Original Article

Burden of frailty and its correlates among the elderly: a cross-sectional study in a rural community of West Bengal

Sauryadripta Ghose[1], Dipak Pal[2], Bobby Paul[3], Aparajita Dasgupta[4], Pritam Ghosh[5], Neelam Maurya[1]

[1]Department of Community Medicine, ESIPGIMSR and ESIC MC, Joka, Kolkata, West Bengal, India, [2]Department of Community Medicine, JIMSH, Budge Budge, Kolkata, West Bengal, India, [3]Department of Preventive and Social Medicine, AIIH and PH, Kolkata, West Bengal, India, [4]Department of Community Medicine, KPC MCH, Kolkata, West Bengal, India, [5]NTEP Consultant, World Health Organization, India

Abstract

Context: With the ageing of Indian society, providing a healthy life among older people is a public health precedence. Therefore, beforehand discovery and possible forestalment of frailty may help promote healthy ageing and dwindle the social, mental and financial burden of their families and caregivers. **Aims:** The study aimed to assess the proportion of frailty and its associated factors among the elderly aged 65 years and above in a rural community of West Bengal. **Settings and Design:** A community-based cross-sectional study was conducted among 270 elderlies selected from 15 villages out of a total 64 villages of Singur under the Hooghly District of West Bengal from January 2019 to February 2020. **Materials and Methods:** Cluster sampling technique was used. Data was collected using a pre-designed, pre-tested structured schedule including Fried frailty phenotype (FFP), geriatric depression scale short form (GDS 15) and mini nutritional assessment (MNA) tool. **Statistical Analysis Used:** Associated factors of frailty were assessed by univariate and multivariable logistic regression using SPSS version 16 software and MS Excel 2019. **Results:** The proportion of frailty was observed to be 23.7% and that of prefrailty 40.7%. Frailty was significantly associated with increasing age [AOR(CI) 1.2(1.1-1.3)], decreasing years of schooling [AOR(CI) 1.3(1.1-1.5)], loss of spouse [AOR(CI) 4.2(1.2-15.2)], financial dependency [AOR(CI) 19.3(2.7-139.0)], staying at home [AOR(CI) 16.3(2.7-98.2)], presence of anaemia [AOR(CI) 3.6(1.3-9.5)], at risk of malnutrition [AOR(CI) 6.5(1.9-22.3)], increasing number of falls in the last 1 year [AOR(CI) 4.3(1.2-15.6)], presence of 3 or more chronic diseases [AOR(CI) 154.7(12.1-1981.9)] and depression [AOR(CI) 8.3(2.5-27.0)]. **Conclusion:** The burden of frailty among the study population is relatively high. It's an intimidating situation that needs bettered screening provisions for early discovery with special stress on nutritive upliftment. Screening for depression should also be done regularly.

Keywords: Elderly, frailty, Fried frailty phenotype (FFP), geriatric depression scale (GDS), mini nutritional assessment (MNA) tool

Introduction

Ageing is a normal natural miracle. The world is on the point of a demographic corner. Since the morning of recorded history, youthful children have outnumbered their elders. Soon, still, the number of people aged 65 or aged will outnumber children under age 5. Driven by falling fertility rates and remarkable

Address for correspondence: Dr. Sauryadripta Ghose, Barabazar, Mogaltuli (Bibir Bagan), Chinsurah, Hooghly - 712 101, West Bengal, India.
E-mail: sauryadriptaghose@gmail.com

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increases in life expectancy, population ageing will continue, indeed accelerate. The number of people aged 65 or aged is projected to grow from an estimated 524 million in 2010 to nearly 1.5 billion in 2050, with the utmost of the increase in developing countries.[1] According to the Population Census 2011 India has 7.4% population aged above 60 years of which around 5.3% of senior people are aged 65 years and above. For a developing country like India, this may pose mounting pressures on various socio-economic fronts including pension expenses, healthcare expenditures, financial discipline, savings situations, etc., along with their enormous physical and mental problems.[2]

Frailty is considered to indicate the end of healthy life expectancy and develops as a consequence of the age-related decline in physiological systems, resulting in increasing individual vulnerability to health status changes. 'Frailty' is a multidimensional geriatric syndrome that increases with age and leads to high risk for adverse health outcomes such as falls, hospitalization, institutionalization and mortality (Bauer and Sieber, 2008).[3] Frailty is different from normal ageing in terms of poor resolution of homeostasis after any stressor event such as infection or fall or surgery. These minor stressors lead to disproportionate changes in the health status, decreasing mobility and limiting independence, thereby increasing the vulnerability of the older adults. Increased risk of adverse health outcomes affects health and may also affect the overall quality of life of the older adults.

