

# The prevalence and the risk of falls among institutionalised elderly in Penang, Malaysia

Sheng Hui Kioh, MSc, Abdul Rashid, PhD

Department of Public Health, Faculty of Medicine, Penang Medical College, Penang, Malaysia.

## ABSTRACT

**Introduction and Objectives** Over the years, falls has been increasingly the most common public health issue worldwide that affects all age groups. However, the risk is nine times higher in older persons especially among those residing in nursing homes. The objective of this study is to determine the prevalence and the risk of falls and their associated factors among elderly living in nursing homes in Penang, Malaysia.

**Methodology** Data were obtained from a cross-sectional survey in ten different nursing homes in the state of Penang, Malaysia. Participants were selected through convenience sampling were interviewed face-to-face using a questionnaire. Information concerning demographic characteristics, fall risk and depression status were collected.

**Results** Of the 357-elderly aged 60 years and above interviewed in the nursing homes, 32.8% (n=354) reported having one or more falls in the past 12 months whereas 13.3% were at moderate/high risk of fall. Depression (Adjusted Odds Ratio (aOR)=1.71, 95%CI: 1.00 to 2.91) and respiratory illnesses (aOR=3.38, 95%CI: 1.11 to 10.30) were shown to be associated with prevalence of falls. Depression (aOR=2.12, 95%CI: 1.06 to 4.23) and history of fall more than once in the past 12 months (aOR=3.90, 95%CI: 1.72 to 8.8) were found to be associated with moderate/high risk of falls. **Conclusion** This study showed that the prevalence of fall was higher among depressed elderly and those with respiratory illness. Elderly with higher history of falls were also at higher risk of falls. These findings suggest the importance of screening the elderly for the risk factors of falls as a preventive measure.

## KEY WORDS:

Falls, Older Adults, Nursing Home, Malaysia

## INTRODUCTION

The population of the elderly is increasing. The world's older population has grown fast and is nearly 10% of the world's total population<sup>1</sup> and this figure is expected to double in the next three decades especially in developing countries. In 2014, older adults aged 65 made up 5.6% to the total population in Malaysia while in 2016, the proportion increased to 6.0%.<sup>2</sup> According to the Department of Statistics Malaysia, older adult aged 65 and above will have the highest increment in population growth. It is expected that

the proportion of the older adults will increase to 14.5% in 2040 from 5.0% in 2010.<sup>2</sup>

According to the World Health Organization (WHO), fall is defined as an incident which causes a person to unintentionally rest on the ground or floor.<sup>3</sup> It is the most common public health issue worldwide among different age groups but older adults are at higher risk.<sup>3</sup> As age increases, the risk of falls increases with severe and usually chronic consequences.

Fall has been identified as the top ten leading cause of deaths in people aged more than 65 years old with the incidence rate of approximately 20% annually worldwide.<sup>4</sup> The prevalence of falls among the Chinese elderly in Hong Kong, Singapore and Taiwan have been shown to range from 14.7% to 34.0%<sup>5-8</sup> whereas in the West the prevalence has been reported to range from 28.0% to 42.0%.<sup>9,10</sup> In Malaysia, the prevalence of falls among elderly has been reported to range from 19.1% to 47.0%.<sup>11,12</sup> However, there is a dearth in the information on falls among elderly residing in institutions in Malaysia. There is only one published study among elderly living in nursing home in Kuala Lumpur reported the prevalence of fall as 30%.<sup>13</sup> Previous studies conducted in other countries have also shown that elderly residing in nursing homes have higher risk and prevalence of falls as compared to community-living elderly.<sup>3,14,15</sup> The high prevalence of falls in nursing homes is associated with increased morbidity, disability and healthcare costs<sup>4</sup> and is a major public health problem not only to the older individual but also to the family members, healthcare professionals, government and non-governmental organisations.<sup>16</sup>

Falls have multi-factorial origin and therefore identification of the risk factors are extremely crucial in elderly care. Studies have shown both intrinsic and extrinsic factors associated with the risk of falls. Examples of intrinsic risk factors are demographic factors such as age, gender, previous occupation, history of fall and medical comorbidities and examples of extrinsic factors include medication side effects and environmental surroundings.

