Contribution of the Built Environment towards Elderlies' Quality of Life and Risk of Falling

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Abstract
Recent study trends on elderlies range from improving their quality of life to reducing the risk of falling. This paper investigates current concerns on the risk of any untoward fall or injury of elderly residents in public housing due to the rising number of the elderly population. This study aims to analyze published literature with a focus on finding a non-semantic relation on the built environment with the elderly quality of life and risk of falling. Results show that a pleasant environment could introduce social activities in which significantly improves the quality of life and reduce fall risk among the elderly population.

Keywords: elderly; quality of life; fall risk; environment.

1.0 Introduction
Malaysia is currently facing an increase in its population, especially in its cities. Statistics taken by the Department of Statistics Malaysia (2010) showed that Kuala Lumpur has the highest population density in the nation with 6,891 people per square kilometre followed by Putrajaya and Pulau Pinang with densities of 1,478 and 1,490 people per square kilometre, respectively. Even though the density level is closely associated with the size of these states, Selangor, which has the most significant state size amongst the three, has only 674 people per square kilometre because most of its population scattered around the city centre.

The number of living quarters and households has increased by 0.1 million from its 2016 figures wherein 2017, living quarters and houses totalled at 8.5 million and 7.7million respectively, with an average household increase of 4.06% (Department of Statistics Malaysia, 2010). Malaysia is reaching the status of an ageing population country by 2020, with the percentage of elderly population exceeding 7.2%. By the year 2040, the rate could reach up to 15% of the total population. Such an increase in the elderly population marks a change in the median ages of Malaysia; in 2017, the median age was 28.3 years, but in 2040 the median age will be 38.3 years which indicates an increase of 10 years in the median age over only 23 years. All the data discussed in this section gathered from the statistics provided by the United Nations Population Division and the Department of Statistics Malaysia.

The rapid increase of urban population is evident with the rise of multi-storey residential buildings. In turn, the growth of the older people living in multi-storey buildings has raised concerns on the quality of life amongst the elderly. Plus, with the increment of the

elderly causing interest in the fall risk, which could lead to reducing their quality of life. Many studies highlighted on the elderly quality of life and fall prevention, but the relation with the built environment with both issues not adequately addressed.

Thus, this study aims to analyze the published literature with a focusing on finding a non-semantic relation on the built environment with the elderly quality of life and risk of falling. The main objective is to evaluate a significant factor that could contribute to improving the elderlies quality of life.

2.0 Literature Review

As discussed in the preceding section, the population pattern in Malaysia is slowly shifting to having a much bigger composition of the elderly. Although the age for one to qualify as an elder varies, the baseline for this age group (ageing of 60 and above) is consistent. While the World Health Organization defines the elderly to be 65 years old and above; the United Nations World Assembly on Ageing held in Vienna in 1982 described an elder to be anyone of the age of 60 and above (Hamid, 2015; Othman & Fadzil, 2015; Rizawati, 2008). Malaysia has adopted the demarcation recommended by the UN (Mohammad, & Abbas, 2012). Therefore, the elderlies in Malaysia include those aged 60 years and above. The term "senior citizen" or "Warga Emas" used to address this group of people individually. Additionally, the age of 60 marks the compulsory retirement age for workers in the government sector (Abbas & Saruwono, 2012).

Following the escalating number of the elderly population, many studies focusing on the needs of these elderlies. The trending topics projected by most recent studies ranged from improving the elderlies' quality of life to reducing the risk of falling among elderly residents. This study made upon the latest concerns on the increasing number of the elderly population as preventing injury among the elderlies is essential to avoid an increase in hospitalization and disabilities. Subsequent parts of this paper studies on both issues.

3.0 Methodology

The research methodology applied was a content analysis of past literature to determine the trend of research in the areas mentioned. The data searched through online search from Science Directs, Google Scholar and other search engines. The term elderly, together with the term quality of life and fall risk, was used in search strategies to finds related article from 2006 until the latest published article. Then, analysed the data obtained using ATLAS.ti 8 to identify the trends in the areas mentioned and find the non-semantic linkage between the materials. Only studies that limited to the built environment are chosen and analysed as another article might highlighting another factor which is not related to the built environment.

4.0 Findings

From the data collected, two apparent study trends found concerning the increase of the elderly population, which are the quality of life of the elderly and fall prevention amongst the elderly. Concerns mainly focused on elderlies' daily activities; however, concerns on the safety of the elderly during an emergency also need to be taken into account.