As the population ages, a central focus of public health interpreters is to understand and also beneficially intervene on the adjustable factors of all morbidities including frailty that especially torment this veritably vulnerable population. Accumulating substantiation suggests that frailty is addressable and reducing frailty at the individual and population level is a desirable thing for keeping the old people in the mainstream of the active and productive society. So, understanding the predictors of frailty holds the key to make way for delaying its onset and decelerating its progression and indeed forestalment of this curse of frailty among the aged population.

With this background, the current study aimed to assess the proportion of frailty and its associated factors among elderly people in a rural community of West Bengal. This data if participated by health directors or health policy makers applicable and effective strategies may be planned and enforced to bring relief to the sufferings of the senior population.

Materials and Methods

Study type and setting

This community-based observational study with cross-sectional design was conducted in the rural area of Singur in the district of Hooghly from June 2019 to February 2020. It serves a population of 99299 (according to the 2011 census) residing in 64 villages in Singur Block of Hooghly District.

Sampling

The study population comprised of elderly aged 65 years and above in the study area. All elderlies who were residing for at least one year in the village were included in the study. Those who did not give informed written consent were critically ill at the time of the study, had a serious neurological and psychiatric illness and had severe speech, visual and hearing impairment were excluded from the study.

Based on the prevalence of frailty to be 26% from a previous study,[4] taking confidence interval as 95% with $Z_{1-\alpha} = 1.96$; absolute error (L) =7.5% according to the formula $(Z_{1-\alpha})^2 \times (P \times Q/L^2)$, the calculated sample size was 131.39 ≈ 132. As the sampling was conducted by cluster sampling, a design effect of 2 was considered. Accordingly, the sample size was 132 × 2 = 264. 15 clusters had been decided. So, number of elderly people per cluster was 264 ÷ 15 = 17.6 ≈ 18. Therefore, the final sample size was = 15 × 18 = 270 elderly people.

Cluster sampling method was used taking 15 villages (cluster) and 18 study participants in each village. The rural field practice area had 64 villages. List of population of all villages was obtained. From the list, 15 villages were selected by probability proportional to population size (PPS) technique.

After going to centre of the selected village with the help of local maps and local people, at first one direction was chosen randomly with the help of a currency note. Then one house number was chosen randomly by the currency note. If an elderly person was present in that house, the house was considered as the first house. If not present, then the next house was visited and then the neighbouring houses were visited consecutively till 18 elderly people had been covered in the selected cluster. In case, all the houses had been visited in the selected lane similar exercise was performed in the next lane. The same procedure was followed in all the 15 clusters.

Data collection

After obtaining permission from the Institutional Ethics Committee, house to house visit was done. Informed written consent was taken from all study participants before data collection. Face-to-face interview was done for all study participants using a pre-designed, pre-tested, structured schedule (in Bengali language) with the following contents:

A. Questions related to demographic and socioeconomic characteristics
B. Questions related to societal characteristics
C. Questions related to behavioural characteristics
D. History of fall and morbidity profile (assessed by the researcher along with medical records provided by the participant or his/her family members)
E. Fried frailty phenotype (FFP), a five-item scale (Bengali version)
F. Geriatric depression scale (GDS 15 short form) (Bengali version)

G. Mini nutritional assessment (MNA) tool for elderly (Bengali version)
H. Assessment of anaemia with blood for haemoglobin measured by digital haemoglobinometer.

