PUBLIC HEALTH RESEARCH

Nutritional and Non-Communicable Disease (NCD) Status Association with Fall among Older Persons in Malaysia: Findings from National Health and Morbidity Survey (NHMS) Malaysia 2018

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ABSTRACT

Introduction	Fall is a health problem for older persons. This study investigates the potential factors of concern: the nutritional status of older persons and non-communicable disease association with incidence of falls.
Methods	This study used data from NHMS 2018, and conducted a cross-sectional design by applying two-stage stratified cluster sampling. Descriptive statistics such as the percentage of each variable were done. Factors associated with falls were determined at both univariate and multivariable levels using simple logistic regression and multiple logistic regression. The data were presented as standard values for each analysis and adjusted odds ratios with 95% CI with p values (<0.05).
Results	A total of 3,867 from 3,977 elderly (mean age 68.2+ 6.85) were recruited with the response rate of 97.2%. Factors associated with fall were 70 years old and above (AOR= 1.34, 95% CI: 1.09, 1.64), obesity (AOR=1.55, 95% CI: 1.21, 1.98), undernutrition (AOR=1.59, 95% CI: 1.30, 1.94), persons with 2 NCDs (AOR=1.49, 95% CI: 1.15, 1.92) and persons with 3 NCDs (AOR=1.63, 95% CI: 1.23, 2.16).
Conclusions	Advanced age, malnutrition, obesity, and having two or more NCDs are associated with falls in the NHMS 2018 study. In conclusion, falls are prevalent among older persons. There is an urgent need for public health strategies and programmes to decrease the incidence of modifiable risk factors and early identification of those at risk. Implementation of fall preventive programs which includes multifactorial interventions at hospitals and homes can also significantly reduce incidence of falls among older persons.
Keywords	Fall, Older persons - Nutritional Status - NCD - National Health and Morbidity Survey (NHMS).

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INTRODUCTION

Fall is a health problem for older persons. A fall is defined as an event in which the individual comes to rest on the ground, floor or lower level.[1] It can also result in mortality and morbidity (1). Falls are the most common cause of injuries among older persons.[2] The most serious consequences of falls include hip fractures and intracranial injury.[3] Numerous studies revealed that fall could be accounted as an initial sign of weakness in physical, cognitive and disability of the muscle.[2, 3] These studies have identified falls and fall-related injuries as a strong predictor of admission to a long-term care (LTC) home and can further lead to mortality and morbidity among older persons.[2-6]

Based on Falls Prevention Baseline Surveys, New South Wales 2009, 25.6% of the older people had fallen in the last 12 months and out of this percentage, 61.2% had fallen once (6). 66.1% had an injury due to their fall, and out of this, 10.7% required hospitalization (6). The study conducted by Tanaka et al.[8] and Kioh et al.[9] linked obesity with falls among older persons. Fall significantly affects the quality of life.[9] Studies have shown that a fall can cause higher nursing home placement rates, expensive medical treatment, and loss of confidence leading to voluntary restriction of activities.[5] In the elderly, falls are the largest cause of injury, mortality, and functional decline, leading to 40% of nursing home admissions. Gale et al. showed that USD50 billion was spent on fatal and non-fatal falls among the elderly in the United States of America.[10] Generally, many complications arose from falls and significantly decreased the quality of life for older persons.

National Health and Morbidity Survey (NHMS) reported 15% of older persons experienced a fall in the previous 12 months. This report also showed that females, singles and those with no formal education had a higher prevalence of falls.[4] According to the report, 18.4% had a severe injury, and 16.0% were hospitalized.[5] Most falls occurred outdoor at 43.9%.[4] Surprisingly, nearly 30% of those who fell reported two or more falls.[4] Azidah et al. mentioned the association between diabetes and falls among older persons.[5]

There are also a few studies in Malaysia that looked into incidents of falls among older persons. Azidah et al. study showed age group more than 75 years old, gender female, retinopathy, low balance and gait score, and orthostatic hypotension as the main factors for fall among Malaysia older persons with diabetes.[5] Shaharudin et al. claimed that medical condition, mobility limitation, sensory deficit, age, female, history of stroke, poor balance and gait scores, medication, neuropathy and orthostatic hypotension among factors contributing to falls.[7]

There are a few studies available that investigate the nutritional status factors and non-communicable disease association impact on falls. This study investigates the potential association between nutritional status and non-communicable disease of the respondents with incidents of falls using the National Health and Morbidity Survey (NHMS). Tertiary clinics or hospitals can then use the study's outcome to improve patients' fall management.

