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# Psychological and Sensory Determinants of Fall Risk among Older Adults

**A Cross-Sectional Analysis in Indonesian Long-Term Care Facilities**

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ABSTRACT

Falls represent a significant health issue among the elderly worldwide, particularly those residing in long-term care institutions. Although physical and environmental causes have been widely examined, there is limited research within Indonesian settings that investigates how psychological and sensory factors contribute to fall risk in institutionalized older adults. This study explores the association between psychological and sensory factors with the risk of falls among elderly individuals living in Indonesian care facilities. A cross-sectional analytical study was carried out involving 100 individuals aged 60 years and older in various long-term care homes across Indonesia. Data were obtained through structured interviews using standardized tools. Bivariate analyses were then analyzed using multivariable logistic regression to determine independent predictors. Out of all participants, 46% were found to have a heightened risk of falling. Multivariate analysis showed that higher levels of fear of falling (OR = 1.15; 95% CI: 1.04–1.28; p = 0.006), anxiety (OR = 2.97; p = 0.005), depression (OR = 2.85; p = 0.008), poor sleep quality (OR = 3.81; p = 0.001), visual problems (OR = 2.14; p = 0.038), hearing challenges (OR = 2.50; p = 0.022), and advancing age (OR = 1.04; p = 0.049) were all significantly linked to fall risk. This study highlights that psychological and sensory health significantly impact fall vulnerability among elderly residents in care institutions. Incorporating these often-overlooked dimensions into routine fall risk assessments may enhance preventative care approaches.

**Keywords**
Anxiety
Depression
Fear of Falling
Older Adults
Sensory Impairment

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## Introduction

Falls continue to be one of the most pressing threats to the health and autonomy of older adults worldwide, consistently ranking as a primary cause of injury, long-term disability, and mortality among individuals aged 65 years and over [1]. Globally, between 28% and 35% of seniors in this age group are estimated to experience at least one fall each year, and this figure rises to 32–42% in those over 70 years of age [1]. In Indonesia, over 30% of institutionalized elderly individuals report experiencing falls annually, often leading to serious consequences, such as fractures, head injuries, functional decline, and increased care dependency [2]. With national projections estimating that adults aged 60 and above will comprise nearly 19.5% of the population by 2045 [3], the burden of falls is expected to increase significantly, posing a major public health challenge.

The underlying causes of falls in older adults are complex and often interrelated. While physical and biomedical contributors, such as muscle weakness, polypharmacy, and impaired mobility, have been widely recognized [4], more recent studies underscore the importance of psychological and sensory contributors. These include fear of falling (FoF), anxiety, depressive symptoms, sleep disturbances, and sensory impairments, such as vision and hearing loss [5],[6]. Despite their clinical relevance, these factors are frequently neglected in routine fall risk assessments even though they are modifiable and closely associated with both falls and fall-related injuries. For instance, fear of falling has been found to predict future falls independently of prior fall history, often leading to reduced mobility and increased isolation, which in turn worsens physical deconditioning and further elevates fall risk [7],[8]. Depression and sleep disorders may also negatively affect balance and cognition, while uncorrected sensory loss contributes to spatial disorientation and difficulty navigating one's environment [6],[9].

The World Health Organization, through its Integrated Care for Older People (ICOPE) approach, advocates comprehensive assessments that include psychological and sensory domains. This model promotes early identification of declining intrinsic capacities to support healthy aging and prevent functional deterioration [10]. Applying such frameworks within long-term care facilities can support the creation of personalized and holistic fall prevention strategies that address both physical and psychosocial health.

Although international evidence supports the inclusion of psychological and sensory variables in fall risk models, studies conducted in Indonesia have often focused narrowly on physical and environmental risks. Research specifically examining how psychological distress and sensory loss interact to increase fall susceptibility in institutionalized settings remains scarce. Furthermore, while global studies have addressed these variables individually, there is limited exploration of their combined effects using comprehensive multivariable approaches, particularly within resource-constrained or culturally diverse settings [11]–[13].

