The Dimensions of Health in Elderly People: A Preliminary Study for Reliability Testing and Questionnaire Validation

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ABSTRACT

The study evaluates the reliability and validity of a multidimensional tool designed to assess the health dimensions of elderly populations of 32 respondent in Rourkela Block, with a focus on Sundargarh District. Initial findings reveal a raw Cronbach's alpha of 0.568, indicating moderate internal consistency, while a standardized Cronbach's alpha of 0.859 demonstrates strong reliability upon variance standardization. This discrepancy highlights the need for refining the tool by addressing item redundancy, misalignment, and extreme variance. Recommendations include item analysis, dimensionality assessment, and the incorporation of test-retest reliability to ensure longitudinal robustness. The tool's comprehensive structure, covering physical, mental, emotional, social, and spiritual health, aligns with global geriatric assessment practices, emphasizing its relevance for elderly health research.

The study underscores the importance of adapting validated tools like the Cronbach Alpha Test, the Community Vulnerability Index, and context-specific instruments for targeted interventions. Limitations such as sample size, questionnaire length, and cultural relevance are identified, with strategies proposed to enhance applicability and generalizability. The integration of multidimensional assessments and innovative frameworks such as data mining for scheme awareness highlights the potential for addressing health disparities and policy gaps among elderly populations. This research emphasizes the critical role of reliable tools in improving health outcomes, ensuring effective interventions, and fostering sustainable aging in underserved regions.

Key Word: Elderly people, Cronbach alpha Test, Health dimension, Government scheme, Validation

INTRODUCTION

The study of elderly health has gained significant importance globally due to the rapid aging of populations. India, in particular, is undergoing a demographic transition, with projections indicating that by 2050, over 20% of its population will be aged 60 and above. This shift presents critical challenges related to health, well-being, and social support, particularly in underserved rural regions such as Sundargarh District, Odisha. Addressing these challenges necessitates a comprehensive understanding of the dimensions of elderly health, including physical, mental, social, and spiritual well-being. Additionally, the development of reliable and valid assessment tools is essential for ensuring accurate health evaluations and informed policy decisions.

Rural-Urban Disparities in Elderly Health

Elderly populations residing in rural regions, exemplified by Sundargarh, encounter considerable healthcare challenges when juxtaposed with their urban counterparts. These disparities arise from a multitude of determinants, including the pronounced absence of healthcare infrastructure, healthcare practitioners, and specialized services tailored to address age-related health concerns such as cardiovascular diseases, diabetes, and cognitive impairment. A considerable proportion of elderly individuals in rural India experience undiagnosed or inadequately managed health ailments as a consequence of these limitations. Escalated poverty levels, in conjunction with restricted access to pensions and governmental assistance programs, intensify economic

vulnerability among rural elderly populations. Economic dependency on younger family members frequently culminates in the prioritization of familial obligations, thereby undermining individual healthcare needs. Senior adults in rural locales often confront feelings of isolation as younger relatives transition to urban living. This social detachment is significantly associated with adverse mental health outcomes, including depression and anxiety. The degree of awareness regarding preventive healthcare strategies and governmental welfare initiatives, such as the Indira Gandhi National Old Age Pension Scheme, is conspicuously lower in rural territories. This inadequacy in health literacy hinders the elderly from accessing vital healthcare resources and supportive networks.

The Role of Spiritual and Social Health

Spiritual well-being plays a crucial role in elderly health, particularly in regions like Sundargarh, where spirituality is deeply ingrained in daily life. Research suggests that engagement in spiritual and religious practices fosters mental tranquility, reduces stress, and provides coping mechanisms for age-related health challenges. Similarly, active participation in social or religious community activities has been correlated with improved mental health, fostering a sense of purpose and belonging among the elderly.

Urban-Rural Comparisons

While urban elderly populations have better access to healthcare and social services, they face distinct challenges such as pollution, overcrowding, and stressful lifestyles that contribute to chronic diseases. Conversely, rural regions like Sundargarh struggle with inadequate infrastructure, limited geriatric care services, and low health awareness, making elderly health management more difficult. Addressing these disparities requires targeted policy interventions, including the development of mobile healthcare units, increased awareness of government welfare schemes, and the integration of geriatric healthcare within primary care services.

The Need for Reliable and Valid Health Assessment Tools

Accurate and culturally pertinent assessment instruments are indispensable for the evaluation of geriatric health and the formulation of efficacious interventions. The health status of elderly individuals encompasses various dimensions; thus, the evaluation of chronic illnesses, mobility, disability levels, and functional capabilities is paramount. Although instruments such as the Katz Index of Independence in Activities of Daily Living (ADL) and the Barthel Index serve to gauge functional capacity, they frequently neglect to encompass broader health concerns, including pain, fatigue, and sensory deficits. A holistic assessment framework is requisite to bridge these deficiencies. Issues related to mental well-being, encompassing depression, anxiety, and cognitive decline like dementia, are particularly widespread in older adults. Widely used assessment methods, including the Geriatric Depression Scale (GDS) and the Mini-Mental State Examination (MMSE), might struggle to maintain cultural validity consistently, especially in rural contexts. The adaptation of these instruments to specific linguistic and cultural frameworks is imperative. Sleep quality, stress management, and lifestyle adjustments profoundly affect the emotional well-being of older adults, demonstrating the importance of these factors on their emotional health. Studies show that negative emotional experiences correlate with elevated risks of mental distress and potential suicidal thoughts. Approaches like aromatherapy and physical workouts have been validated as beneficial for fostering emotional stability. The concept of social health is primarily perceived through the framework of community interactions and assistance frameworks, essential markers of the comprehensive health of elderly people. The Lubben Social Network Scale (LSNS) is frequently utilized to evaluate social connectivity; however, it may not comprehensively capture the unique social engagement patterns prevalent in rural settings. The development of culturally attuned tools is necessary to enhance the assessment of social health within geriatric populations. Spiritual and religious practices constitute vital coping mechanisms for numerous elderly individuals. The Spiritual Well-Being Scale (SWBS) is extensively employed to evaluate spiritual health, yet its applicability within diverse cultural contexts necessitates further validation.

