Prevalence, Risk Factors and Measures of Frailty in Malaysia: A Scoping Review

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ABSTRACT

This scoping review aimed to map out the empirical evidence on the prevalence, associated risk factors, and measures of frailty among older people in Malaysia. This scoping review is guided by the methodological framework suggested by Arksey and O’Malley. Literature searches were conducted on academic journals published from 2010 to 2020 (Malaysian studies only). Ten studies were included in this review from 1778 papers screened from the electronic databases. Frailty prevalence was found in the range of 5.7% to 56.5%, whereas pre-frailty was 57.9% to 72.8%. Associated risk factors of frailty can be categorized into body impairments, activity limitations, and personal factors. The most commonly used measure is based on Fried’s Phenotype Model, however, the procedure for each criterion varied. The findings of the scoping review highlighted the gaps regarding the risk factors and inconsistencies in the measure of frailty.

Keywords: Fatigue, Frailty, Malaysia, Older people, Weight loss.

INTRODUCTION

Malaysia is currently facing the prospect of an aging population as in 2020 about 10% of its population are 60 years old and above (1). It is estimated that by 2030 the elderly population will grow to about 15% that qualifies Malaysia as an aging population (2). Aging brings about many consequences with frailty has been identified as one of the most common ones (3), which has been regarded as a new geriatric syndrome (4) that leads to higher risks of adverse health outcomes (5). Frail old people are at greater risk of premature death and multiple adverse effects, including falls, injuries, disabilities, and dementia, all of which may lead to poor quality of life (QOL) and increased cost and use of health care services, such as visits to the emergency room, hospitalization, and institutionalization (6).

Frailty has been defined in numerous ways. Frailty term originated from the Greek word that means loss of flesh, and later was updated as the loss of muscle mass and function that occurs with aging (7). The loss of muscle mass has been evident as the cause of reductions in the metabolic rate and physical activity leading to depletion in energy production and consumption (8). Others suggested that frailty occurs when there is increased vulnerability to stressors leading to a multi-system impairment (9). The latest update is that frailty is associated with a homeostatic instability due to the disturbance in the interaction between genetic, biological, functional, cognitive, psychological, and socio-economic domains or dimensions (5). The evolution of the definition for frailty indicates that further studies are warranted to enhance its understanding and to determine its risk factors that may depend on how it is measured and which factors can be modified through rehabilitation.

Studies on the prevalence of frailty have been conducted among various countries in Asia such as China, Indonesia, Thailand, and Singapore, and reported the ranges between 5.7% and 62.8% (10,11,12,13). Some of these countries classified frailty status into either frail, pre-frail, or robust. In addition, various screening tools have been used to define frailty status. According to a previous study (14), screening tools may depend on the model characteristics and clinical settings. Thus, previous findings on the prevalence of frailty in Asia may not represent Malaysia due to differences in the methodological framework.
sociodemographic factors.

Since Malaysia is moving very fast to become an aging population, thus, it is important to examine the prevalence and risk factors of frailty specific to the Malaysian setting. This identification may provide evidence and guide the planning of health care provision and rehabilitation strategies for older people aiming to optimize their functions. No doubt a few studies have been conducted in Malaysia, however, there is little effort to conduct a review of both frailty and the risk factors among the older persons in Malaysia. Hence, there is a need to map the findings of the current evidence in Malaysia regarding frailty. Therefore, the objective of this scoping review is to map the existing literature related to frailty in older persons, specifically in Malaysia. Besides, it is also the aim of this scoping to review the common screening tools used among studies conducted in Malaysia. It is anticipated that the results of this study will provide the baseline information on the prevalence of frailty, the associated risk factors of frailty, and the screening tool or measure for frailty.

MATERIALS AND METHODS

This scoping review was undertaken to summarize the prevalence, risk factors, and measurement tools of frailty in Malaysia. This scoping review is guided by the methodological framework suggested by Arksey and O’Malley (15). The review was divided into five stages, that include:

1) Identification of research questions,
2) Identification of relevant studies,
3) Study selection,
4) Charting the data, and
5) Collating, summarizing and reporting the results.

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2009) was used to depict the flow of articles from the initial search until the final selection (Fig 1) (16).

Identification of research questions

Based on the purpose of this study, the following are the questions that were attempted to be answered in this review:

1) What is the prevalence of frailty in Malaysia?
2) What are the risk factors associated with frailty? and
3) What is the measure or screening tool used to define frailty status?

