UNIVERSITI PUTRA MALAYSIA

RISK OF FALLS AND ITS ASSOCIATION WITH BODY MASS INDEX, BODY COMPOSITION, PHYSICAL ACTIVITY AND HEALTH STATUS AMONG COMMUNITY-DWELLING ELDERLY RESIDENTS IN FLAT PPR KUALA LUMPUR

JENNY HII AI NA

RISK OF FALLS AND ITS ASSOCIATION WITH BODY MASS INDEX, BODY COMPOSITION, PHYSICAL ACTIVITY AND HEALTH STATUS AMONG COMMUNITY-DWELLING ELDERLY RESIDENTS IN FLAT PPR KUALA LUMPUR

JENNY HII AI NA

DEPARTMENT OF DIETETICS

FACULTY OF MEDICINE AND HEALTH SCIENCES

UNIVERSITI PUTRA MALAYSIA

2021/2022

RISK OF FALLS AND ITS ASSOCIATION OF BODY MASS INDEX, BODY COMPOSITION, PHYSICAL ACTIVITY AND HEALTH STATUS AMONG COMMUNITY-DWELLING ELDERLY RESIDENTS IN FLAT PPR KUALA LUMPUR

BY

JENNY HII AI NA

A project submitted as a partial fulfilment of the requirement for the degree of Bachelor of Science in Dietetics with Honours at the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia

This project entitled “Risk of Falls and its Association with Body Mass Index, Body Composition, Physical Activity and Health Status Among Community-Dwelling Elderly Residents in Flat PPR Kuala Lumpur” was prepared by Jenny Hii Ai Na and submitted to the Faculty of Medicine and Health Sciences as a partial fulfilment of the requirement for the degree of Bachelor of Science in Dietetics with Honours from the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

Received and examined by:

_____

(Assoc. Prof. Dr. Siti Nur’Asyura Adznam)

Date: **13 September 2022**

ACKNOWLEDGEMENT

First and foremost, I would like to address my sincere gratitude to my supervisors, Assoc. Prof. Dr. Siti Nur'Asyura Adznam, for her continuous support and guidance in this research. Without her patience, enthusiasm, motivation, care and support, I would not be able to complete my work smoothly throughout the process of planning and writing. The completion of this study is successfully done under her splendid guidance and expertise in geriatric fields.

Besides my supervisors, I would like to send my deepest appreciation for the PHD students supervised by Assoc. Prof. Dr. Siti Nur'Asyura Adznam, Nurul Izzati Binti Mohd Suffian, for providing me with continuous guidance when completing my thesis. Her excellent ideas and insightful suggestions helped me to clear a lot of doubts when I went through the writing process.

Next, special thanks and gratitude is directed towards all the organisations, Program Perumahan Rakyat (PPR) for allowing me to conduct the physical data collection at their activity rooms. In addition, a debt of gratitude is owed to all the participants that are willing to come to the physical data collection. Their cooperation and participation made this study a lot more meaningful and significant.

I am very grateful to the other three friends that are also under the supervision of Assoc. Prof. Dr. Siti Nur'Asyura Adznam, who are Jenny Boon Zean Lea, Nur Dhamirah Binti Khairuddin and Nur Aqila Binti Yusri for their support and motivation. Thanks for keeping each other accountable and checking on the progress together with a lot of inspiration. Deep gratitude also for those who help directly and indirectly in the study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

RISK OF FALLS AND ITS ASSOCIATION WITH BODY MASS INDEX, BODY COMPOSITION, PHYSICAL ACTIVITY AND HEALTH STATUS AMONG COMMUNITY-DWELLING ELDERLY RESIDENTS IN FLAT PPR KUALA LUMPUR

JENNY HII AI NA

Falls often resulted in severe injuries and hospitalisation, but there were limited studies that focused on risk of falls and its associated factors among community-dwelling elderly in the local context specially body composition and health status. Thus, the study was conducted to study the risk of falls and its association with body mass index, body composition, physical activity and health status among community-dwelling elderly residents. This cross-sectional study recruited 97 community-dwelling elderly from flat PPR Kuala Lumpur through simple random sampling. The proportion of falls, demographic characteristics and health status were assessed using self-developed questionnaires while body mass index and body composition using anthropometric measurement; physical activity level using PASE-Malay version and risk of falls using Berg Balance Scale. The data was analysed using SPSS IBM version 25. The mean age of the respondents was 68.04 $\pm$ 5.54 years old ranging from 60 to 81 years old. Around 7.2% experienced falls within past 6 months and 14.4% have high risk of falls. The mean BMI score of participants was 28.49 $\pm$ 5.02 kg/m^2. The mean values for skeletal muscle percentage, subcutaneous fat percentage and handgrip strength were 21.22 $\pm$ 3.51 %, 31.61 $\pm$ 6.64 % and 13.03 $\pm$ 6.53 kg respectively. Approximately 19.6% participants had a low physical activity level, 30% did not have chronic disease, and 33% did not take chronic disease medication. There were significant associations found between demographic characteristics specifically age (r=-0.407, p=0.0001), ethnicity (p=0.001) and educational level (p=0.003) with risk of falls. Skeletal muscle percentage (r=0.204, p=0.045) and handgrip strength (r=0.394, p=0.0001) had weak and medium positively correlated with risk of falls respectively, while no significant correlation between subcutaneous fat percentage, physical activity level and body mass index with risk of falls. Hearing impairment significantly associated with risk of falls (p=0.020). In conclusion, fall-related education and exercise to increase muscle strength might be necessary to reduce risk of falls among community dwelling elderly.

ABSTRAK

RISIKO JATUH DAN PERKAITANNYA DENGAN INDEKS JISIM BADAN, KOMPOSISI BADAN, AKTIVITI FIZIKAL DAN STATUS KESIHATAN DALAM KALANGAN WARGA EMAS DI FLAT PPR, KUALA LUMPUR

JENNY HII AI NA

Jatuh sering mengakibatkan kecederaan teruk dan kemasukan ke hospital, tetapi kajian yang memfokuskan kepada risiko terjatuh dan faktor yang berkaitan dengannya dalam kalangan warga emas di flat PPR dalam konteks tempatan khususnya komposisi badan dan status kesihatan masih sangat terhad. Justeru, kajian ini bertujuan untuk mengkaji risiko jatuh dan perkaitannya dengan indeks jisim badan, komposisi badan, aktiviti fizikal dan status kesihatan dalam kalangan warga emas di flat PPR Kuala Lumpur. Kajian keratan rentas ini melibatkan 97 warga emas dari flat PPR Kuala Lumpur melalui persampelan rawak mudah. Perkadaran jatuh, ciri demografi dan status kesihatan diperoleh melaui soal selidik kendiri manakala indeks jisim badan dan komposisi badan dinilai melalui pengukuran antropometrik. Tahap aktiviti fizikal dan risiko jatuh dinilai menggunakan PASE versi Melayu dan Skala Imbangan Berg. Semua data dianalisis menggunakan SPSS IBM versi 26. Purata umur responden ialah 68.04 $\pm$ 5.54 tahun melingkumi umur 60 sehingga 81. Terdapat 7.2% yang mengalami jatuh dalam tempoh 6 bulan lalu dan 14.4% mempunyai risiko jatuh yang tinggi. Purata skor BMI peserta ialah 28.49 $\pm$ 5.02 kg/m^2. Nilai min bagi peratusan otot rangka, peratusan lemak subkutan dan kekuatan genggaman masing-masing ialah 21.22 $\pm$ 3.51 %, 31.61 $\pm$ 6.64 % dan 13.03 $\pm$ 6.53 kg. Sebanyak 19.6% peserta mempunyai tahap aktiviti fizikal yang rendah, 30% tidak mempunyai penyakit kronik, dan 33% tidak mengambil ubat penyakit kronik. Terdapat perkaitan yang signifikan antara ciri demografi khususnya umur (r=-0.407, p=0.0001), etnik (p=0.001) dan tahap pendidikan (p=0.003) dengan risiko jatuh. Peratusan otot rangka (r=0.204, p=0.045) dan kekuatan genggaman (r=0.394, p=0.0001) mempunyai kolerasi positif yang lemah dan sederhana dengan risiko jatuh, manakala tiada korelasi yang ketara ditemui antara peratusan lemak subkutan, aktiviti fizikal tahap dan indeks jisim badan dengan risiko terjatuh. Kecacatan pendengaran dikaitkan secara signifikan dengan risiko jatuh dalam kalangan warga emas (p=0.020). Kesimpulannya, pendidikan berkaitan dengan jatuh dan senaman untuk meningkatkan kekuatan otot adalah penting untuk mengurangkan risiko jatuh dalam kalangan warga emas.

CHAPTER 1

INTRODUCTION

1.1 Background

Widely, elderly and older adults were defined as those aged over 65 years old. Elderly between the ages of 65 to 74 were defined as "early elderly" while those over the age of 75 was defined as "late elderly" (Orimo et al., 2006). However, since Malaysia was still considered as a young nation, the Malaysian government adopted "individuals chronologically aged 60 years and above" as the definition of elderly or senior citizens as stated in Public Service Delivery and Local Government Malaysia. Globally, there were approximately 703 million of elderly that exceed the age of 65 in 2019 and the number was predicted to increase to 1.5 billion in 2050, in which Eastern and Southeast Asia show the greatest increase (Department of Economic and Social Affairs, 2019). Meanwhile, the World Health Organisation (2021) made predictions whereby the total number of elderlies aged over 60 would increase to 1.4 billion by 2030 and 2.1 billion by 2050. According to the Department of Statistics Malaysia (2021), Malaysia showed an increase from 3.5 million in 2020 to 3.6 million of elderly in 2021 which accounted for 11.2% of total population in Malaysia. The Department of Statistics had shown that the total population of elderly in Malaysia increased from 5.7% in 1970 to 11.1% in 2020 and would continue to double to 19.8% in 2040 (Mutalib et. al., 2020), indicating that elderly population would make up 1/5 of the Malaysian population in 2040.

Population ageing was defined as increased life expectancy and decreased fertility rate that occurred simultaneously with a broad range of changes among social and economic sectors such as the demographic characteristics and the development and shift in economics (United Nations, 2021). Population ageing had become a very

challenging issue globally as increased life expectancy meant lengthening health care duration and raise in economic burden since elderly which were more susceptible to diseases generally live longer (Worapanwisit et al., 2018). Population ageing definitely raised financial burden on the elderly health and overall support system but well-chosen strategies and plans could avoid macroeconomic decline in one country (Department of Economic and Social Affairs, 2019).

Community-dwelling elderly were defined as those aged over 60 and living alone (Steultjens et. al., 2004). Community-dwelling also meant "individuals who live in a private residence, which could include a retirement community, but not a personal care home or government-funded supportive housing" (Chateau et al., 2019). Community-dwelling was also defined as living in the community outside of nursing homes or other government charity homes (Chi et al., 2019). Community-dwelling elderly were a special group that required extra care to live a convenient and quality life since they were more prone to health care issues and suffered from a variety of diseases (Steultjens et. al., 2004). A cohort study on community-dwelling elderly in Manitoba concluded this population as a group associated with higher levels of depression, anxiety and disease risk such as hypertension and diabetes (Chateau et al., 2019). National Institute of Health Malaysia (2018) had recorded a higher proportion of pre-elderly aged 50-59 living alone, indicating a higher number of elderlies that might be living alone in the future.

The burden on one country increased along with the growing population of elderly. Some of the leading causes of injuries and death among elderly that led to economic and health care system burden were non-communicable diseases such as ischemic heart attack (WHO, 2021; Department of Statistics Malaysia, 2020), chronic obstructive respiratory diseases (Burney et al., 2015) and unintentional accidents or

injuries especially falls (Kramarow et al., 2015; Mack et al., 2013). Falls had been proven as the second leading cause of death globally whereby elderly was the group that was being affected the most (WHO, 2021).