Addressing this knowledge gap is essential. Gaining insight into how fear of falling, emotional health, and sensory function contribute to falls may enhance the accuracy of screening tools, support more targeted interventions, and inform resource prioritization in aged care. Accordingly, the current study aimed to investigate the influence of psychological and sensory determinants—specifically, fear of falling, anxiety, depression, sleep quality, vision, and hearing function—on fall risk among older adults living in Indonesian long-term care facilities. By mapping these multidimensional risk factors, this study seeks to inform integrated evidence-based approaches to fall prevention and geriatric care planning.

## Literature Review

Fear of falling (FoF) is a widespread concern among older adults, with studies estimating that it affects nearly half of the global elderly population [14]. Beyond its psychological impact, FoF has been recognized as a strong independent risk factor for future falls [15]. It often causes individuals to limit their daily movements or avoid physical activity together, which can result in muscle weakening, increased dependence, and frailty [16]. Interestingly, older adults who experience FoF may adopt overly cautious walking patterns, such as slower steps or stiff posture, which ironically reduce stability and elevate the risk of falling.

Emotional health also plays a crucial role in vulnerability to falls. Anxiety, for example, can intensify FoF and is frequently associated with decreased mobility and functional independence [17]. Depression may dampen the motivation to stay active, which, over time, contributes to deteriorating balance and gait. Both conditions are known to affect cognitive functions such as attention and decision-making capacities, which are essential for maintaining postural stability and safely navigating the environment [18].

Sleep quality is another significant, but often overlooked contributor. Disrupted sleep patterns, including difficulty falling asleep or staying asleep, are closely linked to impaired concentration and increased daytime fatigue, both of which can compromise postural control and coordination [19]. Moreover, extremes in sleep duration, whether too little (≤5 hours) or too much (≥9 hours), have been shown to negatively influence physical functioning and

independence in daily tasks [20]. Sleep disturbances can further exacerbate underlying depression or anxiety, reinforcing a feedback loop that worsens fall risk [21].

Sensory impairments, especially those related to vision and hearing, further compounded this risk. Reduced visual acuity limits the ability to accurately perceive obstacles or depths, affecting balance and walking ability [22]. Meanwhile, hearing loss has been linked to vestibular dysfunction and difficulties in spatial awareness, which may destabilize the gait [23]. When these sensory deficits coexist with psychological stress or cognitive strain, their combined effects can significantly increase the likelihood of falling by disrupting both physical coordination and mental alertness.

## Material and Methods

### A. Research Design

This study adopted a cross-sectional analytical framework implemented across multiple long-term elderly care homes in selected areas of Indonesia. Data were collected from September to November 2024, and encompassed both government-supported and privately operated institutions to capture variations in living conditions and care practices.

### B. Participants

The study targeted individuals aged 60 years and older who had resided in the selected facilities for a minimum of three months. Eligible participants were required to communicate effectively and demonstrate either intact or mildly reduced cognitive function, as determined through on-site clinical screening. Those with severe cognitive impairment, end-of-life care needs, or permanent bedridden status were excluded. Sampling was conducted using a purposive and consecutive recruitment approach, which was pragmatic given the study context but may introduce selection bias. This approach potentially limits the generalizability of findings beyond the participating institutions. Although the included facilities reflect common institutional care structures in Indonesia, variations across regions and facility types mean the results should be interpreted with caution when extrapolating to the broader older adult population.

The sample size was estimated using G-Power version 3.1 to detect a moderate correlation ($r = 0.30$) with 80% statistical power and a 5% significance level. Based on these parameters, the minimum required sample was approximately 86 participants. To account for potential nonresponses or incomplete data, an additional 15% was added, resulting in a target sample size of approximately 100 participants. The final sample size closely matched this target, suggesting that the study retained adequate power for the primary correlational analyses examining associations between key variables.

### C. Instruments

Data were obtained through in-person interviews conducted by trained assessors fluent in Bahasa Indonesia and experienced in working with older adults. All assessment tools were either previously validated for use in Indonesia or culturally adapted following the standardized forward–backward translation procedures recommended by the World Health Organization to ensure semantic, conceptual, and technical equivalence. Internal consistency and reliability of the tools in the present study were also examined.

Fall risk was measured using the Fall Risk Questionnaire (FRQ), a screening tool developed as part of the CDC's STEADI initiative, where scores of four or higher indicate elevated risk [24]. The FRQ underwent minor cultural adjustments in wording for older Indonesian adults but retained its original structure.

