

A Community based Cross Sectional Study on Frailty and its Correlates among Elderly Population of Puducherry

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ABSTRACT

Background

Longevity and frailty have a significant role in healthcare and demand a surge surge risk of hospitalization. Though they get serious attention recently, it remained to be a unmeasured in rural areas. The present study aimed to analyse its prevalence among the rural population in Puducherry.

Materials and Methods

The present cross sectional and community based study was carried out between February 2019 to October 2019 in Puducherry district with approval of Institutional Ethics Committee. Lastly elderly individuals from each town and village are chosen by door to door visits after starting at a random household (n = 300). The questioner was based on the Tilburg frailty indicator, depression measurement and Normal cognitive function. The responses against the questioner was analysed by statistical methods.

Results

The prevalence of frailty in our study population was 54.6% in which rural population 54% and urban population 55.3% females were more frail in both rural (33.3%) and urban population (30.7%). There was significant association between education status, longest held job, living arrangement, unexpected events in last one year, comorbidity status, history of fall in last one year, fear of falling, activities of daily life, depression and cognitive status and frailty. The early identification of frailty in primary care settings helps to prevent them from becoming disabled as frailty can be reversible and prevent them from adverse outcomes.

Conclusion

The ethos of joint family needs to be regained so that family support can avoid depression in elderly which is again interrelated with frailty as elderly people are more vulnerable to adverse health outcomes.

Keywords:

Depression, elderly, geriatric, rural, frailty

1. Introduction

India's population is undergoing a rapid demographic transition and the proportion of elderly persons is high and rising due to increased life expectancy (57.9 years in 1990 to 68.3 years in 2015).¹The elderly population in India defined as those above 60 years of age forms 8 % of the total population currently.²As per the 1991 census, the population of the elderly in India was 57 million as compared with 20 million in 1951. There has been a sharp increase in the number of elderly persons between 1991 and 2001 and it has been projected that by the year 2050, the number of elderly people would rise to about 324 million. In India, the number of older persons is projected to grow by 64 per cent between 2015 and 2030. By 2050, these older adults will outnumber all children under the age of 14.³India has thus acquired the label of an ageing nation with 7.7% of its population being more than 60 years old. The demographic transition is attributed to the decreasing fertility and mortality rates due to the availability of better health care services. It has been observed that the reduction in mortality is higher as compared with fertility. There has been a sharp decline in the crude death rate from 28.5 during 1951–1961 to 8.4 in 1996; while the crude birth rate for the same time period fell from 47.3 to 22.8 in 1996.⁴

Over the past decades, India's health program and policies have been focusing on issues like population stabilization, maternal and child health, and disease control. However, current

statistics for the elderly in India gives a prelude to a new set of medical, social, and economic problems that could arise if a timely initiative in this direction is not taken by the program managers and policy makers. More over as the age increases, physiological reserves unsurprisingly decrease in multiple systems and comorbidities become more prevalent. However, chronological age is not a specific indicator of functional decline. The changes that accompany aging depend on genetic and environmental factors, and are lifestyle and life event related. As a result, while some may remain healthy and robust in later life, others may become gradually vulnerable to internal and external stressors. The latter refers to a state of frailty.⁵Frailty can be defined as a physiologic state of increased vulnerability to stressors that results from decreased physiologic reserves and even dysregulation of multiple physiologic systems.⁶Frailty is a different conceptually from ageing, disability and co-morbidity although it is distinctly related to these factors. Fried et al indicated that comorbidity is a risk factor of frailty, the outcome of which is disability.⁷Frail older adults experience an increased risk of several adverse health outcomes such as comorbidity, disability, dependency, institutionalization, falls, fractures, hospitalization, and mortality.⁸Frailty has a considerable influence on subsequent health status and quality of life of elderly people, and available medical health care resources. Therefore, frailty has begun to attract attention in recent years and particular emphasis has been placed on its prevention and postponement in the elderly.⁹Few recent studies have suggested that the frailty status might be reversible with the implementation of specific exercises programs and nutritional supplementation. Therefore, identifying frail elderly subjects is essential. There is a harmony among experts accepting frailty as a diverse syndrome that occurs in elderly individuals who are highly susceptible and at increased risk of dependency and hospitalization and decreased life expectancy.¹⁰Frailty is a geriatric condition characterized by an increased vulnerability to external stressors. It is strongly linked to adverse outcomes, including mortality, nursing home admission, and falls. Frailty is different conceptually from ageing, disability, and co-morbidity although it is distinctly related to these factors. For example, although frailty prevalence increases with age, it occurs independently from chronological age.¹²Frailty does not yet have an internationally recognized standard definition, although the general premise is that frailty may be considered to be a geriatric syndrome reflecting multi-system dysfunction and in which individuals are able to dynamically transition between severity states. Multiple reasons exist as to why it is so difficult to define frailty, including: its complex etiology the often independent work of frailty researchers and the inherent difficulty in distinguishing frailty from both ageing and disability. Regardless of these issues, and perhaps because of them, international groups such as the World Health Organization (WHO) and the International Association of Geriatrics and Gerontology (IAGG) are working on an internationally accepted frailty definition.¹¹

Frailty is an important clinical and public health problem and is linked with an increased risk of falls, institutionalization and mortality. There remains a lack of agreement on a standard definition and operational classification for frailty. A number of classification criteria have been proposed, though there are few data comparing these methods in prospective studies particularly among men. The mechanism or cause of frailty remains unknown, though it is likely to be a result of multiple dysregulations across multiple systems. A number of factors have been linked with frailty, though relatively little is known about the impact of lifestyle factors on the new occurrence of frailty. Obesity has been linked with frailty, and although it is uncertain whether this is a causal association such data are important, as the prevalence of obesity is increasing. Furthermore, most studies have focused on BMI only, which may not be an optimum marker of adiposity in older adults.

2. Materials And Methods

The present cross sectional and community based study was carried out between February 2019 to October 2019 in Puduchery district. The study proposal was presented and approved by Institutional Ethics Committee. The sample size (n = 300) was calculated with the prevalence of frailty as 63% from Kendhapedi et al study¹³ using the formula $n = Z(1-\alpha)^2 pq / d^2$ (z = relative deviate (at 95% confidence interval) i.e. 1.96, p = prevalence of frailty among elderly from previous study=63%). Since two areas are involved, sample size will be calculated separately for both rural and urban areas. So, 300 elderly individuals will be selected from the rural and urban areas each. To ensure equal representation in all towns and all villages, equal number of people was taken from all the selected villages and town making it to 300 individuals from town and 300 from villages. Lastly elderly individuals from each town and village are chosen by door to door visits after starting at a random household. Individuals who belonged to the age of 60 years and residing at least for a year and willing to give the consent were included in the study. Severely ill and who had improper visits were excluded from the study. The questionnaire based on sociodemographic variables such as age, gender, marital status, religion, educational qualification, family income, living arrangements, longest held occupation, history of fall, fear of falling unexpected events, alcohol consumption, tobacco chewing, smoking habits and comorbidities. The second to sixth part contained validated measurement tools for measuring the frailty, functional status, and fear of falling, geriatric depression and cognitive status as a measure of correlates. The second part had Frailty measurement using Tilburg frailty indicator⁷⁷ which was a 15 items questionnaire comprising physical, psychological and social component with a score ranging from 0 to 4 means frail, third part had depression measurement using the validated Tamil version GDS short form by Sonali Sarkar et al⁷⁸ with total score ranging 0 to 15 where 0 to 5 means no depression, fourth part had fear of falling measurement using Short falls efficacy scale, a 7 item questionnaire⁷⁹ scores ranges from 7 to 28 i.e. low concern of falling (7 to 8), moderate concern of falling (9 to 13) and high concern of falling (14 to 28), fifth part had physical activity dependence assessed using activities of daily living measurement using Barthel index¹⁶ which is 10 item questionnaire with scoring from 0 to 100. The scores 80 to 100 implies live independently, 60 to 79 implies minimally dependent, 40 to 59 implies partially dependent, 20 to 39 implies very dependent and less than 20 means Total dependence and finally the sixth part had cognitive status assessment using Montreal Cognitive assessment tool¹⁷ validated in Tamil by Coonghe et al¹⁷ A score of 26 to 30 means Normal cognitive function. Less than 25 implied mild cognitive impairment. Anthropometric measurements like Height and weight measurements will be measured using standard instruments for Body mass index calculation. The statistical analysis of data was done using descriptive and analytical statistics using software SPSS, version 22 software.

