

# Social Participation's Association with Falls and Frailty in Malaysia: A Cross-Sectional Study

S. Risbridger<sup>1</sup>, R. Walker<sup>1,2</sup>, W.K. Gray<sup>2</sup>, S.B. Kamaruzzaman<sup>3</sup>, C. Ai-Vyrn<sup>3</sup>, N.N. Hairi<sup>4</sup>, P.L. Khoo<sup>5</sup>, T.M. Pin<sup>3</sup>

1. Faculty of Medical Sciences, Newcastle University, UK; 2. Northumbria Healthcare NHS Foundation Trust, UK; 3. Department of Medicine, Faculty of Medicine, University of Malaya, Malaysia; 4. Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya, Malaysia; 5. Sports Centre, University of Malaya, Malaysia

Corresponding Author: Tan Maw Pin, Department of Medicine, Faculty of Medicine, University of Malaya, Malaysia, [mptan@ummc.edu.my](mailto:mptan@ummc.edu.my)

## Abstract

**BACKGROUND:** The global population is ageing rapidly, with the most dramatic increases in developing countries like Malaysia. Older people are at increased risk of multimorbidity, frailty and falls.

**OBJECTIVES:** In this study we aimed to determine the relationship between social participation, frailty and falls in Malaysia.

**DESIGN, SETTING, AND PARTICIPANTS:** This was a cross-sectional study of individuals aged 55 years and above selected from the electoral rolls of three Klang Valley parliamentary constituencies through stratified random sampling. They were invited to take part in a questionnaire and physical assessment as part of the Malaysian Elders Longitudinal Research (MELoR) study.

**MEASUREMENTS:** Fallers were individuals who had fallen in the previous year. Frailty was defined as meeting  $\geq 3$  of: low body mass index, reduced cognition, low physical activity, low hand-grip strength, and slow walking speed. Social participation was determined from employment status, social network, and community activity. Binomial logistic regression multivariate analysis was performed to identify links between the measures of social participation and falls and frailty.

**RESULTS:** The mean age of the 1383 participants was 68.5 years, with 57.1% female. Within the population, 22.9% were fallers and 9.3% were frail. Social isolation (OR= 2.119; 95% CI=1.351-3.324), and non-engagement in community activities (OR=2.548; 95% CI=1.107-5.865) were associated with increased frailty. Falls increased with social isolation (OR=1.327; 95% CI=1.004-1.754).

**CONCLUSIONS:** Previous studies have shown social participation to be linked to frailty and falls risk, and social isolation to be a predictor of falls. In this study frailty was associated with all three social participation measures and history of falls was associated with social isolation.

*Key words:* Healthy ageing, frailty, falls, social isolation, community.

## Introduction

The world's population is ageing rapidly and Asian countries are expected to see a much greater increase than their more developed counterparts (1). Already, the proportion of over-65s in the Malaysian population rose from 3.9% in 2000 to 6.7% in 2018. This demographic transition is likely to lead to increased dependency, due to frailty, falls, and other age-related conditions, and requires a shift in health and social care provision (2-4).

Advancing age is associated with frailty as the result of global, cumulative, cyclical physiological decline. There is no single concept or phenotype to describe frailty due to

its complex mixture of increasing vulnerability, decreasing cognition causing confusion and restricted mental capacity, and reduced physical abilities. Frailty can be completely reversible or improved through intervention (5). Frailty-related syndromes include falls, delirium, lack of mobility, incontinence and susceptibility to medication side effects (6). The prevalence of frailty in Malaysia has been reported as being between 5.7-9.4% in the over 65s (3, 7-9). The longer individuals live, the greater their risk developing age-related conditions, with the population aged 80 years and above increasing the most rapidly and representing individuals at highest risk of falls and frailty (10).

A bidirectional relationship is likely to exist between falls and frailty. As one of the frailty-related syndromes, falls have multiple associated risk factors including: sarcopenia, impaired sensorimotor function, environmental factors such as home hazards, medication side effects, and cardiovascular diseases (11-13). Falls have been identified as the second leading cause of unintentional death globally (14). The prevalence of falls in over 55's in Malaysia was reported as 18.9%, with many studies in South-East Asia reporting comparatively lower prevalence than in more developed countries (2). In their discussion on healthy ageing, the World Health Organization highlighted the multifactorial causes of falls; social interaction and community support was highlighted as an area for helping prevent falls (15). They described social participation as one of the key pillars of 'Active Ageing' and highlighted its necessity for healthy ageing (16, 15).

