Original Article

Frailty, Disability, and Mortality in a Rural Community-Dwelling Elderly Cohort from Northern India

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Abstract

Introduction: With increasing proportion of the elderly in the world, detecting and preventing frailty assumes importance to improve the quality of life and health. The study aimed to estimate the prevalence of frailty, disability and its determinants and their relation with mortality among community dwelling elderly cohort. **Materials and Methods:** The study was conducted in a cohort in rural Haryana, India, and was followed till October 2018. Frailty was assessed using the Edmonton Frailty Scale and disability was assessed using the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) scale by trained physicians. **Results:** The prevalence of frailty was found to be 47.3% (95% confidence interval [CI]: 44.0–50.8). The median WHODAS-2 score was found to be 10.4 (2.1–29.2). Those who were older (odds ratio [OR] – 2.5; 95% CI: 1.8–3.4), women (OR – 3.3; 95% CI: 2.2–4.9) and those with chronic disease (OR 2.3; 95% CI: 1.7–3.1) had higher rates of frailty. The adjusted hazard ratio of death among frail people was 4.7 (2.3–9.7). **Conclusion:** In this study we found the frailty is associated with the mortality among community dwelling elderly. Thus early identification of the frailty and its determinants may help us to reduce the mortality related to this.

Keywords: Community dwelling, disability, elderly, frailty, North India

Introduction

Frailty is a multi-domain construct defined as "loss of physiologic reserve of body that predisposes to disability."[1] Diminished mechanical strength, neurologic capacity, and cardiopulmonary capacity are three important components of frailty.[2] Frailty is linked with many adverse health outcomes, especially in older adults.[3] Poor health, related to frailty and its consequences, is preventable if diagnosed early.[4] Disability is an umbrella term used for complex measurement of health of a person and his or her societal environment.[5] Frailty and disability are linked to each other in many ways and are interdependent.[2]

The United Nations estimates that older adults (of age 60 years and above) constituted 13% of the total population of world in the year 2017 and is expected to increase at a rate of 3% per year.[6] According to the census in 2011, older adults comprised 7.5% of the total population of India.[7] Frailty and disability in this age group are likely to worsen poor health and have been bearing on the burden on the health system. Identifying frail people and taking corrective measures will act as primordial prevention for disability or other adverse health outcomes.

Studies conducted in the western world found frailty to be an independent predictor of both disability and mortality.[8] However, there are no studies from India linking frailty and mortality. Thus the study was planned to estimate the prevalence of frailty and disability in community dwelling cohort of elderly in rural north India and to determine the association between frailty and mortality.

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Materials and Methods

The study was conducted within a dynamic cohort of older adults (≥60 years) in five villages in the Ballabgarh block, Faridabad, Haryana. The total population of the cohort was 17,451 with 1404 elderly. All residents of age 60 and more, who gave written informed consent, were eligible for inclusion in the cohort. Assessment of frailty and disability was done in May–June 2016 among a randomly selected subsample from the cohort. 834 randomly selected consenting eligible elderly were included in the survey. Those who were unable to comprehend the question, mentally ill, unable to hear, and did not give consent were excluded from the frailty and disability assessment. Information on mortality was collected up to the end of October 2018 through house visits by trained surveillance workers during weekly follow-up activity.

Frailty was assessed using the Edmonton Frailty Scale. It was translated into the local language Hindi and back translated into English. The scale was pretested in the community before its use. In get-up and go test to assess the functional performance, participants who refused (38, 4.6%) performing the test were given a score of 2. Validated Hindi translation of the World Health Organization Disability Assessment Schedule 2.0 (WHODAS-2.0) (12 items) was used to measure disability by trained physicians.[9] Data on sociodemographic variables, household assets, self-reported morbidity, and tobacco and alcohol use were collected using a pretested questionnaire.

Data were entered in Epi Info-7 and analyzed using Stata version 12 (StatCorp, College Station, Texas, USA). Missing data (17%) for those who could not do clock drawing test as they did not know how to interpret a clock were imputed using age, gender, and presence of chronic disease. For frailty, the results were expressed as frail or not. Those who were frail were further subcategorized into vulnerable (Score: 6–7), mildly frail (Score: 8–9), moderately frail (Score: 10–12), and severely frail (score: ≥12). Disability scores were calculated using procedure as prescribed by the WHODAS group.[9] All scores were represented as mean with their standard deviation (SD). Wealth quintile was calculated using principal component analysis from possession of individual assets, as indicated in the calculation of wealth quintile analysis.[10] Logistic regression model was applied with frail as the outcome measure. All variables included in bivariate analysis were also included in the multivariable analysis. Survival analysis was done taking death as an outcome of interest to find the differences in the survival among frail and not frail participants and hazard ratio was reported with its confidence interval (CI). Ethical approval was obtained from the Institute Ethics Committee of All India Institute of Medical Sciences, New Delhi.

