

## REVIEW ARTICLE

# Environmental hazards and its relationship with falls among older people with low back pain: a systematic review

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## Abstract:

This systematic review aimed to identify the environmental hazards and their relationship with falls among older people with low back pain (LBP). The search strategies were performed via Science Direct, PubMed, Scopus, and Google Scholar databases from 1998 to 2019. The keywords "environmental hazards", "fall", "low back pain", "elderly", "older adults", "older persons" and "older people" were used during the literature search. Boolean operators were used to expanding or limiting the searching scope and manual exclusion was performed to choose articles eligible for this study. A total of 2065 articles were retrieved but only six articles were related to environmental hazards and falls among older people with LBP. The finding shows that environmental hazards are the contributing factors to falls among older people with LBP. In conclusion, the environmental hazards lead to an increase in falls among older people with LBP but, it may not be a primary factor of falls among older people.

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**Keywords:** environmental hazards, fall, low back pain, older people

## 1. INTRODUCTION

Reaching 2050, the world will be established as the total aging community due to the increase of the older people population [1]. Moreover, Malaysia from the latest study found that the aging population had reached 28.3 million among Malaysian and this population expectedly will increase by up to 38.6 million in the following 30 years [2] Along with the growth, there is increasing concern over fall incidence and other health complication related to fall [3]. The previous data reported by World Health Organisation (WHO) showed that 28-35% of older people age over 64 years old in the community fall each year and older people aged above 70 years old approximately 32-42% fall each year [4]. Therefore, the risk factor of fall should be avoided to prevent fall incidence which could lead to physical injury, disability and even mortality[3].

WHO reported the prevalence of low back pain increasing gradually with the increase of human age [4]. From WHO data the prevalence peaks between the ages of 35 – 55 years due to the deterioration of intervertebral disc in older people [4]. The prevalence of musculoskeletal pain in older adults reached 85%, with 36% to 70% of them suffering from back pain [5]. Furthermore, the 1-month prevalence of disabling back pain (pain that affected daily activities within the past month) increased from 3.8% among people aged between 77 and 79 years to 9.7% among those aged between 90 and 100 years [6]. This shows a high incidence of back pain among older persons that may cause falls which need further concern.

Fall incidence can happen due to the various risk factors and it can be easily seen in the community-dwelling older adults [7]. This study focused on environmental hazards as a risk factor of fall. Environmental hazards can be defined as a threat, danger, or risk from different aspects such as physical, chemical, mechanical, psychosocial, or biological which threaten the health of humans [8]. Study had found that environmental factors such as uneven floor surface, wet floor, inappropriate furniture placement, lighting, and obstructed walkways increased the risk of falls among older people [8].

With the concerning issue discussed, there is a lack of evidence about how environmental hazards and LBP affecting fall incidence among older people population. Therefore, this study was conducted (1) to identify the environmental hazards related to falls among older people with LBP and, (2) to determine the relationship between environmental hazards and incidence of fall among older people with LBP.

## 2. MATERIALS AND METHODS

### 2.1. Search strategies

The literature search was conducted through some steps. The objective of the study were identified using population, intervention, comparison and outcome (PICO) techniques. Besides, PICO was used to determine the eligibility criteria for this study.

Population: Older people age 60 and above with LBP

Intervention: Not applicable

Comparison: Not applicable

Outcomes: Pain scale, risk of fall, environmental hazards, home hazards survey and other related outcome measures.

The search strategies were performed through the following online database: Science Direct, PubMed, Springer and Google Scholar and manual searching also had been performed. This study focused on articles from 1998-2019. The keywords "environmental hazard", "fall", "low back pain", "elderly", "older adults", "older persons" and "older people" were used during the literature search. Boolean operators of "OR" or "AND" were used to expand or limit the searching scope and manual exclusion was performed to choose articles eligible for this study (Fig. 1). The criteria of the articles included were: (1) All type of study except systematic review (2) Older people age>60 with LBP (3) Environmental hazard risk factor of fall (4) Full text and English. The exclusion criteria were (1) abstract (2) Older people with history of spine fracture and chronic disease.

**2.2 Study selection and data extraction**

The selections of the studies were based on the title of the study, study design, methodology, result, discussion and conclusion by search engines. Observational studies regarding environmental hazard related falls were included. The studies that do not fulfill the inclusion criteria were excluded. Besides, the studies were screened based on the language and abstract from articles found. If there is no abstract available, or if the study is not clear whether it should be included, full-text articles were retrieved to determine inclusion or exclusion. The article is in English to avoid confusion and misunderstanding.