Fall was defined as "an event which results in a person coming to rest inadvertently on the ground or floor or other lower level" (WHO, 2021). There were a broad range of types of falls where three common classification of falls were anticipated falls, unanticipated falls and accidental falls (The Royal Children's Hospital Melbourne, 2017). Fall was more commonly occurring among the elderly and had become one of the main leading factors to catastrophic injuries and even death (WHO, 2021). Falls in elderly commonly resulted from poor body balance, weak muscle strength, vision impairment and common long term age-related complications (NHS, 2021). According to Centers for Disease Control and Prevention (2020), rates of death due to falls in older adults increased 30% in 10 years from 2009 to 2018. The outcomes of falls among elderly were tremendous as it affects elderly physically in a variety forms of fractures, bruises, injuries and physiological impacts such as death as well as other complications characterised by dislocations, hematoma and sprain (Terosso et al., 2013). Almost all of the falls among elderly resulted in physical consequences (Worapanwisit et al., 2018).

High prevalence of falls ranging from 16 to 40% was found among the community-dwelling adults all over the world (Carrasco et al., 2019; Kim et al., 2020; Lee at al., 2020; Lee et al., 2021; Qian et al., 2020; Tsai et al., 2020; Woranpawisit et al., 2018). On the other hand, few studies on falls and community-dwelling elderly in Malaysia recorded approximately 20% of falls, which generally lower as compared to other countries (Alex et al., 2017; Ooi et al., 2021; Singh et al., 2019; Yeong et al., 2016). As a consequence, falls among elderly were correlated with higher mortality

and morbidity; hence, it required higher healthcare cost to support the elderly health care system and the recovery (Soriano et al., 2008; WHO, 2008). Enormous amount of medical cost up to billions was required for both fatal and non-fatal falls among elderly (Florence et al., 2018).

1.2 Problem Statement

Nowadays, people had a longer life expectancy due to improvement in the health sector (WHO, n.d.). Our world was experiencing population ageing continuously but the ageing progress had been the fastest among a few regions including Southeast Asia (Department of Economic and Social Affairs, United Nations, 2019; Department of Economic and Social Affairs, 2019). According to the World Health Organization (2021), the numbers of elderly would increase 10% from 12% in 2015 to 22% in 2050 and the numbers of elderly would be greater than children aged below 5 by 2020. Statistics from the Department of Statistics Malaysia indicates that Malaysia was expected to have approximately 6 million of elderly by the year of 2030, which was 15% out of the total Malaysia population (Mutalib et al., 2020). Ageing phenomenon was described as humanity's triumph and society's challenge where the size and proportion of the elderly population was growing bigger (WHO, 2008). It was the result of reduced fertility, declined mortality and increased life expectancy.

However, population ageing had continued to become the biggest concern worldwide as elderly populations were prone to illness due to irreversible decline of mental and physical capacity to fight infection (WHO, 2021). Fall was a very common yet fatal issue among elderly. Falls led to severe complications such as bone fractures, severe injuries and even death (Ambroce et al., 2015; Joyce et al., 2020; Muangpaisan

et al., 2015; WHO, 2008; WHO, 2021). The second leading cause of unintentional injury and death was falls which impacted the elderly aged over 60 years old the most (WHO, 2008). Hence, fall among elderly had become a big issue as Malaysia was going to be an aged nation in 2030 according to an information sheet released by the Ministry of Women, Family and Community Development (2017).

Research on prevalence and risk factors of falls among community-dwelling elderly were done massively all over the world (Salari et al., 2022). Nevertheless, despite the commonality of falls among elderly, the study pertaining to the prevalence and risk factor of falls in Southeast Asia and Malaysia was very limited (Kioh & Rashid, 2018). A study on demographic, health and environmental factors with falls in Thailand showed prevalence of 1 out of 4 community-dwelling elderly with falls (Worapanwisit et al., 2018). The prevalence of falls in elderly from previous studies in Malaysia ranged from 30% to 32.8% (Ghazi et al., 2017; Kioh & Rashid, 2018; Joyce et al., 2020, Sahril et al., 2020). However, there was limited study that focused on the occurrence of falls and the factors associated with risk of falls among the community-dwelling elderly in Malaysia.

There was a wide difference between the results of two studies conducted on prevalence of falls among community-dwelling elderly in Malaysia. A cross sectional study conducted at Perak, Malaysia which studied the relationship between age, gender, ethnicity, income, physical activity level, living arrangement, number of comorbidities and medications used revealed very low risk of falls (4.07%) (Yeong et al., 2016). On the other hand, another study conducted in Malaysia on associated factors of falls found 21.5% of falls prevalence among community-dwelling elderly (Goh et al., 2021). Therefore, more studies were needed to identify the prevalence of falls which could represent Malaysia elderly population. Nevertheless, the study of

risk of fall and its associated factors among community-dwelling elderly remained scarce and limited. As support, there were only two out of a few studies on community-dwelling elderly in Malaysia which found significant association between gender, living arrangement, ethnicity and marital status with risk of falls (Ooi et al., 2021; Yeong et al., 2016).

Elderly posture and body balance were affected by body mass index (BMI) whereby higher BMI classification led to lower control over balance which resulted in higher rate of fall (Dutil et al., 2012). A study in Malaysia showed that lower BMI was observed among community-dwelling elderly (Goh et al., 2021). Another literature research on obesity and falls in elderly generally revealed that higher BMI was related to poor postural balance that leads to higher risk of fall (Tan, 2019). Yet, detailed studies that revealed the relationship of BMI and risk of falls among community-dwelling elderly in Malaysia remained scarce and limited. Similarly, body composition such as body fat and muscle which were known to be associated with risk of falls among the community dwelling elderly but there were very limited to no local study that revealed the exact mechanism and relationship among Malaysians community dwelling elderly and risk of falls. As evidence, there were very limited local studies reviewing the relationship between BMI and body composition such as muscle strength and fat percentage with risk of fall among community-dwelling elderly (Jais et al., 2019; Ooi et al., 2021; Singh et al., 2019; Tan et al., 2019).

Physical activity level (PAL) can strengthen muscles among elderly which resulted in greater body postural control and equilibrium (Bianchi et al., 2020). Similarly, there was limited studies that study the association between risk of falls among community-dwelling older adults and physical activity level in local study. Furthermore, even though there are a few local studies that observed the association

between diseases such as diabetes, osteoporosis, vision and hearing problem and respiratory illness (Ghazi et al., 2017; Joyce et al., 2020; Kioh & Rashid, 2018; Sahril et al., 2020), there was no exclusive local study on health status with risk of fall among community-dwelling elderly. There was only one local study specifically focused on health status with risk of falls among community-dwelling elderly Malaysia, which revealed diabetes, arthritis and poor self-rated health as the independent risk factors for falls (Singh et al., 2019). Hence, more studies to reveal the relationship between certain diseases and medications on risk of fall among community-dwelling elderly in Malaysia was needed.

To my knowledge, there was limited number of local studies that focus on prevalence and factors associated with risk of falls among the community-dwelling elderly. Hence, it was crucial to understand the risk factors associated with falls among community-dwelling elderly to develop a well-planned intervention and strategies to lower the falls, falls related injuries and relative health care cost among community-dwelling elderly. Therefore, this study aimed to explore the prevalence and body mass index, body composition, physical activity level and health status with risk of falls among community-dwelling elderly in flat PPR Kuala Lumpur.

Research Questions:

1. What is the prevalence of falls among community dwelling elderly residents in flat PPR Kuala Lumpur?
2. Are there any associations between demographic characteristics, body mass index, body composition, physical activity and health status with risk of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur?

1.3 Significance of the Study

This study was significant for Malaysia that was undergoing active ageing currently to become an ageing nation and the common health concern of falls among the community-dwelling elderly. Thus, the proposed study would be conducted at the flat PPR Kuala Lumpur to examine the prevalence and the association of BMI, body composition, physical activity and health status with the risk of falls among community-dwelling elderly. This study involved the participation of community-dwelling elderly residents to provide data pertaining to falls prevalence, BMI, body composition, physical activity, health status and risk of falls to assess the relationship of risk factors involved with falls among community-dwelling elderly. Since there were very limited studies about falls among community dwelling elderly in Malaysia, this study was important to fill up the gap in existing studies. Moreover, this study might increase understanding and public awareness on falls issues among elderly to establish better intervention to reduce risk of falls that may be severe and fatal.

Other than that, all the findings obtained from this study could be used as the baseline information for future research in the theme of falls. This study aimed to promote and encourage more research pertaining to factors associated with risk of falls among elderly to gain attention from the public to develop models and intervention programs for the elderly. It was also crucial to understand the epidemiology of falls among elderly to minimise the serious consequences pertaining falls and the health care cost required to treat injurious falls. Subsequently, we could promote better health status and life quality among elderly in Malaysia and reduce health and economic burden.

1.4 Research Objectives

General Objective:

To explore prevalence of falls and the association of body mass index, body composition, physical activity and health status with risk of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur.

Specific Objectives:

1. To identify the prevalence of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur.
2. To determine the demographic characteristics, body mass index, body composition, physical activity and health status with risk of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur.
3. To determine the association of demographic characteristics, body mass index, body composition, physical activity and health status with risk of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur.

1.5 Research Hypothesis

There was significant association between demographic characteristics, body mass index, body composition, physical activity and health status with risk of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur.