3. Results

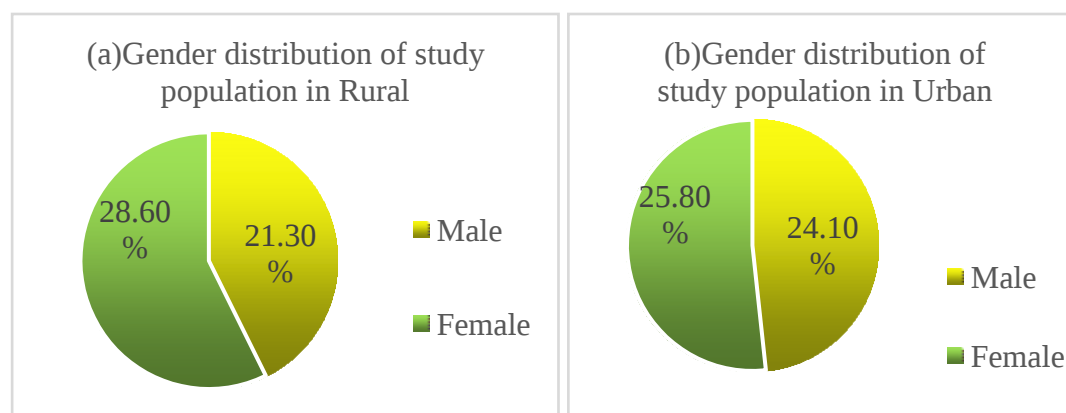
Table 1: Frequency distribution of the study population depending upon their age group

Age group	Residence		Total
	Rural	Urban	
60 - 69	190 (31.6%)	184 (30.6%)	374 (62.3%)

70 - 79	102 (17%)	98 (16.3%)	200 (33.3%)
80 and above	9 (1.5%)	18 (3.0%)	27 (9.0%)
Total	300 (50%)	300 (50%)	600 (100%)

Table 1 depicted the frequency distribution of the study population depending upon their age group. 62.3% of the study population belonged to the age group 60 - 69 years, in which around 31.6%, 30.6% were residing in rural and urban area respectively. Around 33% of the study population were belonging to age group 70- 79 years in which 17% resided in rural area and 16.3% lived in urban area. In the study population, 27% belonged to age group 80 years and above, in which around 1.5%, 3% resided in rural and urban area respectively (Figure. 1).

Fig 1(a) & 1(b): Frequency distribution of the study population depending upon their gender in Rural and Urban location.



Above figure 1(a) & (b) showed that the frequency distribution of the elderly study population based on gender. It was found that female population (54.5%) was more than the male population in both rural and urban location. Among the respondents in elderly population, 21.3% of males and 28.6% of females were present in rural location whereas 44.1% of males and 25.8% of females were present in urban location.

Table 2: Frequency distribution of the study population depending upon their religion

Religion	Residence		Total
	Rural	Urban	
Hindu	286 (47.6%)	276 (46%)	562 (93.6%)
Christian	9 (1.5%)	15 (2.5%)	24 (4%)
Muslim	5 (0.8%)	8 (1.3%)	13 (2.1%)

Jain	0 (0.0%)	1 (0.1%)	1 (0.16%)
Total	300 (50%)	300 (50%)	600 (100%)

The distribution of elderly population depending upon their religion was described in the table 2. Almost 93.6% of the overall study population belonged to Hindu religion. There was only a little increase in Christian and Muslim participants in urban location compared torural.

Table 3: Frequency distribution of the study population depending upon their marital status

Marital status	Residence		Total
	Rural	Urban	
Married	212 (35.3%)	234 (39%)	446 (74.3%)
Widowed	74 (12.3 %)	49 (8.1%)	123 (20.5%)
Unmarried	10 (1.6%)	14 (2.3%)	24 (4%)
Separated	4 (0.6%)	3 (0.5%)	12 (2%)
Total	300 (50%)	300 (50%)	600 (100%)

The frequency distribution of marital status of the elderly population was observed (Table3).Among the elderly population, 39% and 35.3% were married and living with their spouse in urban and rural population. 20.5% of the overall study population was widowers, with 12.3% in the rural and 8.1% in the urban population. About 4% of the overall population was unmarried and 2 % were separated.

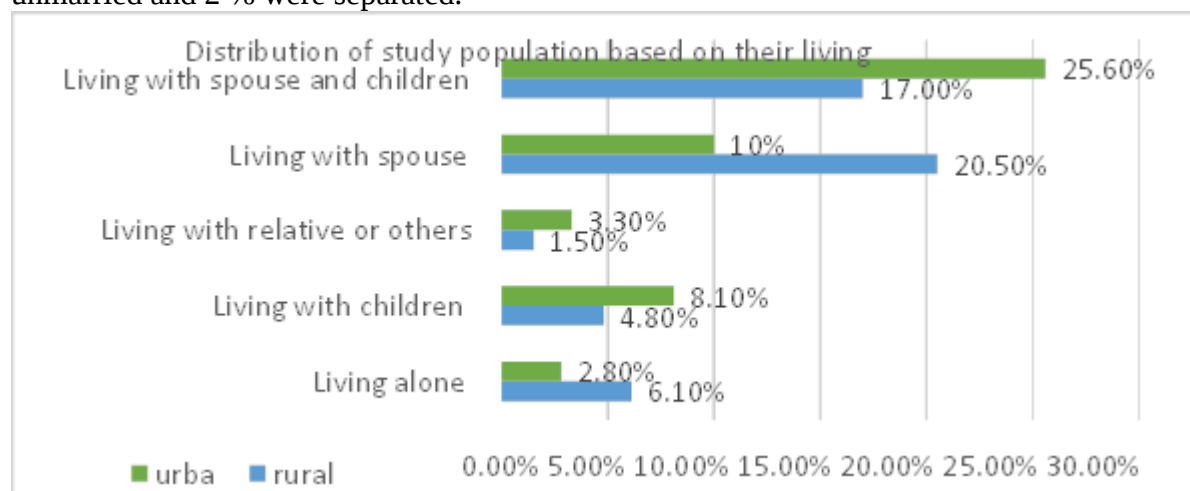


Fig 2: Frequency distribution of the study population depending upon their Living arrangement

The frequency distribution of study population upon their living arrangements was observed in figure 2. It is seen that, 25.6% of the elderly in urban were living with their spouse and children, whereas 17% in rural. Nearly 20.5%, 10% of the elderly population were living with their spouse in rural and urban areas. In the rural, 6.1% of the elderly were living alone and in the urban it was 2.8%. Around 4.8% of the elderly in rural were living with their children and in the case of urban it is 8.1%.

Table 4: Frequency distribution of the study population depending upon their education

Education	Residence		Total
	Rural	Urban	
Illiterate	197 (32.8%)	76 (12.6%)	273 (45.5%)
Primary	72 (12%)	23 (3.8%)	95 (15.8%)
Middle school	1 (0.1%)	49 (8.1%)	50 (8.3%)
High school	23 (3.8%)	61 (10.1%)	84 (14%)
Higher secondary or PUC*	7 (1.1%)	69 (11.5%)	76 (12.6%)
Graduation or above	0 (0.0%)	22 (3.6%)	22 (3.6%)
Total	300 (50%)	300 (50%)	600 (100%)

*Pre university course

Table 4 depicted the frequency distribution of rural and urban elderly population based on their educational status. Among the 45.6% of the study population who were illiterates, 32.8% of them were residing in rural area and 12.6% were residing in urban area. In the study population 15.8% had primary education in which 12%, 3.8% were residing in rural area and urban area. Among the 8.3% of the study population who had middle school education everyone was belonging to urban area. Fourteen percent of the study population did their high school education with 3.8% & 10.1% in rural and urban area.

Table 5: Frequency distribution of the study population depending upon longest held job

Longest held job	Residence		Total
	Rural	Urban	
Homemaker or Nil	64 (10.6%)	83 (13.8%)	147 (24.5%)
Unskilled	38 (6.3%)	30 (5%)	68 (11.3%)
Semi-skilled	171 (28.5%)	38 (6.3%)	209 (34.8%)

Skilled	24 (4%)	81 (13.5%)	105 (17.5%)
Semi professional	3 (0.5%)	48 (8%)	51 (8.5%)
Professional	0 (0%)	20 (3.3%)	20 (3.3%)
Total	300 (50%)	300 (50%)	600 (100%)

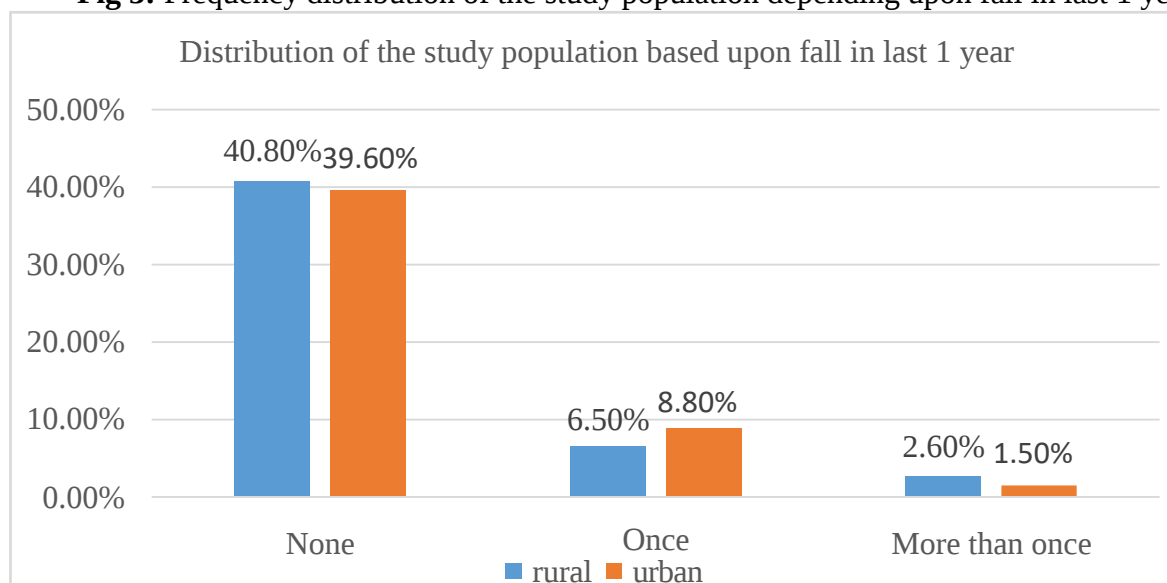
Above table 5 described the frequency distribution of the longest held occupation of the study population. In the rural elderly population, nearly 10.6% were homemaker, 6.3%, 28.5% and 4% were doing unskilled, semiskilled and skilled job respectively. Similarly, in the urban study population it is observed that 13.8% were homemaker, 5% did unskilled job, 6.3% did semiskilled job, 13.5% did skilled job, 8% were semiprofessional and 3.3% were professional. Overall 34.8% belonged to semiskilled, 24.5% homemaker, 17.5% skilled job, 11.3% unskilled job. Only 3.3% held professional job.