Operational definition

1. Frailty: An individual was said to be frail when he/she met three or more out of five Fried phenotypic criteria (unintentional weight loss, exhaustion, low physical activity, low hand grip strength, slow walking speed). If he/she met one or two criteria would be said to be prefrail and if no criteria were present, the individual was considered as robust.[5]
2. Depression: Depression was screened by GDS (short form, a 15-item questionnaire). In this questionnaire, answers indicating depression were in bold and italicized; score one point for each one selected. A score greater than 5 suggested depression.[6]
3. Nutritional Status: Nutritional status was assessed by mini nutritional assessment tool for elderly. Maximum 14 points possible. 12–14 points indicated normal nutritional status, 8–11 points indicated 'at risk of malnutrition', 0–7 points indicated 'malnourished'.[7]
4. Anaemia: In males, <13 gm/dl Hb concentration was considered as anaemia, and in females, <12 gm/dl Hb concentration was considered as anaemia.
5. Blood Pressure: Systolic blood pressure ≥140 mm hg and diastolic blood pressure ≥90 mm hg were considered as hypertension.
6. Diabetes Mellitus: Diabetes mellitus was elicited by review of medical records.
7. Addiction: Ever smoked or consumed alcohol or used smokeless tobacco.

Statistical analysis

Data were analysed using Microsoft Excel 2016 and Statistical Package for the Social Sciences (SPSS for Windows, version 16.0, SPSS Inc., Chicago, USA) software. Descriptive and inferential statistics including univariate and multivariable logistic regression were performed. Level of statistical significance was defined as P value < 0.05. Biologically plausible variables which were statistically significant in univariate models were selected in final multivariable model.

Results

Socio-demographic and socio-economic characteristics

Mean age of the study participants was 69.1 ± 5.6 years. Female participants consisted of 51.5% of the total participants. Mean years of schooling was 3.8 ± 4.5 years with 38.9% of illiteracy. According to B.G. Prasad socioeconomic scale 2020, most (55.9%) of them belonged to Class III socioeconomic group. Most (62.6%) of the study participants were financially dependent. Most (67.4%) of the study participants were married and majority (65.9%) belonged to joint family. Approximately two-thirds of them were not working and were staying at home (67%).

Socialization characteristics

Majority (97.1%) of the elderly were living with family members. More than one-third (36.3%) of the elderly were always participated in social gatherings, whereas 10% of the elderly never attended any social gathering.

Behavioural characteristics

Addiction to tobacco smoking was found in 35.9% study participants, whereas 11.9% consumed alcohol. Smokeless tobacco products were consumed by 18.9% of the study participants.

Nutritional status

MNA tool for elderly assessed that 7.4% participants were malnourished and 47.8% were at risk of malnutrition with a mean BMI of 22.5 ± 3.9. More than half (53.3%) of the study participants were diagnosed with anaemia with a mean haemoglobin concentration of 12.2 ± 1.4 gm/dl.

Morbidity profile

A total of 47% participants had single morbidity, 18.2% had two and 3.7% had three morbidities. Medical reports and self-reporting revealed that 61.5% of the study participants were hypertensive and 19.6% were diabetic. By GDS, 45.6% of the participants were screened for depression.

Proportion of frailty

Frailty was measured by Fried frailty phenotype (FFP) scale. The proportion of frailty observed in the current study was 23.7% and that of prefrailty was 40.7%.

Associated factors of frailty

Univariate logistic regression showed that frailty was significantly associated with increasing age, lesser years of schooling, female gender, joint family, loss of spouse, financial dependency, staying at home and less participation in social ceremony. Frailty was also significantly associated with increase in number of falls in the last 1 year, presence of 3 or more chronic diseases, those who were suffering from depression, those who were malnourished and were at risk of malnutrition and were diagnosed with anaemia [Table 1].

All the significant correlates of frailty were put into hierarchical multivariable model [Table 2].

Model 1 included socio-demographic and socio-economic characteristics which explained a variance of 0.399 (Nagelkerke R-squared value) and 0.265 (Cox and Snell R-squared value) of the outcome variable.

Model 2 included socio-demographic, socio-economic and socialization characteristics which explained a variance of

Table 1: Univariate logistic regression showing association of frailty with various socio-demographic characteristics, behavioural factors and morbidity profile (*n*=270)

