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Primary Subject Heading:	Geriatric medicine
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Keywords:	Falls, Prevalence, Elderly, Ethnic differences

TITLE

Ethnic Differences in Falls Prevalence in Urban-Dwellers Aged 55 Years and Over in the Malaysian Elders Longitudinal Research (MELoR) Study

AUTHORS

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ABSTRACT

Objectives: Falls represent major health issues within the older population. In low- and middle-income Asian countries, falls in older adults remain an area which has yet to be studied in detail. Using data from the Malaysian Elders Longitudinal research (MELoR), we have estimated the prevalence of falls among older persons in an urban population, and performed ethnic comparisons on the prevalence of falls.

Design: Cross-sectional analysis

Setting: Urban community-dwellers in a middle-income South East Asian country

Participants: Participants aged 55 years and over were selected by simple random sampling from the electoral rolls of three parliamentary constituencies.

Interventions: Consenting participants from the MELoR study were asked the question 'Have you fallen down in the past 12 months?' during their computer assisted home-based interviews. Logistic regression analyses were conducted to compare the prevalence of falls among various ethnic groups.

Results: The overall estimated prevalence of falls for individuals aged 55 years and over adjusted to the population of Kuala Lumpur was 18.9%. The estimated prevalence of falls for the three ethnic populations of Malays, Chinese and Indians aged 55 years and over were: 16.2%, 19.4% and 23.8%, respectively. Following adjustment for ethnic discrepancies in age, gender, marital status and education attainment, the Indian ethnicity remained an independent predictor of falls in our population (odds ratio = 1.63, 95% confidence interval = 1.20 to 2.21).

Conclusion: The prevalence of falls in this study is comparable to other previous Asian studies, but appears lower than in Western studies. The predisposition of the Indian ethnic group to falls

has not been previously reported. Further studies will be needed to elucidate the reasons underlying the ethnic differences in fall prevalence.

Keywords

Falls, Prevalence, Elderly, Ethnic differences

Strengths and Limitations

1. This was the first study to measure the prevalence of falls in urban community dwelling older people in Malaysia.
2. Ethnic differences in fall prevalence have not been previously reported.
3. Our study was conducted in an urban area which may not be representative of the national population.
4. The reasons for differences in fall risk among different ethnic groups is a topic for future studies.

INTRODUCTION

Falls are common among older people and are major causes of morbidity, mortality and reduced quality of life. The consequences of falls include intracranial haemorrhage, limb fractures, loss of confidence and institutionalization, which represent major public health issues.[1] A 10-year prospective study of individuals presenting with falls to the emergency department revealed that falls are associated with increased dependency and a high mortality rate.[2] The financial burden associated with falls directly related to health care services and indirectly related to loss of social productivity is high.[3] The cost of falls will increase with global population ageing unless effective strategies are developed to reduce their burden.

The prevalence of falls has been reported as 28% to 35% in the ≥ 65 year age group[4,5] and 32% to 42% in the ≥75 year age group.[6,7] It remains unclear whether falls prevalence differ according to geographical regions as many Asian studies have reported a lower prevalence of falls compared to North American, European and Australian studies.[8,3] The differences in prevalence measured in different studies may be due to differences in study design and sample populations. Furthermore, it is unclear whether cultural differences may lead to different falls risk.

Malaysia is a multiethnic nation with the three major Asian ethnic groups: Malays (67.4%), Chinese (24.6%), and Indians (7.3%).[9] We have, therefore, determined the prevalence of falls for the overall population as well as according to ethnic groups in an urban area in Malaysia.

METHODS

Study Population

This cross-sectional study included participants from the Malaysian Elders Longitudinal Research (MELoR) study. The MELoR study is a longitudinal cohort study based in Kuala Lumpur and its surrounding suburbs (Klang Valley). Individuals aged 55 years and above were selected through simple random sampling from the electoral rolls of the Parliamentary constituencies of Petaling Jaya North, Petaling Jaya South, and Lembah Pantai, stratified by the three ethnic groups and by 5-year age groups. This study was approved by the University of Malaya Medical Centre Medical Ethics Committee (Ref: 925.4) and complied with the Helsinki Declaration of 1975, revised in 1983. Written informed consent was obtained from all study participants prior to their inclusion. The inclusion criteria were individuals aged 55 years and above, who were able to provide informed consent, and belonging to one of the three major ethnic groups of Malays, Chinese or Indians.

Data collection

Participants were contacted and visited at their own homes initially to recruit them into the study. A structured interview using a computer-aided questionnaire was completed during this encounter. Participants were then requested to attend the hospital for a detailed health check. Information on basic demographics (including age, sex, and ethnicity) were collected during the initial home visit. At this home visit, participants were asked the following question, 'Have you fallen in the past 12 months?' with answer categories: 1- 'No', 2- 'Yes'. A fall was defined as "unintentionally coming to rest on ground, floor, or lower level".[10]

Statistical analysis

Data analyses were conducted using SPSS Version 23 (IBM, Armonk, NY, USA). Descriptive statistics were first obtained. We categorized the participants into five year age bands: 55-59, 60-64, 65-69, 70-74, and ≥75 years. The crude prevalence of falls was estimated by age groups and ethnicity. As the sample was stratified to allow for equal representation of the three ethnic groups and the different age groups in the cohort study, weighted data analysis was necessary in order to estimate prevalence for the local population. Sample weights were calculated by ethnicity and 5-year age groups using population statistics published by the Department of Statistics, Malaysia, obtained from the 2010 population census.[9] Binary logistic regression was carried out to compare prevalence of falls between the ethnic groups using the Malay ethnicity as the reference group. Multiple logistic regression was then performed with the factors age, gender, partner status, and education to eliminate potential confounding effects.

RESULTS

Data on falls was available in 1565 individuals, 519 were ethnic Malays, 544 ethnic Chinese and 502 ethnic Indians. Table 1 shows the socio-demographic characteristics of the sample population according to ethnicity. There were significant differences in age, marital status, education and smoking status according to ethnicity.

Table 1. Basic Characteristics according to Ethnicity

	Total (n=1565)	Malay (n=519)	Chinese (n=544)	Indian (n=502)	p-value
Age (yrs), mean ± SD	68.9 ± 7.5	67.8 ± 7.1	69.4 ± 7.4	69.5 ± 7.9	<0.001
Age Categories (years), n(%)					0.015
55-59	189 (12.1)	72 (13.9)	52 (9.6)	65 (12.9)	
60-64	325 (20.8)	126 (24.3)	111 (20.4)	88 (17.5)	
65-69	361 (23.1)	117 (22.5)	133 (24.4)	111 (22.1)	
70-74	364 (23.3)	118 (22.7)	131 (24.1)	115 (22.9)	
≥75	326 (20.8)	86 (16.6)	117 (21.5)	123 (24.5)	
Female Gender, n (%)	892 (57.0)	282 (54.3)	331 (60.8)	279 (55.6)	0.074
Single/Widowed, n (%)	414 (26.5)	127 (24.5)	121 (22.2)	166 (33.2)	<0.001
Secondary/Tertiary Education, n (%)	1133 (72.4)	298 (57.6)	447 (82.2)	388 (77.3)	<0.001
Smoker, n (%)	309 (19.7)	133 (26.1)	90 (16.9)	86 (17.6)	<0.001

Prevalence of Falls

The crude prevalence for the overall population aged 55 years and over was 22.8%, and for those aged 65 years and over was 24.5%. The crude prevalence of falls among the ethnic Malays aged 55 years and over was 18.9% compared to the ethnic Chinese at 22.4% and the ethnic Indians at 27.3%. The crude prevalence of falls according to age groups and ethnic groups are shown in Table 2. Weighted prevalence was then estimated according to the population composition of Kuala Lumpur. The estimated true prevalence of falls for all ethnic Malays aged 55 years and over was 16.2%, Chinese 19.4% and Indians 23.8%. The prevalence of falls increased with age for the overall population and all three ethnic groups (Figure 1). The overall prevalence of falls weighted for the population of Kuala Lumpur aged 55 years and over was 18.9%. The weighted prevalence of falls for individuals aged 65 years and over was 23.5%.

Table 2. Crude prevalence of falls according to age group and ethnicity

Age Group (Years)	Falls, n (%)*			
	Overall	Malay	Chinese	Indian
55-59	30 (15.8)	9 (12.5)	8 (15.4)	13 (20.0)
60-64	69 (21.2)	23 (18.2)	24 (21.6)	22 (25.0)
65-69	76 (21.0)	18 (15.4)	31 (23.3)	27 (24.3)
70-74	77 (21.1)	28 (23.7)	21 (16.0)	28 (24.3)
75+	105 (32.2)	20 (23.3)	38 (32.5)	47 (38.2)

*Crude prevalence is presented in as percentages parenthesis

Ethnic Differences in Fall Prevalence

Table 3 shows the results of the binary and multiple logistic regression analyses. Compared to the ethnic Malays, the ethnic Indians were significantly more likely to fall in unadjusted analysis (p = 0.001). After adjustment for age and gender and further adjustment for marital status and educational level, the ethnic Indians remains statistically more likely to report at least one fall in the preceding year compared to the ethnic Malays.

Table 3. Univariate and Multiple Logistic Regression for Ethnic Differences

		Falls		
		B	Odds Ratio	95% Confidence Interval
Model 1	Ethnicity			
	Malay (reference)			
	Chinese	0.217	1.24	0.92-1.67
	Indian	0.478	*1.61*	*1.20-2.16*
	Constant	-1.46	.233	
Model 2	Ethnicity			
	Malay (reference)			
	Chinese	0.133	1.14	0.84-1.54
	Indian	0.419	*1.52*	*1.13-2.05*
	Age*	0.037	*1.04*	*1.02-1.05*
	Female Gender	0.394	*1.48*	*1.15-1.90*
	Constant	-4.175	.015	
Model 3	Ethnicity			
	Malay (reference)			
	Chinese	.220	1.24	0.91-1.70
	Indian	.488	*1.63*	*1.20-2.21*
	Age*	.035	*1.04*	*1.01-1.05*
	Female Gender	.336	*1.39*	*1.07-1.82*

	Single/Widowed	.056	1.06	0.79-1.40
	Secondary/Tertiary Education	.327	*1.39*	*1.06-1.82*
	Constant	-4.155	.016	

*per year increase

DISCUSSION

The overall prevalence of falls among adults aged 55 years and over residing in Kuala Lumpur was 18.9%, and for those aged 65 years and over was 23.5%. There was an increase in fall prevalence with older age. Among the ethnic groups, the Indian ethnicity was associated with a higher prevalence of falls compared to Malay ethnicity. Our study was the first to report the prevalence of falls in the urban population in Malaysia and the first to demonstrate increased risk of falls in ethnic Indians in an Asian population.