Results

A total of 834 randomly selected elderly individuals in the cohort were followed up for a period of 30 months. Sociodemographic, comorbidity details of the study participants are provided in Table 1. The prevalence of frailty among participants was found to be 47.3% (95% CI: 44.0–50.8); 24.9% (95% CI: 22.1–28.0) were vulnerable, 14.1% (95% CI: 11.9–16.7) were mildly frail, 7.4% (95% CI: 5.8–9.4) were moderately frail, and 0.8% (95% CI: 0.4–1.7) were severely frail. Functional performance was most compromised with a mean score of 1.03 (SD: 0.87), followed by functional independence (0.92, SD: 0.80). Continence (0.12; SD: 0.33) and medication use (0.05; SD: 0.22) were least compromised. The mean population score for the Edmonton Scale was 4.88 (with an SD of 2.54).

The median WHODAS-2 score of the participants was 10.4 (interquartile range: 2.1–29.2). From six domains of WHODAS-2.0, mobility (2.41, SD: 2.53) was the most compromised domain followed by cognition (1.96; SD: 2.31), whereas self-care was the least compromised domain. The mean WHODAS score among those who were frail (34.9; SD: 25.0) was significantly higher (*P* value: 0.000) from those who were not frail (8.8; SD: 11.9).

The prevalence of chronic comorbidity among individuals with frailty was higher than those without and this was found to be statistically significant (*P* value: 0.000). Similarly, mortality at the end of the follow up period was found to be significantly associated with comorbid conditions (*P* value: 0.000). Among those who died during the follow-up period, a statistically significant difference was observed in age, gender, presence of chronic disease, and tobacco use. A statistically significant difference was also observed in the WHODAS-2 scores in total and also in each domain among those who were frail and not at baseline and also those who died within the follow-up period [Table 1].

In univariate analysis, age more than 70 years, female gender, presence of any chronic disease, and alcohol use were found to be significantly associated with frailty. In multivariate analysis, it was found that those in the age group more than 70 years were 2.5 (95% CI: 1.8–3.4) times more likely to be frail than those in the age group of 61–70. Female participants had almost three times higher risks of being frail than their male counterparts. Similarly, those suffering from any chronic disease were 2.3 times (95% CI: 1.7–3.1) more likely to be frail [Table 2].

At the end of 30 months, a total of 53 (6.4%) deaths were reported in the cohort and three (0.4%) were lost to follow-up. From these, 11 (20.7%) deaths were reported among those who were nonfrail and the rest were among frail individuals. The death rate among nonfrail individuals was found to be 2.5% (1.03–4.00), 5.8% (2.6–9.0) among vulnerable, 16.1% (9.4–22.8) among mildly frail, and 15.9% (7.0–24.8) among moderately and severely frail individuals. The survival curve according to frailty status of participants is given in Figure 1. The adjusted hazard ratio became 4.7 (2.3–9.7) with a hazard ratio of 0.33 (0.2–0.6) for female gender, 2.6 (1.5–4.6) for age more than 70 years as compared to those aged between 60 and 70 years, and 1.84 (1.04–3.25) for presence of any chronic disease.

Table 1: Socioeconomic and clinical character of participants

	All participants (*n*=834) *N* (%)	Frail at Baseline (*n*=395) *N* (%)	*P* value	Mortality at the end of follow up *N* (%)	*P* value
Age					
61-70	571 (68.4)	235 (41.2)	0.000	4 (0.7)	0.000
71-80	263 (31.6)	160 (60.8)		11 (4.2)	
Gender					
Male	358 (43.0)	117 (32.7)	0.000	10 (2.8)	0.002
Female	476 (57.0)	278 (58.4)		5 (1.1)	
Wealth quintile					
1st	168 (20.2)	74 (44.0)	0.383	12 (7.1)	0.798
2nd	157 (18.8)	79 (50.3)		12 (7.6)	
3rd	146 (17.5)	78 (53.4)		11 (7.5)	
4th	168 (20.2)	75 (44.6)		9 (5.4)	
5th	195 (23.3)	89 (45.6)		9 (4.6)	
Presence of chronic diseases	340 (40.8)	198 (58.2)	0.000	33 (9.7)	0.002
Tobacco user	486 (58.3)	223 (45.9)	0.313	38 (7.8)	0.031
Alcohol user	173 (20.8)	51 (29.5)	0.000	14 (8.1)	0.346
WHODAS score, median	13.0 (6-22)	13 (6-22)	0.000	16 (10-29)	0.000
Cognition, median	3.0 (1-5)	3 (1- 5)	0.000	3.0 (2-6)	0.000
Mobility Median	4.0 (2-6)	4 (0- 6)	0.000	4.0 (3-8)	0.000
Selfcare Median	0.0 (0-2)	0 (0-2)	0.000	0.0 (0-2)	0.000
Getting along Median	0.0 (0-2)	0 (0-2)	0.000	1.0 (0-3)	0.000
Life Activities Median	3.0 (1-5)	3 (1-5)	0.000	4.0 (2-6)	0.000
Participation Median	2.0 (1-5)	2 (1-5)	0.000	3.0 (2-6)	0.000

