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Original Study

Social Frailty and Functional Disability: Findings From the Singapore Longitudinal Ageing Studies



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A B S T R A C T

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Background/Objective: To examine the association between the social frailty (SF) phenotype and functional disability, independently of the physical frailty (PF) phenotype, and compare the abilities of the PF, SF, and combined social and physical (PSF) indexes for predicting functional disability.

Method: Cross-sectional and longitudinal analyses of a population-based cohort (Singapore Longitudinal Ageing Study, SLAS-1) of 2406 community-dwelling older adults with 3 years of follow-up (N = 1254 and N = 1557 for instrumental activity of daily living (IADL) disability and severe disability (≥ 3 basic ADL) respectively).

Measurements: Seven-item social frailty index (living arrangements, education, socioeconomic status, and social network and support, 0 = nil SF, 1 = low, 2–7 = high), PF phenotype (Fried criteria), and instrumental activities of daily living (IADLs) disability and severe disability (≥ 3 basic ADLs).

Results: Compared to nil SF, low and high SF were significantly associated with 1.3 to 2.4 fold increased prevalence and incidence of IADL disability, and 6.3 fold increase in severe disability. Frail individuals with and without SF stood out with 5–11 fold increased prevalence and incidence of IADL disability and 21–25 fold increased prevalence and incidence of severe disability, compared to robust individuals without SF. A combined PSF index more accurately identified individuals with increased risk of functional disability (ROC = 64%) and severe disability (ROC = 81%) than either the SF or the PF indexes alone (55% to 68%).

Conclusion: The SF index alone or in combination with the PF index has clinical relevance and utility for identifying and stratifying older people at risk of disability. The mental frailty construct is closely related to SF and should be further investigated in future studies.

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Frailty is a state of increased vulnerability due to adverse health outcomes related to aging.¹ It is recognized as a multidimensional construct comprising physical, psychological, and social domains.^{2,3} The physical frailty (PF) phenotype is most widely described and has been shown in many studies to predict adverse health outcomes, such as disability, hospitalization, and mortality.^{4,5} Social frailty (SF), on the

other hand, is the least explored and understood. The relevance, validity, and utility of the SF construct has not been made clear.

Some studies have narrowly defined SF in terms of the lack of participation in social networks and perceived lack of contacts and support. However, a variety of facets of social vulnerability have been used to define the concept.⁶ Thus, a multifaceted concept proposed by Bunt et al¹ is that SF is a continuum of being at risk of losing, or having lost general or social resources, social behaviors and activities, and self-management abilities that are important for fulfilling basic social need(s).

The SF construct has salient relevance to the development of functional disability. The process of disablement postulates the interactions among biomedical, behavioral, and social-environmental factors in producing functional disability as a terminal outcome.⁷ SF may thus have utility on its own or within a multidomain context for assessing the risk of disability and the need for nursing home care,

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thus helping in preemptive interventions to relieve the burden of care in aging societies and promote healthy aging.

However, few studies have determined the predictive value of the SF phenotype vis-à-vis the PF phenotype, and their combined ability to predict adverse outcomes. A study of community-dwelling seniors in Italy reported that the SF phenotype using a deficit accumulation model significantly predicted mortality risks differentially from the PF phenotype.⁸ In another study among Japanese community-dwelling seniors, a 7-item SF index was shown to predict disability onset, independent from the PF index.⁹ The Canadian Study of Health and Aging showed that an index of social vulnerability operationalized by the deficit accumulation approach was associated with increased mortality.⁶ It was related to but was also distinct from the cumulated deficit multidomain frailty index.

Our previous studies have shown that the PF phenotype strongly predicted functional disability and other adverse health outcomes.^{10,11} In this study, we developed a 7-item SF index based on multiple facets of general or social resources, and social behaviors and activities. Using cross-sectional and longitudinal data of community-dwelling seniors in the Singapore Longitudinal Ageing Study, we examined the association between the SF phenotype and functional disability, independently of the PF phenotype; we compared its predictive value for functional disability with the PF phenotype, and determined whether the combined social and physical phenotype substantially increased the ability to predict functional disability, and finally assessed its clinical utility using data in the population-based sample.

