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Environmental Hazard at Home and Fall Incidence among the Elderly in Malaysia

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Abstract
This study investigated falls among the Malaysian elderly and hazards in their homes. Data from 458 participants showed that falls are common and linked to physical, sensory, cognitive, and psychological issues, as well as environmental hazards. Most home areas showed higher hazard scores among those who had fallen, except in the kitchen. The study highlights that falls result from multiple factors, not just home hazards alone. Findings support the importance of occupational therapy home modifications to reduce fall risks.

Keywords: Home hazards; falls among older people; Home Safety Self-Assessment Tool (HSSAT)

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1.0 Introduction

Falls are a significant public health concern among the elderly population, leading to injury, disability, and even mortality. Globally, falls are the second leading cause of unintentional injury deaths, with approximately 36 million fall cases reported annually among older adults (World Health Organization [WHO], 2021). In Malaysia, the aging population is rising steadily, with individuals aged 60 years and above projected to comprise 15% of the population by 2030 (United Nations Development Program [UNDP], 2024). As the Malaysian elderly population grows, the risks associated with age-related functional decline, chronic illnesses, and hazardous living environments become more prominent (Linggi, 2024). Environmental hazards within the home are among the most significant contributors to falls among the elderly. Common hazards include slippery floors, poor lighting, cluttered spaces, absence of grab bars, and unsafe stairways (Romli et al., 2021; Zahari et al., 2022). A study by Boonkhao et al. (2024) highlighted that bathrooms and toilets often pose the highest fall risks due to wet surfaces and inadequate safety adaptations. Similarly, Lee (2021) emphasized that homes lacking structural safety features significantly increase the likelihood of falls. Despite existing global evidence, Malaysian-specific data on the interaction between home hazards and fall risks among the elderly remain limited. Research by Romli et al. (2021) found that many Malaysian homes lack basic safety modifications such as grab bars, slip-resistant surfaces, and adequate lighting, exposing older adults to heightened fall

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risks. Moreover, Hussain et al. (2023) found that environmental hazards in Malaysian homes, particularly in bathrooms, continue to be overlooked despite being associated with a high frequency of falls. Given these concerns, this study aims to investigate the relationship between environmental hazards at home and the Incidence of falls among elderly Malaysians. Understanding the specific hazards that contribute to falls can guide healthcare professionals, particularly occupational therapists, in developing targeted home modification strategies to promote safer living environments and prevent falls.

2.0 Literature Review

Malaysia is experiencing rapid growth in its elderly population, with 11.1% of the population currently aged 60 years and above, and projections suggest this will rise to 15% by 2030 (Linggi, 2024; UNDP, 2024). Aging commonly leads to declining health and functional abilities, which increases the risk of falls. Falls are a major concern as they are the leading cause of injury and death among older adults worldwide. Each year, approximately 36 million older adults experience falls, resulting in around 3 million emergency department visits and over 300,000 hospitalizations for hip fractures (Vaishya & Vaish, 2020). In Malaysia, a 2020 study reported a fall prevalence of 37.3% among the elderly attending a Kuala Lumpur government clinic, highlighting the urgent need for fall prevention strategies (Joyce et al., 2020). Research has identified two main categories of fall risk factors: intrinsic and extrinsic. Intrinsic factors include physical, cognitive, and psychological elements. Physically, older adults may face muscle weakness, frailty, impaired vision or hearing, chronic diseases such as diabetes, and difficulties performing activities of daily living (ADLs) (Tristan, 2017; Sahril et al., 2020). Cognitive impairments, including dementia and Alzheimer's disease, also significantly raise fall risks due to poor motor control and decision-making, influenced by executive function deficits (Zhang et al., 2019; Keleman et al., 2020). Psychological factors like depression and fear of falling further worsen the risk. Elderly individuals who have previously fallen often experience fear and reduced confidence, leading to social isolation and depression, which limit physical activity and increase vulnerability to future falls (Byun et al., 2021). Extrinsic factors are primarily related to environmental hazards. Unsafe home environments, such as cluttered spaces, poor lighting, slippery floors, and a lack of safety features like handrails, can significantly increase fall risks. Footwear also plays a role, with the use of inappropriate shoes or socks being linked to higher fall rates (Menz et al., 2024). Studies indicate that most falls occur at home, especially in bedrooms, bathrooms, kitchens, staircases, and parking areas (Boonkhao et al., 2024). Common hazards include split-level flooring, squat toilets, unsecured mats, uneven step heights, and poorly designed staircases (Alshammari et al., 2018; Nugraha et al., 2022).