WHODAS: WHO Disability Assessment Schedule, IQR: Interquartile rang

Discussion

To our knowledge, this is one of the very few studies in India which has reported the burden of frailty and disability among community-dwelling older adults. The prevalence of frailty was found to be 47.3% with 0.8% being severely frail. This prevalence was lower than that reported by Biritwum *et al*.(56.9%), higher than Kashikar *et al*.(26%), and Jotheeswaran *et al*.(26.1%) in a multicentric study.[11-13] Kashikar *et al*. and Jotheeswaran *et al*. used frail phenotype, i.e. clinical features related to frailty for assessment of frailty. Biritwam *et al*. created a new frailty assessment tool. Hospital-based studies by Verma and Singh, Khandelwal *et al*. found higher (78%) and lower prevalences (33.2%) than the current study, respectively.[14,15] These differences may be attributed to the geographic location of study place (Rural vs. Urban) with elderly studied and the age of the participants and tool used for measurement of frailty.

In this current study, age more than 70 years, female gender, and presence of chronic disease were found to be associated with frailty of any grade. A study by Kashikar *et al*. in Pune, India found that age and gender were not associated with frailty where as presence of other comorbidity was associated with frailty.[12] A study by Biritwum *et al*. showed that increasing age, female gender were associated with being frail.[11] In addition to the reasons reported above, the study differences could also be due to the differences in the confounders included in the multivariate analysis.

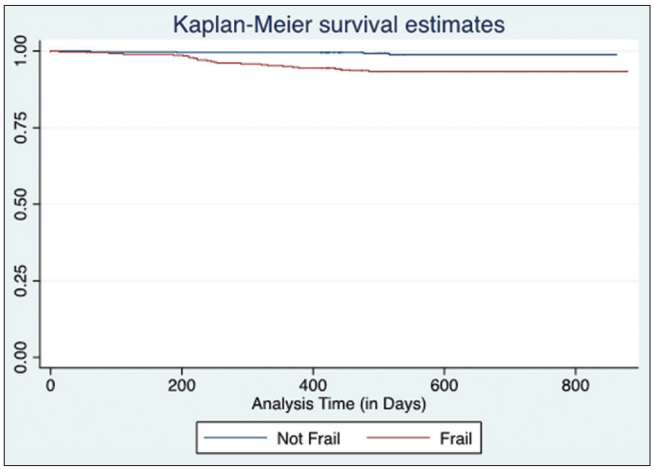

Figure 1: Kaplan–Meier survival estimates among frail and nonfrail participants with weekly outcome assessment

Our study found that frail individuals were 4.7 times more likely to die than nonfrail. This hazard ratio was similar to that obtained by Buchman *et al*. in their study in hospital settings and in a community setting by Escobar *et al*.[16,17] However,

Table 2: Prevalence and determinants of frailty in a community-dwelling elderly in rural North India

Determinant	Frailty of any grade	
	Crude OR	AOR*,#
Age		
61-70	1	1
71-80	2.2 (1.6-3.0)	2.5 (1.8-3.4)
Gender		
Men	1	1
Women	2.9 (2.2-3.9)	3.3 (2.2-4.9)
Wealth quintile		
1st	1	1
2nd	1.3 (0.8-2.0)	1.4 (0.9-2.3)
3rd	1.5 (0.9-2.3)	1.7 (1.1-2.8)
4th	1.0 (0.7-1.6)	1.0 (0.6-1.6)
5th	1.1 (0.7-1.6)	1.0 (0.6-1.6)
Any chronic disease	2.1 (1.6-2.8)	2.3 (1.7-3.1)
Tobacco user	0.9 (0.7-1.2)	1.3 (0.9-1.8)
Alcohol user	0.4 (0.3-0.6)	0.8 (0.5-1.3)

*Adjusted for age, gender, wealth quintile, presence of chronic disease, tobacco use and alcohol use, #R^2=0.138. OR: Odds ratios, AOR: Adjusted odds ratio

this result was higher than that reported by Song *et al*. and Liu *et al*.[18,19] In addition to methodological differences, the association of frailty and mortality might be affected by access to health care to the study population.

The strengths of the study are that data were collected by physicians using standard tools and community setting with frequent follow-up. The limitations were that some of the items in EFS were difficult to implement in this largely illiterate rural population. The sample size was not specifically calculated for this analysis but taking the prevalence of frailty to be 12.7% with a relative precision of 20%, and nonresponse rate of 20% the sample size came out to be 821.[20]

This study documents the high prevalence of frailty among the elderly in community settings in rural northern India, its determinants, and its strong relation to mortality. Inclusion of the currently program for the elderly with the community-based frailty assessment may help in prioritizing the need.

Conclusion

The prevalence of frailty was high in this rural cohort of elderly individuals. Prevalence of frailty was higher in older individuals, women and those with chronic disease. Frail individuals were almost five times more likely to die than those who were not frail. Early identification of frailty, disability and its determinants may help in reducing morbidity and mortality in elderly.

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Conflicts of interest

There are no conflicts of interest.

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