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Prevalence and factors associated with frailty among elderly in central Rajasthan: A cross-sectional study

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ABSTRACT

Background: Frailty increases the risk of disability, falls, cognitive decline, hospitalisation, dependency, and mortality in older adults. The study aimed to find out the prevalence and associated factors of frailty among the elderly using Field's physical constructs of frailty.

Methods: It was a hospital-based cross-sectional study, conducted in a tertiary care hospital in central Rajasthan, from May 2022 to October 2022. Data were collected from 288 participants. Categorical data were presented as proportion, and continuous data were presented as mean (SD). The Chi-square test and multivariate logistic regression were used to find out the association between frailty and other variables.

Results: About one-third (32.3%) of participants were frail, 32.3% were pre-frail, and 35.4% were robust. In multivariate analysis, frailty was found more in the participants who were not in union than those who were in union (aOR = 3.62, p = 0.001). It was more in sedentary persons (aOR = 13.54, p < 0.01) and persons with some physical activity (aOR = 4.39, p = 0.003) than the persons with strenuous physical activity levels. The prevalence of frailty was also associated with morbidity (aOR = 5.84, p < 0.01); and with a history of falls (aOR = 2.67, p = 0.003).

Conclusion: Nearly one third elderly population is frail and one third is prefrail. The growing older population and the corresponding increase in the prevalence of frailty would have a significant negative impact on the already overburdened health services. Community-based interventions should be developed and incorporated to avert and mitigate the effects of frailty.

1. Background

The number of elderly persons (defined as those over 60 years old) is expected to rise from 605 million to 2 billion globally between 2000 and 2050 as a result of recent medical developments in the field of public health that have extended life expectancy.[1] The number of persons aged 80 years or over is projected to triple, from 143 million in 2019 to 426 million in 2050.[1] Along with other chronic illnesses like arthritis, hypertension, cataracts, osteoporosis, cancer, and Alzheimer's disease, the elderly population is at increased risk for age-related physiological degradation. Physical frailty, which arises as a result of a cumulative age-related reduction of our body systems' physiology, is an even more unpleasant aspect of an ageing population. Frailty is a biologic or geriatric syndrome defined by multisystem dysregulation that results in a loss of dynamic homeostasis and diminished physiological, functional, and cognitive reserves that make a person more susceptible to adverse consequences.[2–4] Frailty is a significant clinical and public health concern since it increases the risk of disability, falls, cognitive decline, hospitalisation, dependency, and mortality in older adults.[3,4]

Over 25 distinct subjective and objective frailty assessment techniques have been developed worldwide to evaluate frailty with a wide range of conceptual criteria. The most popular method of measurement includes Fried's definition of frailty, a unidimensional, primarily physical domain that comprises fatigue, a weak grip and slow walking speed, low energy expenditure, and weight loss.[3]

The demographic shift in India is leading to a rise in the proportion of older persons. It is anticipated that by 2050, there will be 19% more elderly individuals than there were in 2015.[1]

It is critical to quantify the burden of frailty to help policymakers to understand the changing difficulties and requirements of the growing geriatric population. The prevalence of frailty in India has been reported to range from 11% to 58% using different assessment methods[2,5–7]

However, we couldn't find any study from Rajasthan which had quantified and studied frailty. So, this study was conducted to measure

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and compare the prevalence of frailty among the elderly residing in central Rajasthan using Field's physical constructs of frailty. We also assessed the socio-demographic determinants of frailty among older people. We further studied the associations between frailty and falls.

2. Methodology

It was a hospital-based cross-sectional study, conducted in a tertiary care hospital in central Rajasthan, from May 2022 to October 2022. The sample size was calculated with a 25% prevalence of frailty,[5] 5% absolute error, and 95% Confidence interval; and it came out to be 288. (Epi info™ 7). It was a convenient sampling technique. Eligible participants were recruited from various registration counter areas of the hospital. Maximum of 10 participants per day were approached for data collection to ensure data quality.

2.1. Inclusion criteria

Older adults aged 60 years and above, permanently residing in Ajmer district.

2.2. Exclusion criteria

Elderly with terminal illness, bedridden or wheelchair bound, severe hearing or visual impairment and with any acute illness at the time of the survey.

2.3. Data collection

After obtaining written informed consent, face-to-face interviews were conducted and data were collected using a pre-tested, semi-structured, interviewer-administered, questionnaire. The questionnaire was administered in Hindi, the local language of the area. The questionnaire consists of three parts-sociodemographic and health-related information, frailty and fall assessment.

