer (0, 1, 2, 3 and more conditions); remoteness (urban or rural setting); marital status (single or never lived with a partner, married/living with a partner in common-law relationship, widowed or divorced/separated); retirement status (retired, retired and returned to work or not retired); social inequality (assessed using the MacArthur Scale of Subjective Social Status with scores of 1–4 categorized as 'bad', 5–6 as 'regular', 7–8 as 'good' and 9–10 as 'very good')[35 36]; total annual household income (<$20 000, $20 000–<$50 000, $50 000–<$100 000, $100 000–<$150 000 or >=$150 000); and education level (less than secondary school, secondary school, some postsecondary diploma/certification or postsecondary degree) were included as covariates.

Data analysis

Analyses were conducted using STATA (V.16.0, StataCorp, College Station, Texas, USA). The CLSA sampling weights (inflation weights for descriptive analysis and analytical weights for any statistical modelling or testing) were incorporated into all the analyses as appropriate. The chained equations algorithm with a fully conditional specification technique for multiple imputation (n=20) was used for missing data (n=5654; 11%) using all variables described above (online supplemental table 2).[37] Categorical variables were summarised using frequency and percentages. Continuous data were summarised using mean and SD.

To examine the associations between social participation, functional disability and behavioural risk factors, a series of multivariable linear regression models were conducted using the analytical weights with social participation as a continuous outcome, and disability and four behavioural risk factors as the primary exposure variables. To further examine the extent to which the association between social participation and disability is modified by the behavioural risk sets, two-way interaction between disability and number of risk factors present (ranging from 0 to 4) were included in the regression models. All multivariable analyses were adjusted for covariates identified a priori in the literature for their association with functional disability and are listed above. All models were first adjusted for preselected core variables including urban/rural status, marital status, retirement status, BMI, social inequality, income level, education level, and age and sex (for models that were not stratified by age and sex), and then further adjusted for behavioural risk factors, and number of chronic conditions. The model stability and the goodness-of-fit model were evaluated graphically (residuals plots) and using statistics (likelihood ratio test, deviance, Akaike's Information Criteria (AIC) and Bayesian Information Criteria (BIC) criteria).

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Participant characteristics

Of the participants who were classified as having functional disability, majority of them (8.2%) had mild impairment (1–3 ADL or IADL problems), about 1.0% had moderate impairment (4–5 ADL/IADL problems) and 0.3% had severe impairment (6 or more ADL/IADL problems). Characteristics of the study population by social participation and social participation by functional disability status are presented in table 1. Overall, older adults in the CLSA cohort (n=51 338) participated in a mean number of 19.4 social participation in activities per month. This mean was lower for the participants with functional disability than those without disability (17.2 vs 19.6, respectively). For participants with functional disability, the mean number of social participation in activities per month was lower among the 45–54 age group (15.5), men (15.5) and individuals with all four behavioural (high nutritional risk, low physical activity, smokers and current alcohol use) risk factors (11.0).

Associations between social participation, functional disability and behavioural risk factors

Regression estimates representing difference in mean total social participation score, and 95% CIs for the associations of functional disability and behavioural risk factors with social participation are presented in table 2. Functional disability was associated with participating in fewer social activities (b=−1.1, 95% CI −1.5 to −0.7). All four risk factors were also associated with fewer social participation activities with an adjusted regression coefficient of −1.4 (95% CI −1.6 to −1.2) for smoking, −3.8 (95% CI −4.1 to −3.6) for low physical activity, −1.8 (95% CI −2.2 to −1.4) for high nutritional risk and −0.7 (95% CI −1.0 to −0.3) for high-risk drinking. A similar trend was observed for the association between the number of risk factors and social participation. The regression estimates showed a consistent gradient with the number of risk factors present when compared with those with no risk factors: −2.7 (95% CI −3.1 to −2.3) when any one risk factor was present, −4.6 (95% CI −5.0 to −4.2) when any two factors were present, −6.3 (95% CI −6.8 to −5.9) when any three risk factors were present and −7.8 (95% CI −9.0 to −6.6) when all four risk factors were present.