Cultural and Regional Relevance in Health Assessments

Most existing health assessment tools have been developed in Western contexts and may not be fully applicable in regions with distinct cultural and social structures, such as rural India. In areas like Sundargarh, where

traditional family structures and community dynamics differ significantly from urban settings, standardized questionnaires may require linguistic adaptation and contextual modifications. Additionally, given the lower literacy rates in rural areas, self-administered surveys may not be feasible, necessitating interviewer-administered or observational assessment methodologies. This preliminary study aims to validate a comprehensive questionnaire that reliably assesses the dimensions of elderly health in rural India. By integrating culturally relevant modifications, this research seeks to bridge the gap in elderly health assessments, ensuring accurate and meaningful data collection. The findings will contribute to the development of more effective health interventions and policy measures tailored to the unique needs of elderly populations in underserved rural regions. Future research should focus on refining these assessment tools to enhance their reliability and applicability across diverse cultural settings.

LITERATURE REVIEW

The health of elderly individuals is a multidimensional construct that encompasses physical, mental, social, and spiritual well-being. Aging populations present unique challenges, necessitating a holistic approach to health assessment. This review synthesizes existing literature on the assessment of elderly health, focusing on validated tools, methodologies, and influential factors across multiple dimensions.

Dimensions of Elderly Health Assessment

Physical Health Assessment

Physical health serves as an essential determinant of overall well-being in the geriatric population. A variety of scholarly studies have employed numerous evaluation tools, including Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL), aimed at assessing functional autonomy (Katz, 1963). Additional evaluation approaches, comprising the Frailty Index and Geriatric Assessment Scales, showcased by the Fried Frailty Phenotype and the Comprehensive Geriatric Assessment (CGA), are key in understanding frailty and risk among the elderly. Health in older populations is notably affected by crucial indicators like chronic illnesses, dietary habits, and physical mobility (WHO, 2020).

Mental Health Assessment

The assessment of mental health in the elderly population is frequently conducted utilizing standardized psychological instruments, such as the Geriatric Depression Scale (GDS), which is extensively employed for the identification of depression in older individuals (Yesavage et al., 1982). The MMSE and the MoCA have illustrated their value in identifying cognitive decline (Folstein et al., 1975; Nasreddine et al., 2005). The assessment of stress and anxiety levels, like through the Perceived Stress Scale (Cohen et al., 1983) and the Generalized Anxiety Disorder Scale (GAD-7), serves to measure emotional health.

Social Health Assessment

Social engagement and the presence of support networks are pivotal factors influencing the well-being of the elderly. The LSNS, or Lubben Social Network Scale, and the DSSI, which refers to the Duke Social Support Index, are valuable instruments for assessing social connectivity and perceived support (Lubben, 1988; Koenig et al., 1993). Additionally, loneliness scales, such as the UCLA Loneliness Scale, serve as instruments for assessing social isolation. In addition, taking part in community initiatives has shown a connection to enhanced mental and physical health results.

Spiritual Health Assessment

Spirituality plays a significant role in enhancing overall life satisfaction and resilience in the aging population. The Spiritual Well-being Scale (SWBS) alongside the Daily Spiritual Experience Scale (DSES) serves as tools for evaluating individual faith and methods of spiritual resilience (Ellison, 1983; Underwood & Teresi, 2002). Research indicates that religious coping mechanisms and the search for meaning in life contribute to emotional stability and improved quality of life (Koenig, 2012).

Influencing Factors in Elderly Health Assessment

Health assessments are subject to the influence of a variety of socio-demographic and environmental determinants. Socioeconomic Status (SES), encompassing income, educational attainment, and access to healthcare services, significantly affects health outcomes. Cultural and Regional Variations indicate that disparities in perceptions of aging and health practices manifest across different geographical locales. Policy and Government Interventions that enhance awareness and encourage utilization of welfare programs for the elderly are instrumental in shaping health assessments (WHO, 2021). A comprehensive evaluation of elderly health necessitates a multidimensional framework that incorporates physical, mental, social, and spiritual dimensions. The employment of standardized assessment tools and frameworks is vital for facilitating effective evaluations, while demographic characteristics and policy-related influences are essential in determining health outcomes. Future inquiries should prioritize the cross-cultural validation of assessment instruments and examine the effects of policy interventions on the well-being of the elderly population.

