How frail are our elderly? An assessment with Tilburg frailty indicator (TFI) in a rural elderly population of West Bengal

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Abstract

Context: "Frailty" is a multidimensional geriatric syndrome that increases the risk for adverse health outcomes, such as falls, hospitalization, increased morbidity, and mortality, among elderly persons. **Aim:** The objective of this study is to find out the proportion of frailty and its associates among elderly (aged ≥60 years) in a rural area of West Bengal. **Settings and Design:** It is a community-based cross-sectional observational study done during May–August 2018 among 165 elderly persons selected by systematic random sampling by probability proportionate to size method from three villages at the rural field practice area of our institute. **Materials and Methods:** Tilburg frailty indicator is used to measure frailty. An elderly is considered as frail if s/he scores ≥6 in this scale. **Statistical Analysis:** Data analysis is done by SPSS Version 16. The logistic regression is done to find out the associates of frailty. **Results:** Proportion of frailty is 38.8% (mean age ± SD: 67.03 ± 3.43 years) among the study subjects. Age, female gender, loss of spouse, illiteracy, economic dependency, no job/at home status, ≥2 chronic diseases are significantly associated with frailty in univariate logistic regression. In multivariable logistic regression, ≥2 chronic diseases [AOR: 8.4, CI: 4.6, 11.33] and illiteracy [AOR: 3.3, CI: 1.05, 9.8] retain their significance. **Conclusion:** Frailty should be recognized as a public health priority and awareness generation among elderly population for healthy ageing including self-motivation for proper management of their ailments should be emphasized for reduction of morbidity as well as for augmenting their quality of life.

Keywords: Elderly, frail elderly, frailty, frailty syndrome, Tilburg frailty indicator

Introduction

Frailty can be defined as a dynamic condition affecting a person who feels weak or has reduced function in one or more domains of human physiologic conditions like physical, psychological, and social, which is caused by the influence of a range of various factors and these factors increase the risk of adverse outcomes.[1] It is a multidimensional geriatric syndrome characterized by compromised reserve and decline in functions of multiple organ systems.[2]

Fried *et al.* defined five key areas indicating compromised energetics, i.e. low grip strength, low energy, slow walking speed, low physical activity, and/or unintentional weight loss for diagnosis of frailty.[3] Very briefly, frailty means infirmity, weakness, and lack of physical and mental strength.

There are two models for identifying frailty.[4] The first is the frailty "phenotype" model[3] that defines frailty as with three or more out of the five characteristics: unintentional weight

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loss (10 lb in the past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity.[3] The second model is the cumulative deficit model proposed by Rockwood *et al.*,[5] which is based on counting the number of clinical deficits (symptoms, signs, conditions, and biochemical values) and using certain cutoffs to establish the diagnosis of frailty. Both have independently predicted falls, disability, hospitalization, institutionalization, and death.

Frailty is a condition that goes side by side with old age. As per WHO, in 2015, more than 900 million people worldwide are in elderly age group, and by 2050, this number will be increased to 2 billion.[6] Currently, 8.6% of Indian population are in elderly age group (>60 years) as per 2011 census, and with the advancement of medical sciences, the proportion of the elderly population is also increasing rapidly.[7] It is predicted that by 2050, India will hold the highest number of geriatric population in the world.[7]

Frailty, in fact, is regarded as a predisability state and, therefore, if identified on time, may avert many adverse health outcomes in the elderly such as cognitive impairment including dementia, multiple chronic diseases, falls, prolonged hospitalization, disability, etc., leading to positive mental and physical health and satisfactory quality of life.[8-20] National Programme for Health Care of the Elderly (NPHCE) was launched in 2011 and was expected to provide an accessible, affordable, comprehensive, and effective high-quality health services to meet up the needs of geriatric population over time and to make a framework to promote the concept of active, creative, and healthy aging to forestall geriatric morbidities.[21]

An optimistic presumption is early detection of frailty and its risk factors will evoke much needed timely and appropriate intervention for its delay and even prevention. Previous studies show that increasing age, female gender, lower level of education, economic dependency, depression, nutritional status, low level of physical activity, etc., are very much associated with frailty.[22-24]

A systematic review on 2017 found scarcity of studies on frailty in developing countries and recommended widespread research in this context.[25] Though a handful of studies are available to examine the morbidity pattern of the elderly in the country, there are very few studies that have assessed the associates of frailty. Moreover, there is dearth of studies on frailty among the elderly in this part of the country. With this background, a study was conducted in a rural area of West Bengal to find out the magnitude of frailty among the elderly population and to identify its associated factors.