The stratified analyses based on four behavioural risk factors showed that functional disability with each behavioural risk factor present was associated with participating in fewer social activities than functional disability without risk factor present (table 2). The association between functional disability and social participation was statistically significantly modified by the presence of behavioural risk factors. We found an interaction between disability and the number of risk factors present with the lowest social participation observed for older adults with disability and all four risk factors present (table 2, figure 1). Figure 1 shows the marginal effects (linear predictive margins with 95 CIs) for social participation at each combination of number of risk factors present and functional disability status. The regression estimates showed a statistically significant decrease from 2.0 (95% CI −0.4 to 3.9) for disability and no risk factors present as main effects to −2.9 (95% CI −5.1 to −0.8) for interaction between disability and any one risk factor present, −3.7 (95% CI −5.8 to −1.5) for interaction between disability and any two risk factors present, −3.9 (95% CI −6.2 to −1.7) for interaction between disability and any three risk factors present and −4.3 (95% CI −7.5 to −1.2) for interaction between disability and all four risk factors present.

We conducted sensitivity analyses exploring the association between severity of functional disability and social participation (online online supplemental table 3, figure 1). The results showed a gradient association, with individuals with mild impairment (1–3 ADL/IADL problems; b=−0.82, 95 CI −1.25 to −0.39), moderate impairment (4–5 ADL/IADL problems; b=−3.68, 95% CI −4.87 to −2.49) and severe impairment (6 or more ADL/IADL; b=−5.47, 95% CI −7.44 to −3.49) participating in fewer social activities compared with those with no functional disability after adjusting for covariates. Further, we explored the associations between functional disability, behavioural risk factors and social participation stratified by age and sex (online online supplemental table 4 and 5). After adjusting for all covariates, functional disability was associated with lower social participation in all subgroups, but the association was stronger in older compared with younger individuals. The results for the association between behavioural risk factors and social participation were largely consistent with those reported for the overall sample. We also explored the associations of functional disability and behavioural risk factors on subtypes of social participation activities. Overall, there was no meaningful difference in the associations by social participation subtypes (online online supplemental table 6 and 7).

DISCUSSION

This is the first study to examine the associations between functional disability, behavioural risk factors and social participation among middle to older aged adults using a nationally generalisable sample. Our study found that functional disability and behavioural risk factors including smoking, low physical activity, high nutritional risk and high-risk alcohol consumption were associated with lower social participation. Of the four risk factors, low physical activity had the greatest influence on social participation. Moreover, we found that the greater the number of behavioural risk factors that were present, the lower the social participation, suggesting a gradient relationship. The results of our study also demonstrated that the association between functional disability and social participation was modified by the number of behavioural risk factors present. Individuals with functional disability who had all four risk factors experienced the lowest social participation.

Table 1 Characteristics of the study population by social participation and social participation by functional disability status