Characteristic	Total	Frailty		OR (95% CI)	*P*
		Absent (%)	Present (%)		
*Age ↑	270	-	-	1.2 (1.1-1.3)	<0.001
Female	139	97 (69.8)	42 (30.2)	2.1 (1.2-3.8)	0.01
Hindu	254	191 (75.2)	63 (24.8)	4.9 (0.6-38.2)	0.125
Joint Family	178	125 (70.2)	53 (29.8)	3.1 (1.5-6.3)	0.002
Widow/Widower	88	51 (58)	37 (42)	4.2 (2.3-7.5)	<0.001
*Years of schooling ↓	270	-	-	1.2 (1.1-1.3)	0.001
Socioeconomic class					
II	31	26 (83.9)	5 (16.1)	0.4 (0.02-5.1)	0.469
III	151	125 (82.8)	26 (17.2)	0.4 (0.04-4.8)	0.481
IV	80	49 (61.3)	31 (38.8)	1.3 (0.1-14.5)	0.850
V	5	4 (80)	1 (20)	0.5 (0.02-12.9)	0.676
Financially dependent	169	117 (69.2)	52 (30.8)	3.3 (1.7-6.5)	0.001
Staying at home	181	123 (68)	58 (32)	6.5 (2.7-15.8)	<0.001
No health insurance	201	154 (76.6)	47 (23.4)	0.9 (0.5-1.8)	0.833
Living Alone	8	6 (75)	2 (25)	1.1 (0.2-5.5)	0.930
Never attended social gathering	27	12 (44.4)	15 (55.6)	12.4 (4.4-34.3)	<0.001
Presence of addiction	140	111 (79.3)	29 (20.7)	0.7 (0.4-1.2)	0.232
No. of Falls ↑ *	270	-	-	3.1 (2-4.7)	<0.001
Presence of 3 or more chronic diseases	10	4 (40)	6 (60)	6.9 (1.7.27.5)	0.006
Hypertension	166	121 (72.9)	45 (27.1)	1.7 (0.9-3)	0.098
Diabetes Mellitus	53	43 (81.1)	10 (18.9)	0.7 (0.3-1.5)	0.358
Depression	123	71 (57.7)	52 (42.3)	8.2 (4.1-16.4)	<0.001
At risk of malnutrition	129	82 (63.6)	47 (36.4)	8.1 (3.6-18)	<0.001
Malnourished	20	11 (55)	9 (45)	11.6 (3.7-36)	<0.001
Anaemia	144	102 (70.8)	42 (29.2)	1.9 (1.1-3.5)	0.025

*Considered as continuous variable during the measurement of association

Table 2: Predictors of frailty: Hierarchical multivariable logistic regression (*n*=270)

	Variables	Model 1 AOR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)	Model 4 AOR (95% CI)
Sociodemographic and economic	Age ↑	1.2 (1.1-1.3)	1.2 (1.1-1.3)	1.2 (1.1-1.3)	1.2 (1.1-1.3)
	Years of schooling ↓	1.2 (1.1-1.3)	1.2 (1.1-1.3)	1.2 (1.1-1.4)	1.3 (1.1-1.5)
	Female	1.1 (0.3-3.0)	1.1 (0.4-3.0)	1.2 (0.3-3.2)	1.3 (0.3-6.2)
	Joint family	1.2 (0.5-3.1)	1.1 (0.4-2.7)	1.2 (0.4-3.2)	1.3 (0.4-4.6)
	Widow/Widower	2.3 (0.9-5.3)	2.2 (0.9-5.1)	3.2 (1.2-8.7)	4.2 (1.2-15.2)
	Financially dependent	4.5 (1.1-19.0)	5.4 (1.2-23.1)	10.8 (2.2-53.5)	19.3 (2.7-139.0)
	Stay at home	10.0 (2.2-43.9)	10.9 (2.4-49.4)	22.1 (4.2-115.4)	16.3 (2.7-98.2)
Socialization	Never attended social gathering		2.9 (0.7-11.6)	1.4 (0.5-3.9)	0.4 (0.1-4.1)
Nutritional Status	At Risk of malnourishment			6.1 (2.3-16.6)	6.5 (1.9-22.3)
	Malnourished			4.6 (1.1-19.3)	3.5 (0.5-19.5)
	Anaemia			3.6 (1.6-8.1)	3.6 (1.3-9.5)
Morbidity Profile	No. of Falls↑				4.3 (1.2-15.6)
	Presence of 3 or more chronic diseases				154.7 (12.1-1981.9)
	Depression				8.3 (2.5-27.0)
	Nagelkerke R-squared value	0.399	0.409	0.511	0.655
	Cox and Snell R-squared value	0.265	0.272	0.340	0.436
	Hosmer and Lemeshow statistic *P* value	0.053	0.162	0.109	0.965

0.409 (Nagelkerke R-squared value) and 0.272 (Cox and Snell R-squared value) of the outcome variable.