Identification of relevant studies

The journals related to this topic were searched comprehensively from January 2010 to November 2020. The electronic databases (e.g., PubMed, CINAHL, Scopus, PROQUEST, Google Scholar, and Cochrane Library) were searched to identify all types of study, except systematic reviews or review papers that can be included in the review. The inclusion criteria were applied to studies conducted only in the Malaysian setting. Frailty, prevalence, incidence, risk factors, risk factor, measurement, measurements, diagnosis, and Malaysia were the key terms suggested for the search of relevant papers. The Boolean terms “AND”; “OR”; NOT were used to separate the keywords. The researchers independently examined the titles, abstracts, and keywords for eligibility to be included in the review.

Study selection

In the first selection stage, all the titles and abstracts were checked by two independent reviewers to remove irrelevant articles. The reviewed studies were selected if information about 1) Malaysia; 2) profile of participants; 3) prevalence of physical frailty; 4) risk factors of frailty, and 5) measure, assessment, or screening tools of frailty were provided. All studies included were written in English. The full texts of the papers found or included from step1 were retrieved (second stage) by the same independent reviewers. The reference lists of these articles were checked for any papers that were missing during the first phase of the search process. The selected papers were reviewed and discussed by the two reviewers for agreement to be in the review. The final decision by a third independent reviewer was required if there were no consensus made by the two reviewers. All factors that could be described as being connected to physical frailty were extracted from the papers by the two reviewers.

Charting the data

The papers that were selected were summarised in Table 1 to present the authors, publication years, study type(s) and purpose(s), study setting, sample data, and findings on the prevalence and risk factors of frailty. The information regarding the screening tools used was summarised based on the screening tools used and their criteria, and in addition to that, the information regarding other outcome measures used was included in Table.
Table I. Prevalence and risk factors of frailty

<table>
<thead>
<tr>
<th>Authors</th>
<th>Study design</th>
<th>Objectives</th>
<th>Study setting</th>
<th>Participants characteristics</th>
<th>Prevalence</th>
<th>Associated Risk factors based on the ICF model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teoh et al. (18)</td>
<td>Cross-sectional study</td>
<td>To investigate the relationship between metabolic syndrome with falls, and the role of frailty markers in this potential relationship, among community-dwelling older adults</td>
<td>Data from the first wave Malaysian Elders Longitudinal Research (MELoR): Hospital-based health check / urban dwellers 10 PPR flats in Kuala Lumpur: Elderly who were residing in the People Housing Project (PPR) at Kuala Lumpur</td>
<td>N=1415 Age=55 and above Mean age=68.56 ± 7.26 years 57.2% women</td>
<td>Not reported (NR)</td>
<td>BI: NF  AL: higher risk of falls  PF: NF  EF: NF</td>
</tr>
<tr>
<td>Norazman et al. (19)</td>
<td>Cross-sectional study</td>
<td>To determine the prevalence and risk factors of the frailty syndrome</td>
<td>N= 301 multi ethnic residents Age=60 years and above Able to ambulate Age range=60-84 years Mean age= 67.08 (5.5) years Male=30%, Female=70% Chinese=37(12.3%), Indian=45(5%), Malay=213(70.8%)</td>
<td>Frail: 15.9% Pre-frail: 72.8%</td>
<td></td>
<td>BI: low skeletal muscle mass, high serum C-reactive protein (CRP) level  AL: NF  PF: NF  EF: increased age, lower household income, being at risk of malnutrition</td>
</tr>
<tr>
<td>Norazman et al. (20)</td>
<td>Cross-sectional study</td>
<td>To explore the prevalence of malnutrition risk and frailty as well as the overlapping constructs</td>
<td>N= 301 multi ethnic residents Age=60 years and above Able to ambulate Age range=60-84 years Mean age= 67.08 (5.5) years Male=30%, Female=70% Chinese=37(12.3%), Indian=45(5%), Malay=213(70.8%)</td>
<td>Frail: 14.6% Pre-frail: 59.7%</td>
<td></td>
<td>BI: Body fat, lower skeletal muscle mass, malnutrition  AL: NF  PF: Increasing age  EF: NF</td>
</tr>
<tr>
<td>Murukesi et al. (21)</td>
<td>Cross-sectional study</td>
<td>To determine the prevalence of frailty in Rumah Seri Kenangan (RSK). To determine the association with cognitive status and functional fitness among frail, and pre-frail in RSK</td>
<td>Institutional residents N = 302 Age= 60 years and above Age range=60-90 years Mean age=68.90 (7.24) years Malay (55.6%); Chinese (26.5%); Indian (17.9%) Mean stay at RSK=4.09-3.85 years</td>
<td>Frail: 56.5% Pre-frail: 40.7% Robust: 2.9%</td>
<td></td>
<td>BI: NF  AL: lower cognitive status, lower dynamic balance and mobility (TUG)  PF: NF  EF: Hypertension</td>
</tr>
<tr>
<td>Mohd Hamidin et al. (22)</td>
<td>Cross-sectional study</td>
<td>To determine the prevalence of frailty association with sociodemographic and socioeconomic characteristics, health-related status, and anthropometric measurements</td>
<td>Community dwelling living: Terengganu (60 villages) N=279 Age= 60 years and above Able to ambulate Age range=63-99 years Mean age=73.32 (6.05) years Male= 18 (42.3%) Female=61 (57.7%)</td>
<td>Frail: 18.3 %</td>
<td></td>
<td>BI: lower BMI  AL: NF  PF: NF  EF: advanced age, being unmarried, hospitalisation in the previous year, poor self-rated health</td>
</tr>
<tr>
<td>Ahmad et al. (23)</td>
<td>Cross-sectional study</td>
<td>To describe the prevalence and transitions of frailty among rural-community dwelling To analyse factors associated with different states of frailty transition.</td>
<td>Rural community-dwellers: Kuala Pilah Negeri Sembilan N=1885 Age=60 years and above Able to ambulate Age range=NR Mean age=NR Male, n=887 (37.9%), Female, n=1437 (62.1%) Chinese=40(1.8%), Indian=432(2%), Malay=2231 (95.6%), Others=10 (0.6%)</td>
<td>Frail: 9.4% Pre-frail: 57.9% Robust: 32.7%</td>
<td></td>
<td>BI: NF  AL: poor cognitive function, low physical activity  PF: older age, women, Ethnicity, low socioeconomic status, higher number of chronic diseases.  EF: NF</td>
</tr>
</tbody>
</table>