Table 6: Frequency distribution of the study population depending upon their total family income category

Total income	Residence		Total
	Rural	Urban	
<3000	64 (10.6%)	36 (6%)	100 (16.6%)
>3000 to <5000	88 (14.6%)	51 (8.5%)	139 (23.1%)
>5000 to <7000	74 (12.3%)	14 (2.3%)	88 (14.6%)
>7000 to <15000	59 (9.8%)	107 (17.8%)	166 (27.6%)
>15000	15 (2.5%)	92 (15.3%)	107 (17.8%)
Total	300 (50%)	300 (50%)	600 (100%)

The frequency distribution of the study population depending upon their family income category was described in the table 6. Out of 27.6% who had total family income ranging above 7000 to below 15000, 17.8% resided in urban and 9.8% resided in rural area. Nearly 23.1% had total monthly family income above 3000 to below 5000. Around 17.8% of the study population had total family income above 15000, in that majority (17.8%) of them living in urban area (15.3%). Of the 14.6% who had family income above 5000 to below 7000, 12.3% resided in rural area and 2.3% resided in urban area.

Fig 3: Frequency distribution of the study population depending upon fall in last 1 year



From the figure 3, the frequency distribution of the study population depending upon fall in last 1 year is observed. Around 80.5% of the population had no history of fall in last 1 year, 15.3% had history of fall atleast once in last 1 year, with 8.8% residing in urban and 6.5% residing in rural area. About 4.16% study population had history of fall more than once, in which 2.6% were in rural residence and 1.5% were in urban residence.

Table 7: Frequency distribution of the study population depending upon their history of alcohol consumption

Alcohol consumption history	Residence		Total
	Rural	Urban	
Present	90 (15%)	55 (9.1%)	145 (24.1%)
Absent	210 (35%)	245 (40.8%)	455 (75.8%)
Total	300 (50%)	300 (50%)	600 (100%)

The above table 7 showed frequency distribution of the study participants based on the history of alcohol usage. Around one fourth (24.1%) of the overall study population had history of alcohol consumption. Out of those 15% resided in rural area and 9.1% resided in urban area.

Fig 4 (a) & (b): Frequency distribution of the study population depending upon their tobacco or betel nut chewing history

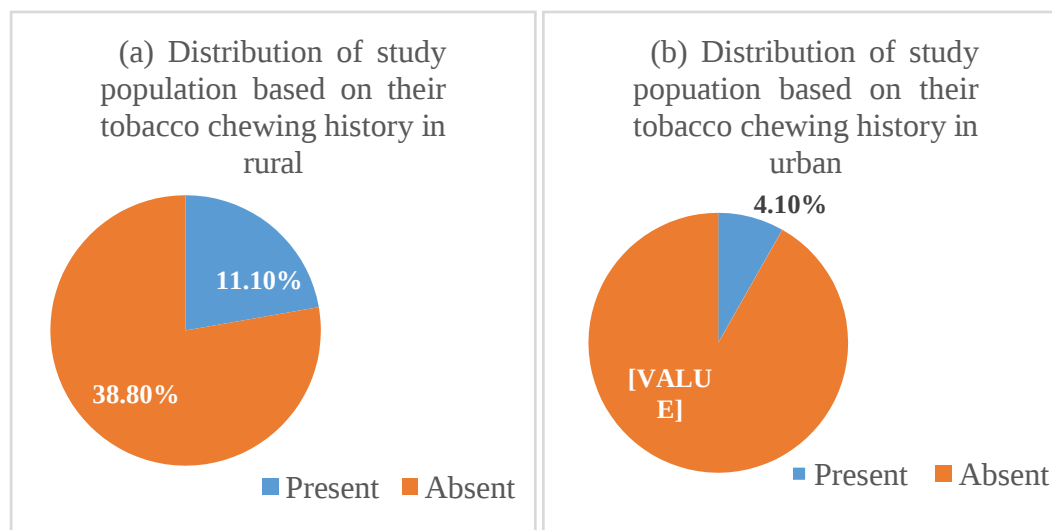


Figure 4 (a) & (b) depicted the frequency distribution of the study population depending upon their tobacco or betel nut chewing habits. The rural population had more history of tobacco chewing habits than the urban participants, 11.1% of the rural participants had history of tobacco chewing whereas it was 4.1% in the urban.

Table 8: Frequency distribution of the study population depending upon their smoking habits

Smoking	Residence		Total
	Rural	Urban	
Present	81 (13.5%)	32 (5.3%)	113 (18.8%)
Absent	219 (36.5%)	268 (44.6%)	487 (81.1%)
Total	300 (50%)	300 (50%)	600 (100%)

The above table 8 showed frequency distribution of the study population depending upon their history of smoking tobacco. The rural population had more history of smoking tobacco then the urban participants. 13.5% of the rural study participants had history of tobacco smoking whereas 5.3% of them were urban population who had history of tobacco smoking.

Table 9: Frequency distribution of the study population depending upon unexpected events in last 1 year

Last 1 year unexpected event	Locality		Total
	Rural	Urban	
Death of loved ones	42 (7.0%)	24 (4%)	66 (11%)
Separated or Divorce	4 (0.6%)	8 (1.3%)	12 (2%)

Road traffic accident	12 (2.0%)	14 (2.3%)	26 (4.3%)
Serious illness of loved ones	11 (1.8%)	26 (4.3%)	37 (6.1%)
Serious illness of self	26 (4.3%)	82 (13.6%)	108 (18%)
Uneventful	205 (34.1%)	146 (24.3%)	351 (58.5%)
Total	300 (50%)	300 (50%)	600 (100%)

Table 9 described the frequency distribution of the study population depending upon unexpected events in last 1 year. In the rural study participants 7% had reported with history of death of loved ones in last 1 year whereas it was 4% in the urban, 0.6% and 1.3% were either separated or divorced in rural & urban areas, 2% and 2.3% with history of RTA in rural & urban. Regarding the history of serious illness of loved ones and self it was 1.8%, 4.3% in rural and 4.3%, 13.6% in urban respectively.

Table 10: Frequency distribution of the study population depending upon co morbidities

Co-morbidities	Residence		Total
	Rural	Urban	
Respiratory	21 (3.5%)	15 (2.5%)	36 (6%)
Diabetes mellitus	28 (4.6%)	33 (5.5%)	61 (10.1%)
Hypertension	18 (3%)	25 (4.1%)	43 (7.1%)
Diabetes mellitus and Hypertension	14 (2.3%)	18 (3%)	32 (5.3%)
Diabetes mellitus, Hypertension and Respiratory	5 (0.8%)	1 (0.1%)	6 (1%)
Osteoarthritis	7 (1.1%)	12 (2%)	19 (3.1%)
Rheumatoid arthritis	2 (0.3%)	2 (0.3%)	4 (1.3%)
Hypothyroidism	3 (0.5%)	4 (0.6%)	7 (2.3%)
Nil	202 (33.6%)	190 (31.6%)	392 (65.3%)
Total	300 (50%)	300 (50%)	600 (100%)

The frequency distribution of known co morbidities among the study population was explained in the table 10. Among the overall study participants, the prevalence of co morbid condition in rural

and urban are, 3.5% & 2.5% history of respiratory co morbidity, 4.6% & 5.5% Diabetes mellitus alone, 3% and 4.1% had history of hypertension alone, 2.3% and 3% had history of both diabetes mellitus and hypertension, 0.8% and 0.1% had history of diabetes mellitus, hypertension and respiratory illness, 1.1% & 2% had history of osteoarthritis, 0.3% had rheumatoid arthritis in both areas and 0.5% & 0.6% had hypothyroidism. Overall 34.7% of the study population had history of the above mentioned co morbidities.