Importance and Challenges in developing of Reliability and Validity Tools

Reliability and Validity of Health Assessment Instruments

For a health assessment instrument to achieve efficacy, it is imperative that it demonstrates both reliability and validity. Reliability guarantees the consistency of outcomes when the instrument is utilized under comparable conditions, which is especially critical in geriatric health research to mitigate misinterpretations that could influence interventions and policy-making. Validity, conversely, confirms that an instrument accurately gauges the designated health parameter. For instance, a tool designed to evaluate cognitive decline must be devoid of biases associated with literacy or cultural influences to avert the underreporting or overreporting of health conditions. The creation of reliable and valid assessment tools for elderly populations poses numerous challenges. The diversity among aging individuals—differing in health status, socio-economic circumstances, and cognitive capabilities—necessitates the development of instruments that are both sensitive and pragmatic. Additionally, physical and sensory disabilities, such as visual or auditory impairments, must be taken into account by integrating large print materials or oral assessments. In areas such as Sundargarh District, Odisha, where access to healthcare is restricted, such instruments are crucial for identifying individuals at risk and for informing the allocation of resources.

Methods for Reliability Testing

Several statistical methodologies evaluate the dependability of health assessment instruments. By examining the relationships among test items, Cronbach's Alpha evaluates the internal consistency. A score exceeding 0.70 is indicative of satisfactory reliability (Cronbach 1951). Test-Retest Reliability assesses temporal consistency by correlating scores obtained from successive evaluations. A robust correlation ($r > 0.70$) implies stability; however, the interval between assessments must be meticulously scrutinized. The study of Inter-Rater Reliability investigates the alignment among several evaluators using techniques such as Cohen's Kappa for categorical analysis or the Intraclass Correlation Coefficient (ICC) for continuous analysis. Split-Half Reliability assesses internal consistency by partitioning a test into two segments and utilizing the Spearman-Brown formula to estimate the overall reliability of the test. Alternate Forms Reliability evaluates the equivalence between disparate versions of a test, thereby mitigating biases such as memory effects in successive assessments. These reliability metrics guarantee that assessment instruments in geriatric research consistently yield accurate and significant outcomes across diverse contexts.

Awareness and Engagement with Government Schemes

The efficacy of government welfare initiatives aimed at the elderly population is contingent upon the levels of awareness and engagement. Evaluating this awareness poses difficulties, as elderly individuals may exhibit limited literacy skills, cognitive impairments, or restricted access to pertinent information. Socioeconomic inequalities, geographical obstacles, and levels of trust in governmental programs further influence participation rates. Reliable survey instruments are imperative for accurately measuring awareness and informing policy-making decisions. In under-resourced regions such as Sundargarh District, validated assessment methodologies

can facilitate the identification of deficiencies in outreach strategies, thereby enabling targeted interventions that promote the well-being of the elderly.

METHODOLOGY

The research employed a cross-sectional pilot study methodology to evaluate the reliability of a specially designed questionnaire attached in supplementary file targeting elderly individuals in Sundargarh District, Odisha. A carefully selected representative sample size of 32 respondent, adhering to established inclusion and exclusion criteria, ensured the outcomes were reflective of the broader population of Rourkela block. The questionnaire assessed various dimensions of health, including physical health (mobility, disability, chronic conditions), mental health (stress, cognitive function), emotional well-being (resilience, stability), social health (social networks, isolation), and spiritual health (religious/spiritual practices). It also explored participants' awareness and utilization of government welfare schemes. Data was collected through face-to-face interviews conducted in the local language, using a mix of Likert scale items, binary questions, and open-ended queries for comprehensive data capture. Trained enumerators facilitated the process to ensure accuracy and uniformity.

To ensure reliability, the study applied two key methods: internal consistency, assessed through Cronbach's alpha, and test-retest reliability, involving repeated administration of the questionnaire to the same group after a time interval using Statistical Packaged SPSS V25. Data analysis and arrangement done by using MS- Excel Ethical considerations were meticulously followed, including obtaining informed consent, maintaining participant confidentiality, and treating the elderly respondents with respect and sensitivity. This rigorous methodological approach supported the systematic validation of the questionnaire, paving the way for its use in future research.

Cronbach’s alpha quantifies the average correlation among items in a test. A high alpha (usually above 0.70) suggests that the items have good internal consistency, meaning they likely measure the same underlying construct.

Cronbach’s alpha is calculated using the formula: $\boldsymbol{\alpha = \frac{k}{k+1} + \left(1 - \frac{\sum Variance\ of\ items}{Total\ varience}\right)}$

where k = the number of items in the test.

Cronbach's alpha is simple to calculate and interpret. It is widely used because it provides a single number that reflects the reliability of a multi-item test. While Cronbach's alpha is popular, it assumes that all items measure the same construct and that each item contributes equally to the test’s overall reliability. Additionally, a very high alpha (e.g., >0.90) may indicate redundancy among items.

RESULTS

This report presents the findings from a pilot study conducted to assess the demographic characteristics of the sample population, specifically focusing on elderly individuals in Rourkela block of Sundargarh District, Odisha. Understanding these demographic characteristics is crucial for tailoring interventions and assessing the overall health and well-being of the elderly population.