The rates of elderly population are different in different states in Malaysia. Penang has one of the highest proportion of elderly in the country, the proportion of older adults in 2010 was 10.0% but increased to 12.2% in 2017 and the figure is expected to increase to 26.2% by 2040.<sup>17</sup> As the population of the elderly increases, there is a strong likelihood that there will be an increase in the number of elderly residing in

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Corresponding Author: SH Kioh

Email: hui5560@hotmail.com

nursing homes. As the number of elderly residing in nursing homes increase there is a possibility of increase in the fall rates.

After an extensive literature search only one published study was found on the prevalence and the risk of falls among elderly living in nursing homes in Malaysia. Because of bereft of information in Malaysia, the objective of this study was to determine the prevalence of falls and the risk of falls in selected nursing homes in Penang, Malaysia and the influencing factors.

## MATERIALS AND METHODS

### Study design and Setting

This cross-sectional study among elderly living in ten different nursing homes in Penang, Malaysia was conducted from October 2016 to July 2017. Five publicly and privately funded homes on Penang island were selected using convenience sampling. Only persons aged 60 and above who are destitute and who have no relatives or whose relatives, or dependents are unable to look after them are allowed to stay in the publicly funded homes. In addition, in some public nursing homes, only people who are healthy are accepted. As for the private nursing homes, the charges range from RM1000-2500 per month (USD 1 = RM 3.90) depending on the elderly's medical condition. These private nursing homes usually provide services such as 24 hours nursing care, bed-ridden care and physiotherapy services for rehabilitation purpose.

### Study Sample

The population for this study was selected from the elderly staying in the nursing homes in Penang, Malaysia. Two largest nursing homes were purposively selected, and the other eight nursing homes were selected based on random sampling from a total of 25 nursing homes on the Penang island. The inclusion criteria for this study included Malaysians aged 60 years old and above residing in the selected nursing homes for more than three months. Participants who did not consent and were unable to communicate effectively were excluded from the study. The participants were selected using convenience sampling from the list given by the matron of the respective nursing homes. The sample size was calculated using Stata 13.0 Software<sup>18</sup> using two sample proportion test. Based on the study done in four nursing homes in India, the proportion of elderly with prevalence of fall was 28.8%<sup>15</sup> while the prevalence of fall among elderly living in three nursing homes in Iran was 47.3%.<sup>19</sup> Using Stata to calculate the sample size with a power of 95% and level of accuracy at 5%, the estimated sample size of 345 participants was required. As for the elderly in the nursing home with high risk of fall in India, the proportion was 37.4%<sup>15</sup> and the proportion of elderly in primary care who were high risk of fall in London was 57.0%.<sup>20</sup> Using Stata to calculate the sample size with a power of 95% and level of accuracy at 5%, the estimated sample size of 332 participants were required. Because the sample size required for prevalence of fall is higher compared to the sample size for the risk of fall, the higher sample size was chosen. Due to the possibility of non-response rate and drop out from study a total of 400 participants were approached.

### Tools

Data was collected using a questionnaire which was divided into five sections: demographics, previous medical condition, history of fall, fall risk level and depression. In this study fall is defined as any incident that causes the person to unintentionally rest on the floor that occurs through accidental and non-accidental in the past 12 months of the interview date.

Demographic information collected included age, gender, race, religion, marital status and previous occupation. Information on previous medical conditions included history of existing illness such as cardiovascular, musculoskeletal, neurological and respiratory illnesses. Consumption of medication was also recorded. History of fall past 12 months and the number of falls were asked and fall risk was assessed using Fall Risk Assessment Tool (FRAT). FRAT is a 4-item falls-risk screening tool which includes history of falls, medication, psychological and cognitive status. The scores on FRAT classified the participants as either low risk (5-11), medium risk (12-15), or high risk (16-20). The sensitivity and specificity of the tool has been shown to be 72.5% and 52.2% respectively.<sup>21</sup> The Geriatric Depression Scale (GDS), short version was used to assess depression. This scale comprises fifteen – items with a yes or no responses to determine the possibility of having depressive symptoms among the study participants. Participants with scores of 0-5 were categorised as normal, 6-8 mild depression, 9-11 moderate depression and 12-15 indicate severe depression. The validity and reliability of the tool have been supported through both clinical practice and research in numerous studies. The sensitivity of GDS has been shown to be 97% and specificity 95%.<sup>22</sup>