Whilst no universal definition of social participation exists it is often described as 'a person's involvement in activities providing interactions with others in society or the community' (17, 18). The continuum of participation ranges from those with 'active' roles running organisations, to solely participating in these activities, and extends to employment. These active roles often require higher levels of interaction with the local community (19). This social participation is recognised as a major contributor to health with evidence demonstrating reduction in all-cause mortality (18).

Social participation may be reduced with increasing age (20). Social isolation is associated with mortality, hospitalisation, mild cognitive impairment (MCI), dementia, and many other health conditions (21-24). Protective mechanisms such as social inclusion and cohesion may decrease frailty prevalence and reduce the incidence of falls

(25).

Social participation, frailty, and falls are related and in turn may influence healthy ageing and quality of life for older adults (26). In this study we aimed to gain insights into the relationship between social participation, frailty, and falls in the elderly Malaysian population.

## Methods

### Design

This was an exploratory analysis using cross sectional data.

### Participants

The MELoR study is a longitudinal cohort study based in Klang Valley, Kuala Lumpur. The initial study consisted of a 14-section questionnaire, which was undertaken at the participant's home, and a clinical assessment completed at the University of Malaya Medical Centre. The questionnaire was administered by trained interviewers in English, Malay, Chinese, or Tamil, as appropriate to the participant.

Data collection occurred between November 2013 and October 2015. The electoral rolls of the Parliamentary constituencies of Petaling Jaya North, Petaling Jaya South, and Pantai Valley were used to determine the base population for the study. Individuals aged 55 years and above in 2013 were selected through simple random sampling, stratified by age deciles and ethnicity, and were included if they could provide informed consent. An age cut-off of 55 years was used as this was the mandatory retirement age in Malaysia at study initiation, though it has since increased to 60 years.

Stratification by ethnicity was for the three main ethnic groups in Malaysia: Malay, Chinese, and Indian. The exclusion criteria included those who were institutionalised, bed-bound, unable to access the research centre, or those who had communication difficulties, including severe cognitive impairment meaning they lacked the ability to answer the questionnaire. These initial cross-sectional data were used for this study, as the longitudinal follow up data were not yet available.

A total of 8769 individuals were invited to take part in the study, of whom 5815 were initially contactable, and 3334 met all the eligibility criteria.

### Measurements

An adapted version of the Fried frailty phenotype was operationalised based on the available data. The 'shrinking' element was defined in line with the HAALSI cohort study (27), using body mass index (BMI); a BMI lower than the WHO recommended 18.5k/m<sup>2</sup> was given a positive score (28). The 'poor endurance and energy' element was replaced by a measure of cognitive impairment, the Montreal cognitive assessment (MoCA); any individual scoring  $\leq 18$  on the MoCA after educational adjustment was determined to have MCI, in

line with the validation of the Bahasa Malaysia MoCA (29). The 'low physical activity' element was measured using the international physical activity questionnaire (IPAQ); the bottom quintile were given a positive score,  $\leq 292.68$  for males and  $\leq 216.00$  for females. The 'slowness' element was a test of walking 15ft; a cut-off of  $\geq 7$  seconds was used for males and females as this included all the bottom quintile. The 'weakness' element was a test of hand-grip strength (HGS); the bottom quintile was any male with right-handed HGS  $\leq 21.83$ kg and any female with right-handed HGS  $\leq 14.50$ kg. In keeping with the original methods, a score of three or more out of five was considered to signify a diagnosis of frailty (5). Adjustments to the original frailty phenotype were undertaken partly due to data availability. The decision to include the MoCA as a measure of cognitive frailty was in recognition of the fact that cognition does have a major effect on frailty. Lack of measurement of cognition is a key issue with Fried's original score (27, 30). Participants were determined to be a faller if they had reported at least one fall in the previous 12 months.