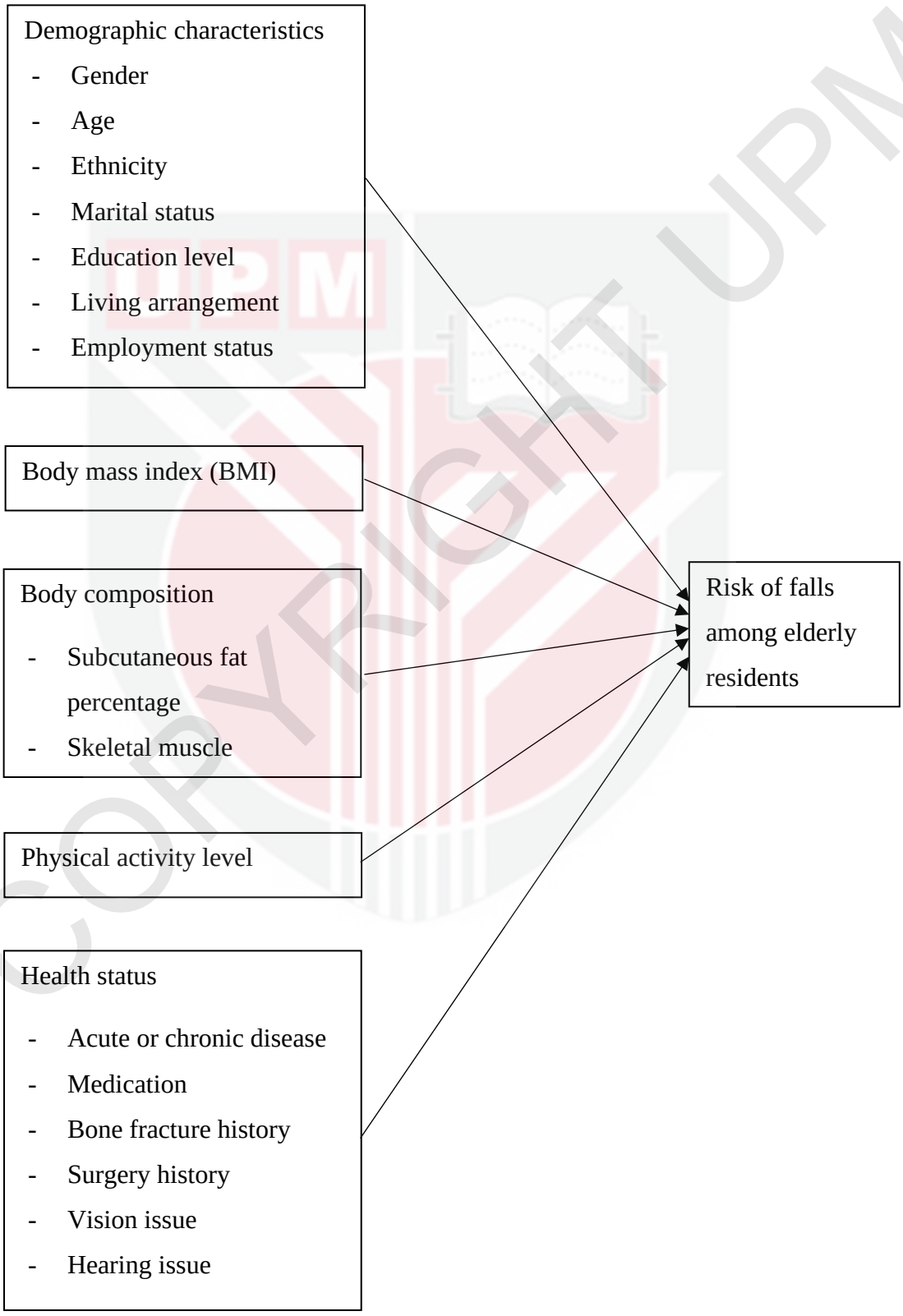
1.6 Conceptual Framework

Figure 1 showed the conceptual framework of the study with the title prevalence of falls and the association of body mass index, body composition, physical activity and health status with risk of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur (Ooi et al., 2021; Yeong et al., 2016). Based on this framework, demographic characteristics, body mass index, body composition, physical activity and health status were the risk factors of falls among community-dwelling elderly.

Figure 1.1

Conceptual Framework

Conceptual Framework:



CHAPTER 2

LITERATURE REVIEW

2.1 Risk of Falls among Community-Dwelling Elderly

Falls had been defined as the unexpected event happening to a person where they came to the ground or any other lower level accompanied with or without loss of consciousness as shown in the clinical guidelines on fall prevention from The Royal Children's Hospital Melbourne (2017). Fall was mostly unintended events due to complicated interchange aspects such as the functional and medical decline or the environment and social factors (Currie, 2008).

There were a lot of studies that study and investigate the prevalence of falls among elderly in different settings and countries. A meta-analysis and systematic review conducted on 37 studies in Brazil by Filho et al. (2019) found a different range of prevalence of falls among healthy elderly across different periods of time. The prevalence of falls among the elderly in Brazil ranged from 21.5% to 53% for 6-months studies and 6.5% to 46.9% among 12-months studies respectively. The huge gap difference of prevalence between the studies might be due to unstandardised prevalence measurement and different regional development. Hence, it was crucial to include the same assessment tool to get standard comparable results that benefits the future studies. However, the concluded mean prevalence of 27% from this study, was similar to results of 28.4% and 28.3% found in the cross-sectional study conducted at Ethopia (Janakiraman et al., 2019) and another study at China (Huang et al., 2015), respectively.

There were also studies conducted to study the prevalence of falls among community-dwelling elderly for three different years to compare the trends and changes. Kim et al. (2020) found prevalence of falls in Korea showed a general

reduction of 5.3% from 21.2% in 2011 to 15.9% in 2017. Another similar study conducted in Taiwan observed similar trends of reduction (4.8%) in prevalence of fall, which lowered from 21.3% in 2005 to 16.5% in 2013 (Tsai et al., 2020). The reduction among the prevalence of falls observed in these two studies might be due to more multifactorial intervention programs carried out across the year to raise awareness among the community. Nevertheless, a study in China showed no significant difference among the prevalence of falls in the overall elderly, where both recorded 19.64% and 19.28% respectively in 2011 and 2013 which deviated a lot compared to another China study due to differences in location (Wu & Ouyang, 2017).

There were also other simple studies that examined the prevalence of falls among the community-dwelling elderly. According to a cohort study conducted on risk factors of falls among community-dwelling elderly in Taiwan, prevalence of falls is 38.1% after 1 year of follow-up (Lee, 2021). Similarly, Qian et al. (2020) reported a high prevalence of falls of 31.9% among the community-dwelling elderly in Hong Kong. However, according to another study conducted by Worapanwisit et al. (2018) in Thailand, also on community-dwelling elderly, found significantly lower prevalence of fall (26.1%). For the international studies, the prevalence of falls among the elderly normally lied within the range of 15% to 40%.

In Malaysia, several studies were conducted to investigate the prevalence of falls and factors associated with risk of falls where the findings varied according to the settings and region. Kioh and Rashid (2018) revealed 32.8% of falls among institutionalised elderly in Penang, and 13.3% of them were categorised to have moderate or high risk of falls. Meanwhile, a review study by Shaharudin et al. (2020) on Malaysian general elderly involving 9 studies and various assessment tools summarised the prevalence of falls ranging from 4% to 74% due to varied locations

of study. National Health and Morbidity Survey Elderly 2018 also reported 14.1% of fall prevalence.

For the studies that focused on falls among community-dwelling elderly in Malaysia, the prevalence of falls was between the range of 4.07% to 23% (Alex et al., 2018; Ooi et al., 2021; Singh et al., 2019; Yeong et al., 2016). Yeong et al. (2016) had observed the lowest prevalence of fall which was 4.07% in Perak. A cross sectional study focusing on urban elderly dwellers in Malaysia revealed 18.9% of falls after being adjusted to Kuala Lumpur population (Alex et al., 2017). Next, pooled analysis of two cross-sectional studies in Malaysia recorded different values of falls prevalence, which are 19% and 23% respectively from two databases extracted (Singh et al., 2019). Lastly, Ooi et al. (2021) found a total of 21.3% of prevalence among community-dwelling elderly, whereby higher rate of falls is observed in occasional falls compared to recurrent falls. Out of all the studies conducted in Malaysia and other countries, there were huge gaps between the prevalence of falls reported. However, most of the studies reported fall within 20% to 40%. Hence, it was important to conduct more future study with standardised instruments to study exclusively on the prevalence of falls in Malaysia.

2.2 Factors Associated with Risk of Falls among Community-Dwelling Elderly

Falls were very common among elderly as they experienced decline in motor and cognitive function due to ageing as well as weaker balance and strength, which in turn led to higher risk of falls (Fortunato et al., 2016). Elderly were more likely to survive with increasing morbidities, diseases and medications as they aged (Al-Aama, 2011). Studies conducted to examine the strength and correlation of the factors associated with risk of falls among the community-dwelling elderly in Hong Kong and Malaysia

had stated sociodemographic, behavioural, physical performances and health or medical condition as the main domains associated with risk of falls (Brito et al., 2014; Qian et al., 2020). However, there were limited amounts of studies in Malaysia that focused and studied exclusively on the association factors mentioned above with risk of falls among community-dwelling elderly.

2.2.1 Demographic Characteristics

Generally, sociodemographic characteristics were found to be strongly correlated with risk of falls among community dwelling elderly such as gender, age, ethnicity, marital status, education level, living arrangement and employment status.

There were a lot of studies done internationally that showed the correlation between gender and risk of falls among community-dwelling elderly. Many studies were done across the years at different countries and regions in which they mostly obtained similar results of gender being significantly associated with the risk of falls among community-dwelling elderly (Carrasco et al., 2018; Chang & Do, 2015; Janakiraman et al., 2019; Kim et al., 2020; Tsai et al., 2020). A systematic review and meta-analysis conducted by Filho et al. (2020) in Brazil stated that women are 1.5 times more prone to falls as compared to men. Similar results of women having 8% of falls prevalence higher than men were obtained from the study conducted by Mitchell-Fearon et al. (2014), where falls occurrence among male and female were 17.5% and 25.5% respectively. Moreover, a study conducted in Korean revealed that women were significantly associated with risk of falls, and falls were multifactorial, being modulated by other factors as well (Kim et al., 2020). Similarly, O and el Fakiri (2015) also identified women with higher risk of falls and falls were multifactorial in their study conducted in Armsterdam. Most of the international studies claimed that women had higher risk of falls as compared to men.

A systematic review conducted by Ngamsangiam and Suttanon (2020) in Asia revealed that two out of nine studies analysed concluded that women were generally associated with higher risk of fall among the community dwelling elderly. Similarly, gender, especially women, were also significant risk factors associated with higher risk of falls among community-dwelling elderly In Malaysia (Alex et al., 2017, Ooi et al., 2021). According to pooled analysis conducted on two different Malaysian datasets, more than 60% of the falls happened among elderly women, indicating that women have higher risk of falls. Nevertheless, there were still a few studies that showed no significant association between gender and risk of fall among community-dwelling elderly in Malaysia (Sahril et al., 2020; Young et al., 2016). Nevertheless, there was a study that revealed the opposite finding of male elderly having a 1.7 times higher chance to fall as compared to women (Nugraha et al., 2019).

The findings on the correlation of age and risk of falls among community-dwelling elderly were mostly polarised. There were a few studies which concluded that older age specifically the "old-old" group aged over 80 years old was associated with higher odd ratio of falls and higher the risk of falls among the elderly in several countries (Filho, 2019; Helgadóttir et al., 2014; Mitchell-Fearon, 2014; Wu & Ouyang, 2017). Worapanwisit et al. (2018) made assumptions in his study whereby community-dwelling elderly in Thailand were expected with higher risk of falls following their advancing age. A systematic review in Asia found that age was strongly associated with risk of falls and different circumference of falls among community-dwelling elderly (Ngamsangiam & Suttanon, 2020), similar to that of China (Zhang et al., 2019) where odds of falling raised 20% by every one-year increase in age. However, according to several studies carried out in Malaysia, most of results obtained were no significant association between age and the risk of falls

among the community-dwelling elderly (Ghazi et al., 2017; Ooi et al., 2021; Sahril et al., 2020; Tsai et al., 2020). However, Joyce et al. (2020) and Lee et al. (2020) discovered significant association between age and falls while Singh et al. (2019) found that the fallers among the community dwelling elderly were mostly of older age as compared to the non-fallers.

There was very limited discussion done on the association of ethnicity with risk of falls among community-dwelling elderly as most of the studies didn't focus or include ethnicity in their analysis and discussion. Nevertheless, a study carried out at elderly visiting government clinic in Kuala Lumpur found that Malays were more likely to report falls (44.5%) as compared to Chinese (34.7%) and Indian (14%). In contrast, a cross sectional analysis among urban elderly dwellers in Malaysia, specifically Kuala Lumpur, had revealed Indians as the independent ethnicity group with highest risk of falls (23.8%) as compared to the Chinese (19.4%) and Malays (16.2%). This result might be due to huge population size differences among each ethnic group that affect the final outcomes. On the other hand, Sahril et al. (2020) found no significant association between ethnicity and risk of fall among the general elderly population in Malaysia. Hence, more studies should be conducted to study the relationship between ethnicity and risk of falls among Malaysians since we were a multi ethnicity country.

Next, marital status had not been a very important focus as a determinant for risk of falls among community-dwelling elderly in the past studies. A systematic review done in Asia found contradictory results where one of the papers concluded that those married were approximately one time more likely to fall while another paper summarised that single elderly had one to three times higher risk of falls (Ngamsangiam & Suttanon, 2020). In China, marital status was one of the factors

affecting risk of fall (Wu & Ouyang, 2017). Chang and Do (2014) revealed widowed or divorced groups as those experiencing higher falls in Canada. Meanwhile, Singh et al. (2019) ranked the married as the group with highest risk of falls followed by divorced or widow and lastly single. On the contrary, a secondary data analysis study carried out among Korean community-dwellers disclosed that the married elderly group was having higher risk of falls (Kim et al., 2020). In addition, Joyce et al. (2020) found no association between marital status and risk of falls among elderly visiting the governmental clinic.