The variable 'morbidity' referred to the presence of any chronic diseases which include hypertension, chronic heart diseases, stroke, any chronic lung disease, diabetes, cancer or malignant tumour, any bone/joint disease or any neurological/psychiatric disease. These were taken as self-reported by the participants. The monthly per capita consumption expenditure (MPCE) was assessed as household expenditure on food in the last month and on non-food in the last year. The variable was then categorized into five quantiles from poorest to richest.

Frailty: The physical frailty was assessed using an adapted version of the frailty phenotype described by Fried and colleagues. The physical frailty phenotype consists of five components-self-reported exhaustion, unintentional weight loss, weak grip strength, self-reported low physical activity, and slow walking time.

Exhaustion was assessed by asking 'Do you feel less active as compared to most men/women of your age', and the response was recorded as 'yes' and 'no'. Unintentional weight loss was taken when there was >5 kg weight loss in one year. Handgrip strength was measured with a portable Smedley's Hand Dynamometer, and it was reported in kilograms. The average of two successive readings in dominant hand was taken as final reading. The handgrip strength score was calculated on the basis of gender and body mass index, as shown in supplementary table 1. For physical activity, respondents were asked "How much difficulty in walking from one room to another at the same level", and the responses were recorded as some, much and unable.

Respondents were asked to walk 15 feet twice at normal speed, and faster reading was taken in completing the 15 feet (stratified by gender and height), as shown in supplementary table 1.

The overall physical frailty phenotype score was obtained between 0 and 5. Respondents with a score of 0 were classified as "robust," 1–2 as "pre-frail," and 3 or higher as "frail."

The history of Falls in the last 1 year was elicited and the response was recorded as no fall versus one or more falls.

2.4. Statistical analysis

Data were analysed using PSSP 1.6.2. Categorical variables such as gender, frailty status etc were presented as proportions. Continuous variables such as age, BMI etc were presented as mean (SD). Chi-square test was applied to find out the association between two categorical variables. Further, multivariate logistic regression was used, and the model was built with variables having $p < 0.05$ in bivariate analysis. P value < 0.05 was considered statistically significant for all computations.

2.5. Ethical approval

It was approved by Institutional Ethics Committee. Written informed consent was taken from all the participants. Appropriate counselling was done by the investigators.

3. Results

Three hundred twenty-four eligible elderly persons were approached for the study; 18 of them refused to take part in the study and 14 couldn't give complete information. So, data from 288 subjects were analysed (response rate = 88.9%). The mean age (SD) of the participants was 69.66 (6.89) years. About half (54.2%) of them were female, 47.9% were living in a rural areas, and 68.4% were Hindu by religion. About two-thirds (66.3%) of participants were married (currently in union), and were living with either their spouses or children. Nearly one-third (30.2%) of participants were illiterate. The majority of the participants (79.1%) were not working at the time of the study; 5.2% had no physical activity, and 15.3% were engaged in only some physical activity. A quarter of the participants (27.4%) were alcoholics, and half of the participants (50.7%) were tobacco users. The mean (SD) BMI of the participants was 23.50 (3.74) Kg/m^2. At the time of the study, about 38.9% of participants had any type of morbidity, and 25% had multimorbidity. About one-third (36.5%) had a history of falls in the last 1 year (Table 1).

About one-third (32.3%) of participants were frail, 32.3% were pre-frail, and 35.4% were robust. Frailty was found to be associated with age, marital status, living arrangement, working status, daily physical activity level, morbidity and history of falls in the last one year. Frailty was more prevalent in older participants, and in persons who were living alone, not in union, not working, had any morbidity and had a history of falls in the last one year (Table 2).

Table 3 shows multivariate logistic regression estimates of the association between frailty and different sociodemographic and health-related variables. It shows frailty was associated with marital status, physical activity level, morbidity and history of falls. It was found more in the participants who were not in union than those who were in union (aOR = 3.62, p = 0.001). It was more in sedentary persons (aOR = 13.54, $p < 0.01$) and persons with some physical activity (aOR = 4.39, p = 0.003) than the persons with strenuous physical activity levels. The prevalence of frailty was found more in persons with morbidity (aOR = 5.84, $p < 0.01$); and with a history of falls (aOR = 2.67, p = 0.003).

Similarly, the pre-frail status was found to be associated with age, physical activity, morbidity and history of falls. It was found more in the 70–79 years (aOR = 2.84, p = 0.017) and 80 years and above age group (aOR = 38.87, p = 0.001) than in the 60–69 years age group. It was less in persons with moderate physical activity (aOR = 0.14, $p < 0.01$) than the persons with strenuous physical activity levels. The prevalence of pre-frailty was found more in persons with morbidity (aOR = 3.14, p = 0.041); and with a history of falls (aOR = 2.15, p = 0.049).