**2.3 Risk of bias assessment**

The risk of bias assessment of the reviewed articles was assessed using the Cochrane Effective Practice and Organization of Care (EPOC) risk of bias tool. This tool consisted of seven domains that are; random sequence generation, allocation concealment, blinding participants and personnel, blinding outcome assessment, incomplete outcome data, selective reporting, and other sources of biases. The domains were evaluated with a score of high risk, low risk, or unclear bias (Table 2).

**2.4 Methodological quality**

All of the studies were ranked based on hierarchy levels of evidence following National Health and Medical Research Council (NHMRC). This study was evaluated using McMaster Critical Review Form for Quantitative Studies as a critical appraisal instrument tool. This critical appraisal tool was selected because it was comprehensive in assessing the methodological quality of quantitative evidence. McMaster Critical Review Form for Quantitative Studies also has good inter-rater reliability. This tool consists of 16 items of methodological quality relating to the study's purpose, literature review, design, sample, outcomes, intervention, results, and conclusions that scored as yes and no. Criteria that been fulfilled as yes, 1 point is given. However, 0 points are

allocated as no. The total score is 16 with classification as excellent with score 15 to 16, very good;13 to 14, good; 11 to 12 fair; 9 to 10, and poor; less than 9 (Table 3)

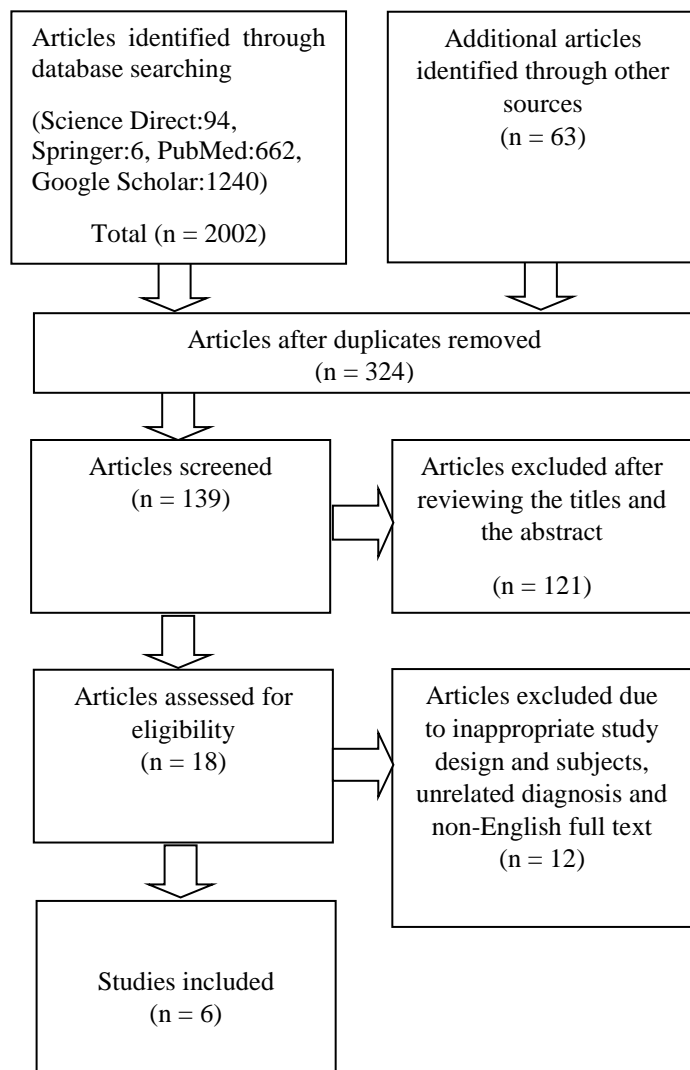


Figure 1: PRISMA Flow Chart of search strategies

Table 1 : Data extraction

| Study   | Participants      | Risk factor assessment  | Results  | Conclusion  |
|---|-------------------|---|--|---|
| Cimilli, Ak, Unal, Onur, & Eroglu, (2019)           | N= 308, aged 65+  | Self-administered questionnaire   | Type of living and fall (not significant)<br>Location of fall and fall (significant) | This study support that environmental hazard is one of risk factor fall.            |
| Yoo, Kim, Yim, & Joen, (2016)                       | N= 534, aged 65+  | -Home environment assessment using Merck manual<br>- Physical activity scale for the Elderly (PASE) | Type of residence and fall (significant)<br>Home environment and fall (significant)  | This study support that environmental hazard is one of risk factor fall.            |
| Gill, Williams, & Tinetti (2015)                    | N= 1103, aged 71+ | Room-by-room assessment for 13 potential trip or slip   | 13 potential trip or slip and non-synopal falls (not significant)                    | This study did not support that environmental hazard is one of risk factor of fall. |
| Sattin, Rodriguez, & Devito (1998)                  | N= 270, aged 65+  | Home Environmental survey (HES)   | Environmental hazards and fall (not significant)                                     | This study did not support that environmental hazard is one of risk factor of fall. |
| Carter, Campbell, Sanson-fisher, & Gillespie (2000) | N= 657, aged 75+  | Self- administered questionnaire  | Environmental hazards and fall (significant)   | This study support that environmental hazard is one of risk factor fall.            |
| Hawk, Hyland, Rupert, Colonvega, & Hall (2006)      | N= 110, aged 65+  | Home hazards checklist  | Environmental hazards and fall (significant)   | This study support that environmental hazard is one of risk factor fall.            |