Fear of falling was assessed with the Falls Efficacy Scale–International (FES-I), which captures concerns about falling during everyday tasks. The Indonesian version of the FES-I has shown good psychometric properties, including high internal consistency (Cronbach's $\alpha > 0.90$) and construct validity in community-dwelling older adults [19].

Psychological distress was measured using the 14-item Hospital Anxiety and Depression Scale (HADS), which has been translated, culturally adapted, and validated in Indonesia, demonstrating acceptable reliability (Cronbach's $\alpha$ values above 0.80 for both subscales) and construct validity in older adult populations [25].

The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality over the past month. The Indonesian PSQI has been validated and widely applied, with studies reporting Cronbach's $\alpha$ around 0.73–0.83. A global PSQI score greater than 5 indicates poor sleep quality [26].

For sensory function, self-perceived visual status was recorded, and hearing was evaluated with the Hearing Handicap Inventory for the Elderly–Screening Version (HHIE-S), a 10-item questionnaire assessing hearing-related challenges. The Indonesian adaptation of the HHIE-S has demonstrated good reliability (Cronbach's $\alpha > 0.85$) and validity in older adults [27].

### D. Data Collection Procedure

The field staff members underwent preparatory training to ensure consistent ethical data collection. Interviews were held in quiet, private areas within each facility to uphold participants' confidentiality and minimize interruptions. Each session took approximately 30–45 minutes to complete. In certain cases, particularly when clarifying sleep or sensory concerns, interviewers were permitted to consult caregivers with permission.

### E. Data Analysis

All collected data were entered and analyzed using SPSS version 26. Descriptive statistics were applied to summarize demographic characteristics and the distribution of study variables.

Bivariate analyses were initially performed to assess the association between each independent variable and fall risk status using the chi-square test for categorical variables and the independent t-test for continuous variables. Consistent with standard epidemiological modeling procedures, variables with a p-value less than 0.25 were included in the multivariable logistic regression model to identify independent predictors of fall risk. A two-tailed p-value < 0.05 was considered statistically significant.

Given the conceptual overlap among several psychosocial variables, particularly anxiety, depression, and sleep quality, multicollinearity diagnostics were conducted to ensure the stability and validity of the regression model. Variance Inflation Factor (VIF) values were examined for all predictors included in the multivariate model. All VIF values were found to be below the commonly accepted cutoff (VIF < 5), indicating no presence of serious multicollinearity. Additionally, a supplementary correlation matrix of key independent variables was generated to further demonstrate the interrelationships among predictors, confirming that no excessively high bivariate correlations ($r \geq 0.80$) were present. These steps strengthen the robustness of the multivariate analysis and support the interpretability of the final model estimates. For categorical variables included in the logistic regression model, reference categories were defined as the absence of the condition or the lowest-risk group (e.g., male gender, no anxiety, no depression, good sleep quality, and no sensory impairment).

**F. Ethical Approval**

This study received ethical approval from the Health Research Ethics Committee (*Komite Etik Penelitian Kesehatan*), Nursing School of PPNI, West Java (*Sekolah Tinggi Ilmu Keperawatan PPNI Jawa Barat)*, Indonesia. Ethical approval was granted under Ethical Approval No. 205/KEPK/STIKEP/PPNI/JABAR/VIII/2024.

All participants were informed about the objectives and procedures of the study before data collection. Participation was entirely voluntary, and informed consent was obtained from all participants. The confidentiality and anonymity of the participants were maintained throughout the study, and all research procedures were conducted in accordance with applicable ethical principles for research involving human participants.

## Results

A total of 100 elderly residents participated in this study. Their average age was 73.5 years (SD = 6.4) and the majority were women (64%). On average, participants had been living in care facilities for 24.8 months (SD = 13.2). Based on the Fall Risk Questionnaire (FRQ), 46% were found to be at a risk of falling. The mean score on the Falls Efficacy Scale–International (FES-I) was 25.6 (SD = 6.3), reflecting a moderate level of concern about falling during daily tasks. Mental health assessments using the Hospital Anxiety and Depression Scale (HADS) showed that 38% of the participants experienced anxiety symptoms, while 42% reported

symptoms of depression. Additionally, more than half (58%) of the respondents had poor sleep quality according to the Pittsburgh Sleep Quality Index (PSQI). Regarding sensory function, 30% of the participants reported problems with their vision, and 36% had hearing difficulties, as indicated by HHIE-S scores of 10 or higher. The descriptive results are presented in Table 1.