Social participation was measured in three ways; as these do not form a coherent score, each were analysed separately and discussed individually where appropriate. Employment status was self-disclosed within the questionnaire: whether they had ever worked, and whether they were currently working. 'Working' included self-employment, family businesses, and private or governmental employment. We wanted to highlight the difference within the population between those who were retired, as is common in this age group in Malaysia, and those who were unemployed and have never worked who may be at greater risk of conditions associated with ageing. The Lubben Social Network Scale-6 (LSNS-6) was used to determine which individuals were at risk of social isolation, as per the published guidelines (31). Levels of community activities (such as sports groups, clubs, societies, and involvement with non-governmental/ voluntary organisations) were separated into three groups: those who had no community activities 'none', those who had relatively 'inactive roles' or simply stated membership with no role attached, and those with 'active roles' in positions of responsibility such as a committee member or tutor. In the discussion, 'social participation' is used as an overarching concept of inclusion in society, measured through these three scales.

### Statistical methods and data analysis

Data were analysed using SPSS Version 26 with the significance threshold set at  $p < 0.05$ . Univariate analysis was performed using Pearson's chi-squared statistical test of homogeneity. Significant results were then taken on to post hoc analysis with multiple z-tests of two proportions, with Bonferroni corrections, and binomial logistic regression multivariate analysis.

Participants missing demographic data were excluded from analysis as they could not be correctly differentiated within populations. Individuals missing data either for frailty or falls, but not both, were included in the analysis for the sections they had completed. The same process was applied for the

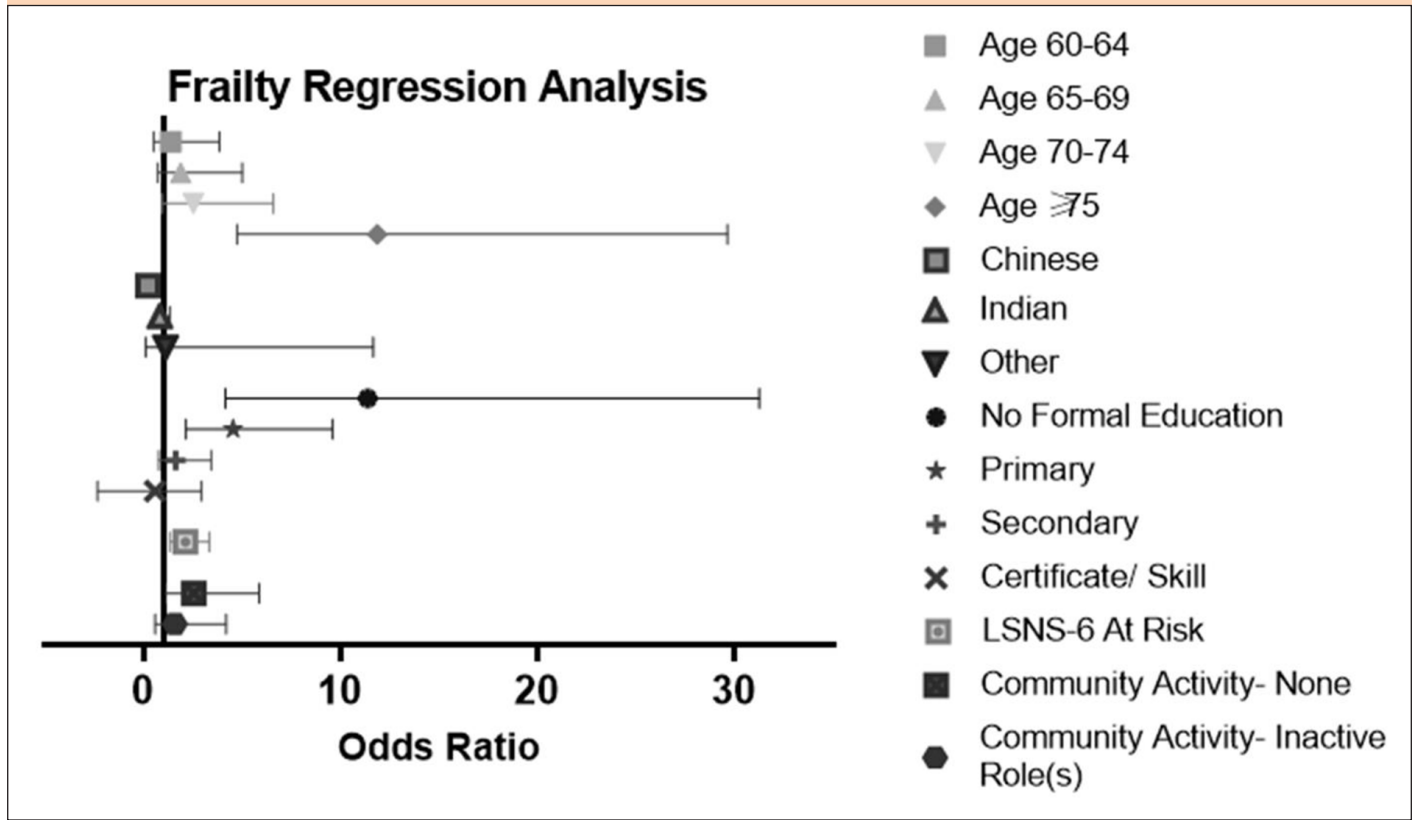
**Table 1.** Basic characteristics and outcome data from the study population