Regarding educational level, there were several studies that involved association of educational level and the risk of falls among the community dwelling elderly. According to cross sectional analysis conducted on 1565 urban community elderly dwellers in Malaysia, educational level was significantly associated with higher risk of falls (Alex et al., 2018). Having not received any formal schooling or low educational level were commonly associated with elevated risk of falls (Kim et al., 2020; Singh et al., 2019). A cross sectional national survey study in Israel found that risk of falls doubled among elderly receiving less than 12 years of formal education as compared to those more than 12 years of education (Frankenthal et al., 2021). Moreover, 37.5% out of the total fall amount of those with no formal education among Malaysian community-dwelling elderly were concluded from the cross-sectional study conducted by Singh et al. (2021). Similarly, those with bachelor degrees recorded the lowest level of falls (5.4%) in a case-control study conducted in Thailand (Kuhirunyaratn et al., 2013). Another cross-sectional study at Ethiopia revealed that uneducated community-dwelling elderly had limited understanding towards the adjustment they should be having against ageing, which led to two times higher risk of falls among them (Janakiraman et al., 2019). However, Worapanwisit et

al. (2018) observed higher risk of falls among two extremities, which were lowest and highest education. But, generally the risk of falls was lowered in higher education levels as they were less likely to do dangerous jobs.

Living arrangement were also found associated with risk of fall among community-dwelling elderly only in a few past studies. According to a study conducted by Goh et al. (2021) in Malaysia, elderly living with their family members would be more likely to adhere to fall awareness behaviour, hence leading to lower risk of fall among those elderly compared to those living alone. Similarly, Ngamsangiam and Suttanon (2020) concluded that living alone trippled the risk of falls as compared to the elderly staying with someone else in the systemic review concluded in Asia. In the same time, Yeong et al. (2016) reported doubled risk of falls among community dwelling elderly involving 250 households in Perak, Malaysia. Nevertheless, living alone was not a significant association as revealed by Joyce et al. (2020) from the study conducted on the elderly that visited government clinics in Kuala Lumpur, same goes for study conducted in China by Zhang et al. (2019). Living arrangement had not been mentioned frequently in the past studies.

Employment status was rarely being included and analysed in the studies about risk of falls among community-dwelling elderly. Kim et al. (2020) had mentioned unemployed elderly groups as the group with higher risk of falls from secondary data analysis involving 31684 community-dwelling elderly in Korea. This might be due to presumptions that employed elderly had higher life satisfaction, and were more socially active and capable to perform activities daily. Other than that, a correlation study done in Thailand by Worapanwisit et al. (2018) has included employment status in the study but there was no further analysis involving this factor with risk of falls. Next, Zhang et al. (2019) found no significant association between risk of falls with

employment status among community-dwelling elderly in China. Hence, more future studies that study the association about employment status and risk of fall among community-dwelling elderly can be done.

2.2.2 Body Mass Index

Body mass index (BMI) was defined as the nutritional status determinant, precisely called as an individual's weight in kilogram to the square of his/her height in centimetres (WHO, 2021). According to Nutritional Education Materials Online (NEMO) 2017, elderly should have different BMI cut off points with the normal adults since their age was increasing with significant decline in body function. In addition, a U-shaped association was found between BMI and mortality or morbidity among elderly. As support, there were several meta-analysis studies which found significant greater increase in mortality and morbidity among elderly with BMI lower than 22-23 kg/m^2 and BMI more than 29-31 kg/m^2, while elderly with BMI generally between 23 to 30 kg/m^2 experience lowest mortality (Starr & Bales, 2015; Winter et al., 2014; Winter et al., 2016). Moreover, NEMO (2017) also adopted and categorised BMI lower than 23 kg/m^2 as underweight, 23 to 30 kg/m^2 as normal weight while higher than 30 kg/m^2 as overweight.

For most of studies involving elderly in the obese category, obesity was found to increase the prevalence of falls for 25% up to 90% specifically among elderly male less than 80 years old from a prospective cohort study conducted by Hooker et al. (2017) involving 160 participants in America. Mitchell et al. (2013) also found approximately one third of increase in risk of falls among the obese elderly from study conducted in Sydney. Obese elderly commonly adhered to negative behavior where they believed that it was difficult for them to be physically active and make changes to prevent falls among themselves. Similarly, a cohort study involving pooled analysis

conducted in Malaysia revealed that increased BMI was positively associated with the risk of falls among community-dwelling elderly (Singh et al., 2019). Another epidemiology study conducted in Malaysia reviewing the papers on obesity and risk of falls concluded that class I and class II obesity elderly had more comorbidities related to obesity which reduced their quality of life, which eventually increased the risk of falls among the elderly (Tan et al., 2019). This might be due to lower self-awareness on fall prevention especially among the obese elderly, as Goh et al. (2021) concluded higher fall awareness behavior among those elderly with lower BMI from the study involving 144 community-dwelling elderly in Malaysia. Furthermore, a study conducted in Canada by Dutil et al. (2012) reported lower balance and postural control among obese women elderly participants, revealing that elderly women commonly had poor balance that led to higher risk of fall.

However, Handrigan et al. (2016) concluded higher falls occurrence among the community-dwelling Canadians elderly which were categorized under both categories of underweight and obese involving 15869 elderly. Moreover, there was no significant relation between risk of falls and obese male elderly but increased fall-related injury in the study. In contrast, both risk of falls and fall related injury was not associated with BMI among women elderly. In addition, there was a study conducted on 606 community-dwelling elderly in Ireland which reported the opposite result of higher BMI as the protective factors against falls among the elderly (Sheehan et al., 2013). Lastly, Cho et al. (2018) found no significant association between BMI and risk of falls but fall injury was lowered among the obese elderly. There was an association between elderly with central obesity and risk of falls but central obesity didn't indicate obese exactly.

Most of the studies concluded obese group of elderly had higher risk of falls but there were also some studies that found opposite results with the association of BMI and risk of falls. Hence, we could conduct more studies on BMI and risk of falls specifically in the Malaysian context.

2.2.3 Body Composition

Body composition was the compartments within the body including protein, water, body fat mass and muscle mass (Saltzman & Mogensen, 2013). Body composition was found correlated with risk of falls among elderly as found in the past study (Xu et al., 2019). Ageing was associated with reduction in muscle strength that eventually affect body composition including muscle mass and quality (Hiol et al., 2021). Handgrip strength could be regarded as one of the strong proxy measures of muscle mass of an individual (Lee, 2021). Body composition components such as total percentage of subcutaneous fat and skeletal muscle as well as handgrip strength as muscle strength proxy measure were associated with risk of fall.

Muscle mass has been found correlated with risk of falls among community-dwelling elderly. Nevertheless, there was a very limited study that studied the percentage of skeletal muscle mass and risk of fall among community-dwelling elderly. Rather, more studies focused only on muscle strength. Gadelha et al. (2018) recorded higher risk and number of falls with lower muscle quality among 139 community-dwelling Brazil women in 18 months prospective cohort study. A total of 57.7% of elderly women with low muscle quality experienced falls while only 15.3% of elderly women with normal muscle quality experienced falls. A study conducted in Malaysia involving 1763 elderly reported reduced muscle strength as the independent risk factor of falls in community-dwelling elderly (Ooi et al., 2019). Interestingly, a cross-sectional study carried out by Lee et al. (2020) which recruited 258 community-

dwelling elderly in South Korea found that BMI, specifically obesity, was associated with higher risk of falls due to lower muscle strength and impaired balance. Similarly, Xu et al. (2019) obtained results of reduced skeletal muscle mass and strength, presented along with obesity, increased risk of falls among the elderly. However, the fact that changing body composition can affect risk of falls among elderly was still unsure.

Studies on association between subcutaneous fat percentage and risk of falls among community-dwelling elderly was lacking overall. Kim et al. (2017) concluded that higher percentage of body fat was associated with lower physical function and handgrip strength, which might affect occurrence of falls among the community-dwelling elderly. Moreover, Ooi et al. (2019) also recorded higher body fat percentage as one of the predictors of falls among 1763 community-dwelling Malaysians elderly in the 18 months follow-up prospective cohort study. Higher fat percentage were commonly found among obese individuals whereby obesity itself was commonly related to higher risk of fall. Hence, assumption of higher body fat percentages correlated with higher risk of falls was somehow supported but the exact mechanism and relationship are unknown.

There were two studies that study the association between handgrip strength and risk of fall among community-dwelling elderly. A study conducted in Singapore involving 31 elderly found significant reduction in functional handgrip strength among the elderly who experienced falls (Jais et al., 2019). Lower functional capacity was positively correlated to handgrip strength, which can be a marker for the deteriorated functional which could predict falls. Meanwhile, a study conducted in Malaysia involving pooled analyses from two cross-sectional Malaysian datasets concluded

handgrip strength as the independent risk factor of falls following the observation of lower handgrip strength with higher fall occurrence in elderly (Singh et al., 2019).

There were very limited studies that study body composition and risk of falls among community-dwelling elderly in Malaysia. Hence, more future studies need to be conducted to study the risk of falls thoroughly.

2.2.4 Physical Activity Level

Physical activity was defined as "any bodily movement produced by skeletal muscles that requires energy expenditure including the movement during leisure time, for transport to get to and from places, or as part of a person's work" (WHO, 2020). Physical activity was proven to have a lot of benefits including reducing occurrence of non-communicable diseases, maintaining healthy body weight and improving overall quality of life and mental health.

From most of the studies done all over the world, physical activity was commonly associated with risk of falls among community-dwelling elderly. A study from Akosile et al. (2021) in Nigeria found that community-dwelling elderly have generally higher levels of physical activity as compared to the assisted living group. In Taipei, Taiwan, a secondary data analysis study concluded negative significant association between physical activity level and risk of falls specifically among the women elderly (Song et al., 2021). Similarly, another study involving 623 community-dwelling elderly, also conducted in Taiwan found those with better ability to perform daily physical activity such as walking, moving around and do heavy works were commonly having lower frequency of falls as compared to the others (Huang et al., 2015).

In addition, Pope et al. (2019) had observed significant reduction in the risk of falls among the elderly following the intervention and increased their physical activity

level. In Japan, similar trends were observed as elderly fallers in Japan generally have lower engagement in physical activity (Sampaio et al., 2016). Meanwhile, a study in Sweden involving 176 elderly noticed higher comorbidities of hypertension and diabetes mellitus among those with lower physical activity, which eventually raised the risk of falls among the elderly (Halaweh et al., 2015). The quality of life among those community-dwelling elderly with moderate and high levels of physical activity level was significantly higher.

A study conducted in Podkarpackie region, Polska recorded a high proportion of sedentary levels among the elderly, where 46% and 38% of males and females respectively, engaged in insufficient level of physical activity (Woloszyn et al., 2018). Three out of four elderly in Polska like to watch television and rest. Those with sedentary lifestyle were found to engage with higher frequency of falls among the elderly. Next, a study carried out in Portugal involving 506 community-dwelling elderly revealed statistical reduction of 2% of falls prevalence for each 100 MET-min/week increase in the physical activity level (Periera et al., 2013). Those with moderate and high physical activity levels were proven to reduce approximately 75% and 60% of severe related fall injuries among the elderly.

In Thailand, a study conducted among 25533 community-dwelling elderly in Bangkok found significant association between falls and physical activity level. Elderly engaged in daily walking more than 5000 steps and doing more moderate and vigorous intensity physical activity were found to have lower risk of falls. However, there were other assumptions that believe higher physical activity engagement and being physically active exposed elderly people to more danger, hence increasing the risk of falls in a cohort study carried out by Stahl and Albert (2015) in Pennsylvania.