Previous studies have shown that the proportion of falls in those aged 65 years and above varied between 28% to 35% per year.[11] The falls prevalence reported in our urban population was comparatively lower than that reported by previous studies performed in the United Kingdom and the United States of America.[3] The prevalence of falls has been observed to vary widely in different parts of the world. Studies from the Caribbean and Latin America reported fall rates from 21.6% to 34%.[12] Falls prevalence in the Australian population was reported as 30%.[13] A recent report from the Irish Longitudinal Study of Ageing involving individuals aged 50 years and over, reported a prevalence of 19.2%.[14] A systematic review of 21 studies from 21 Asian countries on falls found that the fall prevalence varied between 14.7% to 34% in the older Chinese population,[8] which was comparable to our Chinese population.

Age is a well-established risk factor for falls.[15] In our study, with each year's increase in age, the risk of falls increases by 4%, and with the overall prevalence of falls increasing to 32%

in the overall population aged 75 years and above. Similarly, a study of 3000 older people from Singapore reported that there is an 80% higher risk of falls in those aged over 75 years.[16] In the Irish Longitudinal Study of Ageing, the prevalence of falls for those aged 75 years and above was 24.4%.[14] Within our cohort, falls rates were similar in the 60 to 74 year age groups, and only increased in the over 75s, overall. However, the increase in falls rate appeared to occur earlier among the ethnic Malays, at the 70 to 74 year age bracket, compared to over 75 years for the ethnic Chinese and Indians.

Ethnic differences have been studied in the American population where it was reported that African–Americans were less likely to fall than whites, but these differences were influenced by potential confounders.[17] Similar findings were reported in another study from the United States, among older community-dwelling Caucasian and Afro-American women.[18]A study from Singapore showed that ethnic Malays had a significantly higher likelihood of falls compared to the Singaporean Chinese.[16] In contrast, our study found no significant difference in falls prevalence between the ethnic Chinese and Malays. The proportion of ethnic Malays, however, only comprised 8% of the overall population in the previous study.[16] The differences between Singaporean Malays and Malaysian Malays are of interest, and may be explained by differences in occupation, physical activity or social structure. This study was the first to report increased risk of falls in ethnic Indians in comparison to the ethnic Malays. Our study was not able to establish any underlying rationale for the ethnic differences, which would be a subject for future research.

The presence of falls in the preceding year was determined by retrospective recall. Previous reports have suggested that retrospective falls recall may be inaccurate as older adults have a tendency to forget they had fallen.[19] However, the ability to conduct prospective

recording using falls diaries in population-based studies is technically challenging. This study was carried out in an urban area, hence it may not be representative of the rural or semi-urban regions of Malaysia. Further studies will be needed to identify the aetiology underlying ethnic differences in fall rates, as well as to determine whether these differences still exist in prospective studies.

CONCLUSION

The estimated prevalence of falls among individuals aged 55 years and older in an urban area in Malaysia was 18.9%. Among the different ethnic groups in the study, the prevalence of falls was significantly higher among ethnic Indians compared to the ethnic Malays. Future studies should now seek to identify factors determining the ethnic differences in falls risk.

CONTRIBUTORSHIP STATEMENT

AVC, NNH, SO, SK, SBK, MPT conceived the study, contributed to study design, obtained the funding for the study, and were responsible to the conduct of the study. HMK, was involved in data collection. DA, HMK and MPT contributed to data analysis. All authors contributed toward the writing of the manuscript and approved the final submitted version.

COMPETING INTERESTS

None declared

FUNDING

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DATA SHARING STATEMENT

Due to concerns about loss of fidelity of personally identifiable data, the MELoR dataset is currently not available publicly. However, parts of the dataset will be released anonymised through written requests submitted to the corresponding author.

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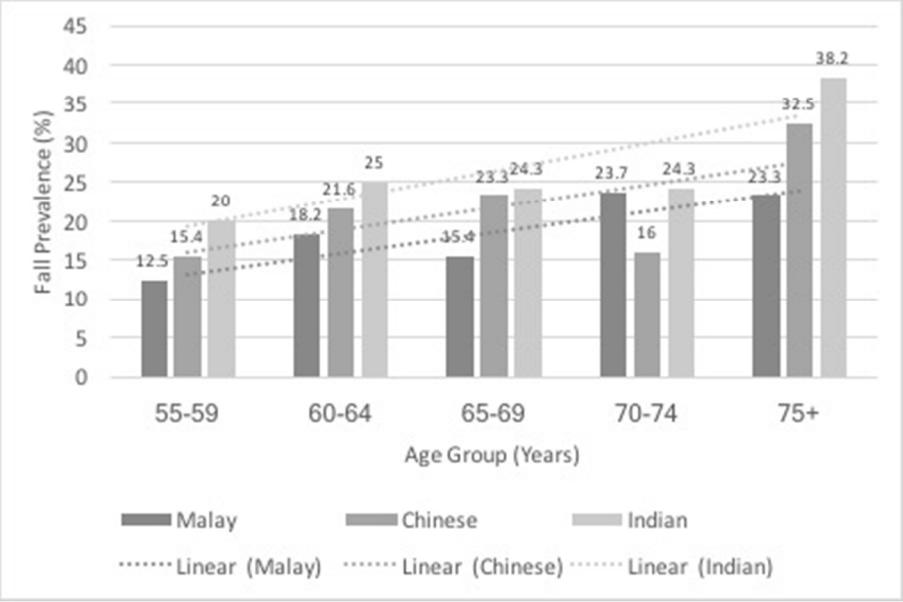
FIGURE LEGEND

Figure1. Crude Fall prevalence according to age groups and ethnicity



Crude Fall prevalence according to age groups and ethnicity

159x105mm (72 x 72 DPI)

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ABSTRACT

Objectives: Falls represent major health issues within the older population. In low- and middle-income Asian countries, falls in older adults remain an area which has yet to be studied in detail. Using data from the Malaysian Elders Longitudinal research (MELoR), we have estimated the prevalence of falls among older persons in an urban population, and performed ethnic comparisons in the prevalence of falls.

Design: Cross-sectional analysis was carried out using the first wave of data from MELoR which is a longitudinal study.

Setting: Urban community-dwellers in a middle-income South East Asian country

Participants: 1565 Participants aged ≥55 years were selected by simple random sampling from the electoral rolls of 3 parliamentary constituencies.

Interventions: Consenting participants from the MELoR study were asked the question 'Have you fallen down in the past 12 months?' during their computer assisted home- based interviews. Logistic regression analyses were conducted to compare the prevalence of falls among various ethnic groups.

Results: The overall estimated prevalence of falls for individuals aged 55 years and over adjusted to the population of Kuala Lumpur was 18.9%. The estimated prevalence of falls for the three ethnic populations of Malays, Chinese and Indian aged 55 years and over were: 16.2%, 19.4% and 23.8% respectively. Following adjustment for ethnic discrepancies in age, gender, marital status and education attainment, the Indian ethnicity remained an independent predictor of falls in our population (odds ratio= 1.63, 95% confidence interval=1.20 to 2.21).

Conclusion: The prevalence of falls in this study is comparable to other previous Asian studies, but appears lower than Western studies. The predisposition of the Indian ethnic group to falls,

has not been previously reported. Further studies may be needed to elucidate the causes for the ethnic differences in fall prevalence.

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Strengths and Limitation

1. This is the first study to look at prevalence of falls in urban community dwelling older people in Malaysia.
2. Ethnic differences in fall prevalence have not been previously reported.
3. Our study was conducted in an urban area which may not be representative of the national population.
4. The reasons for differences in fall risk among different ethnic groups is a topic for future studies.
5. We have examined the prevalence of falls in the preceding 12 months by retrospective recall, which is now the commonly employed method to measure falls. However, validity is difficult to determine.

INTRODUCTION

Falls are common among older people and is a major cause for morbidity, mortality and reduced quality of life. The consequences of a fall include traumatic brain injuries, limb fractures, loss of confidence and institutionalization, which represent major public health issues.[1,2] A 10-year prospective study of individuals presenting with falls to the emergency department revealed that falls are associated with increased dependency and a high mortality rate.[3] The financial burden associated with falls directly related to health care services and indirectly as loss of social productivity is high.[4] The cost of falls will increase with global population ageing unless effective strategies are developed to reduce their burden.

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METHODS

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Data collection

Participants were contacted and visited at their own homes initially to recruit them into the study. A structured interview using a computer aided questionnaire was completed during this encounter. Participants were then requested to attend the hospital for a detailed health check. Information on basic demographics (including age, sex, and ethnicity) were collected during the initiate home visit. At this home visit, participants were asked the following question, 'Have you fallen in the past 12 months with answer categories: 1- 'No', 2- 'Yes'. A fall was defined as "unintentionally coming to rest on ground, floor, or lower level".[13]

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Data analyses were conducted using SPSS Version 23 (IBM, Armonk, NY, USA). Descriptive statistics were used for analysis. We categorized the participants into five year age bands: 55-59, 60-64, 65-69, 70-74, and ≥75 years. The crude prevalence of falls was estimated by age groups and ethnicity. As the sample was stratified to allow for equal representation of the three ethnic groups and the different age groups in the cohort study, weighted data analysis was necessary in order to estimate prevalence for the local population. Sample weights were calculated by ethnicity and 5 year age group using population statistics published by the Department of Statistics, Malaysia, obtained from the 2010 population census.[11] Binary logistic regression was carried out to compare prevalence of falls among the ethnic groups using the Malay ethnicity as the reference group. Multiple logistic regression was then performed with the factors age, gender, partner status, and education to eliminate potential confounding effects.

RESULTS

	Total (n=1565)	Malay (n=519)	Chinese (n=544)	Indian (n=502)	p-value

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Female Gender, n (%)	892 (57.0)	282 (54.3)	331 (60.8)	279 (55.6)	0.074
Single/Widowed, n (%)	414 (26.5)	127 (24.5)	121 (22.2)	166 (33.2)	<0.001
Secondary/Tertiary Education, n (%)	1133 (72.4)	298 (57.6)	447 (82.2)	388 (77.3)	<0.001
Smoker, n (%)	309 (19.7)	133 (26.1)	90 (16.9)	86 (17.6)	<0.001

Prevalence of Falls

The crude prevalence for the overall population aged 55 years and over was 22.8%, and for those aged 65 years and over was 24.5%. The crude prevalence of falls among the ethnic Malays aged 55 years and over was 18.9% compared to the ethnic Chinese at 22.4% and the Ethnic Indians at 27.3%. The crude prevalence of falls according to age groups and ethnic groups are shown in Table 2. Weighted prevalence was then estimated according to the population composition of

Kuala Lumpur. The estimated true prevalence of falls for all ethnic Malays aged 55 years and over was 16.2%, Chinese 19.4% and Indians 23.8%. The prevalence of falls increased with age for the overall population and all three ethnic groups The overall prevalence of falls weighted for the population of Kuala Lumpur aged 55 years and over was 18.9%. The weighted prevalence of falls for individuals aged 65 years and over was 23.5%.