Table 1
Socio-demographic characteristics of the participants (n = 288).

Variable	Number	Per cent
Sex		
Male	132	45.8
Female	156	54.2
Residence		
Rural	138	47.9
Urban	150	52.1
Age		
60–69 years	160	55.6
70–79 years	97	33.7
Above 80 years	31	10.8
Mean (SD) years	69.66 (6.89)	
Marital status		
In union	191	66.3
Widowed	95	33.0
Never married	2	0.7
Living arrangement		
With spouse and/or children	191	66.3
With spouse only	68	23.6
With relatives	14	4.9
Alone	15	5.2
Education		
Illiterate	87	30.2
Primary	95	33
Middle	40	13.9
Secondary	32	11.1
Senior Secondary	19	6.6
Graduation and above	15	5.2
Working status		
Working	63	21.9
Non-working	225	79.1
Physical Activity Level		
Sedentary	15	5.2
Some	44	15.3
Moderate	165	57.3
Strenuous	64	22.2
Alcohol consumption		
Yes	79	27.4
No	209	72.6
Tobacco consumption		
Yes	146	50.7
No	142	49.3
BMI (Kg/m^2		
<18.5	9	3.1
18.5–25	205	71.2
25.01–30	52	18.1
>30	22	7.6
Mean (SD)	23.50 (3.74)	
Morbidity		
Present	112	38.9
Absent	176	61.1
Multimorbidity		
Yes	72	25.0
No	216	75.0
MPCE		
Poorest	60	20.8
Poor	59	20.5
Middle	58	20.2
Rich	56	19.4
Richest	55	19.1
Religion		
Hindu	197	68.4
Muslim	82	28.5
Others	9	3.1
Fall in last one year		
Once	88	30.6
More than once	17	5.9
No	183	63.5

MPCE: Monthly Per Capita Expenditure.

4. Discussion

The prevalence of frailty among the elderly living in central Rajasthan was 32.3% and pre-frailty was 32.3%. Similarly, Kendhapedi KK et al. found a 28% prevalence of frailty in south India.[5] Another study

Table 2
Association of frailty with sociodemographic and health-related characteristics (n = 288).

Variable	Number (n)	Frailty (N = 93)	Pre-frailty (N = 93)	Robust (N = 102)	P-value
		n (%)	n (%)	n (%)	
Sex					
Male	132	37 (28.0)	50 (37.9)	45 (34.1)	0.146
Female	156	56 (35.9)	43 (27.6)	57 (36.5)	
Residence					
Rural	138	45 (32.6)	40 (29.0)	53 (38.4)	0.455
Urban	150	48 (32.0)	53 (35.3)	49 (32.7)	
Age					
60–69 years	160	47 (29.4)	38 (23.8)	75 (46.9)	<0.01*
70–79 years	97	30 (30.9)	41 (42.3)	26 (26.8)	
Above 80 years	31	16 (51.6)	14 (45.2)	1 (3.2)	
Marital status					
In union	191	42 (22.0)	67 (35.1)	82 (42.9)	<0.01*
Not in union	97	51 (52.6)	26 (26.8)	20 (20.6)	
Living arrangement					
With spouse and/or children	191	61 (31.9)	59 (30.9)	71 (37.2)	<0.01*
With spouse only	68	13 (19.1)	28 (41.2)	27 (39.7)	
With relatives	14	8 (57.1)	2 (14.3)	4 (28.6)	
Alone	15	11 (73.3)	4 (26.7)	0 (0)	
Education					
Illiterate	87	24 (27.6)	31 (35.6)	32 (36.8)	0.802
Primary	95	32 (33.7)	32 (33.7)	31 (32.6)	
Middle	40	13 (32.5)	11 (27.5)	16 (40.0)	
Secondary	32	14 43.8)	8 (25.0)	10 (31.3)	
Senior Secondary	19	4 (21.1)	8 (42.1)	7 (36.8)	
Graduation and above	15	6 (40.0)	3 (20.0)	6 (40.0)	
Working status					
Working	63	13 (20.6)	19 (30.2)	31 (49.2)	0.020*
Non-working	225	80 (35.6)	74 (32.9)	71 (31.6)	
Physical Activity Level					
Sedentary	15	11 (73.3)	0 (0)	4 (26.7)	<0.01*
Some	44	24 (54.5)	12 (27.3)	8 (18.2)	
Moderate	165	41 (24.8)	44 (26.7)	80 (48.5)	
Strenuous	64	17 (26.6)	37 (57.8)	10 (15.6)	
Alcohol consumption					
Yes	79	27 (34.2)	30 (38.0)	22 (27.8)	0.227
No	209	66 (31.6)	63 (30.1)	80 (38.3)	
Tobacco consumption					
Yes	146	52 (35.6)	49 (33.6)	46 (30.8)	0.231
No	142	41 (28.9)	44 (31.0)	57 (40.1)	
BMI (Kg/m^2					
<18.5	9	3 (33.3)	2 (22.2)	4 (44.4)	0.766
18.5–25	205	68 (33.2)	62 (30.2)	75 (36.6)	
25.01–30	52	15 (28.8)	22 (42.3)	15 (28.8)	
>30	22	7 (31.8)	7 (31.8)	8 (36.4)	
Morbidity					
Present	112	57 (50.9)	29 (25.9)	26 (23.2)	<0.01*
Absent	176	36 (20.5)	64 (36.4)	76 (43.2)	
Multimorbidity					
Yes	72	40 (55.6)	16 (22.2)	16 (22.2)	<0.01*
No	216	53 (24.5)	77 (35.6)	86 (39.8)	
MPCE					
Poorest	60	21 (35.0)	20 (33.3)	19 (31.7)	0.214
Poor	59	16 (27.1)	27 (45.8)	16 (27.1)	
Middle	58	23 (39.7)	15 (25.9)	20 (34.5)	
Rich	56	14 (25.0)	16 (28.6)	26 (46.4)	
Richest	55	19 (34.5)	15 (27.3)	21 (38.2)	
Religion					
Hindu	197	65 (33.3)	67 (34.0)	65 (33.0)	0.635
Muslim	82	24 (29.3)	24 (29.3)	34 (41.5)	
Others	9	4 (44.4)	2 (22.2)	3 (33.0)	
Fall in last one year					
Yes	105	44 (41.9)	38 (36.2)	23 (21.9)	0.002*
No	183	49 (26.8)	55 (30.1)	79 (43.1)	