### Analysis

Analysis of the data was performed using IBM SPSS version 20.0. Data entry was done using double entry method to omit error before transferring into SPSS. Data cleaning was performed to ensure there was no missing data. Data cleaning was then done to screen for errors. The dependent variable was falls past 12 months and defined as any incident that caused the participant to unintentionally rest on the floor either accidentally and non-accidentally. This information was obtained by self-reporting. The data is presented descriptively, and odds ratio was used to quantify the risks. Binary logistic regression was performed and p-value of less than 0.05 was considered as statistically significant.

### Ethical considerations

The study received the approval of the Penang Medical College Institutional Research and Ethical Committee (MscPh7) Permission from the administrators of the participating nursing homes was received prior to commencing the study. Respondents were given a participant information sheet and a written consent was taken before commencing the face-to-face interview. The anonymity of the participants is assured.

Table I: Demographic Characteristics of the Participants

Characteristics	Frequency (N=354)	Percentage (100%)
<b>Age group</b>		
60–69	47	13.3
70–79	162	45.7
80–89	145	41.0
<b>Sex</b>		
Female	230	65.0
Male	124	35.0
<b>Race</b>		
Chinese	330	93.2
Others	23	2.3
Indian	14	4.0
Malay	2	0.5
<b>Religion</b>		
Buddhist	149	42.1
Christian	90	25.4
Taoist	81	22.9
Others	23	6.5
Hindu	8	2.3
Muslim	3	0.8
<b>Marital status</b>		
Single	233	65.8
Widowed	79	22.3
Married	32	9.1
Divorced	10	2.8
<b>Previous Occupation</b>		
Unemployed	33	9.4
Employed	321	90.6
<b>Existing illness</b>	301	85.0
<b>Types of illnesses*</b>		
<b>Cardiovascular system</b>	248	82.4
Musculoskeletal system	102	34.0
Respiratory system	14	4.7
Neurological system	77	25.6
<b>On medication</b>	290	96.3
<b>Depression</b>		
Yes	76	21.5
No	278	78.5
<b>History of falls</b>		
Yes	116	32.8
No	238	67.2
<b>No of times fall</b>		
One time	68	19.2
More than one time	48	13.6
None	238	67.2
<b>Risk of fall</b>		
Low Risk	307	86.7
Moderate/ high risk	47	13.3

\*Multiple Answers

**RESULTS**

A total of 400 participants who fulfilled the inclusion and exclusion criteria of the study were approached but only 354 participants responded giving a response rate of 89.0%. The characteristics of the study population are shown in Table I.

Majority of the participants were aged between 70 and 79 years old (45.7%), women (65.0%), Chinese (93.2%), Buddhist (42.1%) and single (65.8%). Most (90.6%) of the participants were employed before entering the nursing home. Most participants (n=301) had history of existing

Table II: Factors associated with falls among elderly in selected nursing homes in Penang