In conclusion, no Malaysian paper that studies the association between physical activity level and risk of falls among community-dwelling elderly.

2.2.5 Health Status

According to Rumsfeld (2002), health status was referred to as the self-reporting of the effect of disease on a patient himself or herself. Health status could also be defined as "the range of manifestation of disease in a given patient including symptoms, functional limitation, and quality of life, in which quality of life is the discrepancy between actual and desired function" more precisely. In this study, a wide range of diseases and problems such as diabetes mellitus, hypertension, heart disease, gout, arthritis, stroke, chronic kidney disease, breathing problem, eyesight problem, hearing problem, surgery, bone fractures and medication related were included in health status assessment to study the association with risk of fall among community-dwelling elderly.

There were very limited studies in Malaysia that discussed the health status and comorbidities on risk of falls among community-dwelling elderly. Hence, the relationship between health status and risk of falls would be reviewed in the global perspective. A meta review and meta-analysis conducted by Hacıdursunoğlu Erbaş et al. (2021) among elderly patients had concluded that most of the chronic disease was significantly associated with high risk of falls. Similarly, Janakiraman et al. (2019) recorded 5 times higher risk of falls among the community-dwelling elderly with more than one comorbidity such as hypertension, stroke, cardiovascular disease and diabetes from cross-sectional study conducted in Ethiopia. Moreover, as the number of chronic illnesses among community and home dwelling elderly increases, risk of falls was significantly increased as medication prescribed might lead to dizziness and hypotension, which further increases the risk of fall (Nugraha et al., 2019).

Regarding diabetes mellitus, risk of falls was positively associated with diabetes mellitus since related treatment, lifestyle and comorbidity might contribute to risk of falls among elderly in Malaysia through the secondary data in National Health and Morbidity Survey 2018 (Sahril et al., 2020). According to the systematic review and meta-analysis on six studies regarding diabetes mellitus and risk of falls among elderly, diabetes mellitus raised more than 90% and 20% of risk of falls among the insulin treatment and non-insulin treatment group respectively (Yang et al., 2016). Similarly, Filho et al. (2019) mentioned diabetes mellitus and osteoarthritis as significant contributors to risk of falls among community-dwelling elderly in the systematic review and meta-analysis among Brazilians. Meanwhile, diabetes mellitus and cardiac disease were found significantly correlated with fall and fear of fall in a study conducted by Frankenthal et al. (2021). However, Carrasco et al. (2018) reported no significant association between diabetes mellitus and risk of falls among 508 community-dwelling elderly in Portugal.

In the Netherlands, Goto et al. (2018) found significant association between chronic kidney disease and risk of fall. Those with reduced kidney function recorded higher risk of falls but the results might be due to other comorbidities coexisting with the chronic kidney disease which caused more falls among the community-dwelling elderly. However, two studies conducted by Britting et al. (2020) in Europe and Rottenbacher et al. (2013) in Germany found no association between chronic kidney disease with risk of falls among the elderly. For hypertension, there was one study conducted by Abu Bakar et al. (2021) among hypertensive elderly in Kuala Terengganu, Malaysia revealed one out of three elderly with hypertension experience falls specifically due to high number of diuretics, polypharmacy and antihypertensive medications taken by the respondents. In Jamaica, a study conducted by Mitchell-

Fearon on community-dwelling elderly reported association of multiple diseases with risk of falls. Bad vision, specifically cataracts and hypertension were independent contributors to falls among the elderly experiencing falls, which recorded 26.5% and 28.3% of falls respectively. Stroke, heart disease was most commonly found among those experiencing falls followed by hypertension, diabetes mellitus and arthritis. In the meantime, Ooi et al. (2021) described a higher occurrence of recurrent falls among the stroke survivors in falls among the community-dwelling elderly in Malaysia.

For respiratory illnesses, Kioh and Rashid (2018) found significant association between falls among institutionalised elderly in Penang, Malaysia with respiratory illnesses. Heart failure patients reported higher odds of falling which is approximately 15% as compared to those elderly without heart failure in a retrospective cohort study conducted among 17,712 community-dwelling in Korea (Lee et al., 2020). However, there was suspicion that increased odds of falling was due to other comorbidities coexisting with heart failure among the elderly. In terms of sensory impairment, a systematic review and meta-analysis on 12 studies by Jiam et al. (2016) revealed doubled odds of falling among the elderly with hearing loss issues. This might probably be due to declined cognitive function from age related hearing loss which resulted in declined life quality and other functions that raised the risk of fall (Fortunato et al., 2016). Joyce et al. (2020) also observed higher risk of falls among the elderly with hearing and vision problems, various diseases and antidiabetic drugs intake that visited government clinics in Kuala Lumpur Malaysia.

In Sweden, Helgadóttir et al. (2014) conducted a case control study among the elderly and revealed doubled risk of injurious falls for each increase in the number of medication compliances. Meanwhile, according to the special report from CDC America on antidepressant and risk of falls among community-dwelling elderly, the

usage of antidepressant, specifically SSRI or serotonin-norepinephrine reuptake inhibitors (SNRI), significantly increase the risk of fall (Haddad et al., 2020). In contrast, Yeong et al. (2016) recorded no association between number of medications and comorbidities from the cross-sectional study among community-dwelling elderly with risk of falls in Perak, Malaysia. Similar findings were concluded from another cross-sectional study carried out among elderly in Kuala Lumpur Malaysia (Ghazi et al., 2017).

CHAPTER 3

METHODOLOGY

3.1 Study Design

This was a cross-sectional study that aims to determine the proportion of fall and the association of body mass index, body composition, physical activity and health status with risk of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur.

3.2 Study Location

This study was conducted among community-dwelling elderly living in flat PPR Kuala Lumpur. Kuala Lumpur was considered as the most developed district in Malaysia and it ranked second to Johor Bahru in terms of population density with a total of 1,453,975 people staying in relatively small area as shown from Worldmeter live statistics this year 2021. Moreover, there were relative higher number of flat PPR in Kuala Lumpur with total of 59 flats PPR in 4 different zones as shown in the list released by official portal of Dewan Bandaraya Kuala Lumpur in year 2021.

Table 3.1

Number of flat PPR Kuala Lumpur in Different Zones

District	Zone	Number of flat PPR
Kuala Lumpur	1	17
	2	17
	3	11
	4	14

3.3 Participants

The potential participants for this study were community-dwelling elderly who reside in flat PPR Kuala Lumpur and are community-dwellers. The elderly who fulfilled all the participation criteria will be included in the study. The inclusion and exclusion criteria of this study were shown in Table 2.

Table 3.2

Inclusion and Exclusion Criteria of the Participants

Inclusion Criteria	Exclusion Criteria
• Malaysian elderly aged 60 years and above • Male / Female • Community-dwelling • Able to ambulate and perform physical activity • Completed 2 doses vaccination	• Suffered from cognitive impairment such as dementia • Wheelchair-bounded • Diagnosed with terminal illness and life expectancy less than 6 months

3.4 Sample Size Determination

First, the sample size of this study was determined using the formula of sample size calculation in prevalence study (Lwanga & Lemeshow, 1991).

Formula:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

where

n = sample size

Z = Z score at 1-α/2 confidence level (conventional Z value is 1.96)

P = expected prevalence or proportion

d = precision

Next, the sample size for correlation studies was calculated using the formula shown below (Cole, T. J., 1997).

Formula:

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{r^2/(1-r^2)} + 5$$

where

n = sample size

$Z_{1-\alpha/2}$ = z score for level of significance a in a two-sided test = 1.96

$Z_{1-\beta}$ = z score for power of the test = 0.84

r = correlation coefficient

The significance level α was set at 5% while the power (1-β) was set at 80%. Hence, the value of $(z_{1-\alpha/2} + z_{1-\beta})^2$ was 7.84 according to the table from Cole T. J. (1997).

Table 3.3

Calculation of Sample Size

Studies	Proportion, P	Correlation, r	Sample Size, n
Prevalence	0.429		$n = \frac{Z^2 P(1-P)}{d^2}$
Understanding fall risk factors in community-dwelling older adults: A cross-sectional study			$n = \frac{1.96^2 \, x \, 0.429(1-0.429)}{0.1^2}$ $n = 94.1$ $n \approx 95$

Christina et al. (2018)		
Physical activity Kamińska et al. (2015) Fall Risk Factors in Community-Dwelling Elderly Depending on Their Physical Function, Cognitive Status and Symptoms of Depression.	0.77	$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{r^2/(1-r^2)} + 5$ $n = \frac{7.84}{0.77^2/(1-0.77^2)} + 5$ n = 10.4 n ≈ 11

The sample size obtained from the prevalence of falls among community-dwelling elderly was 95 respondents.

Adjusted for the expected response rate (80%):

95 ÷ 0.8 = 118.75 ≈ 119

The sample size obtained from the association between physical activity and risk of falls among community-dwelling elderly was 11 respondents.

Adjusted for the expected response rate (80%):

11 ÷ 0.8 = 13.75 ≈ 14

To calculate the sample size needed in this study, the largest sample size was chosen as the final sample size of this study. The largest sample size (n=119) obtained from the prevalence of falls among community-dwelling elderly was used. Hence, the actual sample size needed was 119 respondents after considering 20% of non-response rate.

3.5 Sampling Design

In this study, an online random number picker was used to select 4 flat PPR out of a total of 59 flat PPR in Kuala Lumpur by performing simple random sampling. The selected flat PPR are PPR Wahyu, PPR Batu Baru, PPR Kampung Limau and PPR Kampung Muhibbah. The information on the contact number and person in charge for the PPR was obtained through official portal of Dewan Bandaraya Kuala Lumpur. Cooperation with the person in charge for the selected flat PPR to disseminate the information about this study was done one week earlier to inform 30 eligible elderlies to come on physical data collection from each PPR. All the elderly who fulfilled the study criteria were included in the study.

Figure 3.1

Flow Chart of Sampling Design and Strategy

3.6 Study Instruments

This study was conducted via face-to-face interview and physical assessment screening session using printed questionnaire. Hence, all the respondents had to be presented at the center for the interview, specifically for the physical assessment. It was better for the elderly to have a caregiver accompany them to assist if there was any communication barrier or when the elderly cannot literate. Respondents were being interviewed on demographic characteristics, body composition, physical activity level and health status while physical assessment were performed during risk of falls data collection. The questionnaire included Malay versions only because most of the Malaysian elderly can literate in Malay language.

3.6.1 Demographic Characteristics

All demographic characteristic data of the respondents were collected through a self-developed questionnaire. The questions comprised of gender, age, ethnicity, marital status, education level, living arrangement and employment status.

3.6.2 Body Mass Index and Body Composition

Anthropometric compartment was self-developed fully to assess body mass index and body composition. Details of the items involved in data collection including height, weight, BMI, subcutaneous fat percentage, skeletal muscle mass and handgrip strength. Height was measured using SECA stadiometer while weight, BMI, subcutaneous fat percentage and skeletal muscle mass are measured using OMRON BIA (HBF-375). If the elderly cannot stand erectly without assistance, Lufkin measuring tape W606PM was used to measure demi span to calculate height. In the meanwhile, handgrip strength was measured used Jamar hydraulic hand dynamometer.