Materials and Methods

Study design: A community-based observational study with cross-sectional design was carried out from May to August 2018 at three randomly selected villages in the rural field practice area of All India Institute of Hygiene and Public Health, Kolkata. All elderly (≥ 60 years) individuals who were permanent residents (≥1 year) of the study area were included. Those who

were critically ill or mentally unstable to respond and those who did not give informed written consent was excluded.

Sample size: The sample size was calculated using the formula: $n = (Z_{\alpha/2})^2 \times p \times q/l^2$, where $n = 1.96 \times 1.96 \times 50 \times 50/10^2 = 10000/100 = 100$ (taking proportion $P = 50\%$ and $q = 50\%$, $(100 - p)$, allowable error (l) =10%, and standard normal deviate $Z = 1.96$ (for 95% confidence interval). There is no study available in this area regarding proportion of frailty; so, the 50% proportion was taken to calculate the sample size. As multistage sampling was used, design effect of 1.5 was given and total sample size calculated was $1.5 \times 100 = 150$. Taking the nonresponse rate as 10%, the final sample size was calculated to be 165.

Sampling method: Multistage sampling method was used for the selection of participants. In the first stage, 3 villages were selected randomly from 64 villages of the block under rural field practice area of our institute. Total number of study participants from each village were selected by the population proportionate to size method. Then, each of the study participants were selected by systematic random sampling technique by using the voters' list from those three villages [Figure 1].

Method of data collection: After obtaining permission from the Institutional Ethics Committee of All India Institute of Hygiene and Public Health, Kolkata, house to house visit was done. Informed written consent was taken from all study participants before data collection. Face-to-face interview was taken from study participants using a predesigned pretested structured schedule with the following domains:
1. Sociodemographic characteristics;
2. Behavioral characteristics;
3. Morbidity profile;
4. Geriatric depression (Geriatric depression scale, short form [GDS]);
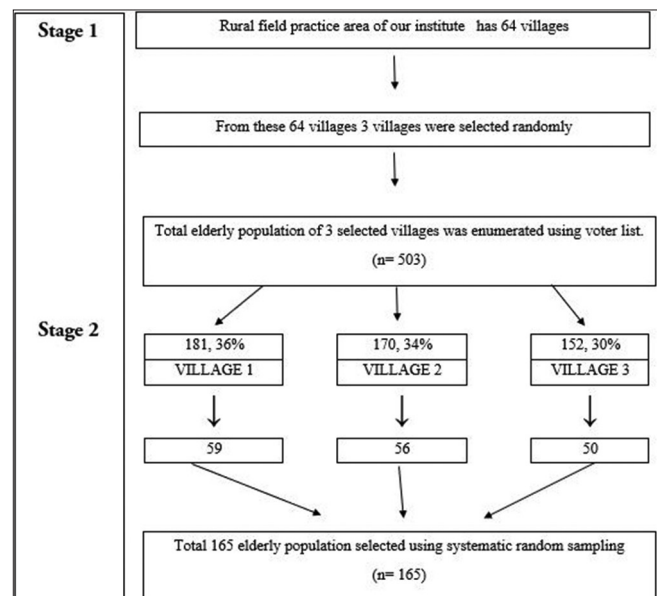
Figure 1: Flowchart showing the sampling technique

5. Frailty [Tilburg frailty indicator (TFI)];
6. Activities of daily life (ADL questionnaire) and instrumental activities of daily life (IADL questionnaire).

Operational definition

1. TFI is a self-reported schedule for assessment of frailty through its three important components, such as physical, phycological, and social. Eight questions regarding physical component, four questions on psychological component, and three questions on social component were asked. Total attainable score was ranged from 0 to 15. An individual with a score of ≥6 was considered to be frail.[26]
2. In geriatric depression scale, short form (GDS), 15 questions regarding geriatric depression were asked. Attainable score ranges from 0 to 15 and an individual with a score of ≥6 was considered to be depressed.[27]
3. ADL questionnaire has six questions and attainable score was 0 to 6. In this study, score of ≥1 was taken as cutoff point for unsatisfactory ADL score.[28]
4. IADL questionnaire have eight questions and attainable score was 0 to 8. Score ≥1 was taken as cutoff for unsatisfactory IADL score.[28]

Statistical analyses

Data was analyzed with IBM SPSS version 16 software. Descriptive statistics was shown by tables and figures. Univariate and multivariable logistic regression was done to find out the factors associated with frailty. *P* value <0.05 was considered as cutoff for statistical significance.

