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RISK OF FALL AMONG THE ELDERLY AND ITS ASSOCIATION WITH COGNITIVE IMPAIRMENT IN RURAL AREAS OF THIRUVALLUR DISTRICT: A CROSS SECTIONAL ANALYTICAL STUDY

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ABSTRACT

Introduction: Falls represent a significant public health issue for the elderly, especially in rural regions where healthcare access is limited. Physiological changes associated with aging and cognitive decline heighten the likelihood of falls, resulting in considerable physical, psychological, and financial repercussions. This research seeks to evaluate the prevalence of fall risk and its correlation with cognitive impairment among older adults in the rural Tiruvallur district of Tamil Nadu, India. Gaining insight into these factors is crucial for creating targeted interventions that can mitigate fall risk and enhance the quality of life for this at-risk population.

Objectives: This cross-sectional study seeks to evaluate the prevalence and contributing factors associated with fall risk among elderly individuals residing in rural Tiruvallur, Tamil Nadu. Additionally, it aims to investigate the relationship between cognitive impairment and fall risk. The results will guide the development of targeted interventions designed to decrease the incidence of falls and enhance the quality of life for the elderly.

Materials & Methods:This analytical cross-sectional study involved around 90 elderly individuals aged 60 years and older from rural Tiruvallur, who were selected through purposive sampling. Data collection was conducted through interviews utilizing a pretested, Tamil-translated semi-structured questionnaire that evaluated socio-demographics, cognitive function (Mini-Cog test), and fall risk (Berg Balance Scale). Statistical analysis was carried out using SPSS v24, applying descriptive statistics, Chi-square tests for associations, and multivariate logistic regression to investigate the factors affecting cognitive function and fall risk while accounting for confounding variables.

Results: The research indicated that most elderly participants were aged 70 or older, with a slight predominance of females and varied educational backgrounds. Common comorbidities observed included visual impairment, osteoarthritis, hypertension, and cardiovascular disease.Statistical analysis demonstrated significant correlations between cognitive impairment and factors such as advanced age, osteoarthritis, hypertension, visual impairment, and fear of falling. These factors independently heightened the risk of cognitive decline, highlighting the necessity for focused management of comorbidities. The results underscore the significance of addressing these health concerns to enhance cognitive health and overall quality of life for the elderly.

Conclusion: This research highlights the significance of tackling both psychological and physical risk factors that contribute to the fear of falling in older adults, with the aim of enhancing their mobility, confidence, and overall well-being. Timely identification and specific interventions can help decrease dependency and social isolation, thereby fostering independence and promoting healthy aging. Subsequent studies should concentrate on these risk factors to create effective screening and prevention strategies.
Keywords: Elderly, Fall risk, Cognitive impairment, Rural health, Fear of falling

INTRODUCTION

Falls represent a significant public health risk globally, particularly for the elderly population. According to the World Health Organization (WHO), falls result in a considerable loss of disability-adjusted life years (DALYs) worldwide and are a leading cause of morbidity and mortality among older adults (WHO, 2020). The incidence of falls increases with age, particularly among individuals aged 65 and older (WHO, 2020). Older adults are at a heightened risk of falling due to various risk factors. The primary factor is aging itself, which is associated with physiological changes such as muscle weakening and balance loss (Smith et al., 2019) [1].

Research indicates that men tend to experience higher fall rates than women, implying that gender may also play a role (Jones & Mackenzie, 2018) [2]. Other contributing factors include education level and socioeconomic status; individuals with lower socioeconomic status and less education are at an increased risk of falling (Thomas & Stevens, 2016) [3]. Chronic health conditions that elevate the risk of falls among older adults include diabetes mellitus and hypertension. Cognitive impairment has been linked to both of these conditions, further increasing the likelihood of falls. A decline in cognitive function heightens the risk of falling as it diminishes an individual's ability to perform Activities of Daily Living (ADLs) independently (Johnson et al., 2017) [4, 5].