4.1 Quality of Life of the Elderly Population

It has predicted a profound upsurge in the number of elderlies, concerning their awareness towards the environment, have started to be raised in many studies as listed in Table 1.

Table 1 List of Studies on Quality of Life (QoL) of the Elderly Population

Year	Author	Country	Findings
2014	Stenhagen et al.	Malaysia	Elderly evacuees who are prone to falls have low satisfaction towards the environment, which in turn might become another factor contributing to the risk of falling.
	Mauceri & Marco	Malaysia	The psychosocial of elderly evacuees in association with the quality of life yielded a positive correlation between self-efficacy and negative emotions among this particular group.
	Kamarudin et al.	Malaysia	A study on public building facilities which included the elderly as part of the study group highlighted that the implementation of practices and legislation for the disabled was lacking in public buildings.
	Wong & Musa	Malaysia	Identified the reasons for many elderlies choosing Malaysia as their second home. Although other studies had conveyed mixed opinions on the satisfaction level of elderly evacuees, this study had gained positive feedback from international retirees.
2015	Othman & Fadzil	Malaysia	The study on the outdoor environment of care centres found a correlation between decently designed outdoor space and the well-being of elderly evacuees.
	Pramitasari & Sarwadi	Indonesia	The study on QoL of the elderlies was incorporated with the built environment in a dense community to test the sufficiency of facilities provided in Yogyakarta
2016	Onunkwor et al.	Malaysia	Both social support and the physical factor contribute to the quality of life, but emphasis need to be given to social support intervention.

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	Dahlan et al.	Malaysia	Good environment factors facilitate the opportunity to socialize which increases the social factor.
	Sajin et al.	Malaysia	Leisure facilities help to increase engagement among the elderly which increases the social factor.
2017	Dahlan & Ibrahim	Malaysia	Increased activities give a significant improvement in Quality of Life amongst the elderly in the institution.
	Tobi et al.	Malaysia	The built environment plays a role in defining the quality of life. Proper accessibilities and basic needs of the elderly have a positive outcome and become key factors supporting the independent living lifestyle amongst the elderly.
2018	Hamzah & Ismail	Malaysia	Engagement in voluntary activities could increase the social factor and in turn, significantly increase life satisfaction.
	Marzo et al.	Malaysia	Neutral satisfaction towards the quality of life but high scores on the social and physical factors which need to be strengthened to improve quality of life.
2019	Osman & Ismail	Malaysia	Focus on personal and social needs increase the quality of life among the elderly. Financial status and level of income were the least contributing factors towards positive wellbeing.

Many studies have found low satisfaction levels in terms of elderlies' quality of life not meet their current environment needs. The satisfaction of requirements is not only limited to safety and physiological needs, but also the need for relationship, development, and fulfilment. In summary, the built environment has become a significant factor in determining the quality of life of elderly residents. A pleasant atmosphere is not only able to increase their satisfaction levels, but also leads to positive health and psychology. A friendly environment also helps to increase social interaction amongst the elderly which significantly increases the social factor for them. Review of past studies on building evacuations showed that although low satisfaction levels have recorded among elderly evacuees especially those who are disabled, Malaysia is still seen as a suitable place for international retirees for it renders self-fulfilment for them. It can thus take as a contributing factor to the increase in the number of elderly evacuees in Malaysia. The needs of elderly evacuees in public housing during emergencies have yet to receive much consideration. Thus calls for more emphasis to be dedicated to this group to ensure building evacuation efficacy. More accounts should give to particular population groups such as elderly evacuees and senior citizens through the provision of facilities required for evacuation (Sadri, Ukkusuri & Gladwin, 2017).

4.2 Risk of Falling Among Elderly Occupants
Fall risk among elderly occupants in public buildings has become a massive topic since the predicted increment of the elderly population has become a significant public health concern. Since then, the number of researches in similar areas has increased, signifying that awareness towards fall risk among elderly evacuees has improved. Table 2 summarises the trends observed from these studies

Table 2 shows that much emphasis given to the prevalence and factors of fall risk. It is to determine the category of elderlies who are more prone to fall risk (Rubenstein, 2006; Shariff, Krishnan, Shamsul, Ahmad, & Visvanathan, 2008; Swanenburg, de Bruin, Uebelhart, & Mulder, 2010; Rowe, 2011). Only a few studies have looked into strategies for prevention or reduction of fall risk among elderly evacuees, while none of the studies had attempted to uncover the challenges created post-fall incident (Rubenstein, 2006; Rowe, 2011).