Since both individual and environmental factors significantly contribute to fall risks (Joyce et al., 2020; Lee, 2021), understanding the relationship between home hazards and falls is crucial, particularly in the Malaysian context. Monitoring high-risk areas and identifying common hazards can help reduce the Incidence of falls. In order to investigate this phenomenon, this study has used the Person–Environment–Occupation (PEO) model as its reference. The PEO model is one of the most widely used frameworks in occupational therapy (OT) practice. It was developed by Law et al. (1996) to explain the dynamic interactions between persons, their environments, and the occupations they engage in. This model also helped the researcher achieve a broader direction for this study. This study aims to investigate the types and prevalence of environmental hazards in Malaysian homes and their association with falls among the elderly, providing valuable insights for fall prevention strategies and supporting the role of occupational therapists in home modification interventions.

3.0 Method

3.1 Study design, location, and sampling

This quantitative study involves descriptive and inferential analysis. The sample consisted of 458 individuals, selected from a total of 3,618,700 (Chen et al., 2023) elderly population in Malaysia who met the inclusion criteria. A cross-sectional design was used to obtain data on the prevalence of falls and the types and prevalence of home hazards among 458 samples of the elderly population. A purposive sampling method was used to select participants. Purposive sampling refers to a group of non-probability sampling techniques in which the selection of samples was based on highlighted inclusion and exclusion criteria (Nikolopoulou, 2023).

3.2 Research instruments

The main instrument used was the Home Safety Self-Assessment Tool (HSSAT). The HSSAT is a validated and reliable assessment designed to help older adults identify environmental hazards at home that could lead to falls (Tomita et al., 2014). Malaysian research has examined home hazards and fall Incidence using screening tools and cross-sectional surveys. Community studies have found that home hazards are prevalent and associated with fear of falling and actual falls; instruments like HOME-FAST and the HSSAT have been used in Malaysian samples to quantify household hazards (bathrooms, stairs, floor surfaces, poor lighting) (Romli et al., 2021). This assessment tool was formulated into a set of questionnaires, which were published on Google Forms. The questionnaires were divided into three parts: Part 1, Sociodemographic data; Part 2, Incidence of falls; and Part 3, the HSSAT. Part 1 identified the sociodemographic uniqueness of each respondent, which consisted of two main sections: demographic data and limitations experienced by the respondents. In the demographic section, five questions were set, including age group, gender, ethnicity, areas of residence, and types of housing.

Meanwhile, the second section was listed with 19 characteristics that determined participants' limitations in physical, sensory, cognitive, and psychological. Part 2 determined whether the respondents had ever experienced a fall in any of the nine areas mentioned

in HSSAT. HSSAT (Part 3) is a standardized assessment encompassing checklists to find and correct or fix the hazards for every room or area in the house, which may be a possible cause of trips or falls. In this assessment, the respondents went through nine home spaces (entrance to front door and front yard, entrance to back/side door, hallway or foyer, living room, laundry room/basement, kitchen, bedroom, bathroom and toilet, and staircases). They identified if the spaces presented any hazards that were listed. The respondents were asked to tick the presented hazards.

3.3 Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. The prevalence of falls, as well as the types and prevalence of home hazards, were described using descriptive statistics. The correlation test was utilized to determine the relationship between the presence of any physical limitations, sensory problems, cognitive problems, or psychological symptoms, the prevalence of falls (Chi-Square test), and the relationship between the means of total hazards across different home spaces and the prevalence of falls (Independent t-test). P-values <0.05 were considered statistically significant.

4.0 Result

4.1 *Sociodemographic characteristics, physical limitations, sensory problems, cognitive problems, and psychological symptoms of respondents*

Most respondents (78.2%) were aged 60–74 years, predominantly female (58.3%) and Malay (67.7%). Nearly half lived in urban (43.7%) or rural (41%) areas, mainly in traditional (41.7%) and terrace (28.2%) houses. Regarding individual factors, lower limb weakness (26.9%) and imbalance (33.4%) were the most common physical limitations. Sensory problems included lower limb pain (33.8%), vision impairment (31.7%), and hearing impairment (22.3%). Dementia affected 14.4% of respondents. Stress (10.9%) was the most common psychological symptom, followed by anxiety (7%) and depression (3.7%). These factors were assessed for their association with fall risk.

