



AcE-Bs2022Cherating

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10th Asian Conference on Environment-Behaviour Studies
Holiday Villa Beach Resort, Cherating, Malaysia, 08-09 Jun 2022



Environmental Hazards and Falls among Elderly with Low Back Pain

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Abstract

This study aimed to identify the existing environmental hazards and their association with falls among the elderly with LBP. A cross-sectional study involving 284 participants was conducted using Fall Risk Assessment Tools (FRAT), and Home Falls and Accident Screening Tools (HOME FAST). There were 234 respondents included for analysis. Most hazards reported no slip-resistant mats in the bathroom (73.5%). There was no association between environmental hazards and falls among the elderly ($p > 0.05$). Environmental factors are the indecisive cause of most falls in the institutions, but their interaction with the physical abilities of the elderly could contribute to falls.

Keywords: Environmental hazards; Fall; Elderly; Low back pain

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DOI: <https://doi.org/10.21834/ebpj.v7i20.3497>

1.0 Introduction

The world population is getting older (Manansala, Marquez, & Rosete, 2022) when people aged >65 years increasing from one in eleven in 2019 to one in six by 2050 (Almohaisen et al., 2022) and from 11% to 22% (Tan et al., 2014). Malaysia is likely to become an aging country by 2035, where the people aged 60 years and above reach 15% of the total population (Tan et al., 2014). The growing number of the elderly and their related health problems cause many implications for healthcare, especially the cost and social care systems. The frequency of morbidity among the elderly would incline, and demand for health care becomes a common trend related to reports of high depressive symptoms with severe pain, reduction in activity levels, and high physical impact from pain (Abolfathi et al., 2010). In the elderly, pain is the great cause of disability in basic activities of daily living such as housework, bathing, eating, dressing, and walking (Martínez-Hernández et al., 2022).

Low back pain (LBP) is one of the main arthritis complaints among the elderly in Malaysia. This problem would limit their functions and cause struggle in daily living. The elderly with LBP usually would have neuromuscular changes, especially alteration in muscle fiber-type proportion, slow motor unit firing rate, and decreased force generation capacity that leads to an increase in the rate of falls among the elderly (Rubens et al., 2015). The incidence of falls among the elderly living in the community is a critical issue in the new era of globalization. Falls could lead to unintentional injury, poor mobility, disability, fear of falling, reduced quality of life, and death in the elderly.

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DOI:

Each year, approximately 32% of the elderly reported falls, where 20% demanded medical attention, and one in ten cases resulted in a fracture. In Malaysia, the death due to falls is ranked 150th, compared to 80th in the United States of America and 4th in Thailand (Tan et al., 2014). In the USA, every 15 seconds the elderly are present in an emergency and every 29 minutes die due to falls (Vieira, Tappen, Engstrom, & Costa, 2015). About 40-60% of falls could lead to injuries such as minor injuries, and major injuries excluding and including fractures (Rizawati and Mas Ayu, 2008).

Usually, a grouping of intrinsic and extrinsic factors were the most common causes of falls among the elderly (Bergland, 2012; Wynaden, Tohotoa, Heslop, & Omari, 2016). Intrinsic factors include age, chronic disease, gait, and balance impairment, muscle weakness, poor cognitive (Bergland, 2012), history of falling and the fear of re-falling, vision, hearing, and blood pressure (Wynaden et al., 2016). Altered mobility could result in decreased strength, pain, fatigue, and difficulty ambulating leading to an increased risk of falls (Wynaden et al., 2016). Extrinsic factors inclusive of medication used to manage primary or co-morbid health problems (Wynaden et al., 2016), environmental hazards, and hazardous activity (Bergland, 2012).

Many healthcare professionals highlighted the home environment as a critical factor undermining the functioning of the elderly. Techniques on how an elderly use the environment or difficulties when using the equipment to perform their activities are often related to falls (Bergland, 2012). However, the studies on environmental hazards and falls involving the institutions remain scarce while current demands for an institutional living are increasing. Therefore, this study aimed to identify the existing environmental hazards and determine their associations with falls among the elderly with LBP residing in institutions.