The trend of determining and understanding fall risk factors has continued for years; only after a while had some studies started to incorporate strategies to minimise fall risk after foreseeing the challenges faced due to falls. Ambrose, Paul, and Hausdorff (2013) and Greenberg (2012) were among the earliest who observed the challenges elderly evacuees faced in post-fall incidences.

Table 2 List of Studies on Fall Risk and their Scope of Study

Year	Author	Country	Challenges	Prevalence & Risk factor	Strategies
2006	Rubenstein	America	-	X	X
2008	Shariff et al.	Malaysia	-	X	-
2010	Swanenburg et al.	Switzerland	-	X	-
2011	Kadir & Hasim	Malaysia	-	X	-
	Rowe	America	-	X	X
2012	Momtaz et al.	Malaysia	-	X	-
	Greenberg	America	X	-	X
2013	Zijlstra et al.	Netherlands	-	X	X
	Ambrose et al.	America	X	X	X
2014	Stenhagen et al.	Sweden	-	X	-
	Lim et al.	Malaysia	-	X	-
	Tan et al.	Malaysia	X	-	X
	Clemson et al.	Australia	X	X	-
	Tuunainen et al.	Finland	X	X	-

	Gelbard et al.	America	X	-	-
2015	Keall et al.	New Zealand	-	-	X
	Montali et al.	Italy	X	X	X
	Abu Samah et al.	Malaysia	-	X	-
	Alekna et al.	Lithuania	X	-	-
	Luk et al.	Hong Kong	-	-	X
	Kim et al.	Korea	-	-	X
	Smee et al.	Australia	-	X	-
	Eriksen et al.	America	X	-	X
	Pi et al.	China	X	X	X
	Soto-Varela et al.	Spain	-	X	X
	Bruce et al.	Australia	-	X	-
2016	Hatamabadi et al.	Iran	-	-	X
	Thiwabhorn Thaweewannakij et al.	Thailand	-	X	X
	Callis	America	X	X	X
	Leszczyńska et al.	Poland	X	-	X
	Marques-Vieira et al.	Spain	-	-	X
2019	Forth & Aiden	USA	-	X	X
	Thomas et al.	Spain	-	-	X
	Khalifa		-	-	X
	Van Than et al.		-	-	X

Since there are strong justifications on the prevalence of fall risk, as presented in previous studies, in the year 2015 witnessed a shift in study trends, as shown in Table 2. Fall prevention strategies dominated the pattern of the research scope, as many studies tried to find the best strategies to mitigate fall risk among elderly evacuees. However, there were a few pioneer studies in 2014, which highlighted the challenges faced in reducing the issue of fall prevention. The number of studies on this topic predicted to increase as the demography of the population experiences profound growth in its elderly generation.

One of the challenges faced by the researchers is trying to find ways to reduce the number of casualties due to fall incidents (Tuunainen et al., 2014; Montali et al., 2015; Pi et al., 2015; Callis, 2016). Even if one survives from a fall incident, the side effects of the event not only would be detrimental to the person's physiology and psychology but also family members and caregivers. Adverse effects of a fall incident on the psychology of an individual include trauma, depression, anxiety, social isolation, and reduced quality of life.

The impacts of a fall incident on a person's physiology, on the other hand, include functional decline and disability, which subsequently lead to a reduction in physical activity. Fall incidents, as shown by Pi et al. (2015) not only place a burden on the victims but also to those around them, including family and society. The fall nonetheless has the most significant impact on the deterioration of the quality of life of the elderly himself.

Fall risk generally increases as the factors linked to the threat are amplified. People with one or two factors possess a 27% risk of falls, whereas those with more than two factors exposed to the risk of falls at as high as 78% (Rowe, 2011). Therefore, emphasis on the need for a barrier-free environment to be adopted in both indoor and outdoor settings to mitigate the issue of accidental falls among elderly evacuees should be given priority as proposed by many studies (Abbas & Saruwono, 2012; Kamarudin et al., 2014). In 2015, many studies started to test out strategies to reduce fall risk. These strategies involve simple procedures ranging from increasing the elderlies' physical activities to the application of detectors and sensors to track the possibility of falls.