Table 2. Crude prevalence of falls according to age group and ethnicity

Age Group (Years)	Falls, n (%)*			
	Overall	Malay	Chinese	Indian
55-59	30, (15.8)	9, (12.5)	8, (15.4)	13, (20.0)
60-64	69, (21.2)	23, (18.2)	24, (21.6)	22, (25.0)
65-69	76, (21.0)	18, (15.4)	31, (23.3)	27, (24.3)
70-74	77, (21.1)	28, (23.7)	21, (16.0)	28, (24.3)
75+	105, (32.2)	20, (23.3)	38, (32.5)	47, (38.2)

*Crude prevalence is presented in as percentages parenthesis

Ethnic Differences in Fall Prevalence

Table 3 shows the results of the binary and multiple logistic regression analyses. Compared to the ethnic Malays, the ethnic Indians were significantly more likely to fall in unadjusted analysis (p=0.001). After adjustment for age and gender and further adjustment for marital status and educational level, the ethnic Indians remains statistically more likely to report at least one fall in the preceding year compared to the ethnic Malays.

Table 3. Univariate and Multiple Logistic Regression for Ethnic Differences

		Falls			
		B	p-value	Odds Ratio	95% Confidence Interval
Model 1	Ethnicity				
	Malay (reference)				
	Chinese	0.217	.154	1.24	0.92-1.67
	Indian	0.478	*.001*	*1.61*	*1.20-2.16*
	Constant	-1.46	.000	.233	
Model 2	Ethnicity				
	Malay (reference)				
	Chinese	.133	.390	1.14	0.84-1.54
	Indian	.419	*.006*	*1.52*	*1.13-2.05*
	Age*	.037	*.000*	*1.04*	*1.02-1.05*
	Female Gender	.394	*.002*	*1.48*	*1.15-1.90*
	Constant	-4.175	.000	.015	
Model 3	Ethnicity				
	Malay (reference)				
	Chinese	.220	.168	1.24	0.91-1.70
	Indian	.488	*.002*	*1.63*	*1.20-2.21*
	Age*	.035	*.000*	*1.04*	*1.01-1.05*
	Female Gender	.336	*.013*	*1.39*	*1.07-1.82*
	Single/Widowed	.056	.696	1.06	0.79-1.40
	Secondary/Tertiary Education	.327	*.018*	*1.39*	*1.06-1.82*

	Constant	-4.155	.000	.016	

*per year increase

DISCUSSION

The Population adjusted prevalence of falls among adults aged 55 years and over residing in Kuala Lumpur was 18.9%, and for those aged 65 years and over was 23.5%. There was an increase in fall prevalence with older age. Among the ethnic groups, the Indian ethnicity were found to have a higher prevalence of falls when compared to the ethnic Malays. Our study was the first to report the prevalence of falls in the urban population in Malaysia and the first to demonstrate increased risk of falls in ethnic Indians in an Asian population.

Previous studies showed that the proportion of falls in aged 65 years and above varied between 18% to 28% peryear.[7,14] The falls prevalence reported in our urban population was comparatively lower than that reported by previous studies performed in the United Kingdom and United States of America.[4] The prevalence of falls has been observed to vary widely in different parts of the world. Studies from the Caribbean and Latin Americans also reported higher fall rates from 21.6% -34%.[15] Falls prevalence in the Australian population was reported as 30%.[16] A recent report from the Irish Longitudinal Study of Ageing involving individuals aged 50 years and over, reported a prevalence of 19.2%.[17] A systematic review of 21 studies from Asian countries on falls found that the fall prevalence varied between 14.7-34% in older Chinese population,[9] which was comparable to our Chinese population.

Age is a well-established risk factor for falls.[14] In our study, with each year's increase in age, the odds of falls increases by 4%, and with the overall prevalence of falls increasing to 32% in the overall population aged 75 years and above. A study from Hong Kong showed that advanced age

was associated with greater prevalence and incidence of falls.[18]. The prevalence of falls was observed to increase from 24% to 37% for those above the age of 80 years when compared to those in their sixties.[7] Within our cohort, falls rates were similar in the 60-74 year age groups, and only increased in the over 75s, overall. However, the increase in falls rate appears to occur earlier among the ethnic Malays, at 70 to 74 year age bracket, compared to over 75 years for the ethnic Chinese and Indians.

Ethnic differences have been studied in the American population where it was reported that African–Americans were less likely to fall than whites, but these differences were influenced by potential confounders.[19] Similar findings were reported in another study from the United States, among older community-dwelling Caucasian and Afro-American women.[20] A study from Singapore showed that ethnic Malays had a significantly higher likelihood of falls compared to the Singaporean Chinese.[21] In contrast, our study found no significant difference in falls prevalence between the ethnic Chinese and Malays. The proportion of ethnic Malays, however, only comprised 8% of the overall population in the previous study.[21] The differences between Singaporean Malays and Malaysian Malays are of interest, and may be explained by differences in occupation, physical activity or social structure. This study was the first to report increased risk of falls in ethnic Indians in comparison to the ethnic Malays. Our study was, however, not able to establish any underlying rationale for the ethnic differences, which would be a subject for future research.

The presence of falls in the preceding year was determined by retrospective recall. Previous reports have suggested that retrospective falls recall may not be fully accurate as older adults

have a tendency to forget they had fallen, depending on various factors such as recall interval, injury associated fall and their cognitive status[22] A systematic review of methods of measuring falls in randomized control fall prevention trials found that there was a substantial lack of standardization in the use of terminology and documentation methods of falls. The study looked at 90 publications out of which 27% used retrospective reporting methods like telephone interview, face to face interview and postal questionnaires while 42% used prospective reporting methods like calendars and diaries, of which the latter was recommended.[23] However, the ability to conduct prospective recording using falls diaries in population-based studies would be technically challenging with many of our older persons having problems with documenting their falls properly. Another study which examined reliability of patients own reports of falls found that the question 'Did you fall' had a sensitivity of 91.5% and a specificity and positive predictive value of 100% as a tool in the A&E setting.[24] This study was carried out in an urban area, hence it may not be representative of the rural or semi-urban regions of Malaysia. Further studies will be needed to identify the etiology underlying ethnic differences in fall prevalence, as well as determine whether these differences still exist in prospective studies.

CONCLUSION

The estimated prevalence of falls among individuals aged 55 years and older in an urban area in Malaysia was 18.9%. Among the different ethnic groups in the study, the prevalence of falls was significantly higher among ethnic Indians compared to the ethnic Malays. Future studies should now seek to identify factors determining the ethnic differences in falls risk.

CONTRIBUTORSHIP STATEMENT

AVC, NNH, SO, SK, SBK, MPT conceived the study, contributed to study design, obtained the funding for the study, and were responsible to the conduct of the study. HMK, was involved in data collection. DA, HMK and MPT contributed to data analysis. All authors contributed toward the writing of the manuscript and approved the final submitted version.

COMPETING INTERESTS

None declared

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DATA SHARING STATEMENT

Due to concerns about loss of fidelity of personally identifiable data, the MELoR dataset is currently not available publicly. However, parts of the dataset will be released anonymised through written requests submitted to the corresponding author.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			8

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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A Cross-sectional Analysis of Ethnic Differences in Falls Prevalence in Urban-Dwellers Aged 55 Years and Over in the Malaysian Elders Longitudinal Research Study

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Keywords:	Falls, Prevalence, Elderly, Ethnic differences

TITLE

A Cross-sectional Analysis of Ethnic Differences in Falls Prevalence in Urban-Dwellers Aged 55 Years and Over in the Malaysian Elders Longitudinal Research Study

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ABSTRACT

Objectives: Falls represent major health issues within the older population. In low- and middle-income Asian countries, falls in older adults remain an area which has yet to be studied in detail. Using data from the Malaysian Elders Longitudinal research (MELoR), we have estimated the prevalence of falls among older persons in an urban population, and performed ethnic comparisons in the prevalence of falls.

Design: Cross-sectional analysis was carried out using the first wave of data from MELoR which is a longitudinal study.

Setting: Urban community-dwellers in a middle-income South East Asian country

Participants: 1565 Participants aged ≥55 years were selected by simple random sampling from the electoral rolls of 3 parliamentary constituencies.

Interventions: Consenting participants from the MELoR study were asked the question 'Have you fallen down in the past 12 months?' during their computer assisted home- based interviews. Logistic regression analyses were conducted to compare the prevalence of falls among various ethnic groups.

Results: The overall estimated prevalence of falls for individuals aged 55 years and over adjusted to the population of Kuala Lumpur was 18.9%. The estimated prevalence of falls for the three ethnic populations of Malays, Chinese and Indian aged 55 years and over were: 16.2%, 19.4% and 23.8% respectively. Following adjustment for ethnic discrepancies in age, gender, marital status and education attainment, the Indian ethnicity remained an independent predictor of falls in our population (odds ratio= 1.63, 95% confidence interval=1.20 to 2.21).

Conclusion: The prevalence of falls in this study is comparable to other previous Asian studies, but appears lower than Western studies. The predisposition of the Indian ethnic group to falls,

has not been previously reported. Further studies may be needed to elucidate the causes for the ethnic differences in fall prevalence.

Keywords

Falls, Prevalence, Elderly, Ethnic differences

Strengths and Limitation

1. This is the first study to look at prevalence of falls in urban community dwelling older people in Malaysia.
2. Ethnic differences in fall prevalence have not been previously reported in Malaysia.
3. Our study was conducted in an urban area which may not be representative of the national population.
4. The reasons for differences in fall prevalence among different ethnic groups is a topic for future studies.
5. We have examined the prevalence of falls in the preceding 12 months by retrospective recall, which is now the commonly employed method to measure falls. However, validity is difficult to determine.

INTRODUCTION

Falls are common among older people and is a major cause for morbidity, mortality and reduced quality of life. The consequences of a fall include traumatic brain injuries, limb fractures, loss of confidence and institutionalization, which represent major public health issues.[1,2] A 10-year prospective study of individuals presenting with falls to the emergency department revealed that falls are associated with increased dependency and a high mortality rate.[3] The financial burden associated with falls directly related to health care services and indirectly as loss of social productivity is high.[4] The cost of falls will increase with global population ageing unless effective strategies are developed to reduce their burden.