CONTINUED
II. The International Classification of Functioning and Disability (ICF) model was used to guide the mapping of the domains related to the risk factors of frailty (17) based on the following classification: 1) Body function and structures (impairment) (BI); 2) Activity (limitation) (AL); 3) Participation (Restriction) (PR); 4) Personal Factors (PF) and 5) Environmental factors (EF). The purpose of the mapping was to incorporate all variables that were determined to be physical frailty-related.

Collating, summarizing, and reporting the results
Table I illustrates the evaluations of all selected papers guided by the review questions. The information about the measure or screening tools and information on additional measures was also included in Table II.

RESULTS
In the first phase of the search, 1058 titles were found, most of which were found in Google Scholar. There were 101 papers retrieved for review in the full text after a compilation based on titles, abstracts, and the exclusion of duplicates. A total of 10 papers was included in the second phase as shown in Fig 1. Further evaluation of studies included in the selected articles was conducted, however, no additional related studies were discovered. Among the studies included in the final review, three studies were conducted in 2020 (18-20), one study conducted in 2019 (21), three studies in 2018 (22-24), one study in 2017 (25), one study in 2016 (26), one study in 2015 (27). All studies included in the review conducted a cross-sectional study. The sample size of the studies included in this review ranged from 279 to 1885 participants, aged 55 to 99 years old. The majority of the studies have included three major ethnicities in Malaysia, namely, Malays, Chinese, and Indians. This article summarizes the findings of the review according to the research questions, namely, the prevalence, risk factors, and measure of frailty as outlined in Tables I and II.

Prevalence of frailty
The prevalence of frailty was found in nine studies except for one study (18) that did not report the prevalence of frailty status. The frailty status was categorized into pre-frail, frail, and robust. The prevalence of pre-frailty is in the range of 57.9% to 72.8%. The prevalence of frailty...
is in the range of 5.7% to 56.5%. While two studies (21, 23) also included the robust category of frailty that ranged from 2.9% to 32.9.

**Risk factors of frailty**

The risk factors of frailty were tabulated to match the domains described in the ICF model, namely, impairments on body functions and structures (BI), activities limitation (AL), participation restrictions (PR), and two contextual factors, i.e. personal factors (PF) and environmental factors (EF) (Table I).