Model 3 included socio-demographic, socio-economic, socialization characteristics and nutritional status which explained a variance of 0.511(Nagelkerke R-squared value) and 0.340 (Cox and Snell R-squared value) of the outcome variable.

Model 4 or the final model included all the independent variables of Model 3 along with depression and morbidity profile. Increasing

age [AOR 1.2(1.1-1.3)], decreasing years of schooling [AOR 1.3(1.1-1.5)], loss of spouse [AOR 4.2(1.2-15.2)], financial dependency [AOR 19.3(2.7-139.0)], staying at home [AOR 16.3(2.7-98.2)], presence of anaemia [AOR 3.6(1.3-9.5)], at risk of malnutrition [AOR 6.5(1.9-22.3)], increasing number of falls in the last 1 year [AOR 4.3(1.2-15.6)], presence of 3 or more chronic diseases [AOR 154.7(12.1-1981.9)] and depression [AOR 8.3(2.5-27.0)] were remained significant. All these explained the variance of 0.655 (Nagelkerke R-squared value) and 0.436 (Cox and Snell R-squared value) of frailty.

Hosmer–Lemeshow *P* value for all the models including final model was not significant (*P* value > 0.05), which means all the models including the final one were a good fit.

Discussion

Prevalence of frailty

The proportion of frailty observed in the current study was 23.7% and that of prefrailty was 40.7%. The prevalence of frailty was found to be 26% in a study conducted in Pune, Maharashtra, by Kashikar Y *et al.*,[4] whereas the prevalence of frailty was 28% as reported in a study in four villages in Thanjavur District of Tamil Nadu of Southern India by Kendhapedi KK *et al.*[8] A study was carried out in Kolpino District of St. Petersburg, Russia by Gurina NA *et al.*[9] showed that 21.1% of the elderly had frailty. All these studies used FFP for the measurement of frailty, and the prevalence of frailty was more or less similar to our study.

However, the prevalence of frailty was much less (12.2%) in the study by Curcio CL *et al.*[10] in four villages located in the coffee-growing zone of the Colombian Andes Mountains, Columbia. The prevalence of frailty was also less, i.e., 9.4% in a study conducted in Bogota, Colombia by Samper-Ternent R *et al.*[11] and only 7% in a study conducted by Wu C *et al.*[12] in 28 provinces of China. All these studies also have used FFP for the measurement of frailty. Whereas, prevalence of frailty was higher (38.8%) in the study by Dasgupta A *et al.*[13] in rural field practice area of All India Institute of Hygiene and Public Health (AIIH and PH), Kolkata. The prevalence of frailty was also higher (41.3%) in a study conducted by Carneiro JA *et al.*[14] in Northern Minas Gerais, Brazil and 43.9% in a study conducted in Kolpino District of St. Petersburg, Russia by Gurina NA *et al.*[15] However, none of these have used FFP for the measurement of frailty.

Associated factors of frailty

Frailty was significantly associated with increasing age in the current study which is similar to the studies done by Kendhapedi KK *et al.*,[8] Dasgupta A *et al.*[13] in India and the studies done by Curcio CL *et al.*,[10] Samper-Ternent R *et al.*,[11] Wu C *et al.*,[12] Gurina NA *et al.*,[15] Sánchez-García S *et al.*,[16] Carneiro JA *et al.*[14] and Ferriolli E *et al.*[17] outside India. A recent systematic review of 21 cohort studies from high-income countries (HICs) also found a positive association between age and frailty.[18] The influence of ageing on frail syndrome is related due to the decline in the physiological reserve with ageing[19] and other age-related pathological conditions.[20] Even though ageing is a risk factor for frailty, not all older people are frail[21] suggesting that the onset of frailty requires other reasons for augmenting this condition than normative process of ageing.[22]

In the present study, Frailty was higher among those with lower education level and this finding was similar to the findings of Kashikar Y *et al.*,[4] Kendhapedi KK *et al.*,[8] Dasgupta A *et al.*,[13] Wu C *et al.*,[12] Sánchez-García S *et al.*,[16] Carneiro JA *et al.*,[14] Franse CB *et al.*[23] and Gobbens RJJ *et al.*[24] However, a study was done by Samper-Ternent R *et al.*[11] did not find any significant association between lower educational level and frailty. Though education does not have a direct impact on the pathophysiology of frailty, it might interfere with the social structure, individual's healthy lifestyle and access to information that could influence the frailty progression.[25]

In the present study, loss of spouse was associated with frailty. Marriage may provide material, physical and psychological advantages.[26,27] Partnered persons are less likely to be socially isolated and also less likely to develop depressive symptoms. Loss of spouse was associated with frailty in other studies also[13,28-31] although the study by Kendhapedi KK *et al.*[8] did not support this finding.