2.0 Literature Review

In Malaysia, about 27% of the rural community-dwelling elderly fall each year, and the majority experience recurrent falls in the same year (Romli, Mackenzie, & Lovarini, 2016). Lack of awareness of the risk and complications of falls results in hospital admissions among the elderly (Shuman et al., 2016). The incidence of falls among nursing home residents is about three times the rate for community-living elderly (dos Reis & de Jesus, 2015). The elderly who live in institutions are those who have lost family relationships, growing levels of dependency, progressive aging, lower functional and physical capacity, and social isolation with a greater incidence of falling results in more severe complications such as fracture or laceration (dos Reis & de Jesus 2015). However, this study showed a lack of evaluations regarding the extrinsic factors, which cause the falls incidence. De Sousa et al. (2016) conducted a study in Brazil that highlighted that elderly in institutions were related to the various risk of falls such as co-morbidities, sensory and balance deficits, cognitive and functional decline, and use of polypharmacy. However, the study included only two institutions for the elderly with a total of 64 residents and did not investigate the environmental hazards. Therefore, a larger sample size needs to be considered in the future study inclusive of environmental hazards since they may impact the physical and mental health of the elderly.

Furthermore, the elderly with co-morbidities such as diabetes, arthritis, osteoporosis, heart disease, poor circulation, reduced sensory in the legs, neurological disorders, cataracts, cardiorespiratory disease, Alzheimer's disease, neck and back problems had reported falls (Mitchell et al., 2013). The majority of them who had fallen were diagnosed with two or more associated diseases. The elderly with injury to the feet could double the risk of falling resulting from abnormal motion and postural instability (dos Reis & de Jesus., 2015). Increasing age and impairments of vision, hearing, and memory also tend to increase the incidence of trips and stumbles (Rubenstein, 2006), while the decline in body balance systems contributes to an imbalance in the elderly (Sophonratanapokin, Sawangdee, & Soonthornhada, 2012) resulting to falls.

Extrinsic factors such as uneven or slippery floor surfaces, loose mats, inadequate lighting, poorly designed or maintained stairs without a handrail, absence of safety or preventative devices example night lights and grab rails in toilets, and inappropriate furniture contributed most to falls among the elderly (Sophonratanapokin et al., 2012). Carter et al., (1997) reported that 80% of homes of the elderly aged >70 who live in the community had at least one hazard from 37 different measured hazards. This showed the high prevalence of environmental hazards in the homes of the elderly. Romli et al., (2016) found a high frequency of hazards in the bathroom, stairs, living room, kitchen, and bedroom in Malaysian elderly homes. However, these studies only focused on the prevalence of environmental hazards in the homes of older adults but not in the institutionalized centers. These factors need to be identified through various other assessment tools as the structure between elderly homes and institutionalized centers for the elderly are different.

Eshkoor, Hamid, Sa, and Mun (2014) found a decreased risk of falls when the quality of the environment increased. This study had shown the correlation between environmental factors and falls among the elderly, however, they were not associated with the determinant of falls among institutions for the elderly with LBP and this study also was not described details about the environmental hazards involved. Several studies showed the elderly usually had a falls outside of their homes such as while walking on a level surface, shower or bath, stairs and relates to chair/ladder (Bergland, 2012), garden, lawn or woods, outdoor stairs or steps and sidewalks or driveways (Stevens, Mahoney, & Ehrenreich, 2014), kitchen, garden, bathroom/toilet, living room, bedroom and stairs (Lim et al., 2013). The elderly who have urinary incontinence are likely to rush to the toilets and are exposed to wet floors, cords, and carpet edges resulting in falls (Vieira et al., 2015). Thus, all these hazards need to be cleared out from elderly homes to ensure they are not at high risk of falls.

Studies related to home hazards and falls have inconclusive findings. The role of environmental hazards and the magnitude of the influence of environmental factors on the risk of falls for the elderly were also uncertain (Rizawati & Mas Ayu, 2008). Over time, researchers have tried to investigate the factors contributing to the risk of falls among the elderly living in the institutions and communities by developing interventions and prevention programs addressing those risk factors to reduce the frequency of falls among them. However, the prevalence of falls among the elderly in institutions and communities remains high. Hence, this study explored environmental hazards and their associations with falls among the elderly with LBP living in institutions.