Demographic Overview of the Sample Population

a. Sample Size and Composition

The pilot study included a sample of 32 elderly individuals aged 60 and above, selected through stratified random sampling from rourkela blocks within Sundargarh District for Pilot study and validation. The sample was designed to ensure a representative cross-section of the elderly population, considering factors such as age, gender, economic status, and educational background.

b. Age Distribution

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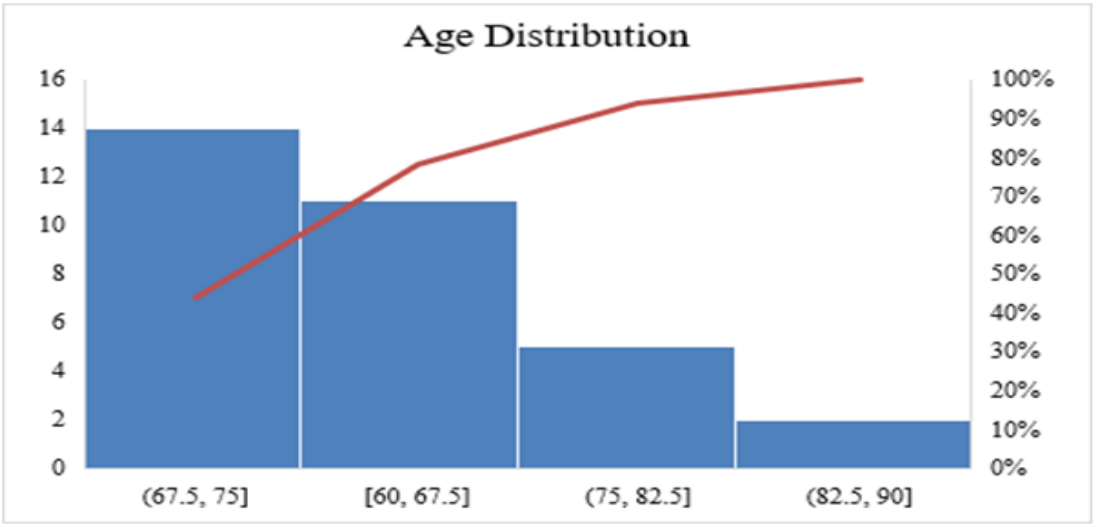

Figure: 1 Age distribution of respondent

The age distribution of the sampled population is depicted in the form of a histogram and Pareto chart, Figure-1 providing insights into the frequency of individuals across different age intervals. The data is categorized into four age groups: 60–67.5, 67.5–75, 75–82.5, and 82.5–90 years. The highest concentration of individuals is observed in the 67.5–75 age group, followed by the 60–67.5 group, while the lowest frequency is noted in the 82.5–90 group. The cumulative percentage curve illustrates that a significant proportion of the population falls within the younger age intervals, with the cumulative percentage nearing 100% as it progresses towards the oldest age group. This distribution provides valuable insights for analyzing age-related trends, particularly in the context of physical, mental, social, and spiritual health dimensions or awareness of elderly welfare schemes

c. Gender Distribution

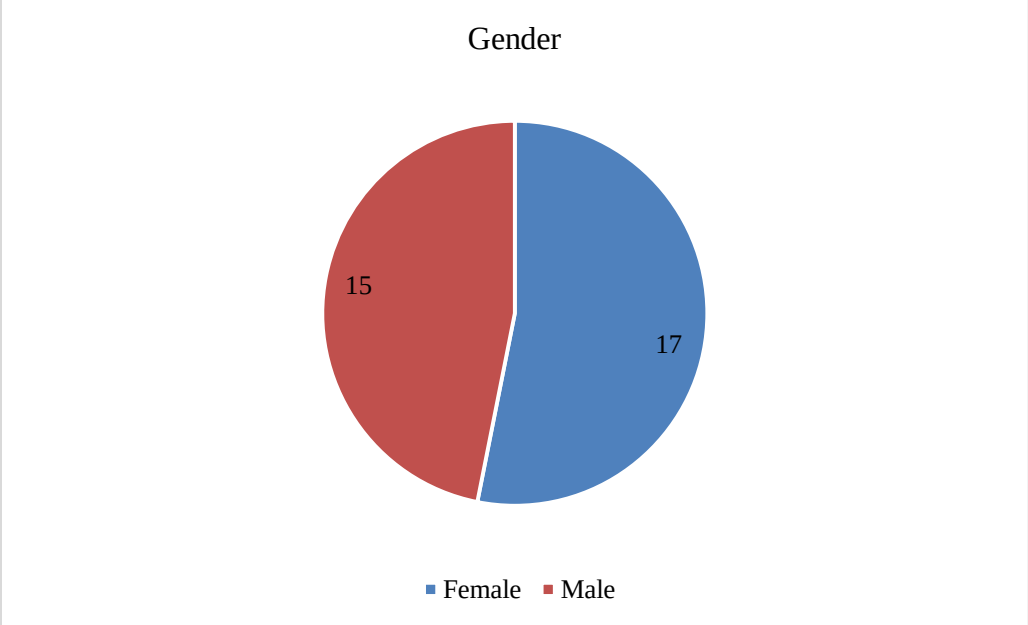

Figure: 2 Gender disparity in respondent

The Figure: 2 presents the gender distribution of the study population, highlighting a total of 32 participants, with 17 females and 15 males. Females constitute the majority, accounting for approximately 53.1% of the total sample, while males represent 46.9%. This relatively balanced gender representation provides an equitable basis for analyzing gender-specific variations, if any, in the study's dimensions such as physical, mental, social, and spiritual health or awareness of elderly welfare schemes. Such a distribution ensures that the findings can address potential gender-based disparities or similarities in the context of the study.