The prevalence of falls has been reported as 19% to 26% in the ≥ 65 year age group[5,6] and 27% to 32% in the ≥70 year age group.[7,8] It remains unclear whether falls prevalence differ according to geographical regions as many Asian studies have reported a lower prevalence of falls compared to North American, European and Australian studies.[9,4,10] The differences in prevalence measured in different studies may be due to differences of study design and sample populations. A handful of studies have reported ethnic and racial differences in fall prevalence.[11,12] Older Asians have been reported to have lower fall rates when compared to Whites residing in the same region.[13,14] These ethnic differences may be due to varying reasons which include cultural, behavioural or health related factors. A study conducted among older U.S women reported lower fall prevalence but more self-reported mobility limitations among Asian women, suggesting that they may be limiting their activities based on their self-perceived limitations, hence leading to a lower fall risk.[15] Cultural factors such as differences in levels of concerns about the individual's health, engaging in regular physical activities such as Yoga or Tai-Chi may also play a role in affecting fall prevalence.[16] The determination of whether ethnic

differences in fall prevalence exist in various geographical regions, will help identify whether genetic and cultural factors may also contribute to fall risk. In addition, as the vast majority of published studies on fall prevention measures have been conducted in Caucasian populations, degree of which existing published evidence may be translated to other ethnic groups and geographical locations will also be determined by potential ethnic differences in falls.

Malaysia is a multiethnic nation with the three major Asian ethnic groups: Malays (67.4%), Chinese (24.6%), and Indians (7.3%).[17] The sizeable population of each ethnic group, residing within the same geographical area, provides us with the opportunity to identify potential ethnic differences in fall prevalence. We have, therefore, determined the prevalence of falls for the overall population as well as according to ethnic groups in an urban area in Malaysia.

METHODS

Study Population

This cross-sectional study included participants from the Malaysian Elders Longitudinal Research (MELoR) study. The MELoR study is a longitudinal cohort study based in Kuala Lumpur and its surrounding suburbs (Klang Valley). Individuals aged 55 years and above were selected through simple random sampling from the electoral rolls of the Parliamentary constituencies of North Petaling Jaya, South Petaling Jaya, and Lembah Pantai, stratified by the three ethnic groups and by 5 year age groups. 8769 invitations were sent out to the main ethnic groups and volunteers were invited through focused community groups. 5815 participants with contactable addresses were identified from the above-mentioned group. Individuals who were bedbound, unable to be transported to the research center for assessment and unable to

communicate due to advanced dementia or severe speech impediments, were excluded from the study.[18] Complete data on all variables of interest for the present study was available in 1565 participants. This study was approved by the University of Malaya Medical Centre Medical Ethics Committee and complied with the Helsinki Declaration of 1975, revised in 1983. Written informed consent was obtained from all study participants prior to their inclusion. The inclusion criteria were age 55 years and above, who were able to provide informed consent, and belonging to one of the three major ethnic groups of Malay, Chinese or Indian. In Malaysia, the voluntary retirement age is 55 years, and so using a cutoff of 55 years enabled the analysis of health issues of individuals as they approached retirement.

Data collection

Participants were contacted and visited at their own homes initially to recruit them into the study. A structured interview using a computer aided questionnaire was completed during this encounter. Participants were then requested to attend the hospital for a detailed health check. Information on basic demographics (including age, sex, and ethnicity) were collected during the initiate home visit. At this home visit, participants were asked the following question, 'Have you fallen in the past 12 months with answer categories: 1- 'No', 2- 'Yes'. A fall was defined as "unintentionally coming to rest on ground, floor, or lower level".[19]

Statistical analysis

Data analyses were conducted using SPSS Version 23 (IBM, Armonk, NY, USA). As age was a continuous variable, the ethnic differences in age were evaluated using analysis of variance, while ethnic differences were determined using the Chi-squared test for the remaining variables in terms of baseline characteristics which were categorical variables. The differences in prevalence of falls with age was compared with the independent t-test later. We also categorized the participants into five year age bands: 55-59, 60-64, 65-69, 70-74, and ≥75 years. The crude prevalence of falls was estimated by age groups and ethnicity. As the sample was stratified to allow for equal representation of the three ethnic groups and the different age groups in the cohort study, weighted data analysis was necessary in order to estimate prevalence for the local population. Sample weights were calculated by ethnicity and 5 year age group using population statistics published by the Department of Statistics, Malaysia, obtained from the 2010 population census.[17] Binary logistic regression was carried out to compare prevalence of falls among the ethnic groups using the Malay ethnicity as the reference group. Multiple logistic regression was then performed with the factors age, gender, partner status, and education to eliminate potential confounding effects. Interaction terms were derived for education and ethnicity to determine potential role of education in the relationship between ethnicity and falls. Risk ratios for falls according to each ethnic group compared to the other ethnic groups (Malays vs. non-Malays, Chinese vs non-Chinese, Indians vs non-Indians) also estimated. However, as this will be considered multiple comparisons, Bonferroni's correction was applied, and a p-value of less than 0.017 was therefore considered the level of statistical significance. For other statistical analyses, p-values of less than 0.05 were considered statistically significant.

Patient and Public Involvement Statement

As this was a population-based cohort study, non-governmental organizations, senior citizens' groups and charitable organizations were consulted in a consultation forum followed by focus groups to identify key issues they felt they would like addressed. The MELoR questionnaire was scrutinized by older persons from local senior citizen groups and their feedback given due consideration in refining the questionnaire. Our recruitment process involved engaging local community leaders who then assisted us with first organizing local publicity events which included health talks, free health screening or exercise sessions. Selected participants were then accessed by identifying these individuals or their neighbors at these events, and enlisting the help of local residents in door-to-door recruitment. Participants were provided with individual feedback during their health check by a medical specialist and this was followed by a written report of their screening results. Preliminary aggregated results have been presented to local residents through numerous local follow-up publicity events, and further individual feedback is planned during subsequent waves.

RESULTS

	Total (n=1565)	Malay (n=519)	Chinese (n=544)	Indian (n=502)	p-value*

Data on falls was available in 1565 individuals, 519 were ethnic Malays, 544 ethnic Chinese and 502 ethnic Indians. Table 1 shows the socio-demographic characteristics of the sample population according to ethnicity. There were significant differences in age, marital status, education and smoking status according to ethnicity.

Table 1. Basic Characteristics according to Ethnicity

Age (yrs), mean ± SD	68.9 ± 7.5	67.8 ± 7.1	69.4 ± 7.4	69.5 ± 7.9	<0.001
Age Categories (years), n(%)					0.015
55-59	189 (12.1)	72 (13.9)	52 (9.6)	65 (12.9)	
60-64	325 (20.8)	126 (24.3)	111 (20.4)	88 (17.5)	
65-69	361 (23.1)	117 (22.5)	133 (24.4)	111 (22.1)	
70-74	364 (23.3)	118 (22.7)	131 (24.1)	115 (22.9)	
≥75	326 (20.8)	86 (16.6)	117 (21.5)	123 (24.5)	
Female Gender, n (%)	892 (57.0)	282 (54.3)	331 (60.8)	279 (55.6)	0.074
Single/Widowed, n (%)	414 (26.5)	127 (24.5)	121 (22.2)	166 (33.2)	<0.001
Secondary/Tertiary Education, n (%)	1133 (72.4)	298 (57.6)	447 (82.2)	388 (77.3)	<0.001
Smoker, n (%)	309 (19.7)	133 (26.1)	90 (16.9)	86 (17.6)	<0.001

*Chi-squared test for categorical variables and analysis of variance for age.

Prevalence of Falls

The crude prevalence for the overall population aged 55 years and over was 22.8%, and for those aged 65 years and over was 24.5%. The crude prevalence of falls among the ethnic Malays aged 55 years and over was 18.9% compared to the ethnic Chinese at 22.4% and the Ethnic Indians at 27.3%. The crude prevalence of falls according to age groups and ethnic groups are shown in

Table 2. The prevalence of falls increased significantly with age (mean age ± standard deviation of fallers vs non-fallers= 70.4 ± 8.1 vs 68.4 ± 7.2; p<0.001). Weighted prevalence was then estimated according to the population composition of Kuala Lumpur. The estimated true prevalence of falls for all ethnic Malays aged 55 years and over was 16.2%, Chinese 19.4% and Indians 23.8%. The prevalence of falls increased with age for the overall population and all three ethnic groups. The overall prevalence of falls weighted for the population of Kuala Lumpur aged 55 years and over was 18.9%. The weighted prevalence of falls for individuals aged 65 years and over was 23.5%.

Table 2. Crude prevalence of falls according to age group and ethnicity

Age Group (Years)	Falls, n (%)*			
	Overall	Malay	Chinese	Indian
55-59	30, (15.8)	9, (12.5)	8, (15.4)	13, (20.0)
60-64	69, (21.2)	23, (18.2)	24, (21.6)	22, (25.0)
65-69	76, (21.0)	18, (15.4)	31, (23.3)	27, (24.3)
70-74	77, (21.1)	28, (23.7)	21, (16.0)	28, (24.3)
75+	105, (32.2)	20, (23.3)	38, (32.5)	47, (38.2)

*Crude prevalence is presented in as percentages parenthesis

Ethnic Differences in Fall Prevalence

Table 3 shows the results of the binary and multiple logistic regression analyses. Compared to the ethnic Malays, the ethnic Indians were significantly more likely to fall in unadjusted analysis (p=0.001). After adjustment for age and gender and further adjustment for marital status and educational level, the ethnic Indians remains statistically more likely to report at least one fall in

the preceding year compared to the ethnic Malays. The interaction terms for ethnicity and level of education as well as ethnicity and age were examined, and found to have no significant effect on the relationship between ethnicity and falls. The risk ratios for falls according to ethnic groups were calculated separately. The ethnic Malays were significantly less likely to fall compared to the non-Malays (Risk Ratio, RR= 0.763, 95% confidence interval, CI= 0.620 to 0.938; p=0.009). The ethnic Chinese were not significantly less likely than the non-Chinese to fall (RR=0.974, 95%CI=0.804 to 1.18; p=0.791). The ethnic Indians were significantly more likely than the non-Indians to experience at least one fall in the previous 12 months (RR=1.319, 95%CI=1.096 to 1.587; p=0.004).

Table 3. Univariate and Multiple Logistic Regression for Ethnic Differences

		Falls		
		Odds Ratio	95% Confidence Interval	p-value
Model 1	Ethnicity			
	Malay (reference)			
	Chinese	1.24	0.92-1.67	.154
	Indian	*1.61*	*1.20-2.16*	*.001*
Model 2	Ethnicity			
	Malay (reference)			
	Chinese	1.14	0.84-1.54	.390
	Indian	*1.52*	*1.13-2.05*	*.006*
	Age*	*1.04*	*1.02-1.05*	*<.001*

	Female Gender	*1.48*	*1.15-1.90*	*.002*
Model 3	Ethnicity			
	Malay (reference)			
	Chinese	1.24	0.91-1.70	.168
	Indian	*1.63*	*1.20-2.21*	*.002*
	Age*	*1.04*	*1.01-1.05*	*<.001*
	Female Gender	*1.39*	*1.07-1.82*	*.013*
	Single/Widowed	1.06	0.79-1.40	.696
	Secondary/Tertiary Education	*1.39*	*1.06-1.82*	*.018*

*per year increase

Model 1- unadjusted

Model 2- adjusted for age and gender

Model 3- adjusted for age, gender, marital status and education level.