Table 11: Frequency distribution of the study population depending upon their BMI range

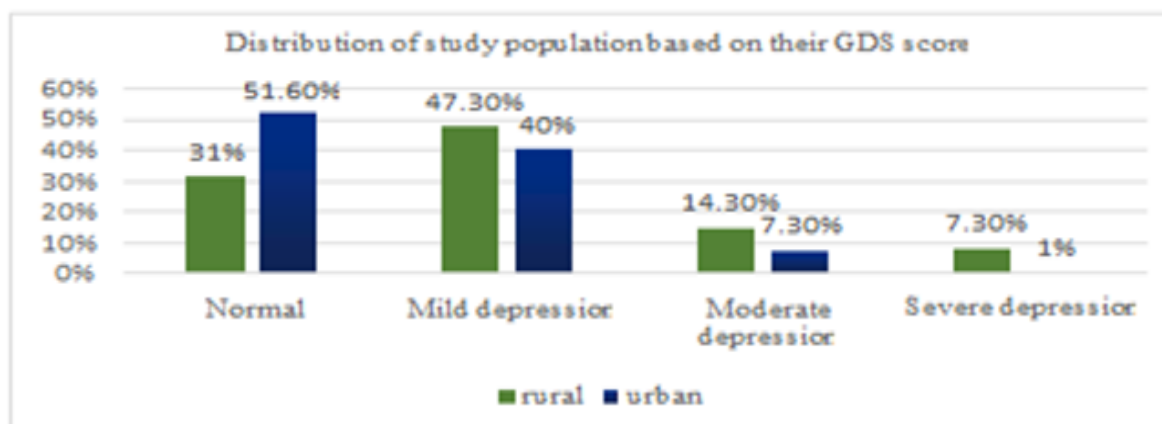
BMI range*	Residence		Total
	Rural	Urban	
≤18.5	48 (8%)	31 (5.1%)	79 (13.1)
>18.5 to <23	90 (15%)	85 (14.1%)	175 (29.1)
>23 to <25	77 (12.8%)	80 (13.3%)	157 (26.1)
>25 to <30	64 (10.6%)	80 (13.3%)	144 (24)
>30	21 (3.5%)	24 (4%)	45 (15)
Total	300 (50%)	300 (50%)	600 (100%)

* International Obesity Task Force (IOTF)

Table 11 showed frequency distribution of the study population based on their BMI range. The overall distribution in the study has reported with 13.1% as underweight, 26.1% as overweight, 24% as Obesity class I and 15% as Obesity Class II.

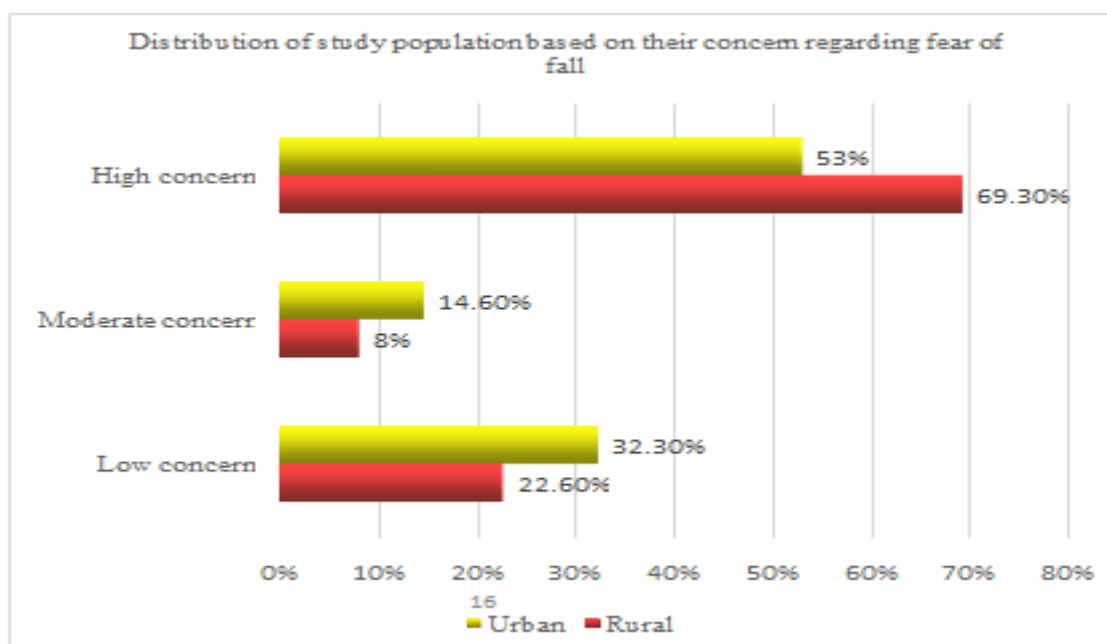
Out of which, the rural & urban population showed 8% and 5.1% as underweight, 12.8% and 13.3% as overweight, 10.6% and 13.3% as Obesity class I and 3.5% and 4% as Obesity class II respectively.

Figure 5: Frequency distribution of the rural and urban study population depending upon their GDS score



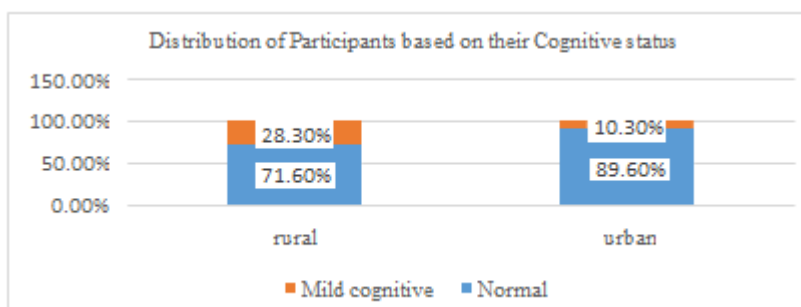
The above figure 5 had summarized the frequency distribution of the study population based upon their Geriatric depression score. It is observed that in rural and urban population, 47.3% and 40% had mild depression, 14.3% and 7.3% reported with moderate depression and 7.3% and 1% with severe depression. Overall depression proportion was 58.7% in both rural and urban population

Fig 6: Frequency distribution of the rural and urban study population depending upon their concern regarding fear of falling



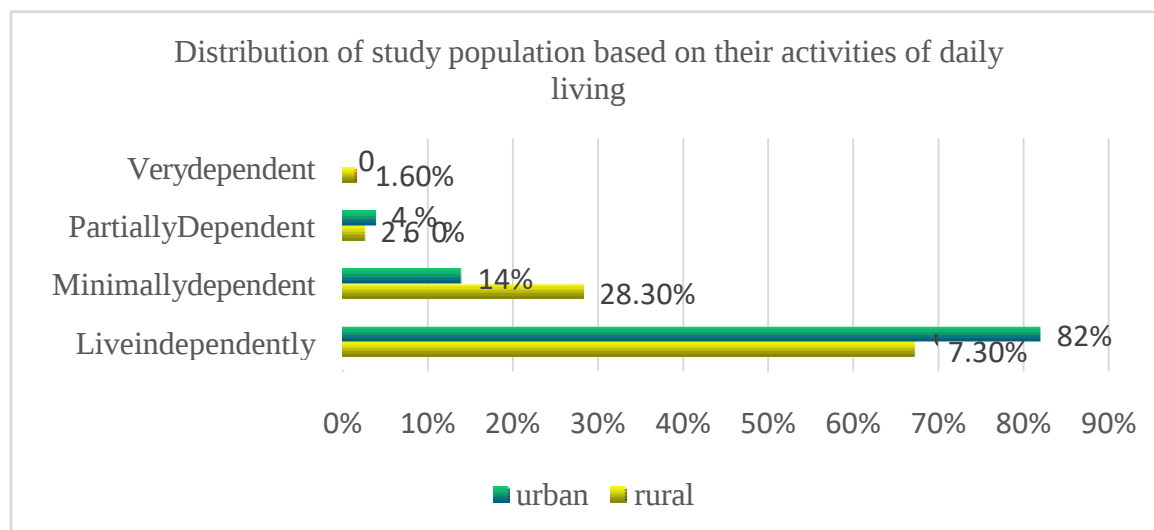
From the figure 6 it was observed that in both rural and urban study participants the prevalence of fear of falling was 56.3%. The rural population showed 22.6%, 8% and 69.3% with low, moderate and high concern on fear of falling whereas in urban population, it was reported as 32.3%, 14.7% and 53% with low, moderate and high concern over fear of falling respectively

Fig 7: Frequency distribution of the rural and urban study population based on their cognitive status



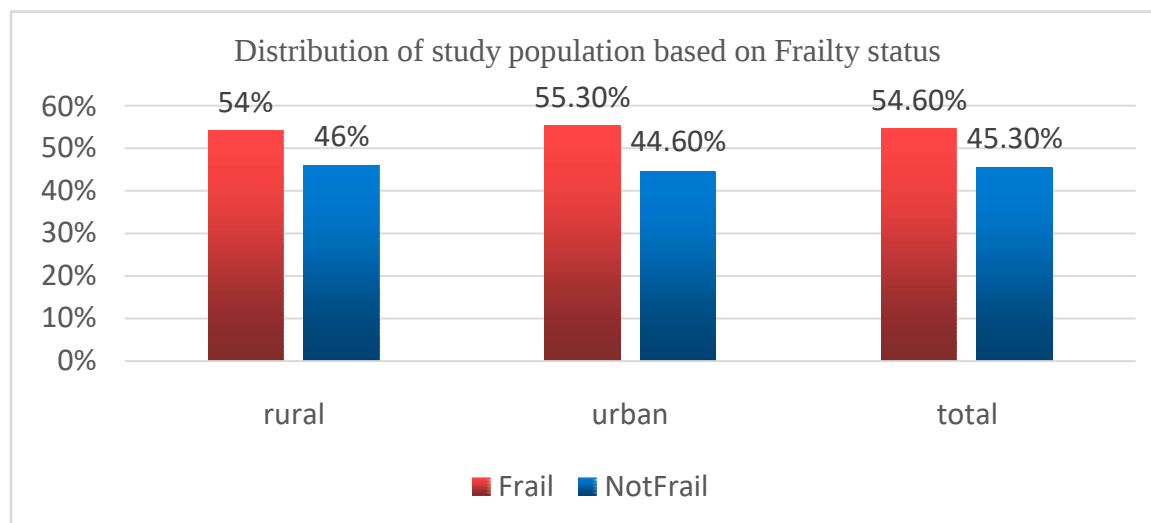
As per the above figure 7, depicted the distribution of the study population based on their cognitive status it is observed that in the rural population 28.3% had mild cognitive impairment whereas in the urban population it was 10.3%. Overall 20% mild cognitive impairment has been reported in the study.