Variable	Value	Number	Percentage (%)
Age (Years)	<60	176	12.7
	60-64	288	20.8
	65-69	331	23.9
	70-74	325	23.5
	≥75	263	19.0
Gender	Male	593	42.9
	Female	790	57.1
Ethnicity	Malay	436	31.6
	Chinese	496	36.0
	Indian	438	31.8
	Other	8	0.6
BMI (kg/m <sup>2</sup> )	Underweight <18.5	55	4.0
	Normal 18.5-24.9	670	49.3
	Overweight ≥25	430	31.6
	Class I Obese 30-34.9	158	11.
	Class II Obese 35-39.9	36	2.6
	Class III Obese ≥40	10	0.7
Educational Attainment	No Formal Education	40	2.9
	Primary	319	23.2
	Secondary	585	42.5
	Certificate/ Skill (Post-Secondary)	82	6.0
	University	349	25.4
Employment Status	Never Worked	117	8.5
	Not Currently Employed	972	70.8
	Currently Employed	284	20.7
LSNS-6 Score	No Risk of Social Isolation	984	72.0
	At Risk of Social Isolation	382	28.0
Participation in Community Groups	No	843	62.0
	Only Inactive Role(s)	272	20.0
	Active Role(s)	244	18.0
Fall in Previous 12 Months	No	1047	77.1
	Yes	311	22.9
Frailty Score	0	591	45.1
	1	397	30.3
	2	206	15.7
	3	89	6.8
	4	26	2.0
	5	2	0.2
Frail	No	1230	90.7
	Yes	126	9.3

three measures of social participation. Participants who did not have every item completed for the frailty score fell into two categories: those with enough data to assign 'frail' or 'not frail'; those without enough available data who were therefore excluded from this part of the analysis. Assignment to a category was determined according to one of three criteria:

they had already scored three so were 'frail'; they had scored zero and were missing one or two items of data so were 'not frail'; they had scored one and were missing one piece of data so were 'not frail'.

**Figure 1.** Adjusted regression analysis for frailty. Odds ratio showing increased frailty compared to index category. Error bars representing 95% CI



## Results

The total study population was 1383 after removal of incomplete entries, duplications, and those who did not meet eligibility criteria. The cohort which were excluded in data cleaning had similar age, sex, ethnicities, levels of social isolation and participation, and number of fallers to the final sample used, according to the data available.

As shown in Table 1, the average age was 68.5 years, with the eldest participant aged 93 years. The largest ethnic group was Chinese. Only 2.9% had no formal education, and 73.9% had secondary education or higher. The mean BMI was 25.33 kg/m<sup>2</sup>, ranging from 13.62 to 59.63. Most of the population were not currently employed, although they had been previously. 28% were found to be at risk of social isolation. 33.1% reported being a member of a society, 10.6% were members of Non-Governmental Organisations or charities, and 18% had active roles in either activity.