DISCUSSION

The Population adjusted prevalence of falls among adults aged 55 years and over residing in Kuala Lumpur was 18.9%, and for those aged 65 years and over was 23.5%. There was an increase in fall prevalence with older age. Among the ethnic groups, the Indian ethnicity were found to have a higher prevalence of falls when compared to the ethnic Malays. Our study was the first to report the prevalence of falls in the urban population in Malaysia and the first to demonstrate increased risk of falls in ethnic Indians in an Asian population.

Previous studies showed that the proportion of falls in aged 65 years and above varied between 18% to 28% peryear.[7,20] The falls prevalence reported in our urban population was comparatively

lower than that reported by previous studies performed in the United Kingdom and United States of America.[4] The prevalence of falls has been observed to vary widely in different parts of the world. Studies from the Caribbean and Latin Americans also reported higher fall rates from 21.6% -34%.[21] Falls prevalence in the Australian population was reported as 30%.[22] A recent report from the Irish Longitudinal Study of Ageing involving individuals aged 50 years and over, reported a prevalence of 19.2%.[23] A systematic review of 21 studies from Asian countries on falls found that the fall prevalence varied between 14.7-34% in older Chinese population,[9] which was comparable to our Chinese population.

Age is a well-established risk factor for falls.[20] In our study, with each year's increase in age, the odds of falls increases by 4%, and with the overall prevalence of falls increasing to 32% in the overall population aged 75 years and above. A study from Hong Kong showed that advanced age was associated with greater prevalence and incidence of falls.[24]. The prevalence of falls was observed to increase from 24% to 37% for those above the age of 80 years when compared to those in their sixties.[7] Within our cohort, falls rates were similar in the 60-74 year age groups, and only increased in the over 75s, overall. However, the increase in falls rate appears to occur earlier among the ethnic Malays, at 70 to 74 year age bracket, compared to over 75 years for the ethnic Chinese and Indians.

Ethnic differences have been studied in the American population where it was reported that African–Americans were less likely to fall than whites, but these differences were influenced by potential confounders.[25] Similar findings were reported in another study from the United States, among older community-dwelling Caucasian and Afro-American women.[26] A study from

Singapore showed that ethnic Malays had a significantly higher likelihood of falls compared to the Singaporean Chinese.[27] In contrast, our study found no significant difference in falls prevalence between the ethnic Chinese and Malays. The proportion of ethnic Malays, however, only comprised 8% of the overall population in the previous study.[27] The differences between Singaporean Malays and Malaysian Malays are of interest, and may be explained by differences in occupation, physical activity or social structure. This study was the first to report increased risk of falls in ethnic Indians in comparison to the ethnic Malays. Our study was, however, not able to establish any underlying rationale for the ethnic differences, which would be a subject for future research. While age, gender and educational level were significantly associated with increased falls risk, these factors did not influence the relationship between falls and ethnicity in our study.

The presence of falls in the preceding year was determined by retrospective recall. Previous reports have suggested that retrospective falls recall may not be fully accurate as older adults have a tendency to forget they had fallen, depending on various factors such as recall interval, injury associated fall and their cognitive status[28] A systematic review of methods of measuring falls in randomized control fall prevention trials found that there was a substantial lack of standardization in the use of terminology and documentation methods of falls. The study looked at 90 publications out of which 27% used retrospective reporting methods like telephone interview, face to face interview and postal questionnaires while 42% used prospective reporting methods like calendars and diaries, of which the latter was recommended.[29] However, the ability to conduct prospective recording using falls diaries in population-based studies would be technically challenging with many of our older persons having problems with documenting their

falls properly. Another study which examined reliability of patients own reports of falls found that the question 'Did you fall' had a sensitivity of 91.5% and a specificity and positive predictive value of 100% as a tool in the A&E setting.[30] This study was carried out in an urban area, hence it may not be representative of the rural or semi-urban regions of Malaysia. Further studies will be needed to identify the etiology underlying ethnic differences in fall prevalence, as well as determine whether these differences still exist in prospective studies.

CONCLUSION

The estimated prevalence of falls among individuals aged 55 years and older in an urban area in Malaysia was 18.9%. Among the different ethnic groups in the study, the prevalence of falls was significantly higher among ethnic Indians compared to the ethnic Malays. Future studies should now seek to identify factors determining the ethnic differences in falls risk.

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CONTRIBUTORSHIP STATEMENT

AVC, NNH, SO, SK, SBK, MPT conceived the study, contributed to study design, obtained the funding for the study, and were responsible to the conduct of the study. HMK, was involved in data collection. DA, HMK and MPT contributed to data analysis. All authors contributed toward the writing of the manuscript and approved the final submitted version.

COMPETING INTERESTS

None declared

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DATA SHARING STATEMENT

Due to concerns about loss of fidelity of personally identifiable data, the MELoR dataset is currently not available publicly. However, parts of the dataset will be released anonymised through written requests submitted to the corresponding author.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			8

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

A Cross-sectional Analysis of Ethnic Differences in Falls Prevalence in Urban-Dwellers Aged 55 Years and Over in the Malaysian Elders Longitudinal Research Study

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Keywords:	Falls, Prevalence, Elderly, Ethnic differences

TITLE

A Cross-sectional Analysis of Ethnic Differences in Falls Prevalence in Urban-Dwellers Aged 55 Years and Over in the Malaysian Elders Longitudinal Research Study

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ABSTRACT

Objectives: Falls represent major health issues within the older population. In low- and middle-income Asian countries, falls in older adults remain an area which has yet to be studied in detail. Using data from the Malaysian Elders Longitudinal Research (MELoR), we have estimated the prevalence of falls among older persons in an urban population, and performed ethnic comparisons in the prevalence of falls.

Design: Cross-sectional analysis was carried out using the first wave data from MELoR which is a longitudinal study.

Setting: Urban community-dwellers in a middle-income South East Asian country

Participants: 1565 Participants aged ≥55 years were selected by simple random sampling from the electoral rolls of 3 parliamentary constituencies.

Interventions: Consenting participants from the MELoR study were asked the question 'Have you fallen down in the past 12 months?' during their computer assisted home-based interviews. Logistic regression analyses were conducted to compare the prevalence of falls among various ethnic groups.

Results: The overall estimated prevalence of falls for individuals aged 55 years and over adjusted to the population of Kuala Lumpur was 18.9%. The estimated prevalence of falls for the three ethnic populations of Malays, Chinese and Indian aged 55 years and over were: 16.2%, 19.4% and 23.8% respectively. Following adjustment for ethnic discrepancies in age, gender, marital status and education attainment, the Indian ethnicity remained an independent predictor of falls in our population (odds ratio= 1.63, 95% confidence interval=1.20 to 2.21).

Conclusion: The prevalence of falls in this study is comparable to other previous Asian studies, but appears lower than Western studies. The predisposition of the Indian ethnic group to falls,

has not been previously reported. Further studies may be needed to elucidate the causes for the ethnic differences in fall prevalence.

Keywords

Falls, Prevalence, Elderly, Ethnic differences

Strengths and Limitation

1. This is the first study to look at prevalence of falls in urban community dwelling older people in Malaysia.
2. Ethnic differences in fall prevalence have not been previously reported in Malaysia.
3. Our study was conducted in an urban area which may not be representative of the national population.
4. The reasons for differences in fall prevalence among different ethnic groups is a topic for future studies.
5. We have examined the prevalence of falls in the preceding 12 months by retrospective recall, which is now the commonly employed method to measure falls. However, validity is difficult to determine.

INTRODUCTION

Falls are common among older people and is a major cause for morbidity, mortality and reduced quality of life. The consequences of a fall include traumatic brain injuries, limb fractures, loss of confidence and institutionalization, which represent major public health issues.[1,2] A 10-year prospective study of individuals presenting with falls to the emergency department revealed that falls are associated with increased dependency and a high mortality rate.[3] The financial burden associated with falls directly related to health care services and indirectly as loss of social productivity is high.[4] The cost of falls will increase with global population ageing unless effective strategies are developed to reduce their burden.

The prevalence of falls has been reported as 19% to 26% in individuals aged ≥ 65 years and over[5,6] and 27% to 32% in thosed aged 70 years and over.[7,8] It remains unclear whether falls prevalence differ according to geographical regions as many Asian studies have reported a lower prevalence of falls compared to North American, European and Australian studies.[9,4,10] The differences in prevalence measured in different studies may be due to differences of study design and sample populations. A handful of studies have reported ethnic and racial differences in fall prevalence.[11,12] Older Asians have been reported to have lower fall rates when compared to Whites residing in the same region.[13,14] These ethnic differences may be due to varying reasons which include cultural, behavioural or health related factors. A study conducted among older U.S women reported lower fall prevalence but more self-reported mobility limitations among Asian women, suggesting that they may be limiting their activities based on their self-perceived limitations, hence leading to a lower fall risk.[15] Cultural factors such as differences in levels of concerns about the individual's health, engaging in regular physical activities such as Yoga or Tai-Chi may also play a role in affecting fall prevalence.[16] The determination of

whether ethnic differences in fall prevalence exist in various geographical regions, will help identify whether genetic and cultural factors may also contribute to fall risk. In addition, as the vast majority of published studies on fall prevention measures have been conducted in Caucasian populations, the degree of which existing published evidence may be translated to other ethnic groups and geographical locations will also be determined by potential ethnic differences in falls.

Malaysia is a multiethnic nation with the three major Asian ethnic groups: Malays (67.4%), Chinese (24.6%), and Indians (7.3%).[17] The sizeable population of each ethnic group, residing within the same geographical area, provides us with the opportunity to identify potential ethnic differences in fall prevalence. We have, therefore, determined the prevalence of falls for the overall population as well as according to ethnic groups in an urban area in Malaysia.

METHODS

Study Population

This cross-sectional study included participants from the Malaysian Elders Longitudinal Research (MELoR) study. The MELoR study is a longitudinal cohort study based in Kuala Lumpur and its surrounding suburbs (Klang Valley). Individuals aged 55 years and above were selected through simple random sampling from the electoral rolls of the Parliamentary constituencies of North Petaling Jaya, South Petaling Jaya, and Lembah Pantai, stratified by the three ethnic groups and by 5 year age groups. 8769 invitations were sent out to the main ethnic groups and volunteers were invited through focused community groups. 5815 participants with contactable addresses were identified from the above-mentioned group. Individuals who were bedbound, unable to be transported to the research center for assessment and unable to

communicate due to advanced dementia or severe speech impediments, were excluded from the study.[18] Complete data on all variables of interest for the present study was available in 1565 participants. This study was approved by the University of Malaya Medical Centre Medical Ethics Committee and complied with the Helsinki Declaration of 1975, revised in 1983. Written informed consent was obtained from all study participants prior to their inclusion. The inclusion criteria were age 55 years and above, who were able to provide informed consent, and belonging to one of the three major ethnic groups of Malay, Chinese or Indian. The voluntary retirement age for Malaysia at the time study commencement was 55 years, and so using a cutoff of 55 years enabled the analysis of health issues of individuals as they approached retirement.