Variables	Overall social participation, mean (SD) (n=51 291)	Social participation by functional disability status, mean (SD)	
		Functional disability (n=5207)	No functional disability (n=45 705)
Overall	19.4 (12.4)	17.2 (13.1)	19.6 (12.4)
Age group			
45–54	18.7 (11.8)	15.5 (12.3)	18.9 (11.8)
55–64	19.0 (12.4)	17.2 (14.0)	19.1 (12.2)
65–74	20.9 (13.2)	18.1 (13.7)	21.3 (13.1)
75–85	20.0 (12.9)	17.8 (12.3)	20.8 (13.0)
Sex			
Male	18.7 (12.3)	15.5 (13.2)	18.9 (12.3)
Female	20.0 (12.5)	17.9 (13.0)	20.4 (12.4)
Smoking			
Yes	18.1 (12.3)	15.7 (12.4)	18.4 (12.3)
No	20.6 (12.4)	18.9 (13.6)	20.8 (12.3)
Low physical activity			
Yes	18.1 (11.9)	16.7 (12.8)	18.4 (11.8)
No	22.5 (12.9)	23.3 (14.6)	22.5 (12.8)
High nutritional risk			
Yes	16.2 (12.0)	14.2 (12.6)	16.8 (11.9)
No	20.0 (12.4)	19.1 (13.1)	20.1 (12.3)
Alcohol consumption			
High-risk drinking	19.1 (12.2)	16.7 (12.0)	19.2 (12.2)
Low-risk drinking	19.4 (12.3)	17.3 (13.2)	19.7 (12.4)
Behavioural risk factors present (n)			
0	23.5 (13.3)	26.1 (16.8)	23.4 (13.1)
1	20.3 (12.0)	19.6 (12.6)	20.3 (11.9)
2	18.1 (12.0)	16.7 (11.9)	18.2 (12.0)
3	15.8 (11.7)	14.3 (13.4)	16.1 (11.3)
4	14.2 (12.2)	11.0 (8.0)	15.0 (12.9)
Built environment			
Rural	18.8 (12.3)	16.5 (12.8)	19.1 (12.2)
Urban	19.5 (12.5)	17.4 (13.1)	19.8 (12.4)
Marital status			
Married/common-law	19.8 (12.4)	17.7 (13.2)	20.0 (12.3)
Single	16.6 (11.7)	15.0 (13.4)	16.8 (11.5)
Widowed	20.2 (13.1)	18.5 (12.3)	20.8 (13.3)
Divorced/separated	18.0 (12.6)	15.2 (12.8)	18.4 (12.5)
Retirement status			
Retired	20.1 (13.0)	17.1 (13.5)	20.7 (12.9)
Retired/return to work	21.8 (13.2)	19.3 (12.7)	22.0 (13.3)
Not retired	18.4 (11.7)	16.6 (12.2)	18.5 (11.7)
Body mass index (kg/m^2)			
<25	19.8 (12.4)	18.0 (14.1)	20.0 (12.3)
25–30	19.7 (12.5)	18.2 (13.5)	19.8 (12.4)
>30	18.3 (12.3)	15.9 (11.9)	18.7 (12.4)

Continued

Table 1 Continued

Variables	Overall social participation, mean (SD) (n=51 291)	Social participation by functional disability status, mean (SD)	
		Functional disability (n=5207)	No functional disability (n=45 705)
Social inequality			
Bad (1–4)	15.0 (11.0)	13.6 (11.4)	15.3 (10.9)
Regular (5–6)	18.7 (11.5)	17.6 (12.1)	18.8 (11.5)
Good (7–8)	21.9 (12.5)	21.9 (14.3)	21.9 (12.4)
Very good (9–10)	24.6 (15.5)	25.1 (17.3)	24.6 (15.4)
Annual household income			
<$20 000	15.3 (12.8)	13.2 (12.7)	16.1 (12.8)
≥$20 000 to <$50 000	18.2 (12.6)	17.4 (13.5)	18.3 (12.5)
≥$50 000 to <$100 000	19.5 (12.2)	18.1 (11.8)	19.6 (12.2)
≥$100 000 to <$150 000	20.0 (12.2)	18.6 (14.2)	20.1 (12.1)
≥$150 000	21.2 (12.1)	19.2 (12.0)	21.3 (12.1)
Education level			
Less than secondary	16.1 (12.2)	13.3 (11.8)	16.8 (12.2)
Secondary only	17.0 (12.1)	15.6 (11.7)	17.2 (12.2)
Some postsecondary	19.1 (12.8)	17.3 (14.7)	19.3 (12.5)
Postsecondary degree	20.2 (12.4)	18.5 (13.2)	20.3 (12.3)
Chronic conditions (n)			
0	20.0 (12.4)	21.6 (14.9)	20.0 (12.3)
1	19.9 (12.3)	20.3 (14.7)	19.9 (12.2)
2	19.4 (12.0)	18.6 (12.0)	19.4 (12.0)
3 or more	18.9 (12.7)	16.7 (13.0)	19.4 (12.6)