Result

Sociodemographic characteristics: From Table 1, it can be seen that majority of the participants were females (67.9%) aged below 70 years (66.1%) and belonged to Hinduism religion (97.6%) and to general caste (70.9%). One-third of study participants (33.3%) had lost their spouse prior to the study. More than one-third (37%) were illiterate, followed by 32.1% who studied up to primary school. Almost one-third (29.1%) of the study population was still working to earn. Most of the study participants (55.8%) belonged to class IV of the Modified BG Prasad scale (January 2018).

In this study, a total of 64 persons (38.8%) among 165 study participants were found to be frail as per TFIs. It was observed that the proportion of frailty was higher among the females (84.4%) than the males [Table 2].

Univariate logistic regression showed that *increasing age* [OR: 1.07, CI: 1.01, 1.12], *female gender* [OR: 4.3, CI: 1.832, 8.747], *loss of spouse or widow/widower* [OR: 3.1, CI: 1.541, 5.896], *illiteracy* [OR: 3.5, CI: 1.382, 15.984], *economic dependency* [OR: 2.7, CI: 1.295, 5.740], *no job/at home status* [OR: 3.8, CI: 1.709, 8.647], ≥2 *chronic diseases* [OR: 5.8, CI: 5.71, 15.95] were significantly associated with frailty. In multivariable

Table 1: Sociodemographic characteristics of study participants (*n*=165)		
Characteristics	Number (%)	Statistics
Gender		
Male	53 (32.1)	
Female	112 (67.9)	
Age (in years)		
60-69	109 (66.1)	Mean: 66.99, Median: 65
70-79	43 (26.1)	SD: 6.5
≥80	13 (7.8)	Range [min, max]: 28 [60,88]
Religion		
Hindu	161 (97.6)	
Muslim	4 (2.4)	
Caste		
General	117 (70.9)	
SC	41 (24.8)	
OBC	7 (4.3)	
Marital status		
Married	110 (66.7)	
Widow	55 (33.3)	
Educational qualification		
Illiterate	61 (37)	
Below primary	33 (20)	
Primary	53 (32.1)	
Middle school	11 (6.7)	
Secondary and above	7 (4.2)	
Occupation		
At home	117 (70.9)	
Others (work for pay)	48 (29.1)	
Modified BG Prasad Scale, 2018 (per capita income, Rs/month)		
Class I (6574 and above)	0	Mean: 1220.87
Class II (3287-6573)	4 (2.4)	Median: 1071.43
Class III (1972-3286)	10 (6.0)	SD: 563.50
Class IV (986-1971)	92 (55.8)	Range [min, max]: 3444.44 [555.56, 4000]
Class V (985 and below)	59 (35.8)	

logistic regression, illiteracy [AOR: 3.3, CI: 1.05, 9.8], ≥2 chronic diseases [AOR: 8.4, CI: 4.6, 11.33] retained their significance (*P* <.05) [Table 3]. The value Cox and Snell *R*² was 0.42 and Nagelkerke's *R*² for the model was 0.52. Hosmer and Lemeshow test was not significant for this model (*P*-value 0.93) so the model was fitting well.

Table 4: Here frailty was taken as an independent variable and ADL, IADL and depression were taken as dependent variables for analysis of univariate logistic regression. From Table 4, it could be seen that the odds of having unsatisfactory ADL score among the frail elderly was 1.91 times more with respect to the normal elderly, which was statistically significant (*P*-value 0.01). The unsatisfactory IADL score was 3.7 times more among frail elderly with respect to normal elderly (*P*-value 0.01). But depression was not significantly associated with frailty. In the study about one-third of the study participants, 54 (32.7%) suffered from depression according to the geriatric depression scale. So, it could be seen that frail elders had more problems in daily living and reduced daily activity might be the consequences of frailty.