**Impairment of body structure and functions**

A total of six studies have reported that impairment of body structure and functions are associated with frailty. These factors include reduced muscle mass, body fat, hypertension, increased body mass index (BMI), increased waist circumference or abdominal obesity, reduced calf circumference (CC), reduced peak expiratory flow rate (PEFR) and lower body weakness.

**Activity limitations and participation restriction**

A total of six studies have reported that activity limitations are associated with frailty. Some of the factors associated with activity limitations include a higher risk of falls, poor cognitive status, reduced dynamic balance and mobility, reduced physical activity, reduced leisure activities, depressive symptoms, reduced physical

### Table II. Measures of frailty

<table>
<thead>
<tr>
<th>Authors (Years)</th>
<th>Frailty Diagnostic Criteria</th>
<th>Frailty criteria</th>
<th>Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teoh et al. (18)</td>
<td>Modified Fried's Phenotype: based on four criteria</td>
<td>In the past year have you lost 10 pounds (4.5 kg) or more in weight when you weren’t trying to, for example, because of illness?</td>
<td>Walking speed (Time for 15 feet); if more than 75th percentile of walking speed (7 seconds)=slow walking speed.</td>
</tr>
<tr>
<td>Norazman et al. (19)</td>
<td>Fried's Phenotype</td>
<td>Unintentional weight loss: &gt; 5kg for the past 6-12 months</td>
<td>Handgrip strength (Jamar Hydraulic): Sitting position, compress max strength for 3 attempts. Cut-off point AWGS</td>
</tr>
<tr>
<td>Norazman et al. (20)</td>
<td>Fried's Phenotype</td>
<td>Frailty Assessment Components: Standardized Protocol. Modification were made for the cut-off points and the assessment of physical activity</td>
<td>Grip Strength using JAMAR (Plus+, Patterson Medical)</td>
</tr>
<tr>
<td>Murukesu et al. (21)</td>
<td>Fried's Phenotype</td>
<td>Unintentional weight loss equal or greater 4.5kg in the past 12 month</td>
<td>Self-reported 2 question from CES-D: I felt that everything I did was an effort; I could not get going</td>
</tr>
<tr>
<td>Mohd Hamidin et al. (22)</td>
<td>Fried's Phenotype</td>
<td>Unintentional weight loss equal or greater 4.5kg or 5% previous year. OR Self-report clothes become too big</td>
<td>Grip strength of the dominant hand (3x): Using digital hand grip (Chander, Model MG4800): 18.0kg (Male) %≤25; 12.5(Female)</td>
</tr>
</tbody>
</table>

CONTINUED
performance, slower gait, and history of falls. None of the studies included in this review has reported any measures or findings on participation restriction.

**Personal and environmental factors**

The nine studies included in this review reported that frailty is associated with personal factors as shown in Table I. Most of these studies showed frailty is associated with age, gender (female), lower household income or socioeconomic, at risk of malnutrition, single, hospitalization in the previous year, poor self-rated or perception of health, ethnicity, hypertension, increased number of chronic diseases, higher overnight fasting, higher energy intake, and depending on mobiles. None of the studies have reported any environmental factors that may be associated with frailty.

**Measures of frailty**

In terms of measures to determine the physical frailty status, nine studies used the criteria by the Fried’s Phenotype Model (18-26) and one study (27) used the Frailty Index. Among the studies that have used the Fried’s Phenotype model, one study (18) used the modified Fried criteria that refer to four criteria without reporting the level of physical activity (PA).

**DISCUSSION**

**Prevalence of frailty**

The prevalence of frailty in Malaysia is expected to increase due to the aging of the population and an increase in life expectancy from year to year. In this review, the majority of the studies to determine the prevalence of frailty were conducted in the community and showed a range of 57.9% to 72.8% for pre-frail and 5.7% to 18.3% for frail. Those living in the institution showed a higher prevalence of frailty and pre-frailty that is 56.5% and 40.7%, respectively. The wide range of the prevalence could be influence by the different samples of the population, sociodemographic factors, economic status, and environment (10). Using different screening tools may produce a different rate of frailty prevalence (28-30). Although, in this review, the majority of the studies included have used Fried’s phenotype model, however, inconsistency existed in the cut-off values, procedures, and outcome measure for each criterion.