Preventive measures include exercise programs aimed at enhancing strength and balance, modifications to ensure home safety, and regular medical check-ups to manage chronic conditions. It is essential to implement and sustain effective fall prevention strategies through a multidisciplinary approach that involves healthcare professionals, caregivers, and community resources (Gillespie et al., 2012) [6].Falls can cause psychological and social problems in addition to physical harm. Falls often lead to functional decline, which compromises an older person's freedom and quality of life (Brown & McArthur, 2018). [7]. Furthermore, fall-related injuries have a substantial financial impact associated with long-term care, rehabilitation, and medical expenses. Equilibrium systems are impacted by physiological changes brought on by age. Changes in motor function, which integrates sensory inputs from the visual, vestibular, and proprioceptive systems, increase the likelihood of balance issues (Stevens, 2020). [8]. Because the ability of their central nervous systems to coordinate these inputs declines with age, older persons are more susceptible to falls, Given the complexity of falls among the elderly, preventive measures are essential.

Falls among the elderly pose a significant global public health issue, particularly in rural regions where access to healthcare and preventive services is frequently restricted. The likelihood of falls escalates with age due to physiological alterations such as weakened muscles, compromised balance, and sensory deterioration. Cognitive decline, including conditions such as dementia and mild cognitive impairment, further intensifies the risk of falls by impairing judgment, motor coordination, and sensory perception (9). These cognitive impairments obstruct an individual’s capacity to maintain balance and safely navigate their surroundings, rendering them more vulnerable to falls.

Falls in older adults can result in severe physical injuries, including fractures and immobilization, but they also carry significant psychological and social repercussions. The fear of falling may lead to decreased mobility, social isolation, and a reduced quality of life, while the financial burden of medical care related to falls places considerable pressure on healthcare systems (10). Elderly populations in rural areas encounter additional obstacles due to environmental risks, inadequate healthcare infrastructure, and socioeconomic disadvantages, which can heighten their susceptibility to falls and complicate timely diagnosis and management.

Despite these issues, research investigating the specific connection between cognitive decline and fall risk in rural areas, such as the Tiruvallur district, is limited. Gaining insight into the prevalence and contributing factors of falls, especially the impact of cognitive impairment, is crucial for formulating effective, targeted interventions. The early identification of individuals at high risk and the implementation of multidisciplinary prevention strategies—including physical rehabilitation, environmental adjustments, and cognitive assessments—can decrease the incidence of falls, reduce healthcare expenses, and improve the well-being and independence of elderly individuals in rural communities (11,12)

Objectives

- To assess the prevalence of fall risk among elderly individuals residing in rural areas of Tiruvallur district, Tamil Nadu, India. This involves identifying factors contributing to their vulnerability to falls, including demographic, health, and environmental factors
- To investigate the association between cognitive impairment and the risk of falls among the elderly population. By investigating these connections, the study aims to shed light on how fall risk in a rural setting is influenced by cognitive decline.