Methods

Participants

We used data collected from the Singapore Longitudinal Ageing Studies Wave 1 (SLAS-1) cohort, a population-based longitudinal study of aging and health of community-dwelling older Singaporeans aged 55 and older, excluding individuals with severe physical or mental disabilities. As detailed previously,¹² participants were first recruited in 2003 or 2005 and have completed 2 approximately 3-yearly interval follow-ups, up to December 31, 2009. Baseline data collected includes demographic, medical, behavioral, biological, psychosocial, and neurocognitive characteristics via questionnaires, interviews, and physical or cognitive assessments. The study was approved by the National University of Singapore Institutional Review Board, and written informed consent was obtained from all participants.

From the total of 2804 older adults who were recruited at baseline, we conducted analysis on the data of 2406 Chinese participants with complete baseline data on the designated variables. Longitudinal analysis was performed on 1254 participants who were free of instrumental activities of daily living (IADL) or severe disability (3 or more activities of daily living [ADL] dependencies) at baseline ($n = 1577$) and had complete follow-up data on IADLs and severe disability.

Baseline Measurements

SF at baseline was operationalized and assessed through socio-demographic variables and self-reported survey questionnaires and based on the following criteria:

- (1) Living alone: assessed through the question: “Who do you live with?” (Alone or with others).
- (2) No education: assessed through the question: “What is your education level?” (Nil, Primary, Secondary or Institute of Technical Education, Pre-University or Polytechnic and University).

- (3) Absence of a confidant: assessed through the question: “Do you have someone to confide in?” (Yes or No).
- (4) Infrequent contact: assessed through 3 questions enquiring the frequency of visits or calls by the individual’s family, friends, or loved ones, and perceived extent of help that can be obtained in their time of need: the presence of any one or more of none or no more than once a year visits from family, friends, or loved ones; none or no more than once a year calls from family, friends, or loved ones; or none to a very little extent of help when they require it.
- (5) Infrequent social activities: assessed through a series of questions on the number and frequencies of usual participation on 6 categories of social activities using a 3-point Likert scale. Participants who have indicated that they rarely or do not at all participate in all categories of social activities are considered to have this risk indicator.
- (6) Financial difficulty: assessed through the question: “Are you limited by your financial resources to pay for needed medical service?” with a 3-point Likert scale. This SF indicator was deemed to be present for participants who indicate that they were limited “to a great extent.”
- (7) Socioeconomic deprivation: assessed by proxy of the participant’s housing type, which has been previously validated to be reliable in predicting readmission risk and increased utilization of hospital services in Singapore.¹³ Participants who lived in “1- to 2-room flats” were deemed to have this SF indicator.

Scores were assigned to each SF indicator (1 = present, 0 = absent), and the summed scores were used to categorize individuals as having high score (2–7), low score (1), and nil score (0 point) on the SF index.

Physical frailty at baseline was assessed based on the criteria used in the Cardiovascular Health Study, with operational modifications as detailed in previous publications.^{10,11} Scores were assigned to each of the 5 frailty components (1 = present, 0 = absent), and the summed scores were used to categorize subjects as frail (score = 3–5), prefrail (score = 1 or 2), and robust (score = 0 point). These modified categorical criteria have been shown in previous studies to predict IADL-ADL disability, depression, hospitalization, and poor quality of life.^{10,11}

Functional Disability

Inability to perform IADLs or basic ADLs was assessed by self-report measures of IADL and ADL.^{14,15} The presence of functional disability was indicated by the requirement for help on 1 or more IADL or ADL items. Severe disability was denoted by dependency on 3 or more ADL items, which in Singapore often necessitates formal help in nursing home care placement and qualifies for disability insurance payout.

Other Variables

Sociodemographic data included age and gender. *Medical comorbidity* was determined through self-reported responses to a checklist of whether participants did or did not have a doctor’s diagnosis and treatment for each of 16 specified or other medical condition(s) in the past year, and estimating the total number of medical conditions. Seniors with 3 or more medical conditions were considered to have medical comorbidity. *Lifestyle variables* included self-reports of current or history of smoking and daily alcohol drinking. *Depressive symptoms* were determined by the Geriatric Depression Scale (GDS), which has been validated for use on Singaporean Chinese, Malay, and Indian individuals.¹⁶ The presence of depressive symptoms was operationalized as having a GDS score of 5 or more. *Cognitive function* was determined using scores of the Chinese version of the Mini-Mental State Examination (CMMSE), with total scores ranging from 0 to 30 (higher scores indicating better cognition). This test has been validated for local use in Singaporean older adults.¹⁷ Cognitive impairment was defined as having a MMSE score equivalent to or lower than 23. *Hospitalization and*

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