Data collection

Participants were contacted and visited at their own homes initially to recruit them into the study. A structured interview using a computer aided questionnaire was completed during this encounter. Participants were then requested to attend the hospital for a detailed health check. Information on basic demographics (including age, sex, and ethnicity) were collected during the initial home visit. At this home visit, participants were asked the following question, 'Have you fallen in the past 12 months with answer categories: 1- 'No', 2- 'Yes'. A fall was defined as "unintentionally coming to rest on the ground, floor, or lower level".[19]

Statistical analysis

Data analyses were conducted using SPSS Version 23 (IBM, Armonk, NY, USA). As age was a continuous variable, the ethnic differences in age were evaluated using analysis of variance, while ethnic differences were determined using the Chi-squared test for the remaining variables in terms of baseline characteristics which were categorical variables. The differences in prevalence of falls with age was compared with the independent t-test later. We also categorized the participants into five year age bands: 55-59, 60-64, 65-69, 70-74, and ≥75 years. The crude prevalence of falls was estimated by age groups and ethnicity. As the sample was stratified to allow for equal representation of the three ethnic groups and the different age groups in the cohort study, weighted data analysis was necessary in order to estimate prevalence for the local population. Sample weights were calculated by ethnicity and 5 year age groups using population statistics published by the Department of Statistics, Malaysia, obtained from the 2010 population census.[17] Binary logistic regression was carried out to compare prevalence of falls among the ethnic groups using the Malay ethnicity as the reference group. Multiple logistic regression was then performed with the factors age, gender, partner status, and education to eliminate potential confounding effects. Interactions between age, education and ethnicity were assessed using product terms. Risk ratios for falls according to each ethnic group compared to the other ethnic groups (Malays vs. non-Malays, Chinese vs non-Chinese, Indians vs non-Indians) were also estimated. However, as this will be considered multiple comparisons, Bonferroni's correction was applied, and a p-value of less than 0.017 was therefore considered the level of statistical significance. For other statistical analyses, p-values of less than 0.05 were considered statistically significant.

Patient and Public Involvement Statement

As this was a population-based cohort study, non-governmental organizations, senior citizens' groups and charitable organizations were consulted in a consultation forum followed by focus groups to identify key issues they felt they would like addressed. The MELoR questionnaire was scrutinized by older persons from local senior citizen groups and their feedback given due consideration in refining the questionnaire. Our recruitment process involved engaging local community leaders who then assisted us with first organizing local publicity events which included health talks, free health screening or exercise sessions. Selected participants were then accessed by identifying these individuals or their neighbors at these events, and enlisting the help of local residents in door-to-door recruitment. Participants were provided with individual feedback during their health check by a medical specialist and this was followed by a written report of their screening results. Preliminary aggregated results have been presented to local residents through numerous local follow-up publicity events, and further individual feedback is planned during subsequent waves.

RESULTS

	Total (n=1565)	Malay (n=519)	Chinese (n=544)	Indian (n=502)	p-value*

Data on falls was available for 1565 individuals, 519 were ethnic Malays, 544 ethnic Chinese and 502 ethnic Indians. Table 1 shows the socio-demographic characteristics of the sample population according to ethnicity. There were significant differences in age, marital status, education and smoking status according to ethnicity.

Table 1. Basic Characteristics according to Ethnicity

Age (yrs), mean ± SD	68.9 ± 7.5	67.8 ± 7.1	69.4 ± 7.4	69.5 ± 7.9	<0.001
Age Categories (years), n(%)					0.015
55-59	189 (12.1)	72 (13.9)	52 (9.6)	65 (12.9)	
60-64	325 (20.8)	126 (24.3)	111 (20.4)	88 (17.5)	
65-69	361 (23.1)	117 (22.5)	133 (24.4)	111 (22.1)	
70-74	364 (23.3)	118 (22.7)	131 (24.1)	115 (22.9)	
≥75	326 (20.8)	86 (16.6)	117 (21.5)	123 (24.5)	
Female Gender, n (%)	892 (57.0)	282 (54.3)	331 (60.8)	279 (55.6)	0.074
Single/Widowed, n (%)	414 (26.5)	127 (24.5)	121 (22.2)	166 (33.2)	<0.001
Secondary/Tertiary Education, n (%)	1133 (72.4)	298 (57.6)	447 (82.2)	388 (77.3)	<0.001
Smoker, n (%)	309 (19.7)	133 (26.1)	90 (16.9)	86 (17.6)	<0.001

*Chi-squared test for categorical variables and analysis of variance for age.

Prevalence of Falls

The crude prevalence for the overall population aged 55 years and over was 22.8%, and for those aged 65 years and over was 24.5%. The crude prevalence of falls among the ethnic Malays aged 55 years and over was 18.9% compared to the ethnic Chinese at 22.4% and the Ethnic Indians at 27.3%. The crude prevalence of falls according to age groups and ethnic groups are shown in

Table 2. The prevalence of falls increased significantly with age (mean age ± standard deviation of fallers vs non-fallers= 70.4 ± 8.1 vs 68.4 ± 7.2; p<0.001). Weighted prevalence was then estimated according to the population composition of Kuala Lumpur. The estimated true prevalence of falls for all ethnic Malays aged 55 years and over was 16.2%, Chinese 19.4% and Indians 23.8%. The prevalence of falls increased with age for the overall population and all three ethnic groups. The overall prevalence of falls weighted for the population of Kuala Lumpur aged 55 years and over was 18.9%. The weighted prevalence of falls for individuals aged 65 years and over was 23.5%.

Table 2. Crude prevalence of falls according to age group and ethnicity

Age Group (Years)	Falls, n (%)*			
	Overall	Malay	Chinese	Indian
55-59	30, (15.8)	9, (12.5)	8, (15.4)	13, (20.0)
60-64	69, (21.2)	23, (18.2)	24, (21.6)	22, (25.0)
65-69	76, (21.0)	18, (15.4)	31, (23.3)	27, (24.3)
70-74	77, (21.1)	28, (23.7)	21, (16.0)	28, (24.3)
75+	105, (32.2)	20, (23.3)	38, (32.5)	47, (38.2)

*Crude prevalence is presented in as percentages parenthesis

Ethnic Differences in Fall Prevalence

Table 3 shows the results of the binary and multiple logistic regression analyses. Compared to the ethnic Malays, the ethnic Indians were significantly more likely to fall in unadjusted analysis (p=0.001). After adjustment for age and gender and further adjustment for marital status and educational level, the ethnic Indians remained statistically more likely to report at least one fall

in the preceding year compared to the ethnic Malays. Inclusion of the product terms for ethnicity and level of education as well as ethnicity and age found no significant interaction effect between education or age with ethnicity. The risk ratios for falls according to ethnic groups were calculated separately. The ethnic Malays were significantly less likely to fall compared to the non-Malays (Risk Ratio, RR= 0.763, 95% confidence interval, CI= 0.620 to 0.938; p=0.009). The ethnic Chinese were not significantly less likely than the non-Chinese to fall (RR=0.974, 95%CI=0.804 to 1.18; p=0.791). The ethnic Indians were significantly more likely than the non-Indians to experience at least one fall in the previous 12 months (RR=1.319, 95%CI=1.096 to 1.587; p=0.004).

Table 3. Univariate and Multiple Logistic Regression for Ethnic Differences

		Falls		
		Odds Ratio	95% Confidence Interval	p-value
Model 1	Ethnicity			
	Malay (reference)			
	Chinese	1.24	0.92-1.67	.154
	Indian	*1.61*	*1.20-2.16*	*.001*
Model 2	Ethnicity			
	Malay (reference)			
	Chinese	1.14	0.84-1.54	.390
	Indian	*1.52*	*1.13-2.05*	*.006*
	Age*	*1.04*	*1.02-1.05*	*<.001*

	Female Gender	*1.48*	*1.15-1.90*	*.002*
Model 3	Ethnicity			
	Malay (reference)			
	Chinese	1.24	0.91-1.70	.168
	Indian	*1.63*	*1.20-2.21*	*.002*
	Age*	*1.04*	*1.01-1.05*	*<.001*
	Female Gender	*1.39*	*1.07-1.82*	*.013*
	Single/Widowed	1.06	0.79-1.40	.696
	Secondary/Tertiary Education	*1.39*	*1.06-1.82*	*.018*

*per year increase

Model 1- unadjusted

Model 2- adjusted for age and gender

Model 3- adjusted for age, gender, marital status and education level.

DISCUSSION

The population adjusted prevalence of falls among adults aged 55 years and over residing in Kuala Lumpur was 18.9%, and for those aged 65 years and over was 23.5%. There was an increase in fall prevalence with older age. Among the ethnic groups, the Indian ethnicity was associated with higher prevalence of falls when compared to the ethnic Malays. Our study was the first to report the prevalence of falls in the urban population in Malaysia and the first to demonstrate increased risk of falls in ethnic Indians in an Asian population.

Previous studies showed that the proportion of falls in aged 65 years and above varied between 18% to 28% per year.[7,20] The falls prevalence reported in our urban population was comparatively lower than that reported by previous studies performed in the United Kingdom and United States of America.[4] The prevalence of falls has been observed to vary widely in different parts of the world. Studies from the Caribbean and Latin Americans also reported higher fall rates from 21.6% -34%.[21] Falls prevalence in the Australian population was reported as 30%.[22] A recent report from the Irish Longitudinal Study of Ageing involving individuals aged 50 years and over, reported a prevalence of 19.2%.[23] A systematic review of 21 studies from Asian countries on falls found that the fall prevalence varied between 14.7-34% in older Chinese population,[9] which was comparable to our Chinese population.

Age is a well-established risk factor for falls.[20] In our study, with each year's increase in age, the odds of falls increases by 4%, and with the overall prevalence of falls increasing to 32% in the overall population aged 75 years and above. A study from Hong Kong showed that advanced age was associated with greater prevalence and incidence of falls.[24]. The prevalence of falls was observed to increase from 24% to 37% for those above the age of 80 years when compared to those in their sixties.[7] Within our cohort, falls rates were similar in the 60-74 year age groups, and only increased in the over 75s, overall. However, the increase in falls rate appears to occur earlier among the ethnic Malays, at 70 to 74 year age bracket, compared to over 75 years for the ethnic Chinese and Indians.