3.0 Methodology

A cross-sectional study recruited 284 participants living in 7 institutions for the elderly under the Department of Social Welfare, Malaysia. The participants included those aged 60 years old and above, male or female, diagnosed with LBP/backache/back pain by medical doctors, walking with or without walking aids, independent activities of daily living, understood Malay/English language, and stable vital signs. The participants excluded those with uncontrolled Type II diabetes, permanent disability, senile, complete dependence, serious medical complications, and severe mental disorders.

The sample size was calculated using Raosoft calculator software with parameters set at 95% CI, type 1 error at 0.05, effect size at 0.5, and the sample size estimated at 218. When considering 30% drop out, the total sample size became 284.

The demographic questionnaire contained part A which consisted of personal details, and part B consisted of health details. The risk of falls screened using Fall Risk Assessment Tools (FRAT) and environmental hazards using Home Falls and Accident Screening Tools (HOME FAST).

The FRAT was used to obtain information on fall risk score, risk of falls, and causes of falls during last and previous falls. Part 1 was about recent falls, medications (anxiety, depression, anti-Parkinson's, diuretics, anti-hypertensives, hypnotics), psychological levels for anxiety, depression, decreased cooperation, decreased insight, or decreased judgment especially re-mobility. Lastly, about cognitive status using Hodkinson Abbreviated Mental Test Score. The risk of falls scored as low risk (5-11), medium risk (12-15), and high risk (16-20). Part 2 was the risk factor checklist that included vision, mobility, transfers, behaviors, activities of Daily Living (ADLs), environment, nutrition, continence, and others. Besides, circumstances of recent falls. Part 3 was about an action plan for intervention strategies or referrals. It has high reliability (ICC=0.79) and 80% accuracy (sensitivity (ER) 70.2%, specificity (ER) 68.8%) (Stapleton et al., 2009).

The HOME FAST was used to identify environmental hazards (Hassani Mehraban, MacKenzie, & Byles, 2011). It has 25 questions with each scored either hazard present or no hazard. The elderly were identified as having a high or low level of fall risk (Vu & Mackenzie, 2012). It has a good reliability where ICC was 0.82 (95% CI, 0.66-0.91) for inter-rater reliability and 0.77 (95% CI, 0.57-0.88) for test-retest reliability (Vu & Mackenzie, 2012).

All data were analyzed using SPSS software (version 21.0). Descriptive statistics were used to analyze the demographic data and Chi-Square for the association between environmental hazards and falls among the elderly with LBP.

The ethical approval was received from Ethical Committee, Research Management Centre, Universiti Teknologi MARA. The permission to conduct the study was obtained from the Social Welfare Department, Malaysia. The purpose and procedure of the studies are informed and explained to participants verbally, and a hard copy is also given to them. Informed consent was obtained before recruitment for the study. All data and information shared by the respondents were kept confidential. This study was supported by the Lestari grant 600-IRMI/DANA 5/3/LESTARI (0102/2016) from Research Management Centre (RMC), Universiti Teknologi MARA.

4.0 Findings

4.1 Demographic and anthropometric characteristics of the study population

There were 298 participants involved however, only 234 were included in the study. Sixty-four respondents excluded from the study (n = 1 age < 60 years; n = 1 non-low back pain; n = 62 did not achieved normal cognitive level). The demographic characteristic of participants illustrated in Table 1.

Table 1. Demographic characteristics of the study population (n = 234)

Variables	n (%)	Mean (SD)
Age (years)		69.15 (8.13)
60-69	130 (55.6)	
70-79	68 (29.1)	
80-89	32 (13.7)	
90 and >	4 (1.7)	
Gender		
Male	151 (64.5)	
Female	83 (35.5)	
Race		
Malay	134 (57.3)	
Indian	47 (20.1)	
Chinese	53 (22.6)	
Education		
Primary	96 (41.0)	
Secondary	77 (32.9)	
Tertiary	7 (3.0)	
No schooling	54 (23.1)	
Health status		
Poor	34 (14.5)	
Good	200 (85.5)	
Walking status		
Independent	187 (79.9)	
Using walking aids	47 (20.1)	
History of fall		
Yes	128 (54.7)	

No	106 (45.3)
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4.2 Types and frequency of environmental hazards in the institutionalized centers for elderly

The types and frequency of environmental hazards are illustrated in Table 2.