MATERIALS & METHODS

- **Study settings**: The study was conducted among elderly individuals residing in rural areas of Tiruvallur district, Tamil Nadu, India.
- **Study period**: The study was carried out over a two-month period, from April 2024 to May 2024.
- **Study design**: This is a cross-sectional analytical study designed to assess fall risk and cognitive impairment among the elderly.
- **Study population:**The study population included elderly individuals aged 60 years and above living in rural Tiruvallur district.
- **Inclusion criteria**
  1. Age 60 years and above
  2. Residents of rural Tiruvallur
  3. Not currently on psychiatric medications
- **Exclusion criteria**
  1. Individuals under psychiatric medication, due to potential effects on cognitive function and balance
- **Sample size and sampling method**: Approximately 90 elderly participants were selected using purposive sampling, based on criteria relevant to the study objectives.
- **Data Collection Method:** Data was collected through interviews using a pretested, semi-structured questionnaire. The questionnaire was translated into the local language (Tamil) to ensure comprehension and ease of response for the participants.
- **Components of the Study Tool**: Part I - Socio-demographic Characteristics: This section of the questionnaire collected information on variables such as age, gender, educational background, marital status, socioeconomic status, and living conditions.Part II - Cognitive Function and Fear of Fall Assessment:
  - ✓ Mini-Cog Test: A validated screening tool used to assess cognitive function. It consists of a three-item recall test and a clock-drawing task.
  - ✓ Berg Balance Scale (BBS) Questionnaire: A widely used tool to assess the balance and risk of falling among elderly individuals. It consists of 14 tasks that measure functional balance.
- **Statistical Analysis**:Data Management: Data collected from the interviews was entered into Microsoft Excel for initial organization and cleaning.Statistical Software: SPSS version 24 was utilized for statistical analysis. SPSS (Statistical Package for the Social Sciences) is commonly used for data management and statistical analysis in research studies.
- **Types of Statistical Tests:**Descriptive Statistics was used to summarize and describe the characteristics of the study population, such as mean, median, mode, standard deviation, and frequency distributions.Chi-Square Test was employed to examine associations between categorical variables in the study, such as the relationship between socio-demographic characteristics and cognitive function.Multivariate Logistic Regression was applied to explore the relationship between multiple independent variables (e.g., age, gender, education) and the dependent variables (cognitive function and fear of falling). This method allows for controlling potential confounding variables and assessing their independent effects.
- **Ethical consideration:** Approval from the Institutional ethics committee was obtained. Privacy and confidentiality of data was maintained.

RESULTS

Table: 1 Sociodemographic characteristics of the study participants (N-90)

Characteristics	Categories	Frequency (percentage)
Age	60–69 70 and above	34(38%) 56(62%)
Gender	Male Female	42(47%) 58(53%)
Education	Illiterate Primary education Secondary education Graduate	55(61%) 25(28%) 8(8.8%) 2(2.2%)
Marital status	Married Widowed/separated/ unmarried	43(48%) 47(52%)
Socioeconomic status	APL BPL	26(29%) 64(71%)
Living arrangement	With spouse Relative other than spouse Alone	27(30%) 51(57%) 12(13.3%)

Table 1 describes the socioeconomic characteristics of the study participants, with a predominant portion (62%) being 70 years old or older, and a marginally greater number of females (53%) compared to males (47%). The educational backgrounds were diverse, with the majority of participants being illiterate (61%), followed by those who had completed primary education (28%), secondary education (8.8%), and graduate education (2.2%). Almost half of the participants (48%) were married, while 52% were either widowed, separated, or unmarried. A notable majority (71%) were classified within the Below Poverty Line (BPL) socioeconomic category. In terms of living situations, the majority of elderly individuals resided with relatives other than their spouse (57%), 30% lived with their spouse, and 13.3% lived independently. These socio-demographic characteristics are crucial for comprehending the vulnerabilities and requirements of the study population.

Figure 1: Distribution of Comorbidities among Geriatrics (N=90)