Fig 8: Frequency distribution of the study population depending upon their Activities of daily living



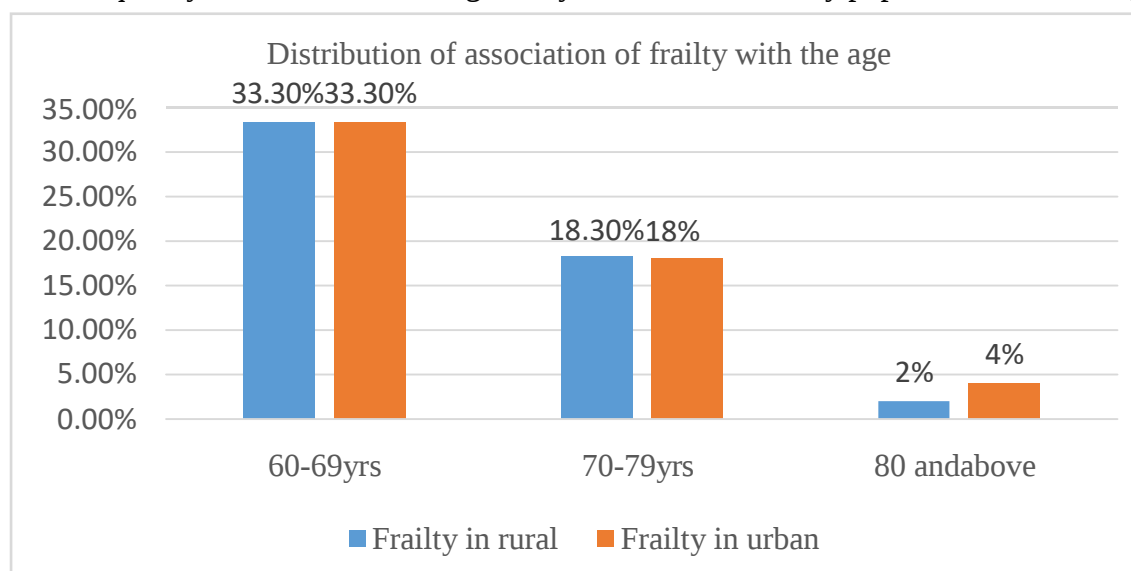
The figure 8 depicted the frequency distribution of the study population depending upon the activities of daily living. Overall 75% of the study population has been reported living independently, of which 21.1 % have minimal dependency. The urban population showed 82% living independently, 14% with minimal dependency and whereas in the rural population 67.3% has been living independently and 28.3% with minimaldependence

Fig 9: Frequency distribution of the study population depending upon their Frailty status



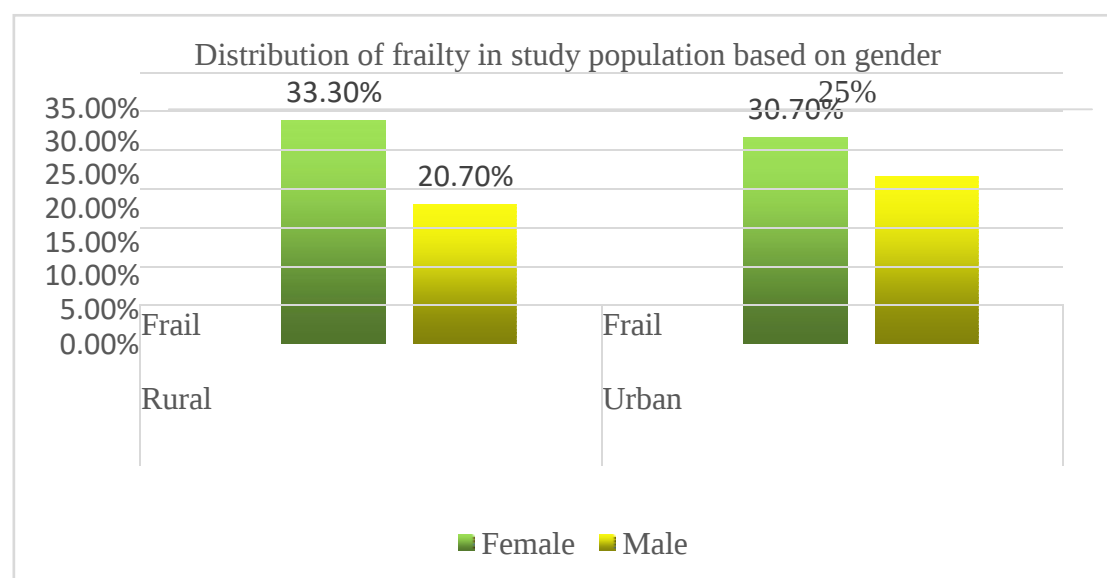
The frequency distribution of the elderly population upon their frailty status was observed in figure 9. The prevalence of frailty in rural and urban population showed 54% & 55.3%. The overall prevalence of frailty in the study was 54.6%.

Figure 10: Frequency Distribution showing Frailty distribution in study population based on age



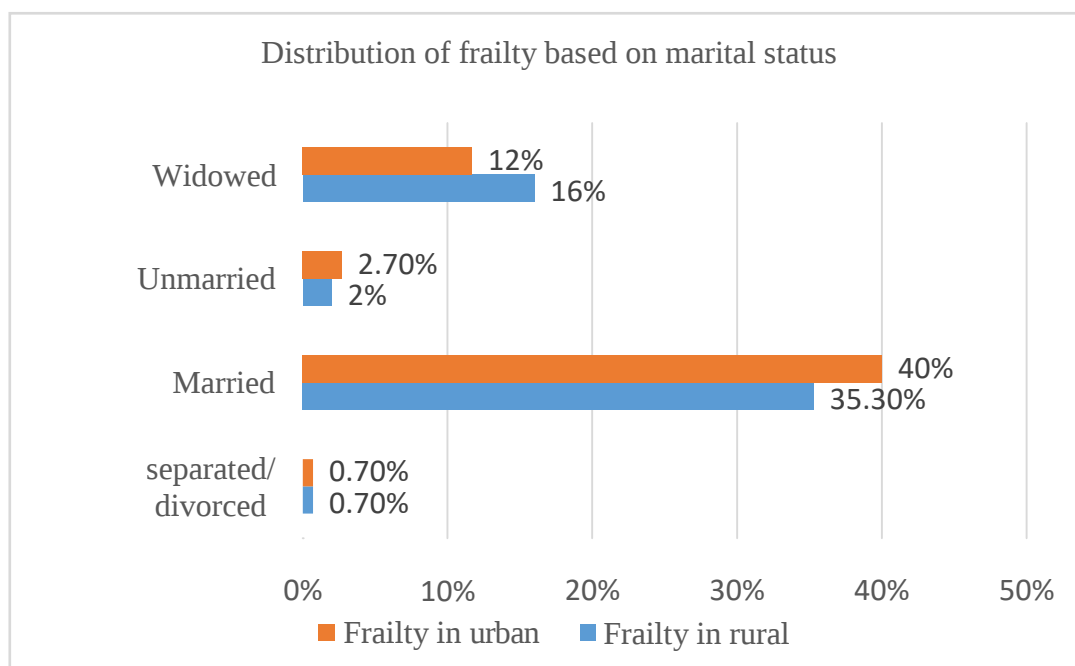
The above figure 10, was showing the frailty distribution among the study population based on the age. It is observed that, among the rural and urban population, the prevalence of frailty at the age of 60-69 yrs were 33.30% in both areas, at 70-79 yrs it was 18.60% and 18%, at the age of 80 and above, it was 2% and 4% respectively.

Figure 11. Frequency distribution of frailty in study population based on Gender



From the figure 11, it was evident that the prevalence of frailty among the males in rural and urban were 20.70% and 25%, whereas in the females it was 33.30% and 21% respectively.

Figure 12. Frequency distribution of frailty status according to marital status



It was observed from the figure 12, that the prevalence of frailty is high and significant among the married in both rural and urban with 35.30% and 40%.