Table 2: Appraisal of risk of bias, according to Cochrane Effective Practice and Organization of care risk of bias tool

| Criterion/ Articles                                 | Random sequence generation (selection bias) | Allocation concealment (selection bias) | Blinding participants and personnel (performance bias) | Blinding outcome assessment (detection bias) | Incomplete outcome data (attrition bias) | Selective reporting | Other bias |
|---|---|---|--|--|--|---------------------|------------|
| Cimilli, Ak, Unal, Onur, & Eroglu (2019)            | High  | High                                    | Low  | Low  | Low                                      | Low                 | High       |
| Yoo, Kim, Yim, & Joen (2016)                        | Low   | High                                    | Low  | Low  | Low                                      | Low                 | High       |
| Gill, Williams, & Tinetti (2015)                    | High  | Low                                     | Low  | Low  | Low                                      | Low                 | Low        |
| Sattin, Rodriguez, & Devito (1998)                  | High  | Low                                     | Low  | Low  | High                                     | Low                 | Low        |
| Carter, Campbell, Sanson-fisher, & Gillespie (2000) | Low   | Low                                     | Low  | Low  | Low                                      | Low                 | Low        |
| Hawk, Hyland, Rupert, Colonvega, & Hall (2006)      | Low   | Unclear                                 | Low  | Low  | Low                                      | Low                 | Low        |

Table 3: Methodological quality

| Study   | Study design    | Hierarchy level | Mc Master score | Quality   | Statistical precision |
|---|-----------------|-----------------|-----------------|-----------|-----------------------|
| Cimilli, Ak, Unal, Onur, & Eroglu (2019)            | Cross-sectional | IV              | 9/16            | Fair      | $p < 0.05$            |
| Yoo, Kim, Yim, & Joen (2016)                        | Cross-sectional | IV              | 11/16           | Good      | $p < 0.05$            |
| Gill, Williams, & Tinetti (2015)                    | Cohort          | III             | 13/16           | Very Good | $p < 0.05$            |
| Sattin, Rodriguez, & Devito (1998)                  | Case-control    | III             | 13/16           | Very Good | $p < 0.05$            |
| Carter, Campbell, Sanson-fisher, & Gillespie (2000) | Cross-sectional | IV              | 12/16           | Good      | $p < 0.05$            |
| Hawk, Hyland, Rupert, Colonvega, & Hall (2006)      | Cross-sectional | IV              | 13/16           | Very Good | $p < 0.05$            |

### 3. RESULTS AND DISCUSSION

#### 3.1. Selection of studies

A total of 2065 articles were retrieved but only six articles were included in this systematic review: four were cross sectionals [9][10][13][14], one cohort study [11], and one case-control study [12]. The articles completely discussed environmental hazards as one of fall risk factor among older people. There were also articles used Home Environmental Survey (HES) to assess older peoples' home and room [12]. Moreover, home modification and family education about effectiveness of home modification also had been discussed on the reviewed articles [13][14].