MPCE: Monthly Per Capita Expenditure, *- statistically significant, Chi-square test is applied.

Table 3
Multivariate logistic regression estimates of frailty and pre-frailty with sociodemographic and health-related variables.

Variable		Frail		Pre-frail	
		aOR (95% CI)	P value	aOR (95% CI)	P value
Age	60–69 years	Ref		Ref	
	70–79 years	1.03 (0.53–2.01)	0.929	2.44 (1.17–5.17)	0.017*
	Above 80 years	0.94 (0.32–2.78)	0.916	38.87 (4.37–45.40)	0.001*
Marital status	In union	Ref		Ref	
	Not in union	3.62 (1.65–7.92)	0.001*	0.83 (0.30–2.27)	0.719
Living arrangement	With spouse and/or children	0.42 (0.09–1.78)	0.237	-	-
	With spouse only	0.33 (0.06–1.68)	0.181	-	-
	With relatives	0.43 (0.06–2.94)	0.391	-	-
	Alone	Ref		–	
Occupation	Working	0.49 (0.22–1.07)	0.072	0.56 (0.24–1.27)	0.163
	Non-working	Ref		Ref	
Physical Activity Level	Sedentary	13.54 (2.76–66.39)	<0.01*	–	–
	Some	4.39 (1.67–11.57)	0.003*	0.44 (0.11–1.64)	0.223
	Moderate	1.46 (0.66–3.24)	0.345	0.14 (0.05–0.34)	<0.01*
	Strenuous	Ref		Ref	
Morbidity	Present	5.84 (2.44–13.97)	<0.01*	3.14 (1.05–9.40)	0.041*
	Absent	Ref		Ref	
Fall in last one year	Yes	2.67 (1.40–5.08)	0.003*	2.15 (0.99–4.65)	0.049*
	No	Ref		Ref	

aOR: Adjusted Odds Ratio, CI: Confidence Interval, Ref: Reference, *- Statistically significant.

conducted in west Bengal reported a similar prevalence of frailty i.e., 38.8%.[8] A study from Sri Lanka also reported a prevalence of 34.6% of frailty using CHS criteria.[9] Whereas, a study done in rural Bengaluru found 24.7% and 62.75% prevalence of frailty and prefrailty respectively.[10] Kashikar Y et al. also reported a prevalence of frailty of 26% and prefrailty of 63.6%.[11] The prevalence of frailty and pre-frailty was reported at 12.3% and 55.3% respectively in low-income middle-income countries (LMICs), and 8.2% and 43.9% respectively in high-income countries in a meta-analysis.[6] The variation in the prevalence of frailty may be due to cultural diversity and individual subjectivity, both of which may have an impact on the questionnaire responses and performance assessment results. Self-reported exhaustion is one of the Fried criteria for frailty. The variable prevalence of frailty may have been influenced by the fact that each person's sense of exhaustion differs and is subjective.