Types of Variable	Fall (n) (%)	No fall (n) (%)	OR [95% CI]
<b>Types of nursing home</b>			1.12 (0.53, 2.37)
Public	105 (33.0)	213 (67.0)	
Private	11 (30.6)	25 (69.4)	
<b>Age group</b>			1.56* (1.00, 2.45)
≥ 80	56 (38.6)	89 (61.4)	
< 80	60 (28.7)	149 (71.3)	
<b>Gender</b>			1.47 (0.91, 2.37)
Women	82 (35.7)	148 (64.3)	
Men	34 (27.4)	90 (72.6)	
<b>Race</b>			1.81 (0.79, 4.18)
Non-Chinese	11 (45.8)	13 (54.2)	
Chinese	105 (31.8)	225 (68.2)	
<b>Religion</b>			1.38 (0.88, 2.16)
Buddhist	55 (36.9)	94 (63.1)	
Non-Buddhist	61 (29.8)	144 (67.2)	
<b>Previous Occupation</b>			2.08* (1.01, 4.28)
Unemployed	16 (48.5)	17 (51.5)	
Employed	100 (31.2)	221 (68.8)	
<b>Existing illness</b>			1.15 (0.61, 2.17)
Yes	100 (33.2)	201 (66.8)	
No	16 (30.2)	37 (69.8)	
<b>Cardiovascular disease</b>			1.18 (0.73, 1.94)
Yes	84 (33.9)	164 (66.1)	
No	32 (30.2)	74 (69.8)	
<b>Musculoskeletal disease</b>			0.97 (0.60, 1.59)
Yes	33 (32.4)	69 (67.6)	
No	83 (32.9)	169 (67.1)	
<b>Neurology disease</b>			1.52 (0.90, 2.57)
Yes	31 (40.3)	46 (59.7)	
No	85 (30.7)	192 (69.3)	
<b>Respiratory disease</b>			2.86 (0.97, 8.46)
Yes	8 (57.1)	6 (42.9)	
No	108 (31.8)	232 (68.2)	
<b>On medication</b>			1.20 (0.66, 2.15)
No	19 (29.7)	45 (70.3)	
Yes	97 (33.4)	193 (66.6)	
<b>Depression status</b>			1.14* (0.65, 2.02)
Depression	33 (43.4)	43 (56.6)	
No depression	83 (29.9)	195 (70.1)	

\* Statistically significant

illness but only 290 were on medication. Among the participants, 76 (21.5%) of them were depressed. A total of 116 (32.8%) participants had history of fall past 12 months. Most of them (19.2%) reported a single episode and 13.6% more than once. Based on the scores using the fall risk assessment tool – there were 307 participants (86.7%) who were at low risk of fall and 47 participants (13.3%) were at moderate/ high risk of fall.

#### Factors associated with falls

Table II shows the factors associated with falls among elderly in selected nursing homes in Penang. Being previously

unemployed (OR=2.08; 95%CI: 1.01 to 4.28), having respiratory illness (OR=2.86; 95% CI: 0.97 to 8.46), aged more than 80 years (OR=1.56, 95%CI: 1.00 to 2.45) and having depression (OR=1.80; 95%CI: 1.07 to 3.04) were significant factors associated with falls.

Taking account of possible confounders, binary logistics regression was performed (Table III). Age, gender, previous occupation, respiratory disease and depression status were included in the model which had -2log likelihood 430.446, Cox and Snell R square 0.048 and an overall correct predicted percentage of 69%. Respiratory illnesses (OR=3.38, 95%CI:

**Table III: Binary Logistic Regression table showing the risks associated with falls among elderly in selected nursing homes in Penang**

Variable	B	Wald	Sig	aOR	95% CI
<b>Respiratory disease</b>					
No (reference)					
Yes	1.22	4.61	0.03*	3.38	1.11, 10.30
<b>Depression</b>					
No (reference)					
Yes	0.54	3.89	0.05*	1.71	1.00, 2.91
<b>Age group</b>					
< 80 (reference)					
≥ 80	0.43	3.20	0.07	1.53	0.96, 2.44
<b>Previous Occupation</b>					
Employed (reference)					
Unemployed	0.66	3.05	0.08	1.94	0.92, 4.08
<b>Gender</b>					
Men (reference)					
Women	0.300	1.41	0.24	1.35	0.82, 2.22

\* Statistically significant

1.11 to 10.30) and depression (Adjusted Odds Ratio [aOR]=1.71, 95%CI: 1.00 to 2.91) were significantly associated with prevalence of fall among the participants after adjusting for the independent variables.

#### Factors associated with risk of falls

Table IV shows the factors associated with risk of falls among elderly in selected nursing homes in Penang. Participants who were Buddhist (OR=1.85; 95%CI: 0.99 to 3.43), being depressed (OR=2.38; 95%CI: 1.23 to 4.61) and with history of falls more than one time for the past 12 months (OR=4.24; 95%CI: 1.92 to 9.35) were at higher risk of falls.