Ethnic differences have been studied in the American population where it was reported that African–Americans were less likely to fall than whites, but these differences were influenced by

potential confounders.[25] Similar findings were reported in another study from the United States, among older community-dwelling Caucasian and Afro-American women.[26] A study from Singapore showed that ethnic Malays had a significantly higher likelihood of falls compared to the Singaporean Chinese.[27] In contrast, our study found no significant difference in falls prevalence between the ethnic Chinese and Malays. The proportion of ethnic Malays, however, only comprised 8% of the overall population in the previous study.[27] The differences between Singaporean Malays and Malaysian Malays are of interest, and may be explained by differences in occupation, physical activity or social structure. This study was the first to report increased risk of falls in ethnic Indians in comparison to the ethnic Malays. Our study was, however, not able to establish any underlying rationale for the ethnic differences, which would be a subject for future research. While age, gender and educational level were significantly associated with increased falls risk, these factors did not influence the relationship between falls and ethnicity in our study.

The presence of falls in the preceding year was determined by retrospective recall. Previous reports have suggested that retrospective falls recall may not be fully accurate as older adults have a tendency to forget they had fallen, depending on various factors such as recall interval, injury associated fall and their cognitive status[28] A systematic review of methods of measuring falls in randomized control fall prevention trials found that there was a substantial lack of standardization in the use of terminology and documentation methods of falls. The study looked at 90 publications out of which 27% used retrospective reporting methods like telephone interview, face to face interview and postal questionnaires while 42% used prospective reporting methods like calendars and diaries, of which the latter was recommended.[29] However, the ability

to conduct prospective recording using falls diaries in population-based studies would be technically challenging with many of our older persons having problems with documenting their falls properly. Another study which examined reliability of patients own reports of falls found that the question 'Did you fall' had a sensitivity of 91.5% and a specificity and positive predictive value of 100% as a tool in the A&E setting.[30] This study was carried out in an urban area, hence it may not be representative of the rural or semi-urban regions of Malaysia. Further studies will be needed to identify the etiology underlying ethnic differences in fall prevalence, as well as determine whether these differences still exist in prospective studies.

CONCLUSION

The estimated prevalence of falls among individuals aged 55 years and older in an urban area in Malaysia was 18.9%. Among the different ethnic groups in the study, the prevalence of falls was significantly higher among ethnic Indians compared to the ethnic Malays. Future studies should now seek to identify factors determining the ethnic differences in falls risk.

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CONTRIBUTORSHIP STATEMENT

AVC, NNH, SO, SK, SBK, MPT conceived the study, contributed to study design, obtained the funding for the study, and were responsible to the conduct of the study. HMK, was involved in data collection. DA, HMK and MPT contributed to data analysis. All authors contributed toward the writing of the manuscript and approved the final submitted version.

COMPETING INTERESTS

None declared

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DATA SHARING STATEMENT

Due to concerns about loss of fidelity of personally identifiable data, the MELoR dataset is currently not available publicly. However, parts of the dataset will be released anonymised through written requests submitted to the corresponding author.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			8

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

A Cross-sectional Analysis of Ethnic Differences in Falls Prevalence in Urban-Dwellers Aged 55 Years and Over in the Malaysian Elders Longitudinal Research Study

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Keywords:	Falls, Prevalence, Elderly, Ethnic differences

TITLE

A Cross-sectional Analysis of Ethnic Differences in Falls Prevalence in Urban-Dwellers Aged 55 Years and Over in the Malaysian Elders Longitudinal Research Study

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ABSTRACT

Objectives: Falls represent major health issues within the older population. In low- and middle-income Asian countries, falls in older adults remain an area which has yet to be studied in detail. Using data from the Malaysian Elders Longitudinal Research (MELoR), we have estimated the prevalence of falls among older persons in an urban population, and performed ethnic comparisons in the prevalence of falls.

Design: Cross-sectional analysis was carried out using the first wave data from MELoR which is a longitudinal study.

Setting: Urban community-dwellers in a middle-income South East Asian country

Participants: 1565 Participants aged ≥55 years were selected by simple random sampling from the electoral rolls of 3 parliamentary constituencies.

Outcome Measures: Consenting participants from the MELoR study were asked the question 'Have you fallen down in the past 12 months?' during their computer assisted home-based interviews.

Logistic regression analyses were conducted to compare the prevalence of falls among various ethnic groups.

Results: The overall estimated prevalence of falls for individuals aged 55 years and over adjusted to the population of Kuala Lumpur was 18.9%. The estimated prevalence of falls for the three ethnic populations of Malays, Chinese and Indian aged 55 years and over were: 16.2%, 19.4% and 23.8% respectively. Following adjustment for ethnic discrepancies in age, gender, marital status and education attainment, the Indian ethnicity remained an independent predictor of falls in our population (relative risk= 1.45, 95% confidence interval=1.08 to 1.85).

Conclusion: The prevalence of falls in this study is comparable to other previous Asian studies, but appears lower than Western studies. The predisposition of the Indian ethnic group to falls, has not been previously reported. Further studies may be needed to elucidate the causes for the ethnic differences in fall prevalence.

Keywords

Falls, Prevalence, Elderly, Ethnic differences

Strengths and Limitation

1. This is the first study to look at prevalence of falls in urban community dwelling older people in Malaysia.
2. Ethnic differences in fall prevalence have not been previously reported in Malaysia.
3. Our study was conducted in an urban area which may not be representative of the national population.
4. The reasons for differences in fall prevalence among different ethnic groups is a topic for future studies.
5. We have examined the prevalence of falls in the preceding 12 months by retrospective recall, which is now the commonly employed method to measure falls. However, validity is difficult to determine.

INTRODUCTION

Falls are common among older people and is a major cause for morbidity, mortality and reduced quality of life. The consequences of a fall include traumatic brain injuries, limb fractures, loss of confidence and institutionalization, which represent major public health issues.[1,2] A 10-year prospective study of individuals presenting with falls to the emergency department revealed that falls are associated with increased dependency and a high mortality rate.[3] The financial burden associated with falls directly related to health care services and indirectly as loss of social productivity is high.[4] The cost of falls will increase with global population ageing unless effective strategies are developed to reduce their burden.

The prevalence of falls has been reported as 19% to 26% in individuals aged ≥ 65 years and over[5,6] and 27% to 32% in thosed aged 70 years and over.[7,8] It remains unclear whether falls prevalence differ according to geographical regions as many Asian studies have reported a lower prevalence of falls compared to North American, European and Australian studies.[9,4,10] The differences in prevalence measured in different studies may be due to differences of study design and sample populations. A handful of studies have reported ethnic and racial differences in fall prevalence.[11,12] Older Asians have been reported to have lower fall rates when compared to Whites residing in the same region.[13,14] These ethnic differences may be due to varying reasons which include cultural, behavioural or health related factors. A study conducted among older U.S women reported lower fall prevalence but more self-reported mobility limitations among Asian women, suggesting that they may be limiting their activities based on their self-perceived limitations, hence leading to a lower fall risk.[15] Cultural factors such as differences in levels of concerns about the individual's health, engaging in regular physical activities such as Yoga or Tai-Chi may also play a role in affecting fall prevalence.[16] The determination of

whether ethnic differences in fall prevalence exist in various geographical regions, will help identify whether genetic and cultural factors may also contribute to fall risk. In addition, as the vast majority of published studies on fall prevention measures have been conducted in Caucasian populations, the degree of which existing published evidence may be translated to other ethnic groups and geographical locations will also be determined by potential ethnic differences in falls.

Malaysia is a multiethnic nation with the three major Asian ethnic groups: Malays (67.4%), Chinese (24.6%), and Indians (7.3%).[17] The sizeable population of each ethnic group, residing within the same geographical area, provides us with the opportunity to identify potential ethnic differences in fall prevalence. We have, therefore, determined the prevalence of falls for the overall population as well as according to ethnic groups in an urban area in Malaysia.

METHODS

Study Population

This cross-sectional study included participants from the Malaysian Elders Longitudinal Research (MELoR) study. The MELoR study is a longitudinal cohort study based in Kuala Lumpur and its surrounding suburbs (Klang Valley). Individuals aged 55 years and above were selected through simple random sampling from the electoral rolls of the Parliamentary constituencies of North Petaling Jaya, South Petaling Jaya, and Lembah Pantai, stratified by the three ethnic groups and by 5 year age groups. 8769 invitations were sent out to the main ethnic groups and volunteers were invited through focused community groups. 5815 participants with contactable addresses were identified from the above-mentioned group. Individuals who were bedbound, unable to be transported to the research center for assessment and unable to

communicate due to advanced dementia or severe speech impediments, were excluded from the study.[18] Complete data on all variables of interest for the present study was available in 1565 participants. This study was approved by the University of Malaya Medical Centre Medical Ethics Committee and complied with the Helsinki Declaration of 1975, revised in 1983. Written informed consent was obtained from all study participants prior to their inclusion. The inclusion criteria were age 55 years and above, who were able to provide informed consent, and belonging to one of the three major ethnic groups of Malay, Chinese or Indian. The voluntary retirement age for Malaysia at the time study commencement was 55 years, and so using a cutoff of 55 years enabled the analysis of health issues of individuals as they approached retirement.

Data collection

Participants were contacted and visited at their own homes initially to recruit them into the study. A structured interview using a computer aided questionnaire was completed during this encounter. Participants were then requested to attend the hospital for a detailed health check. Information on basic demographics (including age, sex, and ethnicity) were collected during the initial home visit. At this home visit, participants were asked the following question, 'Have you fallen in the past 12 months with answer categories: 1- 'No', 2- 'Yes'. A fall was defined as "unintentionally coming to rest on the ground, floor, or lower level".[19]

Statistical analysis

Data analyses were conducted using SPSS Version 23 (IBM, Armonk, NY, USA). As age was a continuous variable, the ethnic differences in age were evaluated using analysis of variance, while ethnic differences were determined using the Chi-squared test for the remaining variables in terms of baseline characteristics which were categorical variables. The differences in prevalence of falls with age was compared with the independent t-test later. We also categorized the participants into five year age bands: 55-59, 60-64, 65-69, 70-74, and ≥75 years. The crude prevalence of falls was estimated by age groups and ethnicity. As the sample was stratified to allow for equal representation of the three ethnic groups and the different age groups in the cohort study, weighted data analysis was necessary in order to estimate prevalence for the local population. Sample weights were calculated by ethnicity and 5 year age groups using population statistics published by the Department of Statistics, Malaysia, obtained from the 2010 population census.[17] Modified binary logistic regression was carried out to compare prevalence of falls among the ethnic groups using the Malay ethnicity as the reference group to estimate relative risk[20]. Modified multiple logistic regression was then performed with the factors age, gender, partner status, and education to eliminate potential confounding effects. Interactions between age, education and ethnicity were assessed using product terms. p-values of less than 0.05 were considered statistically significant.