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Economic Status

Analysis of Economic Status (with Respect to Education and Occupation)

Table: 1 Economic Status vs. Education Level

Education Level	Respondents (%)	Economic Status Breakdown
No Formal Education	28%	60% Completely Dependent, 40% Self-sufficient
Below Matriculation	19%	30% Completely Dependent, 40% Self-sufficient, 30% Partially Dependent
Matriculation	9%	50% Self-sufficient, 50% Partially Dependent
Intermediate	19%	40% Self-sufficient, 40% Partially Dependent, 20% Financially Secure
Graduate	12.50%	60% Self-sufficient, 40% Financially Secure
Postgraduate and above	12.50%	40% Self-sufficient, 30% Completely Dependent, 30% Financially Supporting Family
Technical Education	3%	100% Completely Dependent

Table: 2 Economic Status vs. Occupation

Occupation	Respondents (%)	Economic Status Breakdown
Daily Labour/Gardener	6%	50% Completely Dependent, 50% Self-sufficient
Farmer	9%	60% Partially Dependent, 40% Self-sufficient
Housewife/Homemaker	31%	70% Completely Dependent, 20% Partially Dependent, 10% Self-sufficient
Teacher	12.50%	70% Self-sufficient, 30% Partially Dependent
Steel/Nalco Employee	9%	50% Self-sufficient, 50% Financially Secure
Business	9%	80% Partially Dependent, 20% Financially Supporting Family
Lecturer/Jr. Lecturer	6%	100% Self-sufficient
Other (Builder, Peon, etc.)	6%	50% Financially Supporting Family, 50% Self-sufficient

Higher Education Levels Correlate with Financial Security: Respondents with postgraduate and above qualifications are more likely to be financially secure or supporting their family (70%). Lower education levels (no formal education or below matriculation) show higher dependency rates.

Occupation's Role in Economic Status: Government-related jobs (Teachers, Steel Plant Employees) show a higher tendency for self-sufficiency or financial security. Agricultural and unskilled labor roles (Farmers, Gardeners) largely result in partial or complete dependence.

Gender Dynamics: Women, particularly housewives, are more likely to be completely dependent (70%). Men in professional roles exhibit better financial stability compared to those in unskilled jobs.

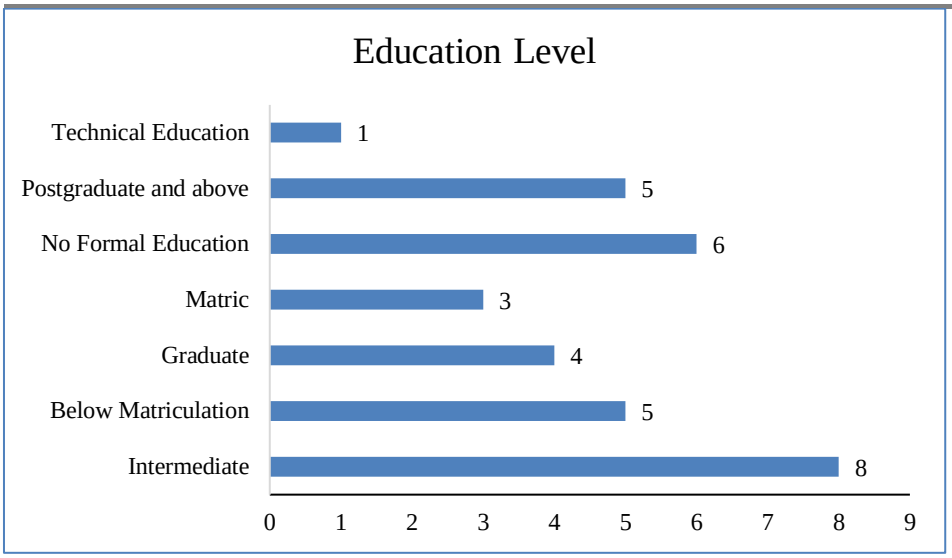

Figure: 3 Educational level of Respondent

The table:1 provides a detailed distribution of the education levels among the study participants. The highest proportion of individuals have attained an intermediate level of education (n=8), followed by those with no formal education (n=6). A similar count is observed for individuals below matriculation (n=5) and those with postgraduate qualifications or higher (n=5). Participants with graduate-level education account for four individuals, while those with matriculation-level education represent the smallest group apart from technical education, at three individuals. Only one participant has received technical education, indicating its limited prevalence within the sample.

This distribution reflects the varying educational backgrounds of the participants, with a notable representation of both formal education at higher levels (graduate and postgraduate) and those with no formal education. Such diversity in educational attainment is critical for understanding its potential impact on the study's key dimensions, including awareness of elderly welfare schemes, health literacy, and access to resources. The data also highlights the limited reach of technical education in the population under study, suggesting the need for targeted initiatives to enhance technical skill development among elderly individuals.