Table V shows the results of a binary logistic regression. Adjusting for other independent variables, depression (aOR=2.12; 95%CI: 1.06 to 4.23) and history of falls more than once past 12 months (aOR=3.90; 95%CI: 1.72 to 8.8) were significantly associated with moderate/high risk of fall. Overall the model had -2log likelihood 265.345, Cox and Snell R square 0.033 and Nagelkerke R square 0.061. The overall prediction of the model was 87.0%. Therefore, it is clearly seen that there is a linear relationship between depression and history of falls with risk of falls when all other predictor variables in the model are held fixed.

#### DISCUSSION

Falls are common incidents that occur among the elderly especially those living in nursing homes.<sup>3,23</sup> In the current study, the prevalence of falls among elderly living in nursing homes was 32.8%. which is higher compared to studies conducted in other Asian countries.<sup>5,6,15,24</sup> The prevalence was reported as 21.7% in Japan,<sup>26</sup> 26.4% in Hong Kong<sup>5</sup> and 28.8% in India.<sup>16</sup> However, studies conducted in the West reported higher prevalence than the current study. In Canada, the prevalence was 31.7%,<sup>26</sup> 42.0% in the United States of America<sup>28</sup> and 41.0% in Brazil.<sup>28</sup> The discrepancies in the prevalence of falls identified in the current and previous studies could be explained by the inconsistencies in

the methodology as well as the different sampling methods. High prevalence of fall that was found in this study might also be due to the fact that participants were older than the participants in the previous studies.<sup>5,25</sup> Also in certain studies, only people who were mobile were included as compared to the current study which included those unable to walk.<sup>5,25,29</sup>

In this current study, depression and respiratory illness were significantly associated with higher prevalence of falls. Studies conducted in different countries using different study designs in Japan,<sup>30</sup> Israel,<sup>31</sup> and the Netherlands<sup>32</sup> showed that elderly with depression were more likely to fall compared to those without expression. Side effects of anti-depression medication such as sedation, insomnia and daytime drowsiness may lead to increased falls.<sup>33-35</sup> However, this could not be corroborated in the current study because medication intake for the depressed patients were not studied.

Like the current study, studies conducted in Canada<sup>26,29</sup> and have shown that people with respiratory illnesses such as Chronic Obstructive Pulmonary Disease (COPD) have a higher incidence of falls. Literature suggests that elderly with respiratory illness experience many respiratory symptoms that may decrease one's function and mobility leading to a lower physical activity. It was presumed that elderly that are less active have a lower muscle strength and would experience muscle atrophy leading to increased risk of falling.<sup>26,36</sup>

The result of this study shows 13.3% of the elderly were at moderate/ high risk of falling. Extensive literature search failed to show any other published study assessing the fall risk among elderly in nursing homes except to the one done in India which showed 37.4% of the elderly were at high risk of fall.<sup>15</sup> However, different fall risk assessment tools were used which could explain the wide difference in the findings.

Depression and fall more than once for the past 12 months were factors associated with the risk of fall. The association of

Table IV: Factors associated with the risk of falls among elderly in selected nursing homes in Penang