Patient and Public Involvement Statement

As this was a population-based cohort study, non-governmental organizations, senior citizens' groups and charitable organizations were consulted in a consultation forum followed by focus groups to identify key issues they felt they would like addressed. The MELoR questionnaire was

scrutinized by older persons from local senior citizen groups and their feedback given due consideration in refining the questionnaire. Our recruitment process involved engaging local community leaders who then assisted us with first organizing local publicity events which included health talks, free health screening or exercise sessions. Selected participants were then accessed by identifying these individuals or their neighbors at these events, and enlisting the help of local residents in door-to-door recruitment. Participants were provided with individual feedback during their health check by a medical specialist and this was followed by a written report of their screening results. Preliminary aggregated results have been presented to local residents through numerous local follow-up publicity events, and further individual feedback is planned during subsequent waves.

RESULTS

Data on falls was available for 1565 individuals, 519 were ethnic Malays, 544 ethnic Chinese and 502 ethnic Indians. Table 1 shows the socio-demographic characteristics of the sample population according to ethnicity. There were significant differences in age, marital status, education and smoking status according to ethnicity.

Table 1. Basic Characteristics according to Ethnicity

	Total (n=1565)	Malay (n=519)	Chinese (n=544)	Indian (n=502)	p-value*
Age (yrs), mean ± SD	68.9 ± 7.5	67.8 ± 7.1	69.4 ± 7.4	69.5 ± 7.9	<0.001
Age Categories (years), n(%)					0.015
55-59	189 (12.1)	72 (13.9)	52 (9.6)	65 (12.9)	
60-64	325 (20.8)	126 (24.3)	111 (20.4)	88 (17.5)	
65-69	361 (23.1)	117 (22.5)	133 (24.4)	111 (22.1)	
70-74	364 (23.3)	118 (22.7)	131 (24.1)	115 (22.9)	
≥75	326 (20.8)	86 (16.6)	117 (21.5)	123 (24.5)	
Female Gender, n (%)	892 (57.0)	282 (54.3)	331 (60.8)	279 (55.6)	0.074
Single/Widowed, n (%)	414 (26.5)	127 (24.5)	121 (22.2)	166 (33.2)	<0.001
Secondary/Tertiary Education, n (%)	1133 (72.4)	298 (57.6)	447 (82.2)	388 (77.3)	<0.001
Smoker, n (%)	309 (19.7)	133 (26.1)	90 (16.9)	86 (17.6)	<0.001

*Chi-squared test for categorical variables and analysis of variance for age.

Prevalence of Falls

The crude prevalence for the overall population aged 55 years and over was 22.8%, and for those aged 65 years and over was 24.5%. The crude prevalence of falls among the ethnic Malays aged 55 years and over was 18.9% compared to the ethnic Chinese at 22.4% and the Ethnic Indians at 27.3%. The crude prevalence of falls according to age groups and ethnic groups are shown in Table 2. The prevalence of falls increased significantly with age (mean age ± standard deviation of fallers vs non-fallers= 70.4 ± 8.1 vs 68.4 ± 7.2; $p<0.001$). Weighted prevalence was then estimated according to the population composition of Kuala Lumpur. The estimated true prevalence of falls for all ethnic Malays aged 55 years and over was 16.2%, Chinese 19.4% and Indians 23.8%. The prevalence of falls increased with age for the overall population and all three ethnic groups. The overall prevalence of falls weighted for the population of Kuala Lumpur aged 55 years and over was 18.9%. The weighted prevalence of falls for individuals aged 65 years and over was 23.5%.

Table 2. Crude prevalence of falls according to age group and ethnicity

Age Group (Years)	Falls, n (%)*			
	Overall	Malay	Chinese	Indian
55-59	30, (15.8)	9, (12.5)	8, (15.4)	13, (20.0)
60-64	69, (21.2)	23, (18.2)	24, (21.6)	22, (25.0)
65-69	76, (21.0)	18, (15.4)	31, (23.3)	27, (24.3)
70-74	77, (21.1)	28, (23.7)	21, (16.0)	28, (24.3)
75+	105, (32.2)	20, (23.3)	38, (32.5)	47, (38.2)

*Crude prevalence is presented in as percentages parenthesis

Ethnic Differences in Fall Prevalence

Table 3 shows the relative risk for falls for the ethnic Chinese and ethnic Indians compared to the ethnic Malays unadjusted, and adjusted for age, gender, marital status and education. . Compared to the ethnic Malays, the ethnic Indians were significantly more likely to fall in unadjusted analysis (p=0.012). After adjustment for age and gender and further adjustment for marital status and educational level, the ethnic Indians remained statistically more likely to report at least one fall in the preceding year compared to the ethnic Malays. Inclusion of the product terms for ethnicity and level of education as well as ethnicity and age found no significant interaction effect between education or age with ethnicity.

Table 3. Univariate and Multiple Logistic Regression for Ethnic Differences

		Falls		
		Relative Risk	95% Confidence Interval	p-value
Model 1	Ethnicity			
	Malay (reference)			
	Chinese	1.19	0.89-1.59	.230
	Indian	*1.44*	*1.08-1.92*	*.012*
Model 2	Ethnicity			
	Malay (reference)			
	Chinese	1.12	0.83-1.50	.451
	Indian	*1.38*	*1.03-1.84*	*.030*
	Age*	*1.03*	*1.01-1.04*	*.001*

	Female Gender	*1.36*	*1.07-1.74*	*.012*
Model 3	Ethnicity			
	Malay (reference)			
	Chinese	1.20	0.88-1.63	.239
	Indian	*1.45*	*1.08-1.95*	*.014*
	Age*	*1.03*	*1.01-1.04*	*.001*
	Female Gender	*1.31*	*1.01-1.70*	*.038*
	Single/Widowed	1.03	0.79-1.36	.818
	Secondary/Tertiary Education	*1.28*	*0.99-1.66*	*.061*

*per year increase

Model 1- unadjusted

Model 2- adjusted for age and gender

Model 3- adjusted for age, gender, marital status and education level.

DISCUSSION

The population adjusted prevalence of falls among adults aged 55 years and over residing in Kuala Lumpur was 18.9%, and for those aged 65 years and over was 23.5%. There was an increase in fall prevalence with older age. Among the ethnic groups, the Indian ethnicity was associated with higher prevalence of falls when compared to the ethnic Malays. Our study was the first to report the prevalence of falls in the urban population in Malaysia and the first to demonstrate increased risk of falls in ethnic Indians in an Asian population.

Previous studies showed that the proportion of falls in aged 65 years and above varied between 18% to 28% per year.[7,21] The falls prevalence reported in our urban population was comparatively lower than that reported by previous studies performed in the United Kingdom and United States of America.[4] The prevalence of falls has been observed to vary widely in different parts of the world. Studies from the Caribbean and Latin Americans also reported higher fall rates from 21.6% -34%.[22] Falls prevalence in the Australian population was reported as 30%.[23] A recent report from the Irish Longitudinal Study of Ageing involving individuals aged 50 years and over, reported a prevalence of 19.2%.[24] A systematic review of 21 studies from Asian countries on falls found that the fall prevalence varied between 14.7-34% in older Chinese population,[9] which was comparable to our Chinese population.

Age is a well-established risk factor for falls.[21] In our study, with each year's increase in age, the odds of falls increases by 4%, and with the overall prevalence of falls increasing to 32% in the overall population aged 75 years and above. A study from Hong Kong showed that advanced age was associated with greater prevalence and incidence of falls.[25]. The prevalence of falls was observed to increase from 24% to 37% for those above the age of 80 years when compared to those in their sixties.[7] Within our cohort, falls rates were similar in the 60-74 year age groups, and only increased in the over 75s, overall. However, the increase in falls rate appears to occur earlier among the ethnic Malays, at 70 to 74 year age bracket, compared to over 75 years for the ethnic Chinese and Indians.

Ethnic differences have been studied in the American population where it was reported that African–Americans were less likely to fall than whites, but these differences were influenced by

potential confounders.[26] Similar findings were reported in another study from the United States, among older community-dwelling Caucasian and Afro-American women.[27] A study from Singapore showed that ethnic Malays had a significantly higher likelihood of falls compared to the Singaporean Chinese.[28] In contrast, our study found no significant difference in falls prevalence between the ethnic Chinese and Malays. The proportion of ethnic Malays, however, only comprised 8% of the overall population in the previous study.[28] The differences between Singaporean Malays and Malaysian Malays are of interest, and may be explained by differences in occupation, physical activity or social structure. This study was the first to report increased risk of falls in ethnic Indians in comparison to the ethnic Malays. Our study was, however, not able to establish any underlying rationale for the ethnic differences, which would be a subject for future research. While age, gender and educational level were significantly associated with increased falls risk, these factors did not influence the relationship between falls and ethnicity in our study.

The presence of falls in the preceding year was determined by retrospective recall. Previous reports have suggested that retrospective falls recall may not be fully accurate as older adults have a tendency to forget they had fallen, depending on various factors such as recall interval, injury associated fall and their cognitive status[29] A systematic review of methods of measuring falls in randomized control fall prevention trials found that there was a substantial lack of standardization in the use of terminology and documentation methods of falls. The study looked at 90 publications out of which 27% used retrospective reporting methods like telephone interview, face to face interview and postal questionnaires while 42% used prospective reporting methods like calendars and diaries, of which the latter was recommended.[30] However, the ability

to conduct prospective recording using falls diaries in population-based studies would be technically challenging with many of our older persons having problems with documenting their falls properly. Another study which examined reliability of patients own reports of falls found that the question 'Did you fall' had a sensitivity of 91.5% and a specificity and positive predictive value of 100% as a tool in the A&E setting.[31] This study was carried out in an urban area, hence it may not be representative of the rural or semi-urban regions of Malaysia. Further studies will be needed to identify the etiology underlying ethnic differences in fall prevalence, as well as determine whether these differences still exist in prospective studies.

CONCLUSION

The estimated prevalence of falls among individuals aged 55 years and older in an urban area in Malaysia was 18.9%. Among the different ethnic groups in the study, the prevalence of falls was significantly higher among ethnic Indians compared to the ethnic Malays. Future studies should now seek to identify factors determining the ethnic differences in falls risk.

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CONTRIBUTORSHIP STATEMENT

AVC, NNH, SO, SK, SBK, MPT conceived the study, contributed to study design, obtained the funding for the study, and were responsible to the conduct of the study. HMK, was involved in data collection. DA, HMK and MPT contributed to data analysis. All authors contributed toward the writing of the manuscript and approved the final submitted version.

COMPETING INTERESTS

None declared

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DATA SHARING STATEMENT

Due to concerns about loss of fidelity of personally identifiable data, the MELoR dataset is currently not available publicly. However, parts of the dataset will be released anonymised through written requests submitted to the corresponding author.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			8

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.