Table 12: Distribution of Frailty and BMI status in study population

BMI	Rural			Urban		
	Frail	Not Frail	Total	Frail	Not Frail	Total
≥18.5	8 (2.7%)	9 (3%)	17 (5.7%)	5 (1.7%)	0 (0%)	5 (1.7%)
>18.5 to <23	40 (13.3%)	35 (11.7%)	75 (25%)	56 (18.7%)	42 (14%)	98 (32.7%)
>23 to <25	71 (23.7%)	55 (18.3%)	126 (42%)	31 (10.3%)	36 (12%)	67 (22.3%)
>25 to <30	31 (10.3%)	28 (9.3%)	59 (19.7%)	57 (19%)	49 (16.3%)	106 (35.3%)
>30	12 (4%)	11 (3.7 %)	23 (7.7%)	17 (5.7%)	7 (2.3%)	24 (8%)
Total	162 (54%)	138 (46 %)	300 (100 %)	166 (55.3%)	134 (44.7%)	300 (100%)

From the figure it was observed that the frequency of frailty in rural and urban population with BMI ≥18.5 were 2.7% and 1.7%, >18.5 to <23 were 13.3% and 18.7%, >23 to <25 were 23.7% and 10.3%, >25 to <30 were 10.3% and 19%, >30 were 4% and 5.7% respectively.

Table 13: Association between Frailty and education status in the study population

Education	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
Illiterate	107 (35.7%)	90 (30%)	197 (65.7%)	56 (18.7%)	20 (6.7%)	76 (25.3%)
Literate	55 (18.3%)	48 (16%)	103 (34.3%)	110 (36.6%)	114 (38%)	224 (74%)
Total	162 (54%)	138 (46%)	300 (100%)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2=0.023$, d.f = 1 p value = 0.87, ** $\chi^2=13.869$, d.f = 1 p value = 0.000

The above table 13 had showed association between frailty and educational status only in the urban population with p value of 0.000 and is hence significant.

Table 14: Association between Frailty and Longest held job in study population

Longest held Job	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
Semiprofessional & Professional	1 (0.3%)	2 (0.7%)	3 (1%)	27 (9%)	41 (13.6%)	68 (22.6%)
Semiskilled	106 (35.3%)	65 (21.7%)	171 (57%)	30 (10%)	8 (2.7%)	38 (12.7%)
Skilled	8 (2.7%)	16 (5.3%)	24 (8%)	37 (12.3%)	44 (14.7%)	81 (27%)
Unskilled	17 (5.7%)	21 (7%)	38 (12.7%)	16 (5.3%)	14 (4.7%)	30 (10%)
Homemaker	30 (10%)	34 (11.3%)	64 (21.3%)	56 (18.7%)	27 (9%)	83 (27.7%)
Total	162 (54%)	138 (46%)	300 (100%)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2=11.656$, d.f = 4 p value = 0.02, ** $\chi^2 = 23.342$, d. = 4 p value = 0.000

As from the above table 14, it was observed that there exists an association between Frailty and longest held job among both the rural and urban population with p value of 0.02 and 0.000 respectively.

Table 15: Association between Frailty and Living arrangement in study population

Living arrangement	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
Living alone	23 (7.7%)	14 (4.7%)	37 (12.3 %)	12 (4 %)	5 (1.7%)	17(5.7%)
Living with children	19 (6.3 %)	10 (3.3%)	29 (9.7%)	29 (9.7%)	20 (6.7%)	49(16.3%)
Living with relative or other	4 (1.3%)	5 (1.7%)	9 (3%)	17 (5.7%)	3 (1 %)	20(6.7%)
Living with spouse	62 (20.7%)	61 (20.3 %)	123 (41 %)	37 (12.3%)	23 (7.7%)	60(20 %)
Living with spouse and children	54 (18%)	48 (16 %)	102 (34%)	71 (23.7%)	83 (27.7%)	154 (51.3%)
Total	162 (54%)	138 (46 %)	300 (100 %)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2 = 3.557$, d.f = 4 p value = 0.469, ** $\chi^2 = 15.298$, d.f = 4 p value = 0.004

An association between Frailty and living arrangement was observed from table 15, in the urban population with p value of 0.004 whereas in rural it is found to be not significant.

Table 16: Association between Frailty and unexpected events in study population

Unexpected event	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
Death of loved one	29 (9.7%)	13 (4.3%)	42 (14%)	18 (6%)	6 (2%)	24 (8%)
Separation or divorce	1 (0.3%)	3 (1%)	4 (1.3%)	8 (2.7%)	0 (0%)	8 (2.7%)
Road traffic accident	7 (2.3%)	5 (1.7 %)	12 (4 %)	8 (2.7%)	6 (2%)	14 (4.7%)
Serious illness of loved ones	7 (2.3%)	4 (1.3%)	11 (3.7%)	20 (6.7%)	6 (2%)	26 (8.7%)
Serious illness of self	21 (7%)	5 (1.7%)	26 (8.7%)	54 (18%)	28 (9.3%)	82 (27.3%)
Uneventful	97 (32.3%)	108 (36%)	205 (86.3%)	58 (19.3%)	88 (29.3%)	146 (48.7%)
Total	162 (54%)	138 (46 %)	300 (100 %)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2 = 16.871$, d.f = 5 p value = 0.004, ** $\chi^2 = 33.197$, d.f = 5 p value = 0.000

The above table 16 showed an association between frailty and unexpected events among the study population in both rural and urban which were found to be significant with p value less than 0.05.

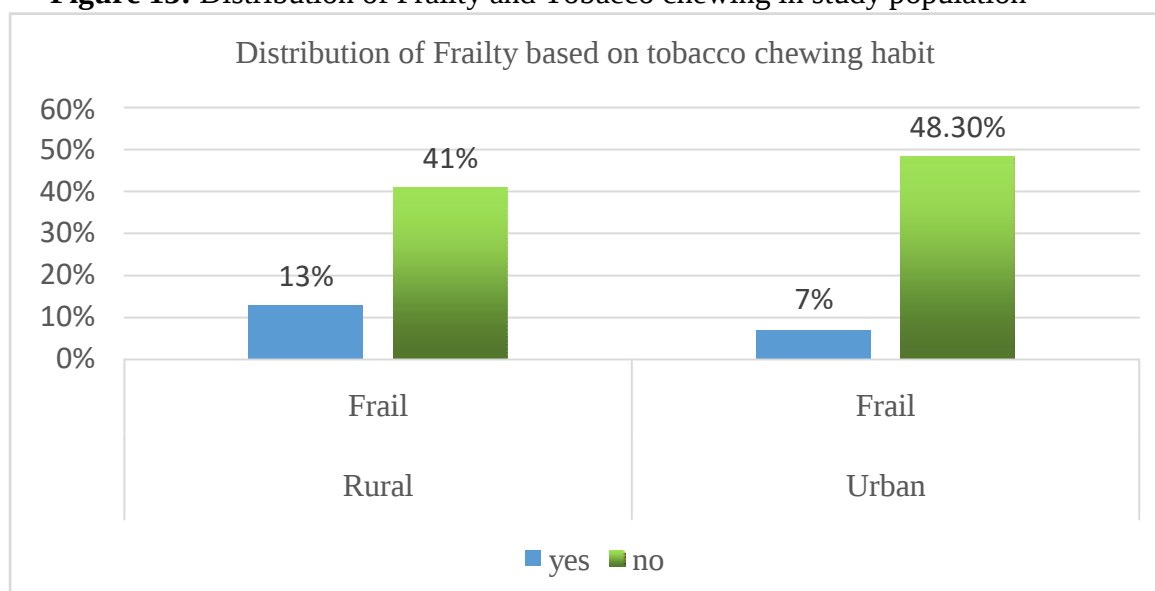
Table 17: Association between Frailty and co morbidity status in study population

Co morbidities	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
One or more	67 (22.6%)	31 (10%)	98 (32.6%)	78 (26%)	32 (10.6%)	110 (36.6%)
Nil	95 (31.4%)	107 (35.9%)	202 (67.3%)	88 (29.3%)	102 (34%)	190 (63.3%)
Total	162 (54%)	138 (46%)	300 (100%)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2 = 12.095$, d.f = 1 p value = 0.000, ** $\chi^2 = 17.049$, d.f = 1 p value = 0.000

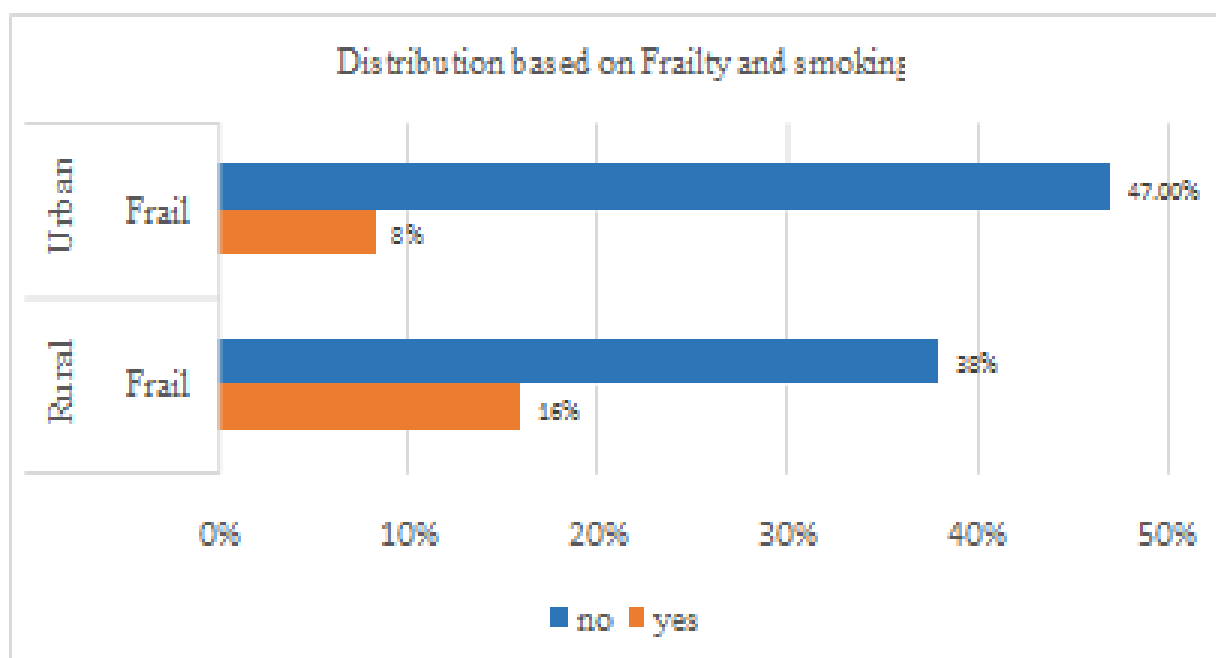
The table 17 was showing an association between frailty and co-morbidities among the study population in both rural and urban areas with p value 0.000