Malaysia seems to have the highest prevalence of frailty when compared to other Asian countries. For instance, Singapore has reported the prevalence of physical frailty that is about 5.7% (12) which seems to be the lowest when compared to other countries such as Indonesia.

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**Table II. Measures of frailty(CONT.)**

<table>
<thead>
<tr>
<th>Authors (Years)</th>
<th>Frailty Diagnostic Criteria</th>
<th>Frailty criteria</th>
<th>Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahmad et al. (23)</td>
<td>Fried’s Phenotype</td>
<td>Weight loss 15% less than lifetime maximum weight (not based on whether the weight loss was intentional or unintentional)</td>
<td>Self-reported from GDS (Do you feel full of energy? No criteria on exhaustion)</td>
</tr>
<tr>
<td>Nur Hafizah et al. (24)</td>
<td>Fried’s Phenotype</td>
<td>Unintentional weight loss of 10 lbs (4.5kg) or &gt;5% body weight, prior years since 60 years old</td>
<td>Using two questions from CES-D scale: I felt that everything I did was an effort. I could not get going. (Score divide to 0-3, 0=rarely, 1=mod. amount of the time, 3=most of the time)</td>
</tr>
<tr>
<td>Badrasawi et al. (25)</td>
<td>Fried’s Phenotype</td>
<td>Unintentional weight loss: &gt;5kg for the past 6-12 months</td>
<td>Two questions from self-reporting on fatigue: CES-D scale of depression that was proposed in the original method</td>
</tr>
<tr>
<td>Badrasawi et al. (26)</td>
<td>Fried’s Phenotype</td>
<td>Unintentional weight loss: &gt;5kg for the past 6-12 months</td>
<td>Self-reported two question from CES-D: I felt that everything I did was an effort; I could not get going</td>
</tr>
<tr>
<td>Sathasivam et al. (27)</td>
<td>Frailty Index</td>
<td>Questionnaire involve 40-item physical domain - 5 items, comorbidities - 16 items, hearing domain - 1 item, visual domain - 3 items, signs and symptoms - 6 items, psychological symptoms - 4 items, physiological parameters – 5 items. All outcomes were dichotomous (yes/no) or trichotomized (0, no; 0.5, may be; 1, yes)</td>
<td></td>
</tr>
</tbody>
</table>
focused on measuring physical performances or physical functions has an implication on rehabilitation indices of chronic diseases (36). PEFR is associated with pulmonary symptoms and other tolerance that leads to immobility among older persons. Reduced peak expiratory flow rate (PEFR) as a factor will limit mobility and participation in physical activity. Further cause increased frailty as lower body weakness, and reduced effort tolerance. Slower gait speed is one of the criteria in the physical frailty screening. This could be because some of the outcome measures for body functions may overlap with measures for the activity limitations. For instance, a study in Korea revealed that frailty was associated with physical performance factors (exercise capacity measured by the 6-min walk test, upper limb function measured by the 30-sec arm curl test, lower limb strength function measured by the 30-sec chair stand test, upper limb strength measured by the grip-strength, upper limb flexibility measured by the Back scratch), indicating the importance of improving physical functions in the prevention of frailty syndromes (37).

**Risk factors of frailty**

Multiple risk factors can contribute to frailty syndrome. It is important to note whether the factors can represent the ICF model as it provides a common conceptual framework for the understanding, exploration, and assessment of human functioning in the sense of disability and explains various factors related to the participation restriction among frail elderly (33). Besides, identifying the ability of the factors whether it can be modified is important as this can be the focus of intervention or rehabilitation for prevention or delaying the consequences of frailty syndrome among older people, while non-modifiable factors can have implications on policy-making.

**Body function and structure (impairment)**

In the ICF model, the impairment domain refers to a substantial loss of body functions and structure (33). In this scoping review, we found impairment factors such as anthropometric and body compositions, lower body weakness, and reduced peak expiratory flow rate (PEFR) were associated with frailty. Findings on anthropometric and body compositions are consistent with other previous studies (11, 34). A study conducted in the Northern part of Thailand has found smaller mid-arm circumference as a risk factor for frailty syndrome (11). Besides, frailty status is associated with higher BMI and waist circumference (34), lower muscle strength, and poorer physical functions (35). With regards to the weakness of the lower body, it could be also related to the reduction of muscle mass, physical inactivity, and thus reduced muscle strength. This will further cause increased frailty as lower body weakness will limit mobility and participation in physical activity. Reduced peak expiratory flow rate (PEFR) as a factor in contributing to frailty could be due to poor exercise tolerance that leads to immobility among older persons. PEFR is associated with pulmonary symptoms and other indices of chronic diseases (36).