3.6.3 Physical Activity Level

Commonly used instruments to measure and evaluate the physical activity level among elderly was Physical Activity Scale for Elderly developed by Washburn et al. (1993). However, considering the general literacy of Malaysian elderly in Malay, the physical activity level and daily activity among the community-dwelling elderly were being evaluated using the translated version of questionnaire namely Physical Activity Scale for Elderly in Malay version (PASE-M) (Singh et al., 2018). PASE-M had been validated by Ismail et al. (2015) in a reliability and validation study. This instrument comprised of 12 items that assess three categories of physical activity among the elderly which are leisure, household and occupational activity by including the frequency, duration and intensity to evaluate elderly's overall physical activity level in the past seven days (Logan et al., 2013). This instrument was validated questionnaire that was very cost saving and easily administered with reasonable validity (Singh et al., 2018). The test-retest reliability of Cronbach alpha coefficient of PASE was 0.75, which was acceptable and validated to be used to among elderly (Washburn et al., 1993). Through the validity and reliability study of PASE-M, PASE-M was found with high reliability (ICC) of 0.493 and 0.960 respectively (Ismail et al., 2015; Singh et al., 2018).

The intensity, duration and frequency of activity was recorded for a total of 12 items divided under three components of leisure, household and occupational activity. Item 1, 2, 3, 4, 5, 6 and 10 responses were collected in terms of frequency, type of activity and duration spend per day. Frequency was categorized to "never", "sheldom", "sometimes" and "always" while the duration was categorized into less than 1 hour, 1 to less than 2 hours, 2 to less than 4 hours and equal to or more than_4 hours. Meanwhile items 7, 8, 9a, 9b, 9c and 9d required only one answer, either yes or no.

The scoring of PASE was mentioned in New England Research Institutes (1991) which may resulted in a total ranging from 0 - 400. First item response describing sitting was not included in the total PASE score calculation. Activity frequency was obtained from Table 3.5 and the weight times frequency was calculated by multiplying activity weight and frequency. PASE score was obtained by adding up the weight times frequency.

Table 3.4

Scoring Form of PASE-M

Type of Activity	Activity Weight	Activity Frequency	Weight Times Frequency
2. Walk outside home	20	a.	
3. Light sport / recreational activities	21	a.	
4. Moderate sport / recreational activities	23	a.	
5. Strenuous sport / recreational activities	23	a.	
6. Muscle strength / endurance exercises	30	a.	
7. Light housework	25	b.	
8. Heavy housework or chores	25	b.	
9a. Home repairs	30	b.	
9b. Lawn work or yard care	36	b.	
9c. Outdoor gardening	20	b.	
9d. Caring for another person	35	b.	
10. Work for pay or as volunteer	21	c.	
		PASE SCORE:	

Table 3.5

Activity Time to Hours per Day Conversion Table

Days of Activity	Hours per Day of Activity	Hours per Day
0. Never		0
1. Seldom	1. Less than 1 hour	0.11
	2. 1 - 2 hours	0.32
	3. 2 - 4 hours	0.64
	4. More than 4 hours	1.07
2. Sometimes	1. Less than 1 hour	0.25
	2. 1 - 2 hours	0.75
	3. 2 - 4 hours	1.50
	4. More than 4 hours	2.50
3. Often	1. Less than 1 hour	0.43
	2. 1 - 2 hours	1.29
	3. 2 - 4 hours	2.57
	4. More than 4 hours	4.29

3.6.4 Health Status

Health status was self-developed to assess the overall health status of the elderly to study the association of health disease with risk of falls. The questions included in the health status questionnaires were presence of acute and chronic diseases ranging from diabetes mellitus, hypertension, cardiovascular disease, joint disease, pulmonary disease, stroke, kidney disease and other as well as treatment or medication received, bone fractures, surgery, vision and hearing.

3.6.5 Risk of Falls

Risk of falls had two segments of question, where first segment included three self-developed questions asking about the history of falls within past 6 months, reason of falls and the injuries related to falls.

Second segment was the physical assessment of risk of falls. Risk of falls among the community-dwelling elderly was assessed using the Berg Balance Scale (BBS) which was developed by Berg et al. (1989) specifically to measure the balance and risk of falls among the elderly. This instrument had been validated by Berg et al. (1991) with significantly high level of both inter-rater and intra-rater agreements that recorded ICC value of 0.98. In the meantime, BBS recorded Cronbach alpha value of 0.96, indicating that BBS was valid and reliable as an instrument to assess risk of falls among elderly. Lee and Lee (2019) found higher level of reliability and validity in BBS as compared to other similar balance test instrument. BBS contained 14 items include physical performances of sitting, standing unsupported, standing, transfer, standing with eyes closed, standing with leg closed, picking up subject, turning around, standing with one leg and standing with leg exchanged and others (Berg at al., 1989; Berg at al., 1991). Each of the items was described with 5 answers stated with scores ranging from 0-4 with different level of achievement for the assessment. BBS score was total up after the whole risk of score assessment was conducted. The total score of BBS was obtained by adding up the scores for each item, whereby the total scores may range from 0 to 56. Total score higher than or equal to 45 indicated normal without risk of fall while total score less than 45 indicated the participant has significant level of risk of fall.

3.7 Procedure

The data collection started from the end of November 2021 to February 2022. From pre testing, each participant would spend around 40 minutes to complete the registration until physical assessment. Ethics approval was acquired from UPM's

Ethics Committee for Research Involving Human Subjects (JKEUPM) prior conducting the study at the flat PPR.

All the randomly selected PPR at Kuala Lumpur was approached through the person in charge to brief through the details and procedures of physical data collection. The consent to conduct the data collection was applied few days ahead to prepared the transportation and instruments needed earlier. The person in charge from each PPR helped with dissemination of the information about the participant criteria. We selected 30 participants each from name list obtained from the PIC from each PPR via simple random sampling. Person in charge and ourselves contacted and invited all of the participants to join the data collection. The subjects were interviewed using self-administered questionnaire as shown in the Appendix. The questionnaire contained five sections, including demographic characteristics, body mass index and body composition, physical activity level, health status and risk of falls. The participants were required to complete all the stations and returned the questionnaire upon completion. Lastly, the researcher keyed in and recorded all the research data in the computer. The data would be saved for a minimum of three years upon completion of the study.

3.8 Pre-testing

Twelve elderly who have fulfilled the study criteria stated was chosen to perform the pre-testing of the instruments before the study started. The participants who were involved in the pre-testing will be excluded from inclusion during actual data collection. Pre-testing was mainly carried out to identify any questions that seems ambiguous, equivocal or unclear in the questionnaire for further improvement. The participants took approximately 40 minutes to complete the whole pre testing

procedure. Pre-testing was also important to ensure reasonable duration required to complete the questionnaire and screening process. Further amendment on the questionnaire was done based on the feedbacks from all the pre-testing participants.

3.9 Data Analysis

IBM SPSS Statistics version 25 was used to performed statistical analysis. The normality of continuous data was determined by using ShapiroWilk`s and KolmogorovSmirnov, where p value greater than 0.05 indicated that the normality assumption was met by the data. In term of descriptive analysis, the results were shown as categorical data including frequencies and percentages as well as continuous data such as means and standard deviations. The results were displayed as median and interquartile ranges for continuous variables if the data were found not normally distributed. Both Chisquare test for independence and Pearson product-moment correlation or Spearman rank order correlation were used to determine the relationship between two variables for the analysis involving two variables. Similarly, p value smaller than 0.05 was considered to conclude the analysis to be statistically significant.

To analyse the first and second specific objectives, descriptive analysis for both categorical data and continuous data were done. Categorical data was reported as frequencies and percentages while continuous data as means and standard deviations or median and interquartile range. On the other hand, bivariate analysis was done for third specific objective. Chi-square test was used to analyse the association between both categorical data while Pearson's correlation test was used to analyse association between continuous data with categorical data. The details were shown in Table 3.6 below.

Table 3.6

Data Analysis

Objectives	Statistical Analyses	Variables
1. To identify the prevalence of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur 2. To determine the demographic characteristics, body composition, physical activity and health status among community-dwelling elderly residents in flat PPR Kuala Lumpur	**Descriptive Analysis** Categorical Data: • Frequencies and percentages Continuous Data: • Means and standard deviations, or • Median and interquartile range	**Categorical Data** Gender, age, ethnicity, marital status, educational level, living arrangement, employment status, BMI, chronic disease, number of medications, PASE score, bone fracture history, surgery history, vision and hearing problem, history of falls and risk of falls. **Continuous Data** Subcutaneous fat percentage, skeletal muscle mass and handgrip strength.
3. To determine the association between demographic characteristics, body composition, physical activity and health status with risk of falls among community-dwelling elderly residents in flat PPR Kuala Lumpur	**Bivariate Analysis** • Chi-Square Test of Independence • Pearson's Product Moment Correlation / Spearman's Rank Order Correlation	**Chi-Square Test** Gender, age, ethnicity, marital status, educational level, living arrangement, employment status, BMI, chronic disease, number of medications, PASE score, bone fracture history, surgery history, vision and hearing problem, history of falls and risk of falls. **Pearson's Correlation Test** Subcutaneous fat percentage, skeletal muscle mass and handgrip strength.

CHAPTER 4

RESULTS

4.1 Proportion of Falls

Table 4.1 showed the history of falls of the respondents in the past 6 months. Approximately 7% of the participants had a fall for the last 6 months, with 4, 2 and 1 experienced one, two and three or more falls, respectively. Hence, the proportion of falls among the respondents at flat PPR Kuala Lumpur was only 7.2%. The term prevalence was replaced with proportion since the final sample size of 97 elderly was too small to represent the community dwelling elderly population in Malaysia.

Table 4.1 History of falls in past 6 months of participants (n=97)

	N (%)
History of falls past 6 months	
No	90 (92.8)
One	4 (4.1)
Two	2 (2.1)
More than three	1 (1.0)

4.2 Demographic Characteristics

Table 4.2 showed the demographic characteristics of the participants. The age of the participants ranged from 60 to 81 years old, with mean age of 68.04 years old and standard deviation of 5.54 years. Around one third of the participants aged between 60 to 64 years old (37.1%), 65 to 70 years old (32.0%) and more than 70 years old (30.9%) each. More than 7 out of 10 participants were females (73.2%), which was more than twice of the male participants (26.8%). Majorities of the participants were Malay (88.7%) followed by a small proportion of Indians (9.3%) and Chinese (2.1%). Regarding marital status, almost half of the participants were

either widow (48.5%) or married (46.4%), followed by minorities of divorced (3.1%) and single (2.1%). Almost 10% of participants had not received any formal education. Half of the participants went to primary school (50.5%), followed by 19.6% of secondary school education and 15.5% of upper secondary school education level. Only one of the participants went to ritual school while four went for tertiary education. Most of the participants lived with their family (82.5%) and not working (88.7%) currently.

Table 4.2 Demographic characteristics of participants (n=97)

	N (%) / Mean ± SD
Age	68.04 ± 5.54
Young old (60-64 y/o)	36 (37.1)
Middle old (65-70 y/o)	31 (32.0)
Old old (>70 y/o)	30 (30.9)
Gender	
Male	26 (26.8)
Female	71 (73.2)
Race	
Malay	86 (88.7)
Chinese	2 (2.1)
Indian	9 (9.3)
Marital Status	
Single	2 (2.1)
Married	45 (46.4)
Divorced	3 (3.1)
Widow	47 (48.5)
Educational Level	
No education	9 (9.3)

Ritual school	1 (1.0)
Primary school	49 (50.5)
Secondary school	19 (19.6)
Upper secondary school	15 (15.5)
Tertiary education	4 (4.1)
Living arrangement	
Alone	17 (17.5)
With family	80 (82.5)
Employment status	
Working	11 (11.3)
Not working	86 (88.7)

4.3 Body Mass Index

Table 4.3 showed the body mass index of the participants. The mean BMI of the participants was 28.49 $\pm$ 5.02 kg/m^2. Around half (47.4%) of the participants was in normal BMI category (23.0 – 29.9 kg/m^2) followed with 38.1% in the overweight category ($\geq$30.0 kg/m^2) and 14.4% in the underweight category (<23.0 kg/m^2) adopting the elderlies' cut off point from Nutrition Education Materials Online (NEMO) 2017.