In the present study, frailty was more prevalent among the old people who never or rarely attended any social gathering compared to persons who always attended all the social gatherings. There is evidence that the relationship between loneliness and frailty is bidirectional. Lonely people are more likely to be inactive,[32,33] and such inactivity increases the risk of physical frailty.[34,35]

Frailty was significantly associated with financial dependency in the current study, which was similar to the findings in studies done by Kashikar Y *et al.*,[4] Dasgupta A *et al.*[13] Financial dependency can trigger frailty in the elderly as they hinder access to adequate food, health services, medicine and to practising physical exercise, predisposing the individual to diseases and decreased functional capacity.

Both fall and fear of falling have a complex aetiology with frailty. It is hypothesized that chronic diseases and polypharmacy in the elderly lead to develop anxiety and fear of falling which in turn cause imbalance in gait and lead to falls.[36-38] In the current study, history of fall was a significant predictor of frailty and the proportion of frailty increased with increasing number of falls. This finding was similar to the observations made by Kashikar Y *et al.*,[4] Kendhapedi KK *et al.*,[8] Wu C *et al.*[12] In the study by Kendhapedi KK *et al.*[8], it was found that across the frailty definitions, the frail elderly were at 1.8 times higher risk of falls compared to the robust elderly. A meta-analysis of ten cohort studies from HICs concluded that frailty is a significant risk factor for future falls among community-dwelling elderly.[39]

Depression symptoms are a geriatric syndrome with a great impact on public health.[40] The present study showed a significant association between depressed elderly and frailty. This finding was similar to the studies done by Samper-Ternent R *et al.*[11] and Sánchez-García S *et al.*[16] In the secondary analysis of the longitudinal study on ageing in Beijing, it was pointed out that higher the score on the CES-D scale, the greater was the probability of frailty in this population.[41] Therefore, depression is closely related to frailty.

In the present study, as in the study by Fried *et al.*,[20] comorbidity was associated with frailty. It was observed that there was a significant association of frailty with the presence of 3 or more chronic diseases. Kashikar Y *et al.*[4] found that frailty status worsened with increasing number of chronic diseases and Dasgupta A *et al.*[13] showed that frailty was significantly associated with the presence of ≥2 chronic diseases.

In the present study, the elderly who were anaemic had 1.9 times higher odds of developing frailty compared to those who were not anaemic. In the study by Wu C *et al.*[12], low level of haemoglobin was associated with frailty which was similar to the current study.

In the present study, frailty was significantly associated with malnourishment and at risk of malnourishment compared to the elderly with normal nutritional status. In the study by Ferriolli E *et al.*[17], it was found that BMI ≤18.5 was significantly associated with frailty among the elderly of 65 years or more. Several nutrients have demonstrated their role in maintaining physical function in the elderly through the optimization of bone and muscle health, and nutrient deficiencies have consistently been linked to physical decline.[42]

Conclusion

Frailty is emerging as a public health priority. Frailty if identified on time may avert many adverse health outcomes in the elderly like disease, disability and dependence. In our primary healthcare setting, frailty among elderly can be detected using FFP or any other tool by even the field level health workers. The timely detection of frailty among elderly may initiate preventive, supportive and self-care measures among them, and ultimately this may reduce the burden of fall, hospitalizations and disability through timely handling the external stressors.

The study design was cross-sectional, and therefore, it was not possible to make causal inferences from the associations found. Nevertheless, timely screening and early intervention of the important preventable risk factors identified in this study may prove useful in improving the quality of life of elderly population by delaying or preventing frailty. To prevent or delay frailty counselling of the elderly for intake of balanced diet and proper medication for chronic diseases and screening for depression should also be done on a regular basis.

There is also a need for a multicentric prevalence study on frailty and its associated factors of frailty in India in order to generate robust data for strengthening of the geriatric care services of this country. This will go a long way in bestowing an excellent quality of life of to the Indian elderly with a big relief to their families and caregivers.

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Conflicts of interest

There are no conflicts of interest.

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