Frailty is known to be associated with advancing age.[12] We also found a positive association between age and frailty. A similar association was also reported in India[5,8,11] and elsewhere.[6] Frailty in the elderly is due to deteriorated physiological reserve with advancing age and accumulation of age-related degenerative changes. Not all elderly persons are frail, even though age is a risk factor for frailty.[13] It suggests the occurrence of frailty demands additional factors than the natural course of ageing.[13]

Elders not in union, living alone, and those who were currently not working had significantly higher odds of frailty. Similar associations were also reported by Shilpa K et al.[10] and Kashikar Y et al.[11] The migration of young people for education and employment leaves the elderly at home and lonely, thus limiting their social interaction. It might be a reason for the higher odds of frailty in this group.

We couldn't find any association between frailty and education. Similarly, Kendhapedi KK et al. also didn't find a significant association between frailty and education.[5] However, Dasgupta A et al.,[8] and Shilpa K et al.[10] found a positive association between frailty and low education. Odds of frailty were found higher among the poor than the rich in studies from India[5,11] and a meta-analysis.[6] But we didn't find any association between frailty and income. Although education and income do not directly affect the pathophysiology of frailty, they may interfere with the individual's lifestyle and affect how frailty develops.[14]

In this study, moderate to strenuous physical activity was found to be a protective factor for frailty among the elderly which is similar to findings from other cross-sectional studies in India.[5,10,11] Due to the cross-sectional nature of the studies, the direction of this association cannot be determined.

In this study, lifestyle factors like alcohol and tobacco consumption, and BMI did not appear to affect the odds of developing frailty. Similar findings were also reported by Kendhapedi KK et al.[5] and Shilpa K et al.[10]

We found that the prevalence of falls was 2.67 times higher among frail elderly than among robust elderly. Similarly, Kendhapedi KK et al. also observed frail elderly had higher odds of falls than robust elderly.[5] A meta-analysis from high income countries also reported frailty as a risk factor for falls.[15]

Frail older persons' processing abilities could be on the verge of failing, and any stressor could cause falls and injuries in these people.[16] Additionally, certain aspects of physical frailty, such as weight loss and balance issues, may differ in how they affect the likelihood of falls.[17]

It is crucial to recognise frailty in the elderly due to the higher prevalence of its association with falls. Since frailty can be reversed, early detection in primary care settings is advised, as well as the provision of prophylactic interventions such as dietary augmentation, physical activity programmes, cognitive therapy, or a combination of these. These frailty-targeted therapies were also linked to a lower risk of falls in older persons.[18]

4.1. Limitations

The study finding should be taken with few limitations. This study was conducted in a hospital-based setting, which may not represent the general population. The study did not examine cognition, which is a key factor in frailty. Self-reported information on some crucial components of the frailty assessment tool may have resulted in imprecision. The cross-sectional design of the study doesn't determine the casualty when an association is present.

4.2. Implications for future

The growing older population and the corresponding increase in the prevalence of frailty would have a significant negative impact on the already overburdened health services as well as affordable healthcare. Policy-makers, implementers and healthcare providers should be sensitized to prevent and manage frailty. It is necessary to design community-based interventions that incorporate physical exercise, nutrient fortification, and cognitive therapy and that are appropriate to the social and cultural context of India to prevent and manage frailty.

5. Conclusion

Nearly one third elderly population is frail and one third is prefrail. It is expected to rise with the growing elderly population. It has an association with morbidity, a sedentary lifestyle, living alone and fall. Community-based interventions should be developed and incorporated in national program to avert and mitigate the effects of frailty. Knowing the social and environmental factors that affect frailty among elderly patients can help healthcare professionals better recognise, manage, and prevent frailty.

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CRediT authorship contribution statement

Conception and design of study: G Meratwal, A Kumar; Acquisition of data: G Meratwal, M Khanna; Analysis and/or interpretation of data: A Kumar, R Banseria; Drafting the manuscript: G Meratwal, M Khanna; revising the manuscript critically for important intellectual content: A Kumar, R Banseria; Approval of the final version of the manuscript: G Meratwal, A Kumar, R Banseria, M Khanna

Declaration of competing interest

Nil.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cegh.2023.101215.

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