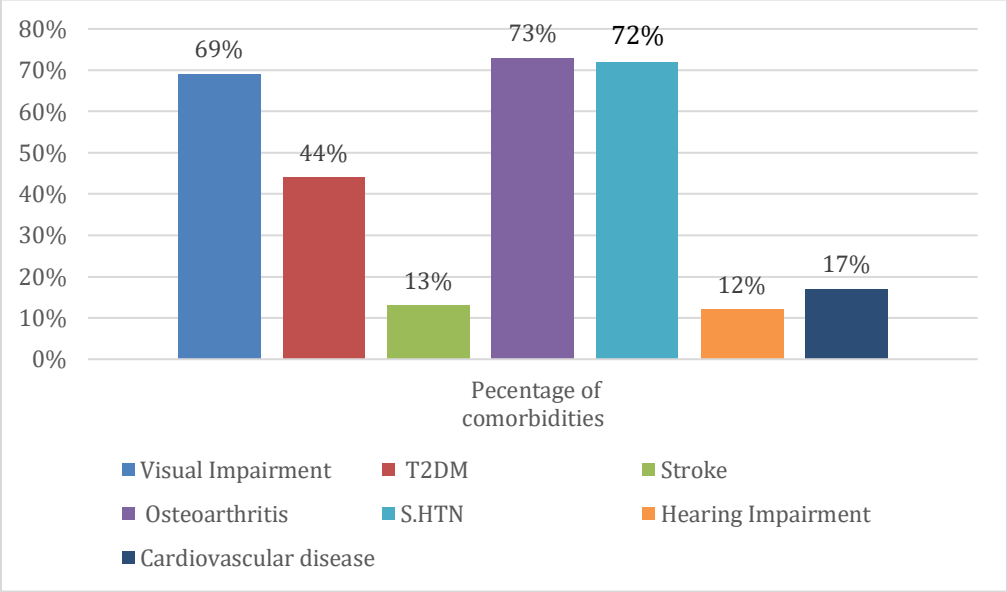

Figure 1 illustrates the distribution of comorbidities among 90 elderly participants, with visual impairment (73%) and osteoarthritis (69%) being the most prevalent. Cardiovascular disease impacted 17%, hearing impairment 13%, and type 2 diabetes mellitus 12%. Stroke was the least frequently reported condition, affecting 4.4% of participants. The considerable prevalence of multiple comorbidities, especially concerning vision and mobility challenges, underscores significant health burdens within this demographic. These results highlight the necessity for focused healthcare interventions aimed at enhancing the well-being of the elderly.

Table 2: Association between Cognitive Impairment among Elderly

Factors	Cognitive impairment	X 2 p value	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Age 60-69 70 and above	 8 44	0.000	11.917(4.308to32.966)	0.08(0.03-2.0)
Presence of osteoarthritis	40	0.000	1.9(1.74 to 5.44)	2.75(1.4-5.1)
Presence of Hypertension	45	0.000	3.5(1.9-5.33)	2.2(1.2-3.8)
Presence of visual impairment	42	0.000	2.1(1.2-4.51)	1.2(0.02-3.45)
Presence of fear of fall	42	0.000	4.6(1.2-5.0)	2.82(0.8-4.83)

Table 2 illustrates significant correlations between cognitive impairment and various factors among elderly participants, such as advanced age, osteoarthritis, hypertension, visual impairment, and fear of falling. Older adults (≥70 years) exhibited a significantly elevated risk (OR = 11.9) in comparison to those aged 60–69, even after adjustments were made. Osteoarthritis (AOR = 2.75) and hypertension (AOR = 2.2) also demonstrated strong independent associations. Visual impairment heightened the risk (OR = 2.1), although the adjusted association was less pronounced. Fear of falling emerged as a significant predictor (AOR = 2.82) of cognitive impairment. Across all variables, chi-square and p-values validated statistical significance. These findings underscore the necessity of addressing comorbidities and fears related to falling in order to reduce the risks of cognitive decline in the elderly.

DISCUSSION

The current research indicates a significant prevalence of chronic health issues among elderly individuals residing in the rural Tiruvallur district, with osteoarthritis and hypertension being notably prevalent. Osteoarthritis, identified as the most common comorbidity, is recognized for its considerable impact on mobility and quality of life in older adults, while systemic hypertension continues to be a significant factor contributing to cardiovascular morbidity and mortality. The coexistence of these chronic conditions not only heightens the physiological vulnerability of elderly individuals but also leads to secondary complications such as decreased physical activity, balance issues, and an increased risk of falls.

One of the most remarkable findings of this research is the extraordinarily high incidence of falls—72% of participants—evaluated using the Berg Balance Scale. This statistic significantly surpasses the global average, where roughly one-third of elderly individuals experience at least one fall each year [13]. Our results are consistent with those of Chen et al. [14], who found that cognitive impairment notably elevates fall risk among older adults in rural China. Echoing their findings, our study highlights that cognitive decline especially deficits in attention and executive function can compromise the ability to maintain balance and navigate safely within the environment.