Our finding that functional disability is associated with lower social participation is consistent with literature.[38 39] Many reasons including health concerns may explain lower social participation among people with functional disabilities. Research shows older individuals with functional disabilities are more likely to have multiple chronic conditions and spend more time in managing their conditions, which may affect their ability to participate in social activities.[11] Data from the CLSA Comprehensive cohort showed that 50.4% of people with functional disability compared with 10.9% of people without functional disability reported health limitations as a factor in preventing participation in social activities. Further, the ability to participate in formal and informal social activities depends on the offer of activities, and on being able to afford and access the activities.[40] Research shows that people with disabilities are more likely to have limited financial resources, perhaps due to barriers in employment, thus lowering their opportunities to participate in social activities.[40] Further, lower social participation among people with functional disabilities may be related to environmental barriers, including structural barriers and inaccessible environments, discriminating attitudes, availability of information and knowledge, and organisational policies and practices.[38 40] Research also indicates that the association between functional disability and social participation may be bidirectional and more complex where losses in functional capabilities may result in reduced social participation, which in turn may accelerate functional decline.[41 42] Given that lower social participation is associated with poor health and well-being, these findings emphasise the need to identify factors that can help guide interventions.

Our results show that behavioural risk factors including smoking, low physical activity, high nutritional risk and high-risk drinking were individually and cumulatively associated with lower social participation and modified the association between social participation and functional disabilities. The association between behavioural risk factors and reduced social participation is consistent with the literature.[19–21] Research suggests that older adults who have an unhealthy dietary pattern and are physically inactive are more likely to experience health concerns, have mobility restrictions, have financial constraints, lack social support or be socially isolated, which may result in reduced opportunities to participate in social activities.[20 43 44] Studies have also shown that participating in physical activities provides people with more opportunities for social interaction and participation.[19] Thus, people who are physically inactive may miss out on these opportunities for social participation. Further, behaviours such as smoking and high-risk drinking may be viewed as

Table 2 Association of functional disability and behavioural risk factors with social participation

	b* (95% CI) n=51 338
Overall	
Functional disability (Yes vs No)	
Unadjusted	−2.1 (−2.5 to −1.7)
Adjusted for core variables†	−1.7 (−2.1 to −1.3)
Adjusted for core variables and number of chronic conditions	−1.5 (−1.9 to −1.1)
Adjusted for core variables and behavioural risk factors	−1.2 (−1.6 to −0.8)
Adjusted for core variables, number of chronic conditions and behavioural risk factors (fully adjusted model)‡	−1.1 (−1.5 to −0.7)
Behavioural risk factors‡	
Smoking versus no smoking	−1.4 (−1.6 to −1.2)
Low versus recommended physical activity	−3.8 (−4.1 to −3.6)
High versus no nutritional risk	−1.8 (−2.2 to −1.4)
High versus low-risk drinking	−0.7 (−1.0 to −0.3)
Behavioural risk factors present‡ (n)	
Any 1 versus none	−2.7 (−3.1 to −2.3)
Any 2 versus none	−4.6 (−5.0 to −4.2)
Any 3 versus none	−6.3 (−6.8 to −5.9)
All 4 versus none	−7.8 (−9.0 to −6.6)
Stratified analysis§	
By smoking status‡	
Smoker	−1.3 (−1.8 to −0.8)
Non-smoker	−0.8 (−1.4 to −0.2)
By physical activity level‡	
Low physical activity	−1.2 (−1.7 to −0.8)
Recommended physical activity	−0.1 (−1.3 to −0.6)
By nutritional risk‡	
High nutritional risk	−1.5 (−2.4 to −0.7)
No nutritional risk	−0.9 (−1.4 to −0.4)
By alcohol consumption‡	
Low-risk drinking	−1.1 (−2.4 to 0.3)
High-risk drinking	−1.1 (−1.5 to −0.7)
Interaction analysis‡	
Functional disability with one behavioural risk factor	−2.9 (−5.1 to −0.8)
Functional disability with two behavioural risk factors	−3.7 (−5.8 to −1.5)
Functional disability with three behavioural risk factors	−3.9 (−6.2 to −1.7)
Functional disability with four behavioural risk factors	−4.3 (−7.5 to −1.2)