**Table 1.** Descriptive Statistics Results (n=100)

| Variable | n or Mean ± SD |
|---|---|
| Age (mean ± SD, years) | 73.5 ± 6.4 |
| Female (%) | 64% |
| Length of stay (mean ± SD, months) | 24.8 ± 13.2 |
| At risk of falling (%) | 46% |
| Fear of Falling (FES-I mean ± SD) | 25.6 ± 6.3 |
| Anxiety (HADS-A ≥ 8, %) | 38% |
| Depression (HADS-D ≥ 8, %) | 42% |
| Poor Sleep Quality (PSQI > 5, %) | 58% |
| Self-reported vision impairment (%) | 30% |
| Hearing difficulties (HHIE-S ≥ 10, %) | 36% |

Further analysis using bivariate comparisons identified several factors significantly associated with fall risk. Participants classified as being at risk were older (average age = 75.1 vs. 71.8 years; p = 0.031) and had higher concern about falling, as reflected in elevated FES-I scores (28.5 vs. 23.2; p = 0.002). They were also more likely to report anxiety (60% vs. 20%, p = 0.001), depression (66% vs. 22%, p = 0.001), and sleep problems (72% vs. 46%, p < 0.001). Visual impairment (43% vs. 19%, p = 0.021) and hearing loss (55% vs. 21%, p = 0.007) were also more frequently observed in the fall risk group. Female sex and a longer residence duration showed weaker associations (p = 0.047 and p = 0.083, respectively). The results of bivariate analysis are presented in Table 2.

**Table 2.** Bivariate association between variables

| Variable | Fall Risk (Mean or %) | No Fall Risk (Mean or %) | p-value |
|---|---|---|---|
| Age (years) | 75.1 ± 6.2 | 71.8 ± 5.9 | 0.031 |
| Gender (Female) | 70% | 58% | 0.047 |
| Length of stay (months) | 26.3 ± 12.4 | 22.9 ± 13.7 | 0.083 |
| Fear of Falling (FES-I) | 28.5 ± 5.8 | 23.2 ± 5.5 | 0.002 |
| Anxiety (HADS-A ≥ 8) | 60% | 20% | 0.001 |
| Depression (HADS-D ≥ 8) | 66% | 22% | 0.001 |
| Poor Sleep Quality (PSQI > 5) | 72% | 46% | 0.001 |
| Vision impairment | 43% | 19% | 0.021 |
| Hearing difficulties (HHIE-S ≥ 10) | 55% | 21% | 0.007 |

Multivariable logistic regression analysis identified several independent predictors of fall risk. Older age was modestly associated with increased fall risk (adjusted OR = 1.04; 95% CI: 1.00–1.09; p = 0.049). Higher fear of falling scores were associated with greater odds of fall risk (adjusted OR = 1.15; 95% CI: 1.04–1.28; p = 0.006). Compared with participants without symptoms, those with anxiety (HADS-A ≥ 8) and depression (HADS-D ≥ 8) had significantly higher odds of fall risk (adjusted OR = 2.97; p = 0.005 and adjusted OR = 2.85; p = 0.008,

respectively). Poor sleep quality (PSQI > 5) was also strongly associated with fall risk (adjusted OR = 3.81; 95% CI: 1.72–8.46; p = 0.001). Sensory impairments remained significant predictors, with vision impairment (adjusted OR = 2.14; p = 0.038) and hearing difficulties (adjusted OR = 2.50; p = 0.022) both increasing the likelihood of fall risk. Gender and length of stay were not statistically significant in the final model. The multivariate results are presented in Table 3.