METHODS

Sampling Design and Sample size

This study was part of the NHMS 2018: Older person Health,[4] a cross-national sectional survey that implemented a complex survey study design for 13 states and 3 federal territories in Malaysia. The National Population and Housing Census 2010 was used as the sampling frame for the study design. A stratified cluster sampling design was used to select the living quarters (LQs) with at least one of the households were older persons (60 years and above) and the respondents' staying period should be at least 2 weeks prior to the start of the data collection. The primary stratum constitutes the states and federal LQs selection, followed by the secondary stratum, which comprises urban and rural areas. The selected LQs with a total of 110 enumeration blocks (EB) (60 urban and 50 rural areas) were selected throughout the country. A total of 5,636 eligible LQs were randomly selected with a minimum sample size of 3,542 older persons required to represent the total older population. A detailed explanation of this section can be seen in the NHMS 2018 report.[4]

Data collection process

Prior to data collection, a pilot study was done in February 2018 involving 50 selected older persons, varied in education levels, ethnicities and gender. The data collectors' training commenced in June 2018 for house listing activities and July 2018 for interview and data collection. The training's main objectives were to familiarize the data collector teams with the questionnaire, develop their interpersonal skills, improve technique in reading the EB maps, and teamwork development. During the course, all the data collectors were also provided with a questionnaire and manual to ensure all the modules followed the standardized interview formats. Data collection was initiated from August 2018 until October 2018 through face-to-face interviews using tablets in all states and federal territories in Malaysia. Two data collectors will be assigned in 1 LQs per time to ensure the older persons' comfort during the interviewer. Data were sent to the server in Institute for Public Health for quality control and database management. A detailed explanation of this section can be seen in the NHMS 2018 report.[4]

Survey Instrument

A structured questionnaire via face-to-face

interview was used as well as anthropometric assessment. History of non-communicable diseases (diabetes mellitus, hypertension and hypercholesterolemia) and fall were captured based on respondent responses. Malnutrition status was defined using validated Mini Nutritional Assessment.[11] For anthropometric assessment, trained data collectors measured the weight and height using the Tanita Scale and stadiometer validated and calibrated. Calf and waist circumference were also done. The anthropometric assessment was done using reference from WHO.[12] Other sociodemographic variables were also being captured.

Statistical analysis

Data analysis was conducted using IBM SPSS for Windows, Version 21.0. Descriptive statistics such as the percentage of each variable were done. Factors associated with falls were determined at both univariate and multivariable levels using simple logistic regression and multiple logistic regression. Independent variables such as sociodemographic, non-communicable status, and history of fall were used in the model. The dependent or the outcome of the model will be recent fall status. Therefore, the outcome was a binary variable coded as "0" for no recent fall status and "1" for recent fall status among the older persons. Variable selection was made using the forward and backward stepwise logistic regression method. Interactions between the variables, multicollinearity, and multiple logistic regression requirements were done to ensure the final model was acceptable. The final model was presented with adjusted odds ratio (AOR) and 95% confidence interval (CI), Wald-statistics and p-value, with the significance level being set at a p-value of less than 0.05. The data were presented as standard values for each analysis and adjusted odds ratios with 95% CI with p values (<0.05), to ensure the model's quality. Incomplete data were excluded from the analysis. Questions not answered by the respondents were coded as missing values and were excluded from the analysis.