Table 4.3 Body mass index of participants (n=97)

	N (%) / Mean $\pm$ SD
BMI	28.49 $\pm$ 5.02
Underweight (<23.0 kg/m^2)	14 (14.4)
Normal (23.0 – 29.9 kg/m^2)	46 (47.4)
Overweight ($\geq$30.0 kg/m^2)	37 (38.1)

4.4 Body Composition

Table 4.4 presented the body composition of the participants. Since there 24% and 29% data missing at random for skeletal muscle percentage and subcutaneous fat percentage respectively, mean substitution was done to obtain full set of respondent data (Kang, H., 2013; Soley-Bori, M., 2013). However, it was notable that marginal mean substitution method might lead to underestimation of standard deviation (Soley-Bori, M., 2013). The mean skeletal muscle percentage was 21.22 ± 3.51 % while the mean subcutaneous fat percentage was 31.61 ± 6.64 %. The mean handgrip strength was 13.03 ± 6.53 kg.

Table 4.4 Body composition of participants (n=97)

	Mean ± SD
Skeletal muscle percentage (%)	21.22 ± 3.51
Subcutaneous fat percentage (%)	31.61 ± 6.64
Handgrip strength (kg)	13.03 ± 6.53

4.5 Physical Activity Level

Table 4.5 showed the physical activity level of the participants using the PASE Malay version questionnaire. The mean score of PASE-Malay of the participants was 104. 58 ± 59.53, with 19.6% and 80.4% categorised in low physical activity level and normal physical activity level respectively by a 52.53 cut-off point at 20th percentiles. From the analysis, most of the participants were found to engage more with household activity such as house chores, cleaning, gardening, lawning and taking care of others given that the highest mean scores of 73.42 ± 35.94 came from household related activity. The participants engaged less with leisure time activity (27.82 ± 32.91) such as walking and exercising or work-related activity (3.36 ± 14.24) like volunteering.

Table 4.5 Physical activity level of participants (n=97)

	N (%) / Mean ± SD
PASE-Malay score	104.58 ± 59.53
Leisure time activity score	27.82 ± 32.91
Household activity score	73.42 ± 35.94
Work-related activity score	3.36 ± 14.24
Low physical activity level	19 (19.6)
Normal physical activity level	78 (80.4)

4.6 Health Status

Table 4.6 showed the health status of the participants. In terms of chronic diseases, only 30% of the participants didn't have any chronic diseases, while 27.8% have one chronic disease, followed by 24.7% with two chronic diseases, 12.4% with three chronic diseases and 5.2% with four chronic diseases. Approximately 50% of the participants had hypertension, followed by diabetes (42.3%), heart disease (14.4%), joint disease (11.3%), respiratory disease (7.2%), chronic kidney disease (3.1%) and stroke (2.1%). Following the presence of chronic diseases, the results of medications intake for chronic diseases was similar. Most of the participants took medications for hypertension (49.5%), followed by diabetes (41.2%), heart disease (14.4%), joint disease (7.2%), respiratory disease (5.2%), chronic kidney disease (2.1%) and stroke (2.1%). One third of the participants didn't have any medications to treat their chronic diseases, 30% had only one type of medication, 23% had two types of medications, 11% had three medications while only 3% had four medications. Only one participant had history of surgery and three and two participants had sight and hearing impairment respectively.

Table 4.6 Health status of participants (n=97)

	N (%) / Mean ± SD
Chronic diseases	
Diabetes	
Yes	41 (42.3)
No	56 (57.7)
Hypertension	
Yes	53 (54.6)
No	44 (45.4)
Heart disease	
Yes	14 (14.4)
No	83 (85.6)
Joint disease	
Yes	11 (11.3)
No	86 (88.7)
Respiratory disease	
Yes	7 (7.2)
No	90 (92.8)
Stroke	
Yes	2 (2.1)
No	95 (97.1)
Chronic kidney disease	
Yes	3 (3.1)
No	94 (96.9)
Number of chronic diseases	
No chronic disease	29 (29.9)
One	27 (27.8)
Two	24 (24.7)
Three	12 (12.4)

Four	5 (5.2)
Chronic diseases medication	
Diabetes	
Yes	40 (41.2)
No	57 (58.8)
Hypertension	
Yes	48 (49.5)
No	49 (50.5)
Heart disease	
Yes	14 (14.4)
No	83 (85.6)
Joint disease	
Yes	7 (7.2)
No	90 (92.8)
Respiratory disease	
Yes	5 (5.2)
No	92 (94.8)
Stroke	
Yes	2 (2.1)
No	95 (97.9)
Chronic kidney disease	
Yes	2 (2.1)
No	95 (97.9)
Number of chronic diseases medication	
No	32 (33.0)
One	29 (29.9)
Two	22 (22.7)
Three	11 (11.2)

Four	3 (3.1)
History of surgery	
Yes	1 (1.0)
No	96 (99.0)
Sight impairment	
Yes	3 (3.1)
No	94 (96.9)
Hearing impairment	
Yes	2 (2.1)
No	95 (97.9)

4.7 Risk of Falls

Table 4.7 showed the risk of falls scores of the participants using Berg Balance Scale. There were only 14.4% of participants in the category of high risk of falls and the majority of them (85.6%) had normal risk of falls for elderly, where the mean BBS score was 50.79 $\pm$ 6.25. The proportion of those with high risk of falls were lower than 30%, which made it difficult to draw a solid conclusion. This could be due to the physical data collection design itself. The participants which attended data collection generally can travel from different tall blocks of PPR to the centre of data collection venue, where assumption of attended participants had better control over their movement could possibly lower risk of falls as they can travel longer and safely.

Table 4.7 Risk of falls scores of participants (n=97)

	N (%) / Mean $\pm$ SD
BBS score	50.79 $\pm$ 6.25
High risk of falls	14 (14.4)
Normal risk of falls	83 (85.6)

4.8 Hypothesis Testing

Table 4.8 showed the associations between demographic characteristics and risk of falls of the participants. Most of the demographic characteristics like gender, marital status, living status and employment status were not significantly associated with risks of falls among community-dwelling elderly except age, ethnicity and educational level. There was significant association between age and risk of falls among community-dwelling elderly (r=-0.407, p=0.0001). Next, there was a significant association between ethnicity (p=0.001) and educational level (p=0.03) with risk of falls.

Table 4.8 Associations between demographic characteristics and risk of falls of participants (n=97)

Characteristics	High risk of falls (n=14)	No risk of falls (n=83)	χ^2	*r*-value	*p*-value
Age				-0.407	[b]0.0001**
Young old 60-69 y/o	4 (28.6)	63 (75.9)			
Old old ≥70 y/o	10 (71.4)	20 (24.1)			
Gender					[a]0.753
Male	3 (21.4)	23 (27.7)			
Female	11 (78.6)	60 (72.3)			
Ethnicity					
Malay	8 (57.1)	78 (94.0)			[a]0.001**
Non-malay	6 (42.9)	5 (6.0)			
Marital status					
Single, divorced, widow	10 (71.4)	41 (49.4)	1.336		[a]0.248
Married	4 (28.6)	42 (50.6)			
Educational level					[a]0.003**

No education	5 (35.7)	4 (4.8)		
Educated	9 (64.3)	79 (95.2)		
Living status				[a]0.452
Alone	1 (7.1)	16 (19.3)		
With family	13 (92.9)	67 (80.7)		
Employment status				[a]1.000
Not working	13 (12.4)	72 (88.0)		
Working	1 (7.1)	10 (12.0)		

** Correlation is significant at the 0.01 level (2-tailed)

a Fisher's exact test

b Pearson correlation

Table 4.9 below indicated the association between body mass index and risk of falls of community-dwelling elderly. However, there was no significant association observed between body mass index and risk of falls.

Table 4.9 Associations between body mass index and risk of falls of participants (n=97)

Characteristics	**High risk of falls (n=14)**	**No risk of falls (n=83)**	χ^2	***p*-value**
BMI			0.048	[a]0.976
Underweight (<23.0 kg/m^2)	2 (14.3)	12 (14.5)		
Normal (23.0 – 29.9 kg/m^2)	7 (50.0)	39 (47.0)		
Overweight (≥30.0 kg/m^2)	5 (35.7)	32 (38.6)		

a Fisher's exact test

Table 4.10 depicted the association between body composition and risk of falls of community-dwelling elderly. According to the table (Table 4.11), there is weak

positive correlation between skeletal muscle percentage and risk of fall, which is statistically significant (r=0.204, p=0.045). There was medium positive correlation between handgrip strength and risk of falls, which was statistically significant (r=0.394, p=0.0001).

Table 4.10 Associations between body composition and risk of falls participants (n=97)

Characteristics	*r*-value	*p*-value
Skeletal muscle percentage (%)	0.204	[a]0.045*
Subcutaneous fat percentage (%)	-0.073	[a]0.476
Handgrip strength (kg)	0.394	[a]0.0001**

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

a Pearson Correlation test

Table 4.11 showed the association between physical activity level and risk of falls of respondents. However, physical activity level is not statistically associated with risk of falls as shown in table below (Table 4.11).

Table 4.11 Associations between physical activity level and risk of falls of participants (n=97)

Characteristics	High risk of falls (n=14)	No risk of falls (n=83)	χ^2	*p*-value
PASE score				[a]0.465
Low physical activity level	4 (28.6)	15 (18.1)		
Normal physical activity level	10 (71.4)	68 (81.9)		

a Fisher's exact test

Table 4.12 concluded the associations between health status with risk of falls of the respondents. Following the table shown below (Table 4.12), hearing impairment was found significantly associated with risk of falls among community-dwelling elderly (p=0.020).

Table 4.12 Associations between health status and risk of falls of respondents (n=97)

Characteristics	High risk of falls (n=14)	No risk of falls (n=83)	χ^2	*p*-value
Chronic diseases				
Diabetes			0.857	[a]0.355
Yes	8 (57.1)	33 (39.8)		
No	6 (42.9)	50 (60.2)		
Hypertension			0.244	[a]0.622
Yes	9 (64.3)	44 (53.0)		
No	5 (35.7)	39 (47.0)		
Heart disease				[a]0.420
Yes	3 (21.4)	11 (13.3)		
No	11 (78.6)	72 (86.7)		
Joint disease				[a]0.658
Yes	2 (14.3)	9 (10.8)		
No	12 (85.7)	74 (89.2)		
Respiratory disease				[a]0.589
Yes	0 (0.0)	7 (8.4)		
No	14 (100.0)	76 (91.6)		
Stroke				[a]0.269
Yes	1 (7.1)	1 (1.2)		
No	13 (92.9)	82 (98.8)		
Chronic kidney disease				[a]1.000

Yes	0 (0.0)	3 (3.6)		
No	14 (100.0)	80 (96.4)		
Number of chronic diseases				[a]0.751
No chronic disease	4 (33.3)	23 (41.1)		
Have chronic disease	8 (66.7)	33 (58.9)		
Chronic diseases medication				
Diabetes			1.027	[a]0.311
Yes	8 (57.1)	32 (38.6)		
No	6 (42.9)	51 (61.4)		
Hypertension			0.825	[a]0.364
Yes	9 (64.3)	39 (47.0)		
No	5 (35.7)	44 (53.0)		
Heart disease				[a]0.325
Yes	3 (21.4)	11 (13.3)		
No	11 (78.6)	72 (86.7)		
Joint disease				[a]0.265
Yes	2 (14.3)	5 (6.0)		
No	12 (85.7)	78 (94.0)		
Respiratory disease				[a]1.000
Yes	0 (0.0)	5 (6.0)		
No	14 (100.0)	78 (94.0)		
Stroke				[a]0.269
Yes	1 (7.1)	1 (1.7)		
No	13 (92.9)	82 (98.8)		
Chronic kidney disease				[a]1.000
Yes	0 (0.0)	2 (2.4)		
No	14 (100.0)	81 (97.6)		
Number of chronic disease medications				[a]0.134

No chronic disease medication	2 (14.3)	30 (36.1)	
Has chronic disease medication	12 (85.7)	53 (63.9)	
History of surgery			[a]1.000
Yes	0 (0.0)	1 (1.2)	
No	14 (100.0)	82 (98.8)	
Sight impairment			[a]0.377
Yes	1 (7.1)	2 (2.4)	
No	13 (92.9)	81 (97.6)	
Hearing impairment			[a]0.020*
Yes	2 (14.3)	0 (0.0)	
No	12 (85.7)	83 (100.0)	

* Correlation is significant at the 0.05 level (2-tailed)

a Fisher's exact test

CHAPTER 5

DISCUSSION

This study aimed to determine the prevalence of falls as well as the associations between demographic characteristics, body mass index, body composition, physical activity level and health status with risk of falls among community-dwelling elderly in flat PPR Kuala Lumpur. A total of 97 respondents were recruited in the study, which was approximately 87% of the minimum sample size needed in this study. The main reason contributed to the inadequate number of respondents was the low number of respondents which came to the physical data collection venue due to limited mobility, time constraints and pandemic safety issues. Some of the flat PPR have various high buildings, which require the elderlies to travel quite a long distance to come to the data collection centre physically, not to add some of them are not free by the time data collection took place.