We believe that assessing the physical performances or physical functions has an implication on rehabilitation strategies as most physical performances are modifiable. On the other hand, we found limited studies that have focused on measuring physical performances or physical functions. This could be because some of the outcome measures for body functions may overlap with measures for the activity limitations. For instance, a study in Korea revealed that frailty was associated with physical performance factors (exercise capacity measured by the 6-min walk test, upper limb function measured by the 30-sec arm curl test, lower limb strength function measured by the 30-sec chair stand test, upper limb strength measured by the grip-strength, upper limb flexibility measured by the Back scratch), indicating the importance of improving physical functions in the prevention of frailty syndromes (37).

**Activity limitation and participation**

The difficulties faced by individuals in carrying out daily activities at a personal level are described as activity limitation (33). Impairment to the body structures and functions is associated with frailty that may progress to an advanced stage when the physical performance of an older person deteriorates and will give a high impact on the mobility of daily activities (38).

In this current scoping review, findings on depression symptoms and cognitive disability as the risk factors for frailty are consistent with a few previous studies (38, 39). A previous study has shown that cognitive frailty is also associated with impairment in the gait speed, Timed Up and Go, and short physical performance battery (PC/PCC, basal ganglia) suggesting that the accumulation of amyloid-β in the brain as a brain imaging biomarker and phenotypes of physical frailty (weight loss, weakness, exhaustion, slowness, low physical activity) contribute to the cognitive frailty (40). Another study that has assessed the association of frailty with neuropsychological domains (based on three factors), namely, (i) speeded executive and fluency, (ii) episodic memory, and (iii) working memory revealed that individuals who were depressed and frail had worse performance than non-frail depressed across all three factors (41). On the other hand, frail persons were almost 8 times more likely to have a cognitive impairment, 8 times more likely to have some kind of dementia, almost 6 times more likely to have vascular dementia (OR 5.6, 95% CI 1.2-25.8) and over 4 times more likely to have Alzheimer’s disease compared to healthy ones as reported in the Cardiovascular Health Study (42). Thus, we believe that cognitive decline has a significant impact on physical frailty, thus the measure for cognitive decline should be one of the criteria in the physical frailty screening. This is supported by one study that found that the rates of change in frailty and cognition are strongly correlated and this may be due in part because they share a common pathologic basis (43).

We found one study that has used the TUG as a measure for walking speed or mobility (21). In frailty assessment, it involves the component that can relate to activity limitation such as slowness in gait, reduced grip strength, and reduced effort tolerance. Slower gait speed...
or reduce dynamic balance lead to immobility and thus may increase the risk of frailty that can be further associated with physical inactivity. Another known risk factor for frailty is physical inactivity or reduce the level of physical activity consistent with previous studies (28, 44). There is a high prevalence among older adults with inadequate physical activity levels in combination with a significant amount of time spent on sedentary behavior (45). Physical activity or regular participation has been shown to consistently promote healthy aging as it helps to maintain neuromuscular functions and promote psychological wellbeing (39). Those participating in physical activity may be able to reverse some effects of chronic disease by regularly completing activities ranging from low intensity walking through to more vigorous sports and resistance exercises (46). A study in Kuala Nerus, Malaysia (24) shows that low physical activity can relate to a higher prevalence of frailty among the elderly in Malaysia. While, there is a lack of study that reported the role of physical activity among older people in Malaysia, this warrant further study to look into this aspect, however, a suggestion from previous studies is to encourage to increase physical activities and increase self-efficacy that can be guided by experts in geriatric rehabilitation.

With regards to the participation domains in the ICF model, we did not find any of the reviewed studies that have measured variables that can indicate this domain. Participation is defined in the ICF model as the ‘involvement in a life situation’, while participation restrictions refer to ‘problems an individual may experience in the involvement in life situations’ (47). Participation is cited as central to a person’s quality of life and well-being (48). The concept of participation is recognized as an important rehabilitation outcome (49), and thus, we believe that it should be measured as the outcome of frailty.