Types of Variable	Moderate / high risk fall group (n) ( % )	Low risk fall group (n) ( % )	OR [95% CI]
<b>Types of nursing home</b>			1.68 (0.69, 4.08)
Public	7 (19.4)	29 (80.6)	
Private	40 (12.6)	278 (87.4)	
<b>Age group</b>			1.02 (0.55, 1.92)
≥ 80	19 (13.1)	126 (86.9)	
< 80	28 (13.4)	181 (86.6)	
<b>Gender</b>			1.18 (0.63, 2.22)
Women	18 (14.5)	106 (85.5)	
Men	29 (12.6)	201 (87.4)	
<b>Race</b>			1.74 (0.40, 7.64)
Non-Chinese	45 (13.6)	285 (86.4)	
Chinese	2 (8.3)	22 (91.7)	
<b>Religion</b>			1.85 (0.99, 3.43)
Buddhist	26 (17.4)	123 (82.6)	
Non-Buddhist	21 (10.2)	184 (89.8)	
<b>Previous Occupation</b>			1.52 (0.59, 3.90)
Unemployed	6 (18.2)	27 (81.8)	
Employed	41 (12.8)	280 (87.2)	
<b>History of fall past 12 months</b>			4.24 (1.92, 9.35)
Fall more than 1 time	29 (60.4)	19 (39.6)	
Fall 1 time	18 (26.5)	50 (73.5)	
<b>Existing illness</b>			2.04 (0.70, 5.95)
Yes	43 (14.3)	258 (85.7)	
No	4 (7.5)	49 (92.5)	
<b>Cardiovascular disease</b>			1.68 (0.80, 3.53)
Yes	37 (14.9)	211 (85.1)	
No	10 (9.4)	96 (90.6)	
<b>Musculoskeletal disease</b>			1.06 (0.54, 2.07)
Yes	14 (13.7)	88 (86.3)	
No	33 (13.1)	219 (86.9)	
<b>Neurology disease</b>			1.28 (0.63, 2.60)
Yes	12 (15.6)	65 (84.4)	
No	35 (12.6)	242 (87.4)	
<b>Respiratory disease</b>			2.76 (0.83, 4.19)
Yes	4 (28.6)	10 (71.4)	
No	43 (12.6)	297 (87.4)	
<b>On medication</b>			2.00 (0.76, 5.27)
No	42 (14.5)	248 (85.5)	
Yes	5 (7.8)	59 (92.2)	
<b>Depression status</b>			2.38 * (1.23, 4.61)
Depression	17 (22.4)	59 (77.6)	
No depression	30 (10.8)	248 (89.2)	

\* Statistically significant

depression with falls could be explained by the indirect effect of anti-depressant medications.<sup>30,37</sup> Depression related factors including fear of falling, cognitive impairment, gait changes, nutritional status and executive dysfunction<sup>37</sup> are possible underlying factors. Still, the exact underlying mechanism on the association between depression and risk of fall warrant further studies.

As older adult fall, the chances he or she is likely to fall again is higher. Studies conducted in Brazil, India and Switzerland.<sup>15,38</sup> also found history of fall to be a significant risk factor of future falls.

Table V: Results of Binary Logistic Regression for the risk of falls

Variable	B	Wald	Sig	aOR	95% CI
<b>Depression</b>					
No (reference)					
Yes	0.60	1.74	0.022*	1.83	1.06, 4.23
<b>Religion</b>					
Non- Buddhist (reference)					
Buddhist	0.56	1.80	0.18	0.57	0.25,1.29
<b>History of fall for past 12 months</b>					
Fall 1 time (reference)					
Fall more than 1 time	1.36	10.56	0.001*	3.90	1.72, 8.8
<b>Gender</b>					
Women (reference)					
Men	0.44	0.92	0.34	1.55	0.64,3.76
<b>Age group</b>					
< 80 (reference)					
≥ 80	0.36	0.75	0.39	1.44	0.63,3.26

\* Statistically significant

### STUDY LIMITATION

Although this is the first study of its kind in Malaysia but it is with some limitations. The nature of the study renders lack of temporality and convenience sampling methods increases the probability of obtaining a biased sample leading to the possibility of over representation from a nursing home. Recall bias is another possibility considering the participants were asked about previous falls past 12 months. This current study also did not review all exhaustive list of medications related to falls. In addition, the environment factors associated with falls were not studied.

### CONCLUSION

In conclusion, depression and presence of respiratory illnesses are strongly associated with the prevalence of falls. Elderly who were depressed and who had history of falls were at higher risk of falls. These findings may help form intervention to prevent falls among the elderly in nursing home and highlights the importance of screening the elderly living in nursing home. Anti-depression medications consumed by the residents of the nursing home's home should be monitored and replacement of pharmacologic to non-pharmacologic therapy among elderly who are depressed should be considered where feasible.