Social Support and Living Arrangements

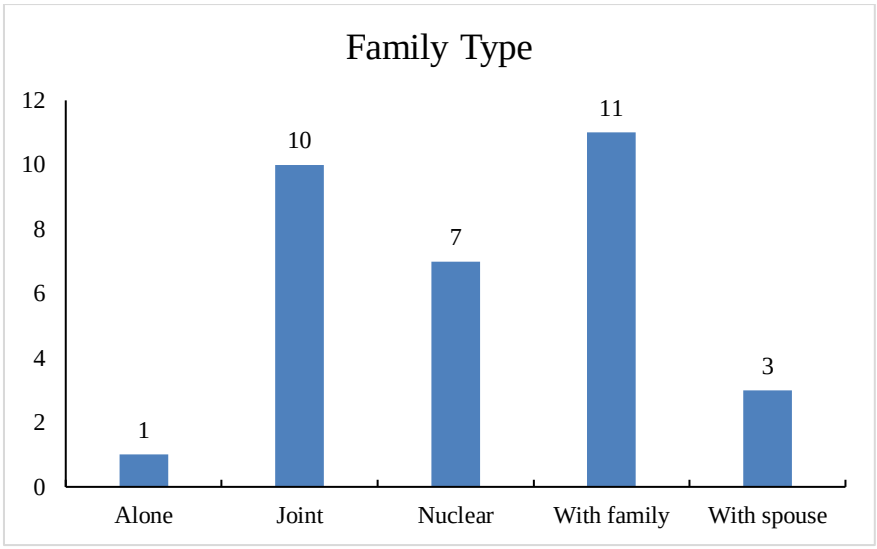

Figure: 4 Type of family living of Respondent

The data provides insights into the living arrangements of elderly individuals, emphasizing the diversity in family structures. (Figure: 4) The majority of elderly participants reside "with family" (n=11) or in joint family

setups (n=10), reflecting the cultural significance of collective living and familial support in caregiving for the elderly. Nuclear family arrangements are also prevalent, accounting for seven individuals. Additionally, a smaller proportion of elderly participants live exclusively with their spouse (n=3), while a lone participant resides independently, highlighting the prevalence of solitary living among the elderly, albeit at a minimal level.

Such findings are critical in understanding the implications of family type on the well-being of elderly individuals. Elderly people living in joint or extended family systems may benefit from greater social interaction, emotional support, and caregiving assistance, which are integral to their physical and mental health. Conversely, those living alone or exclusively with their spouse might face challenges related to social isolation, limited access to immediate caregiving, and increased dependency on external support systems. This variation underscores the need for targeted interventions to address the specific needs of elderly individuals across different family setups, particularly in promoting their social and emotional health and raising awareness about available welfare schemes.

Health Status Indicators

The health data of 32 elderly respondents highlights the prevalence of both chronic and mental health issues, reflecting the multifaceted nature of health challenges faced by this population. Chronic health conditions are notably widespread, with hypertension (high blood pressure) being the most commonly reported ailment, affecting 21 respondents. This condition frequently coexists with diabetes, which is reported by 18 individuals, indicating a significant overlap between these two chronic diseases. Other notable chronic conditions include visual and hearing impairments (9 respondents), urinary incontinence (6 respondents), osteoporosis (3 respondents), stroke (2 respondents), as well as arthritis, chronic kidney disease, and influenza/pneumonia, each affecting one respondent. The high prevalence of comorbidities, such as the co-occurrence of hypertension, diabetes, and sensory impairments, underscores the compounded health risks within this demographic.

Mental health issues are also prevalent, with 10 respondents reporting conditions such as Alzheimer's disease and dementia (6 respondents) and depression (4 respondents). These mental health disorders often coexist with chronic illnesses, further complicating the health profiles of elderly individuals. For instance, Alzheimer's disease and dementia frequently accompany chronic conditions like hypertension, diabetes, and urinary incontinence, highlighting the interconnected nature of physical and mental health.

The data reveals that chronic illnesses dominate the health landscape of elderly individuals, with hypertension and diabetes being the most prominent. However, the notable presence of mental health issues, particularly Alzheimer's disease, dementia, and depression, indicates the need for an integrated approach to healthcare that addresses both physical and mental health concerns. This underscores the importance of targeted interventions and comprehensive healthcare strategies to manage comorbidities and improve the overall well-being and quality of life of elderly individuals.

The pilot study findings also provide crucial demographic insights into the elderly population of Sundargarh District, Odisha. The data indicates that a significant proportion of elderly individuals live in low to middle economic conditions, with high rates of illiteracy and chronic health issues. Understanding these demographic factors is essential for designing and implementing effective health and welfare interventions aimed at enhancing the quality of life for the elderly in this region.

Table 3: Cronbach's Alpha Reliability Statistics

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.568	.859	66

Cronbach's Alpha for the current scale is 0.568, which falls below the widely accepted threshold of 0.7, indicating limited internal consistency among the items. However, when the items are standardized, Cronbach's Alpha rises significantly to 0.859, surpassing the threshold and suggesting strong internal consistency in this adjusted form.

The instrument consists of 66 items, which constitutes a considerable quantity that may, at times, compromise internal consistency due to the possibility of redundancy or the incorporation of items that may not entirely correspond with the foundational construct. The juxtaposition of the raw and standardized alpha coefficients underscores the potential influence of item standardization on reliability, thereby prompting deliberations regarding item refinement to attain a more integrated scale.