Personal factors

Personal factors are another important domain in the ICF model that covers the basic background of the life and health status of the person (33). In this scoping review, personal factors associated with frailty include age, gender (female), low income, at risk of malnutrition, unmarried, hospitalization in the previous years, poor self-rated health, co-morbidities, higher overnight fasting, higher energy intake, and depending on mobiles. A study conducted among hospitalized patients in China found old age, low educational level, more than 5 comorbidities, and polypharmacy were associated with frailty (30). These findings were also supported by a recent systematic review and meta-analysis (50), which concluded that increasing age, being female, and having more than three diseases were associated with frailty. Frailty is also associated with lower education, having no spouse, poorer health perception, and an increasing number of comorbidities (11).

Increasing age as a risk factor for frailty has been reported in many studies (11, 28, 29, 30, 39, 50). The process of aging accompanied by physiological decline increases the vulnerability of becoming fragile, thus, frailty syndrome is expected with advancing age. Women seem to be at risk of frailty more than men that could be due to their longer life expectancy as the majority of the countries in Asia showed women have a longer life expectancy (32). In 2019, life expectancy in Malaysia was 73.4 years old for men and 78.2 years old for women compared to other Asian countries Malaysia is the second-lowest. The lowest life expectancy was in Indonesia (70.1 years for males, 74.6 years for females). Other countries have a higher life expectancy, such as Thailand (81.3 years for females, 74.2 years for males), Hong Kong (82.34 years for males, 88.13 years for females), Singapore (81.4 years for males, 85.7 years for females), and Japan (82.34 for males, 88.13 years for females). It has been found that the 10-year survival rate is associated with the female gender than with the male gender in older adults, from that the prevalence of frailty increased with age in both men and women, but was higher in women than in males (51).

The lower-income level as a risk factor of frailty was consistent with a finding among community-dwelling older people in the rural South Indian population (28). To explain this, older people with low income or having no financial support may have limited access to health care resources as well as poor nutrition as they may not be able to buy food that is suitable for older people. In terms of finding that malnutrition is a risk of frailty, similar to two others (52, 53). A study conducted in Lebanon found that older people with both malnutrition and risk of malnutrition were related to a significantly increased risk of frailty (52). Improper food intake, for instance, the lack of protein intake may promote the development of sarcopenia leading to generalized muscle weakness which is related to becoming frail. This is evidence from a study conducted in Taiwan that found that those who were at increased risk for malnutrition demonstrated a skeletal muscle index of about 9.93 and a body fat mass of <12.25 kg (53).

Hospitalization in the previous year was found to be associated with frailty. In older people, hospitalization may mark the early deterioration of health and thus progresses to becoming frail. Hospitalization can have some hazards which mainly affect the functional capacity of older people functional decline that is temporally associated with hospitalization may be caused by both the illness itself, as well as by the “hazards of hospitalization (54). Also, it was suggested that recovery from pre-frail and frail states is substantially diminished by intervening hospitalization (55). Finding on self-rated health (SRH) status or poor health perception is consistent with another study (11). According to a study conducted in Colombia, frailty arises as a key factor affecting SRH in older adults (56).
The finding from this review that being unmarried is associated with frailty is supported by a previous study that suggested lack of social support may be consistent with a previous study that reported older people who have no spouse are at a higher risk of frailty (11). In contrast, a study has found among urban living elderly in Brazil, the absence of a partner is associated with prefrailty (57), while those married or being a housewife found to be associated with frailty in a study among the Turkish population (58). Being unmarried may lack social support and thus putting them at an increased risk of social frailty (59).

In this scoping review, the presence of a health condition or co-morbidities were found to be associated with frailty syndrome. These are supported with previous studies that reported having more than 5 comorbidities (30) or having more than three diseases (50) or an increasing number of comorbidities (11), while one study found that older people with diabetes increased the risk of frailty (39). Previous studies have shown that older people with comorbidities who are taking more than five drugs are at risk of frailty (11, 30, 50).

This scoping review also found that those who practice overnight fasting and higher energy intake are at risk of frailty. We could not find any previous studies that have similar findings, however, we believe that the practice of fasting especially at night may hamper the recovery process of any illness suffered by the elderly. Fasting may also limit nutritional food intake such as protein into the body that may, in turn, lead to loss of body weight and loss of lean body mass (sarcopenia) contributing to functional impairment (60). One study found that energy intake is associated with less frailty (61).