Table 2: Distribution of study participants according to their response to TFI questionnaire and frailty status (*n*=165)

Sl number	Question	Yes No (%)	No No (%)	Descriptive statistics (score)
Physical components				
1	Do you feel physically healthy?	78 (47.3)	87 (52.7)	Mean: 3.34
2	Have you lost a lot of weight recently without wishing to do so?	19 (11.5)	146 (88.5)	Median: 3.00
	Do you experience problems in your daily life due to:			SD: 1.96
				Range: 8 [0-8]
3	Difficulty in walking?	52 (31.5)	113 (68.5)	
4	Difficulty maintaining your balance?	48 (29.1)	117 (70.9)	
5	Poor hearing?	34 (20.6)	131 (79.4)	
6	Poor vision?	34 (20.6)	131 (79.4)	
7	Lack of strength in your hands?	135 (81.8)	30 (18.2)	
8	Physical tiredness?	143 (86.7)	22 (13.3)	
Psychological components				
9	Do you have problems with your memory?	55 (33.3)	110 (66.7)	Mean: 2.45
10	Have you felt down during the last month?	154 (93.3)	11 (6.7)	Median: 2.00
11	Have you felt nervous or anxious during the last month?	148 (89.7)	17 (10.3)	SD: 0.84
				Range: 4 [0-4]
12	Are you able to cope with problems well?	117 (70.9)	48 (29.1)	
Social components				
13	Do you live alone?	2 (1.2)	163 (98.8)	Mean: 0.21
14	Do you sometimes miss having people around you?	31 (18.8)	134 (81.2)	Median: 0.00
15	Do you receive enough support from other people?	163 (98.8)	2 (1.2)	SD: 0.47
				Range: 3 [0-3]

FRAILTY STATUS

Score	Number (%)			
<6 (Normal)	101 (61.2)			Mean: 6.012
≥6 (Frail)	64 (38.8)			Median: 5.00
				SD: 2.76
				Range: 9 [3-12]

Table 3: Univariate and multivariable logistic regression showing factors associated with frailty (*n*=165)

Characteristics	Frailty No. (%)	OR	*P*	AOR	*P*
Gender					
Male	10 (18.9)	1	0.02	1	0.11
Female	54 (48.2)	4.3		4.4	
Increasing age ↑	–	1.07	0.01	1.09	0.076
Caste					
General caste	50 (42.7)	1	0.81		
Others	34 (70.8)	1.8			
Marital status					
Married	33 (30)	1	0.02	1	0.58
Widow	31 (56.4)	3.1		1.4	
Education					
Illiterate	35 (57.4)	3.5	0.001	3.3	**0.026**
Literate	29 (27.9)	1		1	
Occupation					
At home	55 (47.0)	3.8	0.03	1.5	0.78
Others (work for pay)	9 (18.8)	1		1	
Economic dependency					
No	12 (23.5)	1	0.01	1	0.84
Yes	52 (45.6)	2.7		1.3	
≥2 chronic diseases					
Yes	52 (46.7)	5.8	0.02	8.4	**0.01**
No	12 (19.6)	1		1	
Depression					
Present	25 (46.3)	1.59			
Absent	39 (35.1)	1			

P value was less than 0.05 for the bold values

Discussion

The proportion of frailty was 38.8% among elderly aged 60 years in a rural area of West Bengal. Tilburg frailty scale was used to quantify frailty in this study. Factors significantly associated with frailty were age, female sex, widow or widower persons, low educational status, no occupation, little or no money for expenditure. In multivariable logistic regression illiteracy, and more than two chronic diseases retained their significance.

The proportion of frailty was 26.6% and prefrail persons was found to be 62.4% in a study done by Kashikar *et al.* in Pune in 2016.[24] Lower educations, economic dependency, not going out, fear of falling, and loss of emotional support were significantly associated with frailty. Fried phenotypic scale was used in this cross-sectional study done in an urban area.[24]

Ding *et al.* conducted a retrospective longitudinal study at London in 2017.[29] In the study, the sample size was 4386. Age range of the study subjects was 65–89 years. This study found age, low physical activity, depressive symptoms, cognitive impairment, poor social support, etc., all predict future physical frailty. About 20% frailty was found in wave 2 and 25% frailty was found in wave 6 from this study.[29]

A prospective multicentered cohort study in six centers of Germany was carried out by Hajek *et al.* in 2016.[30] It was a

Table 4: Relationship of ADL, IADL, and depression with frailty (*n*=165)						
Frailty	ADL score unsatisfactory No. (%)	OR (*P*)	IADL score unsatisfactory No. (%)	OR (*P*)	Depression present No. (%)	OR (*P*)
Present	40 (65.5)	1.91 [0.01]	41 (64.1)	3.7 [0.01]	25 (39.1)	1.6 [0.17]
Absent	21 (34.4)	1	33 (32.7)	1	29 (28.7)	1

longitudinal study with sample size 1602 on individuals aged 80 years and older. Frailty was assessed by using the Canadian Study of Health and Aging Clinical Frailty Scale, ranging from 1 (very fit) to 7 (severely frail). Frailty was associated with female gender, marital status, depression, and dementia.