The raw Cronbach's Alpha value of 0.568 indicates potential issues pertaining to internal consistency; conversely, the standardized Alpha of 0.859 signifies a substantial enhancement. This remarkable divergence may arise from discrepancies in item variances, indicating the necessity for further scrutiny. To bolster the reliability of the scale, the subsequent measures should be contemplated: Outlier Identification entails an examination of outliers or suboptimal items that may skew overall consistency. Item-Total Correlations involve the identification of items exhibiting weak correlations with the total scale, as such items may not significantly contribute to the underlying construct. Dimensionality Analysis necessitates the execution of factor analysis to ascertain whether multiple latent dimensions affect the scale's reliability, potentially requiring a more focused approach.

Should standardization be deemed suitable within the context of the study, the reporting of the standardized Alpha of 0.859 would be justified and indicative of robust internal consistency. However, if the enhancement of the raw Alpha is prioritized, the refinement or reassessment of specific items could result in a more integrated and reliable scale. The pilot study further revealed several items that may necessitate revision in order to augment the reliability and clarity of the questionnaire employed to evaluate the health and welfare of elderly individuals within Sundargarh District. Of particular note, certain items exhibited poor reliability, while others appeared perplexing or ambiguous to respondents, potentially undermining the validity of the collected data. For example, inquiries regarding economic status and income levels frequently prompted diverse interpretations among participants, with numerous individuals expressing uncertainty regarding their monthly income due to variable financial circumstances or a lack of awareness of their precise earnings. This indicates a requisite to streamline these inquiries and provide more explicit response options, such as categorizing income ranges in a more defined manner or employing visual aids. Additionally, items concerning health status and chronic illnesses were occasionally met with reluctance, as some respondents were uncertain about their medical diagnoses or unfamiliar with specific medical terminology. This highlights the necessity for clearer language and illustrative examples to ensure comprehension. Moreover, questions related to social support and living arrangements produced inconsistent responses, necessitating more clearly defined categories and explanations to mitigate ambiguity. By revising these items for enhanced clarity and reliability, the questionnaire can be more effectively customized to address the target population, ultimately facilitating more precise data collection and a deeper understanding of the health and welfare needs of the elderly.

DISCUSSION

The raw Cronbach's alpha value of 0.568 falls below the widely accepted threshold of 0.7, indicating limited internal consistency among the items. This suggests potential issues such as redundancy, misalignment, or uneven variance distribution. Conversely, the standardized Cronbach's alpha value of 0.859 exceeds the threshold, reflecting strong internal consistency when item variances are standardized. This significant improvement suggests that variance differences among items influence reliability. The standardization process mitigates these discrepancies, yielding a more cohesive representation of the underlying construct.

The scale comprises 66 items, which, while beneficial for comprehensive construct representation, may introduce redundancy and internal inconsistency. Overlapping or highly similar items may not add unique value, and misaligned items may weaken coherence. The disparity between raw and standardized alpha values suggests potential refinement. Removing or modifying items with unusually high or low variances could enhance the raw reliability score. Reviewing item-total correlations and eliminating weakly contributing items is recommended.

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Additionally, a factor analysis could determine whether the scale is unidimensional or multidimensional, allowing for subscale development to improve overall reliability.

Although test-retest results are not provided, incorporating this measure would offer valuable insights into the scale's stability over time. Test-retest reliability assesses consistency across different time points and would support the tool's robustness even if the raw Cronbach's alpha remains low. Discrepancies across time points could indicate temporal instability or external influences on responses.

To identify the most vulnerable elderly populations in Sundargarh District and develop targeted interventions, a multi-faceted approach using various tools and models is necessary. The Sunfrail tool, a nine-item questionnaire, is effective for screening frailty and guiding further assessments (Longobucco et al., 2021). Additionally, adapting the Community COVID-19 Vulnerability Index (CVI) could help assess vulnerability based on factors such as comorbidities, sanitation, and socio-economic conditions (Mishra & Shukla, 2020). Understanding socio-demographic profiles and health-seeking behaviors, particularly among females, could inform targeted interventions (Patnaik et al., 2022). Integrating meta-population models could optimize resource allocation, such as vaccination efforts, to maximize public health impact (Feng et al., 2017). Furthermore, recognizing the multi-dimensional nature of vulnerability can guide comprehensive support policies addressing gender, socio-religious identity, and financial status (Ghosh, 2023).

A validated tool for comprehensive geriatric assessment, as developed by Liu et al., could be effectively employed in a full-scale study of elderly health in Sundargarh District. This tool demonstrates strong reliability and validity metrics, with a split-half reliability coefficient of 0.706 and a Cronbach's alpha of 0.652 (Liu et al., 2016). It aligns with structured interventions such as the Elderly Health Status Assessment and Screening (EHSAS) intervention proposed by Kshatri et al. (2023), designed for rural settings. The tool can be further complemented by the Perceived Wellness Survey (PWS) (Bhattacharya et al., 2023) and the Perceived Health Problem Questionnaire (Bag et al., 2015) to ensure a holistic assessment of elderly health.