Figure 13: Distribution of Frailty and Tobacco chewing in study population



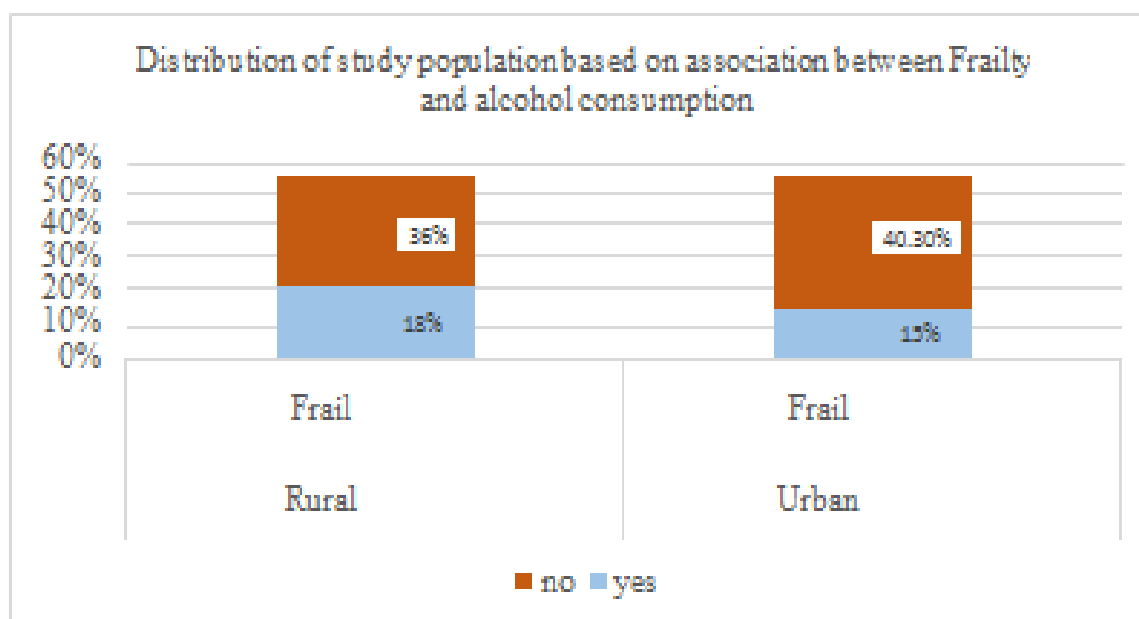
The figure 13 showed the distribution of frailty with tobacco chewing and it is observed that the prevalence of tobacco chewing is 13% in rural and 7% in urban frail individuals.

Figure 14: Distribution of Frailty and smoking in study population



From the figure 14, it is clear that among the rural population 16% were reporting frailty and smoking history whereas it was 8% in Urban.

Figure 15: Distribution of Frailty and alcohol consumption in study population



Among the Frailty population in rural and urban areas, 18% and 15% had the habit of alcohol consumption as described in the above figure 15.

Table 18: Association between Frailty and History of fall among the study population

H/o of fall	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
None	131 (43.7%)	114 (38%)	245 (81.7%)	143 (47.7%)	95 (31.7%)	238 (79.3%)
Once	20 (6.7%)	19 (6.3%)	39 (13%)	16 (5.3%)	37 (12.3%)	53 (17.7%)
More than once	11 (3.7%)	5 (1.7%)	16 (5.3%)	7 (2.3%)	2 (0.7%)	9 (3%)
Total	162 (54%)	138 (46%)	300 (100%)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2 = 1.545$, d.f = 1 p value = 0.461, ** $\chi^2 = 17.566$, d.f = 1 p value = 0.000

As per the above table 18, out of the 55.3% who were in frail status in urban population, 5.3% had history of fall once and more than once it was 2.3% and also it has been found to be statistically significant with p value 0.000.

Table 19: Association between Frailty and fear of falling among the study population.

Fear of falling	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
Low concern	21 (7%)	47 (15.7%)	68 (22.7%)	67 (22.3%)	30 (10%)	97 (32.3%)
Moderate concern	18 (6%)	6 (2%)	24 (8%)	32 (10%)	12 (4%)	44 (14.7%)
High concern	123 (41%)	85 (28.3%)	208 (69.3%)	67 (22.3%)	92 (30.7%)	159 (53%)
Total	162 (54%)	138 (46%)	300 (100%)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2 = 21.099$, d.f = 1 p value = 0.000, ** $\chi^2 = 23.995$, d.f = 1 p value = 0.000

From the table 19, a strong association (p value <0.05) is observed between Frailty and fear of falling among the study participants in both the rural and urban areas

Table 20: Association between Frailty and physical dependence based on activities of daily living

Physical activity Dependence	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
Live independently	97 (32.3%)	105 (35%)	202 (67.3%)	131 (43.7%)	115 (38.3%)	246 (82%)

Minimal dependence	60 (20%)	25 (8.3 %)	85 (28.3%)	26 (8.7%)	16 (5.3%)	42 (14%)
Partial and very dependent	5 (1.6 %)	8 (2.6%)	13 (4.3%)	9 (3%)	3 (1%)	12 (4%)
Total	162 (54%)	138 (46 %)	300 (100 %)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2 = 13.588$, d.f = 2 p value = 0.000, ** $\chi^2 = 3.043$, d.f = 2 p value = 0.218

Frailty among the rural population has reported an association in the above table 20, with physical dependence based on activities of daily living with p value 0.000 and hence it is statistically significant whereas found no association in the urban population.

Table 21: Association between frailty and Cognitive status among the study population

Cognitive status	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
Normal	101 (33.7%)	114 (38%)	215 (71.7%)	148 (49.3 %)	121 (40.3%)	269 (89.7%)
Minimal impairment	61 (20.3 %)	24 (8%)	85 (28.3%)	18 (6%)	13 (4.3%)	31 (10.3%)
Total	162 (54%)	138 (46 %)	300 (100 %)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2 = 15.068$, d.f = 1 p value = 0.000, ** $\chi^2 = 0.104$, d.f = 1 p value = 0.017

From the above table21, an association is observed between frailty and cognitive status among the rural population whereas it is not significant in the urban respondents.

Table 22: Association between frailty and Depression among the study population

Depression grade	Rural*			Urban**		
	Frail	Not Frail	Total	Frail	Not Frail	Total
Normal	29 (9.7%)	64 (21.3%)	93 (31%)	72 (24%)	83 (27.7%)	155 (51.7%)
Mild depression	86 (28.7 %)	56 (18.7%)	142 (47.3%)	71 (23.7%)	49 (16.2%)	120 (40%)
Moderate depression	28 (9.3%)	15 (5 %)	43 (14.3%)	20 (6.7%)	2 (0.7%)	22 (7.3%)
Severe depression	19 (6.3%)	3 (1%)	22 (7.3 %)	3 (1%)	0 (0%)	3 (1%)
Total	162 (54%)	138 (46 %)	300 (100 %)	166 (55.3%)	134 (44.7%)	300 (100%)

* $\chi^2 = 33.37$, d.f = 3 p value = 0.000, ** $\chi^2 = 15.985$, d.f = 3 p value = 0.001

As shown in table 22, depression is strongly associated with the frailty status among the respondents of both the rural (p value = 0.000) and urban (p value = 0.001) population and is found to be significant.

4. Discussion

The present study was conducted to study the prevalence of frailty among elderly in the rural urban and areas of Puducherry and to assess the association between various sociodemographic parameters, other physical and psychological factors. A total of 600 elderly were interviewed from rural and urban areas of Villianur taluk, Puducherry. The mean age of the study participants was 67.66 ± 6.29 . Of the total study participants 62.3% belong to the age group of 60 to 69 years which is categorized as 'Young old', 33.3% belong to age group 70 to 79 years who are also categorized as 'Old old', 9% of the study population belonged to the age group of 80 years and above which is also categorized as 'Oldest old'. Among the study population 45.5% were male in which 21.3% belong to rural residence and 24.1% belong to urban residence and 54.5% were female in which, 28.6% belong to rural residence and 25.8% belonged to urban residence. The majority of the study population were Hindus (93.6%), 4% belong to Christian and 2.1% belong to Muslim religion. The current study showed 74.3% of the elderly were married, 20.5% were widowed in which 12.3% reside in rural area and 8.1% reside in urban area, 4% of the total population was unmarried and 2% were separated or divorced. Almost 45.5% of the study population were illiterate, in which 32.8% belong to rural area, whereas the urban area showed higher proportion literacy with 11.5% completed higher secondary and 3.6% completed graduation or above. The educational qualification of female was lower than that of males.