As shown in Table 1, 126 (9.3%) of the study population were identified as 'frail', while for 2% of the population there were not enough data to determine their status. According to the specific frailty score calculated, 591 (45.1%) were deemed non-frail, 603 (46.0%) were pre-frail, and 117 (9%) frail. 311 (22.9%) were identified as a 'faller' (1.8% of the sample not completing this section) of whom 201 (66.8%) had only fallen once in the preceding 12 months.

117 (8.5%) participants had never worked, of whom 33 (28.9%) were fallers and 26 (23.2%) were frail. Of the 284

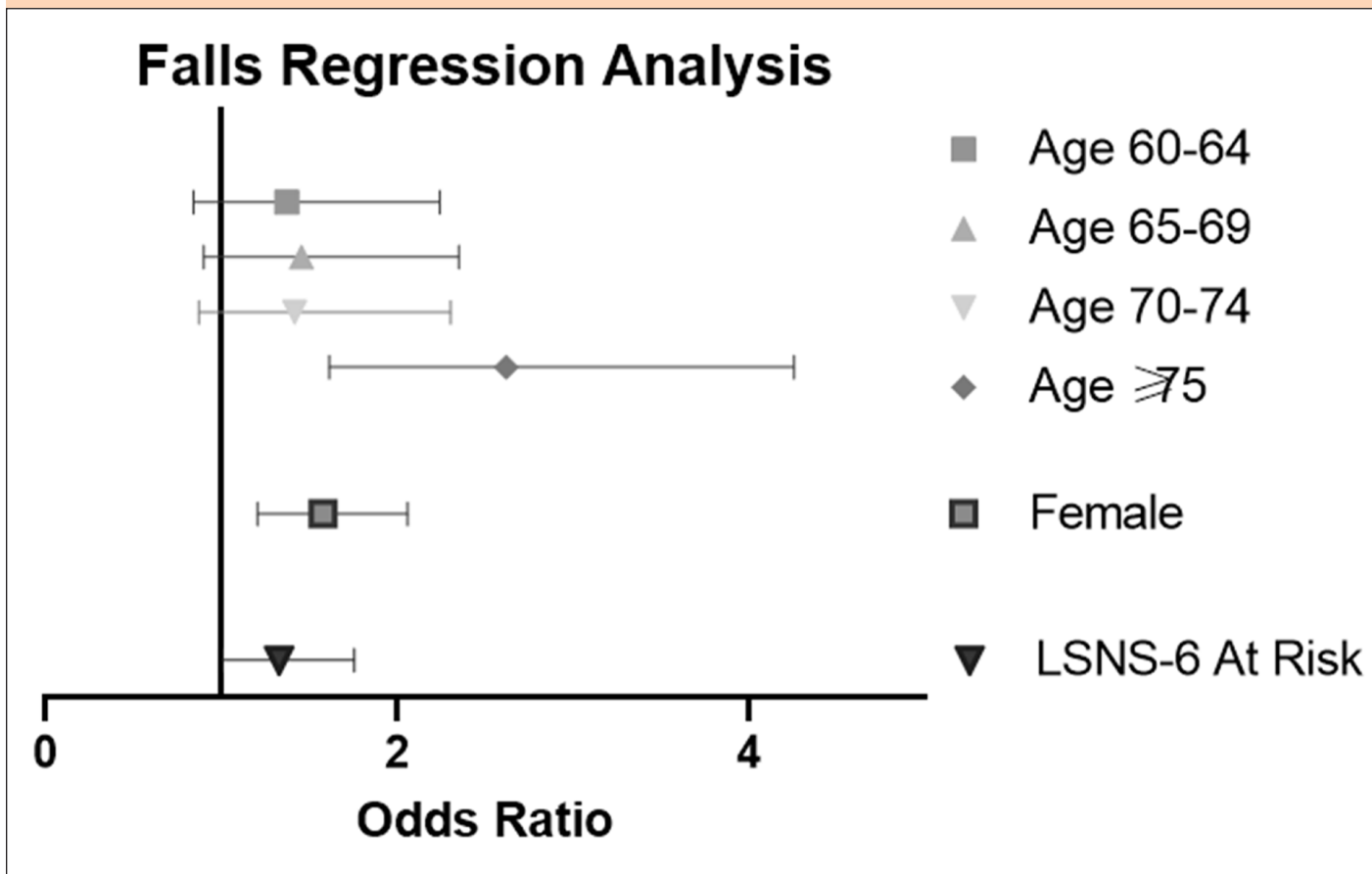
(20.7%) participants who were still currently employed, 53 (18.9%) were fallers and 12 (4.2%) were frail. There was a statistically significant difference in proportions of those who were frail when grouped by employment status,  $X^2 = 34.949$ ,  $p < 0.001$ . Regression analysis showed employment status no longer had a statistically significant effect on diagnosis of frailty when other variables had been considered, mainly educational attainment.