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### REFERENCES

- Cire B. World's older population grows dramatically. Newsroom; 2016 [cited 2017 10th May]. Available from: <https://www.nia.nih.gov/newsroom/2016/03/worlds-older-population-grows-dramatically>.
- DOSM. Current Population Estimates, Malaysia, 2014-2016. Department of Statistics Malaysia; 2017 [cited 2017 15th May]. Available from: [https://www.dosm.gov.my/v1/index.php?r=column/cone&menu\\_id=Nk1JZnJBm1TdMRF50xaTXZnanIrQT09](https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=Nk1JZnJBm1TdMRF50xaTXZnanIrQT09)
- WHO. Falls Fact Sheet. 2016 [cited 2017 17th July 2017]; Available from: <http://www.who.int/mediacentre/factsheets/fs344/en/>.
- World Health Organization. WHO Global Report on Falls Prevention in Older Age. Geneva, Switzerland, 20085.
- Chu LW, Chi I, Chiu AY. Incidence and predictors of falls in the Chinese elderly. *Ann Acad Med Singapore* 2005; 34(1): 60-72.
- Chan KM, Pang WS, Ee CH, Ding YY, Choo P. Epidemiology of falls among the elderly community dwellers in Singapore. *Singapore Med J* 1997; 38(10): 427-31.
- Chang HT, Chen HC, Chou P. Factors associated with fear of falling among community-dwelling older adults in the Shih-Pai Study in Taiwan. *PLoS one* 2016; 11: e0150612.
- Chang NT, Yang NP, Chou P. Incidence, risk factors and consequences of falling injuries among the community-dwelling elderly in Shihpai, Taiwan. *Aging Clin Exp Res* 2010; 22(1): 70-7.
- Bergen G, Stevens MR, Burns ER. Falls and Fall Injuries Among Adults Aged ≥65 Years - United States, 2014. *MMWR Morbidity and mortality weekly report* 2016; 65: 993-8.
- Cesari M, Landi F, Torre S, Onder G, Lattanzio F, Bernabei R. Prevalence and risk factors for falls in an older community-dwelling population. *J Gerontol A Biol Sci Med Sci* 2002; 57(11): M722-6.
- Azidah AK, Hasniza H, Zunaina E. Prevalence of Falls and Its Associated Factors among Elderly Diabetes in a Tertiary Center, Malaysia. *Curr Gerontol Geriatr Res*. 2012; 2012:1-5.
- Sazlina SG, Rajam K, Shah SA, Zaiton A, Visvanathan R. Prevalence of falls among older people attending a primary care in Kuala Lumpur, Malaysia. *Journal of Community Health* 2008; 14(1); 11-16.
- Ghazi HF, Elnajeh M, Abdalqader MA, Baobaid MF, Rahimah Rosli NS, Syahiman N. The prevalence of falls and its associated factors among elderly living in old folks home in Kuala Lumpur, Malaysia. *International Journal of Community Medicine and Public Health* 2017; 4(10): 3524-9.
- Rubenstein LZ, Josephson KR, Robbins AS. Falls in the nursing home. *Ann Intern Med*. 1994; 121(6): 442-51.
- Dhargave P, Sendhilkumar R. Prevalence of risk factors for falls among elderly people living in long-term care homes. *J Clin Gerontol Geriatr* 2016; 7(3); 99-103.
- Meyer G, Kopke S, Haastert B, Muhlhauser I. Comparison of a fall risk assessment tool with nurses' judgement alone: a cluster-randomised controlled trial. *Age Ageing* 2009; 38(4); 417-23.
- Department SoM. Population Quick info. 2017 [cited 31st July 2017]; Available from: <http://pqi.stats.gov.my/result.php?token=4ef1b54b1dde2f95af2a89a2c80bc635>.
- Stata Statistical Software, Release 11. College Station, Tx: Stata Corporation; 2009.
- Mazharizad F, Dadipoor S, Madani A, Moradabadi AS. Investigating the prevalence and causes of events leading to falls among the elderly hospitalized in Bandar Abbas hospitals. *J Educ Health Promot* 2015; 4:11.
- Nandy S, Parsons S, Cryer C, Underwood M, Rashbrook E, Carter Y, et al. Development and preliminary examination of the predictive validity of the Falls Risk Assessment Tool (FRAT) for use in primary care. *J Public Health (Oxf)* 2004; 26(2): 138-43.