Moreover, our findings establish a robust correlation between fear of falling (FOF) and cognitive impairment. This connection has been extensively documented in existing literature, identifying mild cognitive impairment (MCI) as a significant predictor of falls. FOF not only restricts physical activity due to self-imposed limitations but also leads to muscle deconditioning, thus creating a detrimental cycle that exacerbates the actual risk of falling. Additionally, visual impairment was identified as a crucial predictor of FOF in our study group, aligning with previous research that underscores its adverse effects on spatial orientation, depth perception, and hazard detection.

The connection between chronic illnesses such as osteoarthritis and hypertension with fear of falling (FOF) is particularly significant, as these ailments worsen mobility restrictions and heighten psychological fear responses [15]. Therefore, managing these comorbidities may act as a vital preventive measure against both FOF and actual falls. Liu-Ambrose et al. [16] illustrated that organized physical activity programs—particularly those emphasizing strength, balance, and coordination—can greatly diminish the risk of falls in older adults with cognitive impairments. Although our research did not directly assess the impact of exercise, the high incidence of falls indicates a possible advantage in implementing such initiatives within this rural demographic.

The rural context of Tiruvallur district may exacerbate these difficulties due to restricted access to specialized healthcare services, as highlighted in WHO reports. Insufficient infrastructure, a lack of trained geriatric care professionals, and limited knowledge regarding fall-prevention methods can intensify the adverse effects of cognitive and physical disabilities. As a result, interventions in these environments must be customized to tackle both environmental and individual-level risk factors.

In summary, our results emphasize the necessity of a holistic geriatric care framework that incorporates cognitive evaluation, chronic disease management, vision care, environmental adjustments, and psychological assistance. By addressing both the physical and psychological aspects of FOF, healthcare practitioners can not only lower the incidence of falls but also improve functional independence and quality of life for elderly individuals residing in rural regions.

CONCLUSION

This research emphasizes significant risk factors linked to the fear of falling among older adults and explores how these factors can be managed to significantly improve their quality of life. Interventions can successfully mitigate the fear of falling by targeting these factors, which may include psychological issues such as anxiety and previous fall incidents, as well as physical challenges like muscle weakness and balance problems. Such therapies not only

enhance mobility and confidence but also reduce dependence and social isolation, thereby improving overall well-being. To develop targeted screening and prevention initiatives, future studies should focus on these identified risk factors. Prompt intervention and support are crucial for the early detection of cognitive decline, which is often exacerbated by the fear of falling. By integrating these strategies into healthcare practices, more favorable outcomes can be achieved, helping older adults maintain their independence and optimize their physical and mental health as they age. Therefore, there exists a significant opportunity to enhance the lives of the elderly and promote healthy aging by comprehensively addressing these intricate risk factors.

Recommendations

- Incorporate Cognitive Screening into Fall-Risk Assessments – It is essential to routinely evaluate cognitive function in elderly individuals within primary care environments to identify those who are at an increased risk of falls and the associated fear of falling.
- Establish Community-Based Physical Activity Programs – Create organized exercise initiatives that emphasize balance, strength, and coordination to decrease the incidence of falls, particularly in rural regions where healthcare access is limited.
- Improve Management of Chronic Conditions – Focus on the effective management of osteoarthritis, hypertension, and visual impairments to minimize physical limitations and the fear of falling among older adults.

Strengths

- Significant Importance to Rural Geriatric Health – Concentrates on a neglected rural demographic, tackling specific challenges related to healthcare access.
- Thorough Risk Factor Evaluation – Investigates various interconnected factors, such as cognitive condition, chronic illnesses, and the apprehension of falling.
- Application of Verified Assessment Instruments – Employs the Berg Balance Scale along with standardized cognitive assessments, improving dependability.
- Robust Comparative Literature Backing – Correlates and differentiates results with numerous global studies, enhancing external validity**.**

Limitations

- The cross-sectional design restricts the capacity to determine causality.
- The results may not be applicable to populations outside the rural study group.

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