Table 1. Demographic characteristics of the respondents (N=458)

Demographic data	n	%
Age		
60-74 years old	358	78.2
75-84 years old	73	15.9
85 years old and above	27	5.9
Gender		
Male	191	41.7
Female	267	58.3
Ethnicity		
Malay	310	67.7
Chinese	44	9.6
Indian	9	2
Others	95	20.7
Areas of living		
Urban	200	43.7
Suburban	70	15.3
Rural	188	41
Types of houses		
Bungalow	63	13.8
Terrace	129	28.2
Traditional house	191	41.7
Shophouse	18	3.9
Apartment	14	3.1
Flat	21	4.6
Condominium	9	2
Semi-detached	10	2.2
Townhouse	2	0.4
Penthouse	1	0.2
Physical limitations (Yes)		
Upper limb weakness	20	4.4
Lower limb weakness	123	26.9
Weakness of the upper and lower limbs	93	20.3
Upper joint movement limitation	30	6.6
Lower joint movement limitation	97	21.2
Movement limitation of the upper and lower joints	60	13.1
Imbalance	153	33.4
Sensory problems (Yes)		
Upper limb numbness	49	10.7

Lower limb numbness	63	13.8
Numbness of the upper and lower limbs	69	15.1
Upper limb pain	40	8.7
Lower limb pain	155	33.8
Pain in the upper and lower limbs	83	18.1
Hearing impairment	102	22.3
Vision impairment	145	31.7
Cognitive problem (Yes)		
Dementia	66	14.4
Psychological symptoms (Yes)		
Depression	17	3.7
Anxiety	32	7
Stress	50	10.9

4.2 The prevalence and percentage of falls among the respondents

Based on the findings, the highest prevalence of falls occurred in the bathroom and toilet (21.2%), followed by the kitchen (12.2%) and bedroom (11.4%). These results align with previous studies, which have reported that most falls among older adults occur in bedrooms and bathrooms, as these are spaces that are frequently used and often overlooked in fall prevention efforts. While some studies suggest older adults spend more time in bedrooms, others argue that the kitchen and living room are more commonly used. Additionally, longer distances between bedrooms and toilets may increase the risk of falls. Therefore, it is recommended that the route between these areas be shortened and secured. However, the researcher noted that the time spent in specific spaces and the use of preventive measures alone do not fully explain fall occurrences. Instead, a combination of environmental hazards and individual factors, such as physical limitations and cognitive issues, likely contributes more significantly. Ensuring bedrooms and bathrooms are free from obstacles, well-lit, and easily accessible is crucial in reducing falls. These findings underscore the importance of evaluating home environments to mitigate hazards and enhance safety for the elderly.

Table 2. Prevalence of fall & home spaces (N=458)

Incidence of fall in home spaces (Yes)	n	%
Entrance to the front door and the front yard	43	9.4
Entrance to the back/side door	27	5.9
Hallway or foyer	32	7
Living room	49	10.7
Laundry room/basement	30	6.6
Kitchen	56	12.2
Bedroom	52	11.4
Bathroom and toilet	97	21.2
Staircases	27	5.9

4.3 The prevalence of hazards across different home spaces

The study found that the bathroom and toilet had the highest number of hazards, with slippery tubs (43.9%) and lack of grab bars being the most common risks. Insufficient lighting, slippery floors, clutter, and furniture that was too high or too low were also common across all home spaces. These findings align with previous studies that highlight slippery surfaces and the absence of safety features as major hazards in elderly homes. Overall, inadequate lighting, lack of grab bars, and poor environmental adaptations remain key issues contributing to falls, emphasizing the need for safety modifications in Malaysian elderly homes.