**Table 3.** Multivariable Logistic Regression Analysis of Factors Associated with Fall Risk (n = 100)

| Variable | Reference Category | Adjusted OR (95% CI) | p-value |
|---|---|---|---|
| Age (years) | — | 1.04 (1.00–1.09) | 0.049 |
| Gender (Female) | Male | 1.87 (0.92–3.80) | 0.080 |
| Length of stay (months) | — | 1.02 (0.98–1.07) | 0.210 |
| Fear of Falling (FES-I score) | — | 1.15 (1.04–1.28) | 0.006 |
| Anxiety (HADS-A ≥ 8) | No anxiety (HADS-A < 8) | 2.97 (1.38–6.40) | 0.005 |
| Depression (HADS-D ≥ 8) | No depression (HADS-D < 8) | 2.85 (1.31–6.20) | 0.008 |
| Poor Sleep Quality (PSQI > 5) | Good sleep quality (PSQI ≤ 5) | 3.81 (1.72–8.46) | 0.001 |
| Vision impairment | No vision impairment | 2.14 (1.04–4.41) | 0.038 |
| Hearing difficulties (HHIE-S ≥ 10) | No hearing difficulties (HHIE-S < 10) | 2.50 (1.15–5.42) | 0.022 |

Reference categories were defined as male gender, absence of anxiety or depression, good sleep quality, no vision impairment, and no hearing difficulties.

## Discussion

This study examined how psychological and sensory health factors contribute to the risk of falling among older adults living in institutional care facilities in Indonesia. The results provide clear evidence that fear of falling, emotional distress (anxiety and depression), poor sleep quality, sensory limitations, and advanced age are closely associated with increased fall risk. These findings reinforce the idea that fall risk is influenced by more than just physical decline, aligning with the growing global literature that highlights the importance of including psychosocial and sensory domains in fall prevention planning [6],[8],[13],[16]. While these results demonstrate that psychological and sensory variables were statistically significant predictors of fall risk, it must be emphasized that the cross-sectional design precludes any causal inference. The identified associations cannot determine whether these conditions directly increase fall risk, or whether falls and the fear or distress that follow contribute to these outcomes. Longitudinal or interventional research will therefore be essential to clarify the temporal and causal pathways underlying these relationships [4],[5].

The strong link between fear of falling and actual fall risk is consistent with the work of Yao and Chen [28], who showed that such fear can result from and predict future falls. This psychological fear often causes older adults to limit their physical activity, which in turn leads to a loss of strength and balance. Similar findings have been reported in large-scale reviews, where fear of falling was identified as both a consequence and a predictor of fall events across diverse populations [13]-[15]. In the current study, individuals with a higher concern about

falling, as measured by the FES-I, were more likely to experience falls, suggesting that fear itself can contribute to real physical instability.

Anxiety and depression also showed a strong relationship with fall risk, supporting the findings of Gambaro et al. [29], who found that depression significantly increased fall incidence among older adults. Meta-analyses confirm that psychological distress is an independent predictor of falls, as both anxiety and depression impair executive function and reaction time, thereby increasing vulnerability to accidents [17],[25]. Anxiety may lead to exaggerated caution or hesitancy, whereas depression often reduces physical engagement, further compounding fall risk.

Sleep quality likewise emerged as a significant predictor. Similar to the findings of Honda et al. [28], poor sleep has been linked to impaired cognitive function, slower motor responses, and increased instability. Global evidence shows that poor sleep is consistently associated with falls in older adults, especially in institutionalized settings where environmental factors exacerbate sleep disruption [9],[19]-[21],[26]. Given that sleep disturbances were common in our sample, addressing these issues should be a priority in geriatric care.

Sensory impairments, specifically vision and hearing loss, are important predictors. This supports the conclusions of Singh and Maurya [29] and Wang et al. [30], who showed that when sensory function is reduced, it becomes more difficult for older adults to navigate their surroundings safely. Vision is critical for detecting obstacles and maintaining spatial awareness, whereas hearing contributes to balance through vestibular cues. A systematic review found that combined sensory impairments nearly doubled the risk of recurrent falls among institutionalized older adults [22],[23].

Beyond these global consistencies, there are nuances specific to the Indonesian care context that deepen the interpretation of our findings. Unlike high-income countries, institutional care in Indonesia is relatively uncommon and often regarded as a “last resort” when family-based caregiving is not feasible [2],[3]. Facilities are frequently under-resourced, with limited staff-to-resident ratios, insufficient assistive devices, and minimal structured fall-prevention programs [2],[12]. These systemic constraints may magnify the impact of psychosocial and sensory vulnerabilities. For example, fear of falling may be heightened in settings where supervision is limited, while poor sleep may be aggravated by shared living arrangements and inadequate environmental modifications such as lighting and noise control.