382 (28%) participants were deemed to be at risk of social isolation when using the LSNS-6; 101 (26.9%) were identified as fallers and 60 (16.3%) were frail. There was a statistically significant difference in frailty between the isolation classes,  $X^2 = 31.436$ ,  $p < 0.001$ . Regression analysis showed those at risk of social isolation had 2.119 (95% CI 1.351-3.324) times higher odds of being classed as frail,  $p = 0.001$ , as shown in Fig 1.

In relation to social isolation, there was a statistically significant difference in the proportion of those who fell compared to those who did not,  $X^2 = 4.579$ ,  $p = 0.032$ . Regression analysis showed those at risk of social isolation had 1.327 (95% CI 1.004-1.754) times higher odds of falling,  $p = 0.047$ , as shown in Fig 2.

843 (62%) participants were not involved in community groups; 201 (24.1%) of these were fallers and 99 (12%) were frail. 244 (28%) had at least one active role with 48 (19.9%) of these being fallers and 7 (2.9%) being frail. There was a statistically significant difference in proportions of those who were frail when grouped by involvement in community groups,  $X^2 = 26.139$ ,  $p < 0.001$ . Regression analysis showed that those

**Figure 2.** Adjusted regression analysis for falls. Odds ratio showing increased falls compared to index category. Error bars representing 95% CI



not participating in community groups had 2.548 (95% CI 1.107-5.865) times higher odds of being frail than those with active roles,  $p=0.028$  (seen in Fig 1).

### Discussion

Reduced social participation, measured through social isolation according to the LSNS-6 and absence of participation in community groups, was associated with frailty in this study. Falls were also associated with reduced social participation in this study specifically through the measure of increased social isolation.

The prevalence of frailty in this cohort was 9.3%, in keeping with prevalence estimates of between 5.7% and 9.4% from other studies (3, 7-9, 32). As this cohort included individuals aged 55 years and over, rather than the usually employed lower age cut-offs of 60 or 65 years, the prevalence was expected to be lower than previously reported. The relatively high prevalence may be due to the high proportion of both females and those aged  $\geq 75$  in the study, and the way in which Fried's criteria were operationalised in our adapted assessment. As expected, age had a large impact on the diagnosis of frailty; 24.5% of those aged  $\geq 75$  were frail, with only 8.5% of individuals aged 70 to 74 years being considered frail. Badrasawi et al in 2016 studied a demographically similar population in Klang Valley, in people  $\geq 60$ . They found a frailty

prevalence of 8.9% in a smaller sample of 473 participants (8).

Frailty was found to be significantly associated with social isolation, according to the LSNS-6, and lack of participation in community groups. These both caused the odds of being frail to be two times higher in the adjusted models. Once adjusted for education, the relationship between employment status and frailty was no longer statistically significant. Community activities are often physically or mentally stimulating, which appears to maintain healthier levels of activity and cognitive function (18, 33).

Being involved in the community and maintaining social ties will provide a support system for older people, improve their mental wellbeing, and allow them to stay active; having objectives and a purpose in life has been shown to improve happiness and health (24, 23). The link between social activity and frailty has not been as well studied as other aspects of frailty. Few studies exist globally, but the positive nature of social participation is shown often (18, 34, 35). Developing systems to increase social participation, particularly in the oldest age groups, is likely to improve the lives of Malaysia's ageing population.