#### 3.2 Environmental hazards and falls in older people with LBP

Based on all reviewed studies, four articles showed significant relations between environmental hazards and fall among older people with LBP [9][10][13][14], while another two articles did not support the relationship between environmental hazards and fall among older people with LBP [11][12]. The environmental hazard termination in community-dwelling older persons home had no definite impact on fall prevention [11][12]. This is because changes in environmental hazards throughout older peoples' house from time to time weakened the association between environmental hazards and fall [11][12]. Besides, the association between environmental hazards and fall was modified due to underlying impairment had by older people [11]. Generally, we summarized that environmental hazards are a contributing factor to falls among older people with LBP. This can be explained that the older people with LBP presented with a larger center of pressure area and higher mean velocity which increases the postural sway that leads to instability and fall [15][16]. A study found that people with LBP commonly walk with more synchronous horizontal pelvis, and thorax rotations with their arm swing also out of phase [17]. This shows that gait control is also affected by the presence of LBP. They also present with lower movement amplitude of the pelvis, lower ground reaction forces, higher stride to stride variability, more in-phase coordination, and a higher activity of erector spinae (ES) muscles [18]. Due to this, older people with LBP tend to easily lose balance while walking in the area higher in mechanical and physical hazards.

Moreover, our finding was supported by a systematic review [19] which concluded that environmental hazard reduction was effective towards older people with limitations in mobility and had a history of falls. They agreed that the environmental hazards reduction is not effective to lower the risk of fall in older people population. The environmental hazard is not a primary factor of fall towards older people [20].

#### 3.3 Location of fall and fall in older people with LBP

The location of falls among older people with LBP had been analyzed and was found that older peoples' bedroom is the highest percentage of fall incidence occurred followed by bathroom, living room, and kitchen [10]. This is because older people with LBP will experience back stiffness and pain in the morning after waking up from bed [21]. A study found morning back pain is associated with degenerative disc disease [21]. Unsuitable height of the bed, slippery bed sheet or sleeping clothing also the reason of higher percentage of fall recorded in older peoples' bedroom [22].

#### 3.4 Type of residence and fall in older people with LBP

There were significant differences between the type of residence and fall among older people [10]. The study compared older people living in rural and urban areas. Older people who lived in rural areas had a higher risk of falls than those who lived in urban areas. This could be because the rural area environmental safety is lower compared to urban area [23]. Besides, older people commonly did not seek medical attention for their pain [24].

#### 3.5 Living status and fall in older people with LBP

Out of three reviewed articles [9][10][13] discussed the type of living such as living alone, with family or spouse, or living in nursing home with the fall incidence among older people with LBP, only one found a significant difference between the living status and fall among older people with LBP [10]. A possible explanation for this might be that older people who lived with others had more social support compared to those who lived alone making them less fearful to walk [25]. Besides, older people who live alone need to perform their activities of daily living independently even though they are in pain [26]. This makes them at greater risk of falling than those who have better support.

#### 3.6 Limitation of the study

This study was limited in several ways. First, there was a lack of study found within the latest of ten years of publication (2009-2019) that looked into the relationship between environmental hazards and falls among older people with LBP. Most of the articles found were focused on hip fracture injury, neurological disease, and legs problem. Hence, this study had to widen its definition of LBP to get suitable articles to be reviewed. Secondly, it was difficult to access the full-text version of the articles and some of it was not in English language which was not eligible for this study. Finally, some of the databases were not accessible from UiTM databases which led to manual searching strategy.

Hence, further studies regarding environmental hazards and fall among older people with LBP are needed to provide an extension of available knowledge on the risk of fall in older people. A lot more studies need to be done in the future which

relate to how LBP and environmental hazards can be the risk towards increasing fall incidence among older people to provide strong evidence on the relationship of environmental hazards and fall among older people with LBP.

#### 4. CONCLUSION

In conclusion, this study revealed that environmental hazards are contributing factors to falls among older people with LBP. However, the environmental hazard is not a stand-alone factor as falls occurred with more than one factor. So, home modification and removing environmental hazards are not enough to decrease the risk of fall among older people with LBP. Therefore, improvement in physical function such as balance, gait, and posture correction is also needed to reduce fall incidence and improve the quality of life among them. Further research to investigate environmental hazards and other contributing factors of falls among older people with LBP are needed to provide better understanding and safe precautionary measures to avoid falling.

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