*Regression coefficients are the difference in mean social participation score.
†Adjusted for core variables: age, sex, urban/rural setting, marital status, retirement status, body mass index (BMI), social inequality, income and education level.
‡Fully adjusted model: adjusted for core variables, behavioural risk factors and number of chronic conditions.
§Stratified analysis presents the effects of functional disability on social participation in the different strata of each behavioural risk factor in the fully adjusted model.

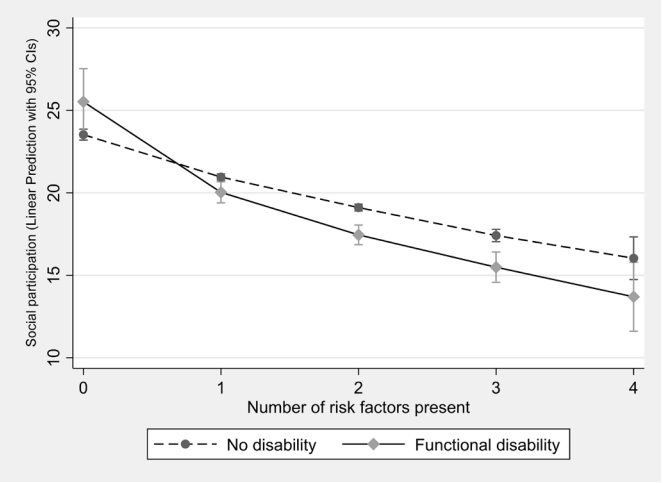

Figure 1 Association of social participation and number of behavioural risk factors by functional disability status.

socially unacceptable or undesirable, which may explain the lower social participation among adults engaging in these behaviours.[21] Although these results demonstrate that accumulation of behavioural risk factors and presence of functional disability have a synergistic effect on the decline in social participation, longitudinal studies are needed to examine whether intervening on behavioural risk factors in people with functional disability would help prevent or lessen the impact of functional disabilities on social participation.

Strengths and limitations

Our analyses were based on the baseline cross-sectional data (at the time of these analyses, CLSA had only baseline data available). The associations between functional disability, behavioural risk factors and social participation may be bi-directional, and thus causal inference cannot be made. Further, behavioural risk factors were dichotomised in the analysis based on clinically relevant and validated cut-points; however, dichotomisation may have resulted in loss of information about individual differences within the groups and increase the chance of misclassifying some participants. Of the participants who had functional disability, majority of them reported mild impairment. Thus, we were unable to explore interactions between severity of functional disability and number of health behaviours stratified by age and sex. The study sample did not include individuals residing in long-term care institutions, which may have underestimated the association between functional disability and social participation and limit the generalisability of our findings to the general community-dwelling middle-aged and older adult populations. Nevertheless, this study included a large, population-based sample, used validated tools to assess study variables, and adjusted for a number of potential confounders to examine the association of functional disability and behavioural risk factors with social participation of older adults.

CONCLUSIONS

The results of this study provide evidence that individuals with functional disabilities and behavioural risk factors are more likely to experience restrictions in social participation. The results also indicate that the greater the co-occurrence of behavioural risk factors, the lower the social participation. Further, the association between functional disability and social participation varies by the number of behavioural risk factors present. Individuals with functional disability and all four risk factors are prone to experiencing the lowest social participation. Given that social participation is a key component of healthy ageing, longitudinal studies are needed to identify whether public health intervention strategies targeting modifiable behavioural risk factors may help prevent or lower the impact of functional disabilities on social participation in the ageing population.

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