21. Hnizdo S, Archuleta RA, Taylor B, Kim SC. Validity and reliability of the modified John Hopkins Fall Risk Assessment Tool for elderly patients in home health care. *Geriatr Nursing* 2013; 34(5): 423-7.
22. Nyunt MS, Fones C, Niti M, Ng TP. Criterion-based validity and reliability of the Geriatric Depression Screening Scale (GDS-15) in a large validation sample of community-living Asian older adults. *Aging Ment Health* 2009; 13(3): 376-82.
23. Rubenstein LZ. Falls in older people: epidemiology, risk factors and strategies for prevention. *Age Ageing* 2006; 35(Suppl 2): ii37-ii41.
24. Izumi K, Makimoto K, Kato M, Hiramatsu T. Prospective study of fall risk assessment among institutionalized elderly in Japan. *Nurs Health Sci* 2002; 4(4): 141-7.
25. Kojima G, Kendrick D, Skelton DA, Morris RW, Gawler S, Iliffe S. Frailty predicts short-term incidence of future falls among British community-dwelling older people: a prospective cohort study nested within a randomised controlled trial. *BMC geriatrics*. 2015; 15: 155.
26. Roig M, Eng JJ, MacIntyre DL, Road JD, FitzGerald JM, Burns J, et al. Falls in people with chronic obstructive pulmonary disease: an observational cohort study. *Respir Med* 2011; 105(3): 461-9.
27. Quach LI, Burr JA. Arthritis, Depression, and Falls Among Community-Dwelling Older Adults: Evidence from the Health and Retirement Study. *J Appl Gerontol* 2016; 733464816646683: 1-17.
28. dos Reis KM, de Jesus CA. Cohort study of institutionalized elderly people: fall risk factors from the nursing diagnosis. *Rev Lat Am Enfermagem* 2015; 23(6): 1130-8.
29. Roig M, Eng JJ, Road JD, Reid WD. Falls in patients with chronic obstructive pulmonary disease: a call for further research. *Respir Med* 2009; 103(9): 1257-69.
30. Kojima R, Ukawa S, Ando M, Kawamura T, Wakai K, Tsushita K et al. Association between falls and depressive symptoms or visual impairment among Japanese young-old adults. *Geriatr Gerontol Int* 2016; 16(3): 384-91.
31. Biderman A, Cwikel J, Fried A, Galinsky D. Depression and falls among community dwelling elderly people: a search for common risk factors. *J Epidemiol Community Health* 2002; 56(8): 631-6.
32. Stalenhoef PA, Diederiks JP, Knottnerus JA, Kester AD, Crebolder HF. A risk model for the prediction of recurrent falls in community-dwelling elderly: A prospective cohort study. *J Clin Epidemiol* 2002; 55(11): 1088-94.
33. Hayley AC, Williams LJ, Kennedy GA, Holloway KL, Berk M, Brennan-Olsen SL et al. Excessive daytime sleepiness and falls among older men and women: cross-sectional examination of a population-based sample. *BMC Geriatr* 2015; 15: 74.
34. Darowski A, Chambers SA, Chambers DJ. Antidepressants and falls in the elderly. *Drugs Aging* 2015; 26(5): 381-94.
35. Iaboni A, Flint AJ. The Complex Interplay of Depression and Falls in Older Adults: A Clinical Review. *Am J Geriatr Psychiatry* 2013; 21(5): 484-92.
36. Sibley KM, Voth J, Munce SE, Straus SE, Jaglal SB. Chronic disease and falls in community-dwelling Canadians over 65 years old: a population-based study exploring associations with number and pattern of chronic conditions. *BMC Geriatr* 2014; 14: 22.
37. Byers AL, Sheeran T, Mlodzianowski AE, Meyers BS, Nassisi P, Bruce ML. Depression and Risk for Adverse Falls in Older Home Health Care Patients. *Res Gerontol Nurs* 2008; 1(4): 245-51.
38. Rodrigues IG, Fraga GP, Barros MB. Falls among the elderly: risk factors in a population-based study. *Rev Bras Epidemiol* 2014; 17(3): 705-18.