The proportion of frailty in our study (38.8% versus 26.6%) was higher than the study done by Kashikar *et al.*[24] This difference may be due to use of different frailty scales in the two studies. There is no chance of measuring prefrailty using TFI but prefrailty can be measured using the Fried phenotypic scale. The proportion of frailty was lower in our study [38.8% versus 25%] than in the study done by Ding *et al.*[29] The cause may be better awareness about healthy living and economic sufficiency among persons living in high-income countries.

In our study increasing age, female gender, loss of spouse, illiteracy, inadequate money in hand for expense, no job/at home status, and ≥2 chronic diseases were significantly associated with frailty. In multivariable logistic regression, illiteracy, ≥2 chronic diseases retained their significance. Lower education and economic dependency were also significantly associated with frailty in the study done by Kashikar *et al.*[24] Ding *et al.*,[29] and Hajek *et al.*[30] found significant association of frailty with depression. But in our study depression was not significantly associated with frailty. Female gender and marital status were significantly associated with frailty in our study and the study done by Hajek *et al.*

Depression was an independent variable in our study. But during analysis, depression was taken as a dependent variable also [Table 4]. The proportion of depression was 32.7% in our study using GDS. The prevalence of depression was 69% in a study done by Laksham *et al.* at Puducherry in 2017.[31] The low proportion of depression in our study may be due to different study settings.

Elderly persons have some difficulties in daily life due to frailty and progressive aging process. We assessed these with the help of ADL and IADL scores. The burden of depression may also be increased due to aging. The hypothesis is that they are all associated with frailty. In our study, the decrease in ADL and IADL were significantly associated with frailty. There was decrease in activities of daily living among frail persons. These type of results might be seen due to consequences of aging.

Conclusion

Frailty or frailty syndrome may be addressed as multidimensional, heterogeneous, and unstable syndrome, thus distinguishing it from disability or ageing alone. Rather, it is widely envisaged as a state of vulnerability and a state of predisability. Therefore, earlier it is assessed and conceived better is the chance of avoidance, delay, or at least preparation of its unpropitious outcome like disease, disability, and dependence. In this study, about 38.8% of the old people were frail. Factors significantly associated with frailty were female gender, marital status of persons, educational status, occupation, money for expenditure. More care and attention is required for the elderly women. Education is an important factor for living a healthy life. Better education makes a society healthy and takes care of frailty to some extent. Since the life span of the general public is increasing, all efforts must be made at both individual, family, and community level to keep the mind and body of the elderly healthy, alert, and agile so that frailty and its aftermath never comes or is delayed. It is worthwhile to mention that economic dependency is an important influencer of frailty, and therefore, to make the elderly population economically independent, government-aided social schemes should be promoted exclusively for this section of the population.

Frailty is a distinct health state where a minor event can trigger major changes in health from which the elderly persons may fail to return to their previous level of health. Frailty is related to reduced function across multiple physiological systems that develops as part of the ageing process. It means that even minor events or minor external stressors can disproportionately change in health status after which the person fails to recover to his previous state and the frail person may also develop adverse health outcomes like hospitalization or disability.[32]

Frailty can present with variable and different vulnerability to some adverse health outcomes of elderly persons of the same chronological age. In primary care, it has its origin in aiming to different health care needs of different older adults, so as to show that "the elderly" are not homogenous.[33]

In our primary care setting, frailty among elderly can be detected using TFIs or any other tool. The timely detection of frailty among elderly will initiate preventive, supportive, and self-care measures among frail persons and ultimately this will reduce the burden of fall, hospitalizations, and disability through timely handling the external stressors.[34]

Many affordable measures like regular physical activities (to improve muscle strength), appropriate medications for diseases, self-support and self-care practices (like using stick in roads, a hand rail in bathroom, etc.) may help frail elderly to live a healthy life.[32]

Personalized preventive and self care measures may also be developed to arrest the progression of frailty after its early detection. The early detection of frailty in primary care settings not only helps the frail elders to prevent the adverse health outcomes in advance but also gives our society a group of healthy elders who will contribute to the advancement of the nation.

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Conflicts of interest

There is no conflicts of interest.

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