Table 2. Types and frequency of environmental hazards identified by the Home Falls and Screening Tool (HOME FAST) (n = 234)

Hazards	n (%)
Walkways cluttered	85 (36.3)
Floor coverings are in poor condition	146 (62.4)
Slippery floor surfaces	70 (29.9)
Loose mats	26 (11.1)
Difficulty with bed transfers	22 (9.4)
Difficulty with lounge transfers	11 (4.7)
Poor lighting	12 (5.1)
No access to the bedside light	19 (8.1)
Poor lighting on outdoor paths	10 (4.3)
Difficulty with toilet transfers	9 (3.8)
Difficulty with bath transfers	4 (1.7)
Difficulty with shower transfers	8 (3.4)
No access to grab rails in the bath	42 (17.9)
No slip-resistant mats in the bathroom	172 (73.5)
Toilet not close to the bathroom	38 (16.2)
Difficulty reaching items in the kitchen	21 (9.0)
Difficulty carrying meals	16 (6.8)
Inadequate / absent step / stair rails indoors	7 (3.0)
Inadequate / absent step / stair rails outdoors	4 (1.7)
Difficulty using stairs	10 (4.3)
Undefined stair edges	11 (4.7)
Difficulty using entrance doors	10 (4.3)
Hazardous outdoor paths	22 (9.4)
Inadequate footwear	33 (14.1)
Hazardous pets	13 (5.6)

4.4 Association between environmental hazards and falls among the elderly

Table 3 shows the association between environmental hazards and falls among the elderly in institutions with low, medium, and high risk. There was no association between each hazard and the risk of falls among the elderly.

Table 3. Association between environmental hazards and falls among the elderly

Environmental hazards	Fall Risk (%)			P-value
	Low risk	Medium risk	High risk	
Walkways cluttered	70 (38.7)	13 (29.5)	2 (22.2)	.353
Floor coverings are in poor condition	108 (74.0)	32 (21.9)	6 (4.1)	.266
Slippery floor surfaces	58 (82.9)	11 (15.7)	1 (1.4)	.299
Loose mats	21 (11.6)	4 (9.1)	1 (11.1)	.942
Difficulty with bed transfers	19 (86.4)	3 (13.6)	0 (0)	.662
Difficulty with lounge transfers	10 (90.9)	1 (9.1)	0 (0)	.394
Poor lighting	10 (83.3)	2 (16.7)	0 (0)	1.000
No access to the bedside light	15 (78.9)	3 (15.8)	1 (5.3)	.790
Poor lighting on outdoor paths	6 (60.0)	4 (40.0)	0 (0)	.409
Difficulty with toilet transfers	5 (55.6)	4 (44.4)	0(0)	.144
Difficulty with bath transfers	2 (50.0)	2 (50.0)	0(0)	.293
Difficulty with shower transfers	6 (75.0)	2 (25.0)	0(0)	.852
No access to grab rails in the bath	32 (76.2)	7 (16.7)	3 (7.1)	.463
No slip-resistant mats in the bathroom	133 (77.3)	31 (18.0)	8 (4.7)	.531
Toilet not close to the bathroom	33 (86.8)	4 (10.5)	1 (2.6)	.371
Difficulty reaching items in the kitchen	15 (71.4)	4 (19.0)	2 (9.5)	.267
Difficulty carrying meals	13 (81.3)	3 (18.8)	0 (0)	1.000
Inadequate / absent step / stair rails indoors	3 (42.9)	4 (57.1)	0 (0)	.144
Inadequate / absent step / stair rails outdoors	3 (75.0)	1 (25.0)	0 (0)	.749
Difficulty using stairs	6 (60.0)	4 (40.0)	0 (0)	.071
Undefined stair edges	10 (90.9)	1 (9.1)	0 (0)	.803
Difficulty using entrance doors	9 (90.0)	1 (10.0)	0 (0)	.793
Hazardous outdoor paths	19 (86.4)	3 (13.6)	0 (0)	.512
Inadequate footwear	29 (87.9)	4 (12.1)	0 (0)	.428
Hazardous pets	12 (92.3)	1 (7.7)	0 (0)	.617

5.0 Discussion

The majority of participants were Malays which could be the dominant race living in these institutions. Most Chinese and Indians are usually found in private nursing homes. Most of them went to primary schools (41%), and some had never received any formal education.