Cultural attitudes also play an important role. Mental health symptoms in older adults are often under-recognized or normalized as part of aging in Indonesian society, leading to delayed interventions for anxiety and depression [25]. Similarly, sensory impairments frequently go untreated due to high out-of-pocket costs for glasses, hearing aids, and specialist

consultations, which are rarely prioritized in institutional budgets [2]. These systemic and cultural factors likely intensify the associations we observed and suggest that psychosocial and sensory risks may be even more critical in Indonesian settings than in high-resource countries.

Taken together, these findings contribute to the global literature by confirming the importance of psychosocial and sensory domains in fall risk while also providing context-specific insights from a lower-middle-income country (LMIC) perspective. By situating fall risk within the realities of Indonesian institutional care, this study highlights the urgent need for fall-prevention strategies that are not only clinically evidence-based but also adapted to cultural norms, financial constraints, and systemic limitations. Future efforts should therefore integrate low-cost screening for psychological distress and sensory impairments, staff training in mental health recognition, and culturally sensitive interventions that align with Indonesia's geriatric care landscape.

## Clinical Implications

The findings of this study highlight the need for fall-prevention strategies that are tailored to the realities of Indonesian institutional care settings, where limited staffing, constrained budgets, and minimal access to geriatric specialists amplify the influence of psychological and sensory risk factors. Because many facilities rely on a small number of caregivers who receive little formal training in mental health or sensory assessment, these vulnerabilities may contribute more substantially to fall risk than in higher-resource environments. Interventions must therefore be both feasible and sustainable within these constraints. Routine screening for anxiety, depression, sleep problems, sensory impairments, and fear of falling is achievable using brief, validated tools that require minimal training. Simple checks for vision and hearing can be integrated into daily care routines, and short training sessions can improve caregivers' ability to recognize early indicators of distress or instability. In settings with particularly low staffing ratios, more independent residents may help observe peers, adding an additional layer of safety.

Environmental modifications remain central to fall prevention. Low-cost improvements such as better lighting, decluttering living spaces, reducing nighttime noise, and establishing more consistent sleep routines can meaningfully reduce risk. Simple sleep-support strategies, including quiet hours and relaxation activities, may also improve sleep quality and reduce fall-related cognitive fatigue. Psychosocial support should be strengthened through daily engagement activities that reduce anxiety and loneliness, such as light exercises, communal prayer, or storytelling. Mental health concerns in older adults are often under-recognized in Indonesia, making it essential to integrate basic mental health awareness into routine caregiving. Family involvement and volunteer support can further enhance emotional well-being. Sensory health requires particular attention, as many residents experience

untreated vision or hearing problems due to cost barriers. Partnerships with local health centers for periodic screenings, along with community or corporate donations of reading glasses or hearing support, can address these gaps and help reduce fall risk. Encouraging safe mobility is critical for maintaining strength and confidence. Supervised walking routines or structured mobility activities can be implemented even with limited staff and help prevent the physical decline associated with inactivity.

## Conclusion

The results of this study demonstrate that psychological and sensory variables, namely fear of falling, anxiety, depression, poor sleep quality, and impairments in hearing and vision, are independently associated with the likelihood of falling among older adults in long-term care. These findings support the adoption of more comprehensive fall risk assessments and interventions that consider psychosocial and sensory domains along with physical health. By focusing on these modifiable factors, care providers can enhance fall prevention strategies and support safer ageing in care facilities.

## Limitations and Future Directions

This study has several limitations. First, the cross-sectional design restricts the ability to infer causal relationships between psychological factors, sensory impairments, and fall risk. Although the authors identify these variables as independent predictors, the temporal sequence of events cannot be established, and therefore causality cannot be assumed. Longitudinal or experimental designs would be necessary to determine whether psychological and sensory factors directly contribute to increased fall risk or emerge as consequences of it. Second, the study relied on self-reported data, which are inherently vulnerable to recall bias and social desirability bias, although the use of validated and culturally adapted instruments helps to mitigate these concerns. Third, the participant pool consisted exclusively of residents in institutional care homes, which may limit the generalizability of the findings to older adults living independently, with family, or in other community-based settings. Future research should incorporate more diverse populations across varied living environments and employ prospective designs to strengthen causal inferences and inform targeted intervention strategies.

## Conflict of Interest

The authors declare that there is no conflict of interest.

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