In this study majority of them held semi-skilled job (34.8%) and around 25% were homemakers and a small proportion held professional job (3%). Based on the total family income generated, 45.5% elderly study population had monthly income of above 7000.

Based on the living condition 42.6% were living with their spouse and children, followed by 30.5% were living with spouse. Around 13% of the elderly are living with children and 9% living alone. On the contrary, study done by Siriwardhana et al¹⁴ in Kegalle district of Sri Lanka showed 6% of the elderly living alone. 11.3% living with spouse, 82.7% living with children/other family. The difference in the living arrangement is due to the geographical and cultural variation. Regarding personal habits our study population showed 24.1% had history of alcohol consumption habit, which is similar to the study done by Kendhapedi et al¹³. Around 15.3% had history of tobacco or betel nut chewing habit and 18.8% had history of smoking habit. The prevalence of falls in the past one year in our study was around 20% whereas a study done by Konda and Giri et al²⁰ reported a prevalence of 13.8% in Khammam District of Telangana.

The data of the present study was analyzed separately to find out prevalence and factor associated with frailty in rural and urban areas. The prevalence of frailty in our study area representing rural population showed 54% were frail with mean age of 67.29 ± 6.09 in which 33.3% were female and 20.7% were male. Similarly, a study done by Karthikayini²¹ in Puducherry showed 53.75% of frailty in rural population and also our results were similar to a study done in community setting of Opale district of southwest Poland by Magdalana Sach et al²² which showed prevalence of frailty as 54.5% with multi dimension scale whereas community based study done by Kendhapedi et al¹³ showed prevalence of 28% for physical definition measured by Fried's phenotype 59% accumulation of deficit by frailty index and 63% with Tilburg frailty indicator. Das Gupta²³ conducted a study in rural elderly population in west Bengal which showed frailty prevalence of 38.8%. In the study done by Uday Narayan Yadav et al⁹¹ in the rural community of

Morang and Sunsari districts of Nepal showed 65% prevalence of frailty in elderly population. Collin Payne et al²⁵ study done in rural African population showed a prevalence of 5.4% to 13.2%. Nguyen et al²⁶ study done in rural community dwelling of Vietnam showed 65.6% were pre-frail, and 21.7% were frail. These differences are due to the variation in geographical location, different measurement tools for frailty and behavioral changes of the elderly. A study done in Odisha by Subashisha Swain et al²⁷ reported 78% frailty in elderly population attending the Community health Centre. This difference from our study result to Swain et al²⁷ may be due to fact that center based study attract more frail individuals than community based study.

The prevalence of frailty in urban area of a study population was 55.3% which is similar to the study done by Karthikayini²¹ which showed 59.8% of frailty in urban Puducherry. On the contrary cross sectional study conducted in urban area in Pune city of Maharashtra by Kashikar, Yashoda et al²⁸ showed prevalence of 26%. A 10/66 population based study done by Rodriguez et al²⁹ showed frailty prevalence in urban India as 15.2%. These differences are due to geographical and behavioral changes.

In our study majority of elderly population belong to the age group of 60 to 69 (62%). Figure shows 10 shows age groups and frailty status among the study population which might be due to the fact that frailty is a normative process of ageing. There was significant association between educational status of the urban study population and frailty. The study showed association between Longest held job and frailty status. Table 14 shows Homemaker or nil occupation shows increased level of frailty in urban population which is also significant which is similar to the study findings of Siriwardhana et al¹⁴ with strong association between longest held occupation and education level. There was association between Frailty and unexpected events in last 1 year in rural study population. The table 16 depicts that the parameters like death of loved ones, separation or divorce, Road traffic accidents, serious illness of loved ones and serious illness of self were slightly higher in frail group than in non frail study group. The categories in unexpected events in last 1 year is statistically significant with the presence and absence of frailty status with a p value=0.005

In the urban location in our present study, out of 166(55.3%) frail individuals, 12.3% were living with spouse, 23.7% were living with spouse and children, 9.7 % were living with children, 4% were living alone and 5.7% were living with relative or others, whereas out of 134(44.7%) non frail individuals 7.7% were living with spouse, 27.7% were living with spouse and children, 6.7% were living with children, 1.7% were living alone and 1% were living with relative or others. This shows that living arrangements without kin could potentially impact the elderly which could lead to frailty. A similar finding was observed in Soldo et al³⁰ stating the importance household and care arrangements for frail female population. Out of 98(32.6%) people with one or more chronic co morbidity 67(22.6%) were frail and 31(10%) were not frail. Out of 202 (67.3%) people with no comorbidity 107 were not frail (35.9%) and 95(31.4%) of them were frail. There was a highly significant statistical association between co morbidity category and frailty status. Among the 55.3% frail individuals 26% had one or more co morbidities and among not frail group 10.6% had co morbidities in the urban setup. These results are comparable to the study done in Odisha by Swain et al⁹⁴

Out of the current study participants 19.46% of the elderly showed history of fall in last one year. Whereas a study done by Kendhapedi et al¹³ in rural Thanjavur district showed around 40% history of fall. The difference may be due to study area and presence of more comorbidity. Table 46 shows there is a significant association history of falls in last 1 year and presence of frailty status implying, frailty should increase tendency of falls in elderly. Our study results display highly statistically significant association between Frailty and fear of falling in urban

elderly study population. 53% of the study population are highly concerned over fear of falling, in which 22.3% were frail. 14.7% of the study population were moderately concerned about falling and 32.3% were least concerned. The difference in degree of fear of falling is associated with the frailty status. Similarly, table shows high statistically significant association between Frailty and fear of falling in rural elderly study population. 69.3% of the rural study population are highly concerned over fear of falling, in which 41% were frail. 8% of the study population were moderately concerned about falling and 22.7% were least concerned. The difference in degree of fear of falling is associated with the frailty status. Frail group showed higher concern to fear of falling. Similarly, table 54 shows highly statistically significant association between Frailty and fear of falling in urban elderly study population. 53% of the urban study population are highly concerned over fear of falling, in which 22.3% were frail. 14.7% of the study population were moderately concerned about falling and 32.3% were least concerned. The difference in degree of fear of falling is associated with the frailty status. Kendhapedi et al⁵⁸ study also showed similar association between frailty and fear of fall.

The present study results show around 67.3% of the urban study population live independently 28.3% had minimal dependency, 2.7% had partial dependency and 1.7% were very dependent. Out of 67.3% who were independent in physical activities 32.3% were frail and 35% were not frail. Among 28.3% rural study population, 20% were frail and 8.3% were not frail. There was significant association between the activities of daily living and frailty status which can be compared with the study results of Dasgupta et al⁹⁰. This shows that there was reduction in activities of daily living in frail person.

Depression among the elderly population was assessed using the validated GDS short form scale^{15,18}. There was mild depression among the study population around 47.3%, 14.3% moderate depression, 7.3% severe depression and the overall depression proportion was 68.9%, which was similar to the study findings of Laksham et al³¹ which showed a prevalence of 69% using GDS short form in rural population. The grades of depression was associated with the frailty status of the current population residing both rural and urban location. Similar results were represented in the cohort study done by Matthew Prina et al³² associating frailty and depression. A population based prospective cohort study done by Hajek et al³² showed frailty increases with onset of depression and dementia. The findings in cognitive status of the study population assessed by Montreal cognitive assessment¹⁹ showed 20.3% frail individuals in rural and 6% frail individuals in urban population showed mild cognitive impairment. The change in cognitive status grade were associated with the frailty status of the study population which was similar to the findings of Ameer et al³⁴ and a population based cohort study done by Del Brutto et al in rural setting of Ecuador et al³⁵.

5. Conclusion

Frailty is a predisability state and state of vulnerability which can be addressed as a multi-dimensional, heterogeneous different from disability. The earlier identification of frailty could avoid the chance of disability and dependency. In this study about 54% of the rural population, 55.3% of the urban population showed frailty as per Tilburg frailty indicator and overall prevalence of 54.6% in the elderly population who has been interviewed. The factors which are significantly associated were education status, longest held job, living arrangement, unexpected events in last one year, Comorbidity status, history of fall, fearing of falling, cognitive impairment, depression based on GDS were associated with the study population. As our study population show increased prevalence of frailty in female population more care and attention are

required for the elderly females. The current prevalence of elderly in India is around 7.7% which will be increasing in the coming years, because of the advancement in the medical sciences. The increasing life span of the general public can lead to various disability and morality status, Frailty is one among them which is reversible and can be prevented if identified early at the individual, family and community level and its aftermath can be avoided and also delayed. It is to be noted that frailty can be triggered by minor events to major unexpected events in the life of elderly from which return to their previous health needs multi-disciplinary approach. Frailty can be related to decreased function across physical, Psychosocial and physiological system that makes the need of early identification and prevention so that adverse outcome like disability or recurrent hospitalization can be avoided.

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Conflict Of Interest

The authors declare no conflict of interest.

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