Considering that elderly evacuee exposed to the risk of falling even in typical situations, a situation of emergency hence exposes this group to a more significant risk of morbidity and casualties. Many studies conducted had mostly focused on the risk of falling among elderly evacuees in normal conditions which presents a gap in knowledge on the risk of falls among elderly evacuees when they encounter panic or emergencies. Since elderly evacuees are prone to falling, the main concern is on their safety when in crowd stampedes of high density (this is also often associated with panic behaviour that believed to be able to cause great danger).
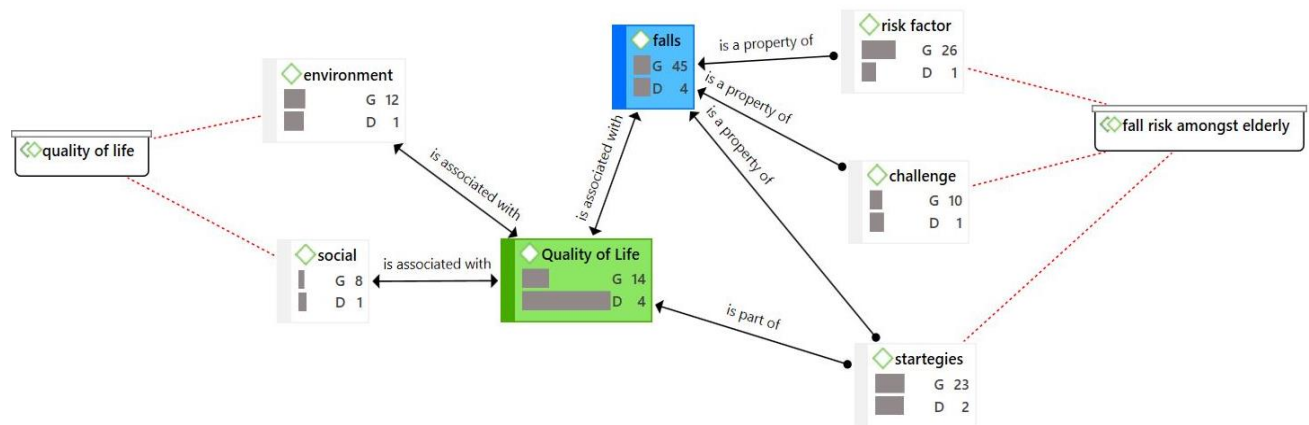
5.0 Discussion

Fig. 1: Visualisation of the non-semantic linkages between the various elements of the project
(Source:Data analysis from ATLAS.ti 8)

Figure 1 presents a visualisation of the non-semantic linkages between the different elements that have highlighted earlier. The analysis shows that the social and environmental factors highly contribute to the quality of life amongst the elderly population. The environmental factor is the most grounded as it linked to 12 quotations compared to the social factor, which only quoted eight times which can be associated with the importance of environmental factors as it could also contribute to social factors. All the quoted element are from the literature reviewed in these studies. As for the fall risk amongst elderly residents, many studies highlighted the risk factor and strategies for fall prevention, where both received 26 quotations and 23 quotations. Amongst the risk factor discusses can be related to the environmental factor which affecting the elderly quality of life. As for the challenge, ten quotes have made to highlight the difficulties faced by mitigating the fall issues of the elderly.

The published literature review is mainly highlighting the social factor and environmental factor as a two separate solution towards improving the quality of life. From the analysis, it found that the environmental factor could significantly contribute to socialising activities amongst the elderly. It also found that most studies that highlighted the risk factor, challenge and strategies also relates to the built environment, which significantly contributes to the risk of falling. Besides built environment factor, the internal factor, which is the psychological and physiological factor of the elderly becomes the cause of fall risk. Their psychological and physiological element of the elderly could be improved if the built environment can be designed in which increased the social activity amongst the elderly, which enhances their lifestyle and quality of life.

6.0 Conclusion and Recommendations

In conclusion, improvements in the environmental factor contributing to an increase in the social factor which results in improvements in the elderlies' quality of life. As for the issue of fall risk, it commonly associated with the elderlies' overall health and the environmental factor that may contribute to a higher incidence of falls amongst elderly occupants which hence proves that the environmental factor can increase the quality of life and decrease the risk of falls amongst the elderly. Its automatically means that the environmental factor linked with the elderlies' quality of life and fall prevention. The social factor is the most significant factor that could improve the quality of life and fall risk. Thus, designing a built environment of the elderlies should focus on enhancing or encouraging socialised activities among the elderly. Future studies should, therefore, focus on the effectiveness of environmental conditions towards both the elderlies' quality of life and prevention of falls as only a small number of studies have been conducted in Malaysia, and all the related article found were separated.

Acknowledgements

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