We found one study in this review that reported older people who are dependent on mobiles are at increased risk of frailty (24). A study conducted in Singapore found that poor social network is a risk factor for frailty (12). The elderly who depends on the mobile or social network may rely on these facilities for health services or to call for medical services or to call their carer in case they fell ill.

**Environmental factors**

The ICF model defines environmental factors as the physical social and attitudinal environment in which individuals live and how they conduct their lives (33). Other study has identified connections between living alone and various negative health effects, such as social isolation, functional disability, and mortality (34). In this scoping review, we did not find any environmental factors that are associated with frailty. However, we noted that the elderly residing in the institution which is known as the Rumah Seri Kenangan, funded by the government has the highest percentage of frailty which was 56.5%. On the other hand, frailty is also highly prevalent among home care elderly clients due to malnutrition and a lower level of education (62). The lowest prevalence of frailty was among older people residing in the urban district (5.7%). When comparing among community-dwellers from a different setting, those living in the rural or villages had the highest prevalence of frailty (18.3%) and those living in the urban district were the lowest (5.7%). These findings are inconsistent with a finding from a systematic review and meta-analyses among community-dwelling in China in which they found those living in the urban (10%) had a higher prevalence of frailty compared to those living in the rural (7%) (50). In Malaysia, those living in the rural setting may have lower education, lower-income, and limited access to healthcare resources which might have contributed to the higher prevalence of frailty. Another study explained that the development of frailty is correlated with environmental factors, such as self-perceived socioeconomic status, living alone, or with family and social networks (33).

**Measure of frailty**

The Fried’s Phenotype Model seems to be the most commonly chosen assessment for frailty status, while only one study has used the Frailty Index (27). Previous research (The HELIAD Study) on the prevalence of frailty using five different instruments (Fried definition, FRAIL Scale, FI, TFI, and CGI) in a cohort of older adults and explore the association between frailty and various risk factors (29). This study highlighted that the prevalence of frailty varied depending on the definition used, in which they showed that by using the GFI they found 30.2% of the sample being studied were frail, while the FRAIL Scale showed only about 1.5%, Fried’s phenotype was 4.1%, FI was 19.7%, TFI was 24.5% of the sample population were frail. Similarly, another study conducted in South India among older people living in the rural village, comparing the Fried’s phenotype, FI and TFI reported varied prevalence of frailty with the TFI (63%) showed the highest percentage of frailty and the lowest is the Fried’s phenotype (28%), while using the FI was 59% (28). Another study among hospitalized elderly also showed varied prevalence using the tools; Fried (32.3%), 36.2% (CFS), 19.25 (FRAIL), 25.2% (Edmonton), 35.1% (FI) (30). We conclude that the sensitivity of these various instruments may be influenced by the different settings of older people. In this review, we did not find any study that has compared the use of different tools to define frailty status. Since studies that were included in this review were from various sociodemographic backgrounds the use of Fried’s Phenotype to define frailty status may underestimate or overestimate the frailty status of the participants. Therefore, more future studies are warranted to compare the sensitivity of different tools for different settings where the elderly reside.

This scoping review has some limitations as there
were scarce studies conducted in Malaysia on the prevalence rate, risk factors, and measures for frailty status. The findings of this review are inconclusive as Malaysia is unique in terms of its sociodemographic factors, such as ethnicities, living environments, settings (elderly institutions, urban, suburban, rural, and FELDA settlements, etc.). Therefore, future studies must give more attention to the overall prevalence rates, especially those who seek medical care in the hospital or primary care clinics so that focus can be given to the needy. Besides, we suggest that more studies are needed in Malaysia to determine whether the concept of body structures and functions that include physical performances, functional performances, physical functions, and functional capacity influences frailty syndromes among Malaysian older people.

CONCLUSION

In conclusion, the finding of this study highlighted that frailty and pre-frailty were highly prevalent among the Malaysian older people compared to other Asian countries. The majority of the findings on the risk factors can be categorized into body impairments, activity limitations, and personal factors. More study is indicated to determine factors that are modifiable such as physical functions, functional status, and quality of life so that early intervention to prevent frailty can be designed based on measurable assessments. Furthermore, the findings presented in this paper may provide knowledge and early recognition for the risk factor related to the ICF model that is specific for the Malaysian older people that may be used to guide further research as well as the plan of intervention.

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