Table 3. Prevalence of hazards & home spaces (N=458)

Types of hazards	Yes
Entrance to the front door and the front yard	
Lack of railings or unstable railing	67
Unmarked or raised threshold	42
Lack of a ramp for a wheelchair	38
Ice or snow on driveway/walkway	3
Entrance to the back/side door	
Unsafe steps (too steep/cracked/slippery)	68
Lack of lighting at night	62
Uneven/cracked pavement	34
Lack of an outdoor grab bar	47
Hallway or foyer	
Cluttered area	12
Lack of access to the ceiling light	1
Presence of a throw or scatter rug	6
The presence of electric cords across the floor	2
Presence of unstable furniture	4
Difficult to access the light switches	1
Laundry room/basement	

Lack of railings	44
Clutter	6
Slippery steps without carpet/luminous light	87
The same colored floor at the bottom of the stairs	29
Is the Cabinet too high or too low	6
Using a stool or a chair to reach things	3
Not enough room to maneuver	5
Presence of a throw/scatter rug	6
Slippery floor	158
Poor lighting	54

4.4 The difference in fall incidence between the elderly group with physical limitations, sensory problems, cognitive problems, and psychological symptoms, and the group without those conditions

This study found that cognitive problems, psychological symptoms, and certain sensory issues like lower limb pain, vision impairment, and hearing loss were significantly linked to falls among the elderly. In contrast, physical limitations, such as limb weakness and joint problems, showed no significant relationship with falls, possibly due to compensatory strategies, including the use of assistive devices. Cognitive decline and emotional distress increased fall risk through poor attention, planning, and fear of falling. Overall, cognitive, psychological, and specific sensory factors appear to play a more critical role in fall risks among the elderly compared to physical limitations alone.

Table 4. Fall incidents and health issues (N=458)

	No fall n(%)	Fall n(%)	X2 statistic (pdf)	P-value
Physical limitation				
Upper limb weakness				
No	297(67.8)	141(32.2)	.042(1)	0.84
Yes	14(70.0)	6(30.0)		
Lower limb weakness				
No	235(70.1)	100(29.9)	2.89(1)	0.09
Yes	76(61.8)	47(38.2)		
Weakness of the upper and lower limbs				
No	276(75.6)	89(24.4)	49.06(1)	0
Yes	35(37.6)	58(62.4)		
Upper joint movement limitation				
No	292(68.2)	136(31.8)	.31(1)	0.58
Yes	19(63.3)	11(36.7)		
Lower joint movement limitation				
No	257(71.2)	104(28.8)	8.45(1)	0
Yes	54(55.7)	43(44.3)		
Movement limitation of the upper and lower joints				
No	291(73.1)	107(26.9)	37.86(1)	0
Yes	20(33.3)	40(66.7)		
Imbalance				
No	231(75.7)	74(24.3)	25.71(1)	0
Yes	80(52.3)	73(47.7)		
Sensory problem				
Upper limb numbness				
No	273(66.7)	136(33.3)	2.34(1)	0.13
Yes	38(77.6)	11(22.4)		
Lower limb numbness				
No	273(69.1)	122(30.9)	1.93(1)	0.17
Yes	38(60.3)	25(39.7)		
Numbness of the upper and lower limbs				
No	285(73.3)	104(26.7)	34.05(1)	0
Yes	26(37.7)	43(62.3)		
Upper limb pain				
No	280(67.0)	138(33.0)	1.85(1)	0.17
Yes	31(77.5)	9(22.5)		
Lower limb pain				
No	216(71.3)	87(28.7)	4.70(1)	0.03
Yes	95(61.3)	60(38.7)		

Pain in the upper and lower limbs				
No	272(72.5)	103(27.5)	20.35(1)	0
Yes	39(47.0)	44(53.0)		
Hearing impairment				
No	263(73.9)	93(26.1)	26.16(1)	0
Yes	48(47.1)	54(52.9)		
Vision impairment				
No	237(75.7)	76(24.3)	27.7	0
Yes	74(51.0)	71(49.0)		
Cognitive problem				
Dementia				
No	285(72.7)	107(27.3)	28.76(1)	0
Yes	26(39.4)	40(60.6)		
Psychological problem				
Depression				
No	308(69.8)	133(30.2)	20.46(1)	0
Yes	3(17.6)	14(82.4)		
Anxiety				
No	300(70.4)	126(29.6)	17.75(1)	0
Yes	11(34.4)	21(65.6)		
Stress				
No	291(71.3)	117(28.7)	20.05(1)	0
Yes	20(40.0)	30(60.0)		

4.5 Comparison of mean total hazards between the elderly group who experienced falls and the elderly group with no experience of falls
This study found that elderly individuals who experienced falls had significantly higher total hazard scores in most areas of their homes, including entrances, hallways, living rooms, bedrooms, bathrooms, and staircases. This suggests that more home hazards increase fall risk. These results align with previous studies showing that environmental risks contribute to falls. However, there was no significant difference in hazard scores in the kitchen between those who had fallen and those who had not. This may be due to reduced kitchen use among older adults as they age, leading to lower exposure to hazards in that space.