Ethical Approval and Consent Forms

The participants were provided with a bilingual consent form (Malay and English), which stated the survey's purpose and methods. Prior to that, the Medical Research and Ethics Committee, Ministry of Health Malaysia, approved the study protocol and ethics. This survey was registered at the National Medical Research Register (NMRR), bearing the number of NMRR-17-2655-39047 dated 18 January 2018 with approval extension dated 26 December 2019.

RESULTS

A total of 3,867 from 3,977 older persons (mean age 68.2+ 6.85) were recruited with a response rate of 97.2%. Among the older persons, 35.6% were aged 70 years and above while 64.4% were 60 to 69 years old. The number of respondents was slightly higher in rural areas (57.5%) and females (52.9%). Based on the anthropometric assessment, 16.7% were considered obese, 59.6% with abdominal obesity and 12.9% had muscle wasting. Among the older persons, 35.7% were categorized with malnutrition. History of non-communicable diseases among the older persons stated 25.7% had diabetes mellitus, 48.9% had hypertension and 60.3% had hypercholesterolemia. In terms of the non-communicable diseases (NCDs) cluster, 23.8% among older persons only had 1 NCDs diagnosis, following by 23.1% had 2 NCDs diagnosis and 15.5% had 3 NCDs diagnosis (Table 1).

Table 1 Descriptive analysis of variables among older persons

Variables		Percentage (%)
Age		
	60-69	64.4
	70 & above	35.6
Strata		
	Urban	42.5
	Rural	57.5
Gender		
	Male	47.1
	Female	52.9
Abdominal Obesity		
	Yes	59.6
	No	32.8
Obesity Status		
	Yes	16.7
	No	83.3
Wasting Status		
	Yes	12.9

No	87.1
Height Mean	
Less than 155 cm	46.8
155 cm and above	53.2
Underweight status	
Yes	35.7
No	64.3
Diabetes Mellitus	
Yes	25.7
No	74.3
Hypertension	
Yes	48.9
No	51.1
Hypercholesterolemia	
Yes	60.3
No	39.7
NCD Status	
No NCD	37.6
1 NCD	23.8
2 NCD	23.1
3 NCD	15.5
Fall History	
No fall	85.9
1 time	10.0
2 times and more	4.1

Older persons aged 70 years old and above were significantly associated with having a fall history (Table 2) with an AOR of 1.34 (95% CI: 1.09, 1.64). Older persons who were obese had 1.55 higher odds of having a fall history (95% CI: 1.21, 1.98). Older malnourished persons had 1.59 times higher odds of having a fall history (95% CI: 1.30, 1.94). Older persons with 2 NCDs diagnoses had 1.49 times higher odds of having a fall history (95% CI: 1.15, 1.92), while older persons who had 3 NCDs diagnoses had 1.63 times higher odds of falling history.

Table 2 Factors associated with fall

Variables	Crude OR (95% CI)	p-value	Adjusted OR (AOR) (95% CI) *	p-value
Age				
60-69	1	-	1	-
70 & above	1.39 (1.15, 1.66)	<0.001	1.34 (1.09, 1.64)	0.005
Strata				
Urban	1.08 (0.90, 1.29)	0.400	-	-
Rural	1	-	-	-
Gender				
Male	1	-	-	-
Female	1.10 (0.92, 1.31)	0.322	-	-
Abdominal Obesity				
No	1	-	1	-
Yes	1.14 (0.94, 140)	0.188	-	-
Obesity Status				
No	1	-	1	-
Yes	1.48 (1.17, 1.87)	0.001	1.55 (1.21, 1.98)	<0.001
Wasting Status				
No	1	-	-	-
Yes	1.02 (0.77, 1.35)	0.872	-	-
Malnutrition Status				
No	1	-	1	-
Yes	1.66 (1.38, 1.98)	<0.001	1.59 (1.30, 1.94)	<0.001
NCD Status				
No NCD	1	-	1	-

1 NCD	1.20 (0.94, 1.54)	0.141	-	-
2 NCD	1.53 (1.21, 1.94)	<0.001	1.49 (1.15, 1.92)	0.002
3 NCD	1.69 (1.30, 2.20)	<0.001	1.63 (1.23, 2.16)	0.001