This reflects the national elderly population pattern that the present cohort of Malaysian elderly is not well educated (1991 census) due to the limited educational opportunity during the nation's economic development in the early twentieth century.

The five hazards detected were no slip-resistant mats in the bathroom, floor coverings in poor condition, walkways cluttered, slippery floor surfaces, and no access to grab rails in the bath. The finding was consistent with Romli et al., (2016) and Rizawati and Mas Ayu (2008). All studies showed the similar type of hazards which demonstrated inadequate bathroom facilities and slippery floor surfaces were vital hazards for falls among the elderly. Furthermore, the location of bathrooms or toilets outside of the home with poor lighting, uneven floors, and the path or walkway to the toilets might cause the loss of balance in the elderly leading to falls.

The common areas of falling in the institutions were in the bathroom, stairs, living room, kitchen, and bedroom also is consistent with Rizawati and Mas Ayu (2008) and Lim et al., (2013). However, the study by Chin, Wang, Ong, Lee, & Kong, (2013) reported the toilet (36%) and bedroom (17%) were the most common areas of falling. As known, bathroom, and toilet support a higher incidence of falls among Malaysians. This could be because Malaysians commonly practice self-care activities in a wet bathroom, and toilet, where they use water for cleaning by scooping from a pail and rinsing in the area or by using a hose. Falls in the bathroom was most likely to cause injury and lead to severe complications and disability. Thus, improving safety in the bathroom is very important by including assistance for the elderly bathing, adopting safer methods when carrying out activities in the bathroom (e.g., wearing shoes with non-slip soles, storing toiletries on easy to reach shelves, using an assistive device safely) and installing safety equipment (e.g., non-skid tub or shower mats, grab bars both inside and outside the tub or shower and around the toilet, and raised the toilet seats).

The majority of participants were at low risk of falls, but the prevalence of falls was high (54.7%). The prevalence of falls was not consistent with Romli et al., (2016) which was 19% and globally at 28-35%. Although high hazards were detected in this study, the association between environmental hazards and falls among the elderly with LBP in institutions was not significant and consistent with Rizawati and Mas Ayu (2008) and Chin, Wang, Ong, Lee, and Kong (2013). This explained that the history of falls could be due to other factors such as intrinsic factors (poor vision, muscle weakness, and poor balance). Most elderly believe that falls occur due to themselves rather than environmental factors.

In contrast, Sophonratanapokin et al., (2012) reported that home hazards are significantly associated with falls. The falls occurred more often among those perceiving poor health, chronic diseases (stroke, hypertension, heart diseases, diabetes mellitus, and paresis), and difficulty in functional mobility. Environmental hazards were the leading cause of falls, accounting for about 25-45% compared to dizziness, vertigo, drop attacks, postural hypotension, visual impairment, and syncope (Al-faisal, 2007).

This study has a large sample size which can represent results for overall institutionalized centers for the elderly in Malaysia. However, there were limitations in the methodology where researchers spent longer time interviewing participants as the majority of them had difficulty reading, writing, and understanding the questionnaire through self-reported questionnaires used. This study also relied on self-report of falls, which might cause some reporting bias from retrospective recall.

6.0 Conclusion

Falls are a critical mechanism of injury that causes disability and mortality among the elderly with LBP. Environmental hazards are not the crucial cause of falls among the elderly living in institutions, but other factors might play an essential role in falls. It is unknown what mixture of hazards and other health problems increased the risk of falls in the elderly living in institutions.

The risk assessment for falls favors the reduction of recurrent events and their complications through a multidisciplinary approach in a safe environment for the care of the elderly. Preventive measures should be undertaken, including providing social support and health education to increase awareness of falls among the elderly. Future research needs to consider exploring various environmental hazards in institutions for the elderly in Malaysia and investigate the association between environmental factors with falls and quality of life among the general community elderly. Further research should consider the emphasis on awareness of falls and education.

Acknowledgement

We would like to thank the Faculty of Health Sciences, UiTM, and the Research Management Centre, UiTM for the financial support.

Paper Contribution to Related Field of Study

This paper would provide information for the development of guidelines and educational programs for the prevention of falls among the elderly, particularly in the institutions for the elderly and the community.

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