5.0 Discussion & Conclusion

This study highlighted key insights into fall incidences among the Malaysian elderly, showing a concerning prevalence across all home spaces, with at least 27 incidents reported per area. The significant link between home hazards and falls supports findings from previous research (Romli et al., 2021; Zahari et al., 2022; Boonkhao et al., 2024). Overall, the results underscore the importance of ongoing monitoring and prevention efforts. These findings can guide more effective implementation of occupational therapy home modification services as a fall prevention strategy (Lee, 2021). Additionally, with proper knowledge of home hazards, occupational therapists can advise on incorporating safety principles into both formal and informal housing construction, ultimately improving home safety standards (Hussain et al., 2023). This study provides valuable insights into the complex interaction between individual factors and home environmental hazards contributing to falls among the Malaysian elderly. The demographic profile revealed that most respondents were aged 60–74 years, predominantly female, and lived in traditional and terrace houses in both urban and rural areas, which may lack safety adaptations, thereby increasing their vulnerability to falls (Linggi, 2024; UNDP, 2024). Individual factors, including physical limitations, sensory problems, cognitive decline, and psychological symptoms, were explored. Although lower limb weakness and imbalance were common, physical limitations showed no significant direct relationship with falls, possibly due to compensatory strategies such as the use of assistive devices or hazard elimination practiced by participants (Odasso et al., 2022). However, sensory problems, such as lower limb pain, vision impairment, and hearing loss, were significantly associated with falls, consistent with earlier research indicating that vision and hearing deficits contribute to poor balance and navigation (Singh & Maurya, 2022; Riska et al., 2022). Notably, cognitive problems, such as dementia, showed a clear relationship with fall incidence, supporting evidence that cognitive decline impairs attention, planning, and decision-making, thereby increasing fall vulnerability (Zhang et al., 2019; Keleman et al., 2020). Psychological symptoms such as depression, anxiety, and stress were also significantly associated with falls, as emotional distress can limit activity, heighten fear of falling, and lead to frailty (Byun et al., 2021; Ellmers et al., 2023). From an environmental perspective, bathrooms and toilets emerged as the highest-risk spaces for falls, primarily due to slippery surfaces and lack of grab bars, consistent with international findings (Boonkhao et al., 2024; Hussain et al., 2023). Interestingly, while most home areas with high hazard scores were linked to falls, the kitchen did not show a significant relationship, potentially due to reduced engagement in kitchen tasks among older adults as they age (Teh et al., 2023). Overall, this study highlights that falls among the elderly in Malaysia are strongly linked to environmental hazards combined with cognitive, sensory, and psychological issues rather than physical limitations alone. These findings emphasize the critical need for targeted home modifications, especially in bathrooms, bedrooms, and entrances, as well as the inclusion of cognitive and emotional health assessments in fall prevention strategies. Addressing both environmental and individual factors holistically can help reduce fall risks and promote safer aging at home. The use of a professional model, such as the PEO, helps our multidisciplinary team (MDT) to develop culturally tailored approaches and policies that will support affordable home modifications.

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Paper Contribution to the Related Field of Study

This study highlights the urgent need for OT services to address falls among Malaysia's growing elderly population. By identifying intrinsic factors (physical, cognitive, and psychological) and extrinsic factors (environmental hazards) contributing to falls, the study supports the expansion of OT roles in in-home safety assessments, fall risk screening, and home modification services. Occupational therapists can use these findings to guide interventions, provide safety consultations during housing design, and promote safer living environments. This reinforces OT's role in fall prevention strategies, empowering both formal and informal sectors to adopt safety principles, ultimately enhancing elderly care and home safety in Malaysia.

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