A robust tool for assessing elderly health in Sundargarh District should encompass multiple dimensions, including medical, cognitive, affective, social, economic, environmental, spiritual, and functional status (Rosen & Reuben, 2011). Assessments should address geriatric syndromes such as vision and hearing impairments, functional decline, falls, incontinence, cognitive impairment, depression, and malnutrition (Elsawy & Higgins, 2011). Given the heightened risk of frailty and daily activity limitations in rural populations, evaluating fall risk and frailty is crucial (Roy et al., 2024). Reliability and validity should be ensured through split-half reliability, Cronbach's alpha, and factor analysis, as demonstrated in prior research (Liu et al., 2016).

The validated tool, supported by a strong standardized reliability score (Cronbach's alpha = 0.859), offers a comprehensive framework for assessing elderly well-being. By capturing key dimensions—physical, mental, social, and spiritual health—the tool enables nuanced analysis and targeted interventions. Socioeconomic and cultural factors play a crucial role in elderly health, necessitating adaptable and reliable measurement instruments. Comparative studies emphasize the importance of reliable scales in validating findings and facilitating cross-regional or longitudinal comparisons.

The preliminary study highlights limitations, including sample size, questionnaire length, and cultural relevance. Small sample sizes introduce biases such as amplified inter-group differences, inflated effect sizes, and biased parameter estimates in ordered logit models (Ziegler & Fiedler, 2024; Meule, 2023; Aidoo et al., 2021). They also increase sampling error in meta-analyses and bias in count-data models (Lin, 2018; Blackburn, 2019). The questionnaire's length (66 items) may contribute to respondent fatigue, though studies suggest that length alone does not significantly impact data accuracy (Kato & Miura, 2021; Cernat et al., 2022). The impact of length on data quality is influenced by survey mode, complexity, and respondent behavior (Žmuk, 2017; Peytchev & Peytcheva, 2017; Roberts et al., 2010). Cultural relevance is another limitation, as seen in translation and leadership studies emphasizing the need for culturally sensitive instruments (Le, 2024; Zhaoxia, 2024; Musthofa & Agustina, 2024). Ensuring cultural appropriateness will enhance the tool's applicability across diverse contexts.

Given the increasing complexity of healthcare needs among older adults, reliable assessment tools are essential for effective health management. Comprehensive Geriatric Assessment (CGA) facilitates multidimensional diagnostics, improving health outcomes and quality of life (Roh, 2023). Platforms like Actuasalud integrate technology to assess frailty through sociodemographic and autonomy-related variables (Cantó et al., 2024). The age-friendly health system assessment tool in Iran and the S.Va.M.A scale further illustrate the need for context-specific and fluid assessment methods (Karami et al., 2024; Scotellaro et al., 2021). Telemedicine-based CGA enables remote health monitoring, though technological and data security challenges must be addressed (Wu et al., 2023).

The validated tool can also help identify gaps in government scheme awareness and inform targeted interventions using data-driven approaches. Platforms like JanJagruti utilize data mining and natural language processing to recommend government schemes, addressing barriers to access (Tripathi et al., 2023). Awareness of government schemes remains low, particularly in rural areas, where socio-demographic factors influence knowledge levels (Sachdev et al., 2022). Despite increased awareness efforts, uptake remains limited, necessitating strategies beyond dissemination (Berg et al., 2021). Governance and resource allocation are key determinants of scheme effectiveness, as demonstrated in studies on poverty alleviation programs (Kahara et al., 2023). Integrating these insights can help policymakers tailor interventions to enhance scheme accessibility and efficacy in Sundargarh District.

CONCLUSION

In conclusion, the analysis underscores the critical importance of employing reliable and validated tools to assess the multidimensional health needs of elderly populations. The disparity between raw and standardized Cronbach's Alpha values highlights the scale's potential for strong internal consistency when variance discrepancies are addressed. Refinements such as item analysis, dimensionality assessments, and the inclusion of culturally relevant constructs can further enhance the tool's reliability and applicability. Additionally, the integration of validated instruments like the Comprehensive Geriatric Assessment (CGA) and other specialized tools tailored to rural contexts, such as Sundargarh District, can ensure holistic health evaluations. By identifying key health dimensions—physical, mental, social, and spiritual—alongside demographic and socio-economic factors, these tools pave the way for targeted interventions aimed at improving the quality of life for elderly populations.

The findings also emphasize the need for innovative approaches to bridge gaps in government scheme awareness and uptake among elderly individuals. Leveraging technology-driven platforms and personalized recommendation systems can significantly enhance the alignment between beneficiaries and available welfare programs. Furthermore, addressing challenges like questionnaire length, cultural relevance, and small sample sizes in future studies will strengthen the robustness and generalizability of research outcomes. By combining comprehensive assessments with context-specific interventions, the study provides a robust framework for addressing the complex healthcare needs of the elderly, ensuring sustainable and impactful improvements in their overall well-being.

Credit authorship contribution statement

Alita Minz: Writing – original draft, Methodology, Investigation, Conceptualization. **Sasmita Behera:** Supervision, Writing – review & editing.

Ethics statements

The Authors have read and follow the ethical requirements for publication and confirm that the current work does not involve human subjects, animal experiments, or any data collected from social media platforms.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Conflict of interest

There is no conflict of interest.

Supplementary data

Appendix A: Full questionnaire used in the preliminary study.

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