Social isolation was associated with increased reported falls after adjusting for age, gender, and ethnicity. This fits with research by Pohl et al in the USA who determined that social isolation is a good predictor of falls, though participants had an average age 10 years older than in this study (22). No similar

studies have been performed in Malaysia or within South-East Asia. Although our cross-sectional study does not suggest a causal link between social isolation and falling, social isolation may increase fear of falling or the consequences of a fall may be more severe, making the experience easier to recall. Many studies have highlighted the chain effect of falling, fearing falling, decreasing social activities, increasing isolation, and then having a greater risk of falling again[36]. An improved social circle, and regular contact with friends and family, could mean the individuals have better quality of life and reduced healthcare burden (34, 35).

The importance of the effects of social participation, and the risks of social isolation could not be more relevant to the current global situation. COVID-19 has led to many countries introducing social-distancing and 'lockdown' measures; it was estimated that in March 2020 over one-third of the global population had some form of restricted movement (37). Individuals who are older, have chronic health conditions, or are otherwise vulnerable are most likely to be facing the longest periods of isolation; social isolation in the elderly is already known to put them at risk of neurocognitive decline, cardiovascular disease, autoimmune problems, depression and anxiety, as well as an increase in mortality of nearly one-third (37-39). To add to that, an increase in frailty and falls will place increased demands on services. However, COVID-19 was not the trigger for social isolation of the older populations (but definitely worsened the problem), insights into the root causes of disintegration within communities and lack of opportunities for participation in the older age groups may inform future interventions and improve all aspects of health for the older population. Protecting this population from the future health risks caused by the social isolation from this pandemic would allow health systems to better prepare for similar future challenges. The WHO Global Network for Age-friendly Cities and Communities is an important example of current policy striving to better provide for our older populations in this way, and more initiatives such as this could have a major impact in improving quality of life (40).

### Limitations

Due to the retrospective nature of the study questionnaire, falls prevalence may have been underestimated, as recall bias can underestimate falls by 13-32% (12). This bias would also limit recall of engagement in community activities. As this study was performed cross-sectionally, reverse causation cannot be assessed, and so temporal relationships can be suggested but not proved.

We used an adapted Fried frailty score which has not been validated, and this may mean that the predictive value demonstrated by the original score is not reflected in this study. The frailty phenotype has several documented limitations including its reliance on physical traits and ignoring psychological and cognitive decline (41). The lack of availability of data about 'exhaustion' is the most limiting aspect of this operationalisation. Previous researchers have suggested links between the physical frailty described in Fried's

phenotype and cognitive decline, and the usefulness of adding a cognitive test to the phenotype, but there is no evidence that this could replace the missing element (42).

The younger cohorts included in this study may also have biased our findings. The older an individual is, the more likely they are to be affected by falls and frailty, and so including down to the ages of 55 may have hidden some key details.

### Recommendations for future work

A longitudinal cohort study could help determine whether social isolation in fact leads to frailty or if frail individuals are less able to participate in current society. Whether greater participation in society before a person retires could reduce their future risk of frailty and falls is an important link to the multifactorial aetiology of frailty.

Creation of a universally agreed measurement of social participation and frailty would make research more relatable to the global population. A score which identifies the key areas of social participation, while being accessible to countries with poor healthcare infrastructure and funding, would best provide a global measurement of participation to allow results to be directly compared between populations. A universal consensus for the diagnosis of frailty would also mean results could be directly compared globally.

### Conclusions

Reduced social participation, measured with reduced social network and absence of participation in community groups, is associated with the frailty phenotype in individuals aged 55 years and over included in this study. Falls, as an outcome of frailty, also shows an association with reduced social participation through increased social isolation. Within developing nations, social participation may be an affordably modifiable risk factor for frailty and its associated syndromes, which would in turn improve quality of life and support healthy ageing.

*Ethics approval:* The MELoR study was approved by the University of Malaya Medical Centre Medical Ethics Committee (Ref: 925.4).

*Authors' contributions:* Material preparation and data collection were performed by Shahrul B Kamaruzzaman, Chin Ai-Vyryn, Noran N Hairi, Phaik Lin Khoo, and Tan Maw Pin. Analysis was performed by Sophie Risbridger, under the guidance of Richard Walker and William Keith Gray. The manuscript was written by Sophie Risbridger and all authors commented on versions of the manuscript.

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