**Forward & Backward LR applied. Hosmer & Lemeshow =0.586. Classification table =86.5. No interaction was detected. Multicollinearity was done and not detected. ROC = 0.61 (0.58, 0.63; p-value=<0.001). Only variables with p-value < 0.05 were appeared in the AOR.*

DISCUSSION

The main findings of the current study revealed that advanced age is a known risk factor for falls. Higher falls prevalence is reported among older persons aged 80 and older, reaching up to 50% of the population. It is known that the risk of falling increases with age. Our study showed that older persons more than 70 years of age have a higher risk of falling. Azidah et al.[5] and Huang et al.[2] found that the age group of more than 75 years of age reflected the highest percentage of falls compared to the other age groups, with 37.5% and 30.3% respectively. It is found that older persons are prone to falls largely due to the decline of physical, cognitive and affective capacities.[1]

According to Sadeghi et al. the elderly with BMI more than 30 kgm^2 are more likely to fall than older persons with normal BMI.[13] This coincides with our current study that supports evidence that older persons with higher BMI have a higher probability of falling than those who are not obese. Fjeldstad et al. study found that older adults with obesity have a lower quality of life which may be explained by the excessive weight that limits their mobility and the presence of multiple medical comorbidities that co-exist with obesity.[14] Previous studies have proposed that older adults with obesity have a higher probability of falling than older adults who have a normal BMI.[15]

Our present study found a significant association between the presence of multiple NCDs and falls. Studies done by Damian et al. and Sibley et al., showed the prevalence of falling increased in an individual with comorbidities compared to no comorbidities.[16,17] Azidah et al. found that older persons with diabetes and hypertension had a higher risk of falling.[5] The prevalence of falls increases with an increased number of chronic diseases, and chronic diseases are a significant predictor in older persons.[5] Through direct and indirect effects such as reduced physical activity, muscle weakness, and balance impairment, the diseases caused an increased risk of falls.[16,17] Generally, previous studies have found that older persons with one or several diseases are significantly more at risk of falls.[3]

One in four adults admitted to a hospital are malnourished.[18] Insufficient absorption of nutrients in older persons is expected, which causes malnutrition and mostly remains undiagnosed.[18] Components of malnutrition, including but not limited to anaemia, clinically significant weight loss, and vitamin D deficiency, maybe unknown interactive risk factors that increase the risk of hospital falls.[19] Malnutrition and dehydration symptoms include fatigue, dizziness, irritability, loss of muscle mass, impulsivity, and the potential for poor judgment.[19, 20] Therefore, it is likely that the severity of specific malnutrition parameters is associated with recurrent falls and possibly injurious falls.[3, 21] Our study found a significant association between malnutrition status and incidence of fall. No significant association was found for strata, gender, abdominal obesity, and wasting status, even though the literature review suggested the association between these parameters with the likelihood of fall among the elderly.[1, 2, 5, 21, 22]

This study's limitations were that it did not take into account the other main factors of fall which is muscle strength (hand grip), multiple use of certain medications, visual impairment and orthostatic hypotension. This study's biggest strength is that it has the advantage of having a large sample size and was a population-based study.

CONCLUSIONS

Falls are prevalent among the older persons. There is an urgent need for public health strategies to decrease the incidence and early identification of those at risk. Advanced age, malnutrition, obesity, and having NCD are associated with falls in the NHMS 2018 study. Intervention studies of weight reduction in terms of fall outcome are recommended for obese older persons. Adequate nutrition provision, monitoring of chronic diseases by both older persons and caretaker should be considered for prevention of fall. Implementation of fall preventive programs can also significantly reduce falls among older persons. Future research or studies on multiple risk factor interventions should be considered to reduce falls among older persons.

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Competing interests

These authors declare that there is no conflict of interest in any form. There is no conflict of interest with the funder; no influence in the design, data collection, data analysis or manuscript writing.

Consent for publication
Not applicable

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