5.1 Proportion of Falls

The data on proportion of falls was hard to compare as most of the studies in Malaysia indicated history of falls within 1 year of duration. According to the study, the proportion of falls among the community-dwelling elderly in the past 6 months was 7.2%, which was only half as compared to 14.1% of falls among general elderly in the past 12 months in National Health and Morbidity Survey for Elderly (NHMS) 2018. The proportion of falls recorded was also lower as compared to past studies which ranged from 18-21% of falls among 1 year of period (Sazlina et al., 2018; Singh et al., 2019). On the other hand, there was a study in Thailand that recorded a slightly higher percentage of falls (11%) within six months (Worapanwisit et al., 2018) as

compared to current finding. In addition, this finding was higher as compared with a study conducted among community-dwelling elderly in Perak with 4.1% proportion of falls within 1 year (Yeong et al., 2016). Meanwhile, proportion of falls recorded in Malaysia setting was generally lower as compared to other countries like Korea, Thailand, Taiwan, Indonesia and United States ranging from 15% to 40% falls within 1 year (Cho et al., 2018; Lee et al., 2021; Kim et al., 2020; Song et al., 2021; Susilowati et al., 2020; Tsai et al., 2020; Worapanwisit et al., 2018). All in all, the proportion of falls obtained was generally lower as compared to local and foreign studies. The discrepancies among local studies could be explained by geographical stratification that affect the proportion of falls across Malaysia as the studies compared involved larger areas with more states or districts included as compared to current study focusing in Kuala Lumpur only (NHMS Elderly, 2019; Sazlina et al., 2018; Singh et al, 2019). On the other hand, possible reason for the proportion in current finding to be lower as compared to other countries was due to relatively younger nation in Malaysia as compared to the international studies (Kim et al., 2020; Lee et al., 2021; Susilowati et al., 2020).

5.2 Demographic Characteristics

The mean age of the participants (68.04 $\pm$ 5.54 years old) in the study was found to be similar to that of National Health and Morbidity Survey for Elderly (NHMS) 2018, which recorded mean age of 68.30 $\pm$ 6.95 years. The percentage of female participants is very high, almost reaching 75%, which was way higher as compared to previous studies which had equal distribution of male and female respondents (Goh et al., 2021; Sazlina et al., 2018; Singh et al., 2019). This was largely affected by the availability and number of male and female dweller elderlies staying

at selected flat PPR. Moreover, almost 90% participants were Malays, which indicated there was predominance of Malay elderly dwellers that stayed in the selected flat PPR due to geographical factors. This study recorded half of the participants with primary education level which is in line with the data from study conducted by Sazlina et al. (2018) and National Health and Morbidity Survey for Elderly (NHMS) 2018. Next, a very high proportion of participants stayed with either family or partner, similar to past studies conducted (Sazlina et al., 2018; Singh et al., 2019; Yeong et al., 2016) as well as the data recorded in NHMS Elderly 2018 which was generally higher than 80%. Generally, most of the participants aged between 60-70 years old, were female, Malay, married or widow, receive primary or secondary education, stayed with family and unemployed.

5.3 Body Mass Index

From this study, the mean body mass index obtained in this study was higher as compared to [(25.0 - 26.5) $\pm$ (3.8 - 5.2)] kg/m^2 averagely from the data recorded in some Malaysia studies (Goh et al., 2020; Ooi et al., 2021; Singh et al., 2019; Strandkvist et al., 2021; Worapanwisit et al., 2018). The difference for the body mass index in the study might be varied corresponding to sociodemographic factors, genetic, environmental factors, lifestyle, food access and availability or comorbidities (Saliba-Serre et al., 2020). This was supported by the summary from NHMS 2015 that reported specific body mass index pattern in elderly with different sociodemographic profiles, comorbidities and smoking habit (Ariaratnam et al., 2020).

5.4 Body Composition

The mean handgrip strength of respondents obtained in current finding was lower as compared to 23.2 ± 8.2 kg in the study conducted by Singh et al. (2018) because the study included younger sample size starting from age 55 years old. On the other hand, there were very limited studies which measure and include non-gender specific skeletal muscle percentage and subcutaneous fat percentage in their studies, hence the reading was hard to be comparable.

5.5 Physical Activity Level

The mean score of PASE-Malay of the respondents recorded in this study was slightly higher as compared to past study during validation studies with a mean score of 94.96 ± 62.82 (Ismail et al., 2017). Similarly, the participants engaged with the household activity category followed by leisure activity and lastly work-related activity, corresponded with the result of study conducted using the same PASE-M questionnaire (Ismail et al., 2017). The finding was lower than another validity and reliability study with 167.91 of mean score. The discrepancy could be explained by younger participants recruited and actively engaged in work-related activity for the population, not to add that it wasn't specified for community-dwelling elderly but general elderly (Singh et al., 2019). The study reported slightly higher percentage of participants being physically active as compared to 70% mentioned in National Health and Morbidity Survey for Elderly (NHMS) 2018. This might be due to different questionnaire GPAQ applied in research for respondents from all over Malaysia instead of only focusing on elderly dwellers in flat PPR Kuala Lumpur.

5.6 Health Status

Even though there was quite a lot of studies focusing on the relationship between diseases and falls among community-dwelling elderly, limited studies categorised them into the number of diseases. Unlike the high percentages (30%) of the elderly without any chronic diseases observed in this study, relatively low percentages of elderly without comorbidities were observed in Malaysian studies, which was lower than 12% (Ghazi et al., 2017; Goh et al., 2021). Similarly, approximately 28% of participants were found to have only one disease while almost 40-50% of participants have two to three chronic diseases among elderly staying in old folk home Kuala Lumpur (Ghazi et al., 2017).

From the study, the percentages of respondents with hypertension corresponded with 51% in past study in Malaysia (Singh et al., 2019). In addition, National Health and Morbidity Survey for Elderly (NHMS) 2018 also acquired 51.1% of hypertension among general elderly. Similar proportions of respondents with diabetes, heart disease, joint disease, respiratory disease and stroke were found in the two studies conducted by Ooi et al. (2021) and Singh et al. (2019). In the meanwhile, there were a few researches that concluded a far low percentage (27%) of elderly with diabetes mellitus (National Health and Morbidity Survey for Elderly, 2018; Singh et al., 2019). This was probably due to high unemployment status in this study, which was supported by observation of high reported diabetes mellitus among unemployed elderly as reported in NHMS for Elderly (2018).

Percentages of participants with one or no medication was relatively higher (60%) in this study than the one observed among elderly at old folk home in Kuala Lumpur (24%), which might be due to higher prioritisation in health care of the elderly since there were trained professions to take care of them at old folk homes (Ghazi et

al., 2017). Similar trend of high proportion community-dwelling elderly who took less than 3 medications was observed in another study conducted in Malaysia (Goh et al., 2021; Singh et al., 2019).

The percentage of vision impairment and hearing impairment obtained in this study was low, in which the results corresponded to NHMS (2018) for Elderly with 4.5% and 6.4% respectively. On the other hand, very small numbers of respondents with sight and hearing impairment were found in this study, which was much lower as compared to the past studies in Malaysia (Ooi et al., 2021; Singh et al., 2019). Likewise, a study conducted among Thailand community-dwelling elderly revealed nearly 40% sight impairment and 10% hearing problem, which were also higher compared to studies' results (Worapanwisit et al., 2018). The lower proportion of hearing and sight impairment may be lower due to urbanisation of the Kuala Lumpur area with high density of public health care setting, indicating that most of the elderly could access health care services at affordable prices (Tew et al., 2021).

5.7 Risk of Falls

The mean score of BBS obtained in this study was higher, opposing the result found in the tools comparison study in Korea with a score of 42.3 ± 8.6 (Jeon & Kim, 2017). The difference in mean BBS scores was probably due to generally younger participants in this study. The mean BBS score result was higher as compared to the Singapore study but the percentages of participants with high risk of falls was similar to current findings (Woo et al., 2017). However, the percentage of high risk of falls were not comparable since the study used lower cut off points. On the other hand, the mean BBS score perceived from this study was similar to that conducted in South Korea despite the generally older age of participants recruited (Lee at al., 2020).

5.8 Hypothesis Testing

Ha1: There are significant associations between demographic characteristics and risk of falls among community-dwelling elderly residents in Flat PPR Kuala Lumpur.

Firstly, in terms of gender, the study found no significant association between gender and risk of falls among community-dwelling elderly in Malaysia, which was congruent with some other past studies (Alex et al., 2017; Rahman et al., 2021; Singh et al., 2019; Yeong et al., 2016), but inconsistent with several past studies (Ooi et al., 2021; Sazlina et al., 2018; Singh et al., 2019). When compared with other countries, this result opposed the findings in past studies conducted in Taiwan (Huang et al., 2015; Tsai et al., 2020). The insignificant finding could be explained with huge gender disparity in this study as 73.2% of respondents were female. Marital status was found to be not significantly associated with risk of falls, which was in line with the past studies in Malaysia (Ooi et al., 2021; Sazlina et al., 2018) but differed from the result acquired in two previous studies in Malaysia (Alex et al., 2017; Singh et al., 2019).

There was no significant association between living status with risk of falls in current findings. This finding was consistent with past studies in Malaysia (Rahman et al., 2021; Sazlina et al., 2018), conflicting with another two studies (Ooi et al., 2021; Yeong et al., 2016). In terms of employment status, employed people generally had sufficient ability to perform daily activity, higher life satisfaction and more socialisation to prevent depression, hence lowering risk of falls (Kim et al., 2020; Sazlina et al., 2018; Singh et al., 2018). However, current findings found no significant association between employment status with risks of falls among community-dwelling elderly, similar with two local studies (Goh et al., 2021; Sazlina et al., 2018). In the

meantime, the findings opposed several local studies and international studies in Korea and Taiwan (Alex et al., 2017; Kim et al., 2020; Lee et al., 2021; Singh et al., 2019).

This study reviewed a significant association between age and risk of falls among community-dwelling elderly, which was consistent with previous local studies (Alex et al., 2018; Rahmad et al., 2021; Sazlina et al., 2018; Singh et al., 2019). Likewise, a few international studies in Korea, Taiwan, Thailand also obtained similar findings (Kim et al., 2020; Lee et al., 2021; Song et al., 2021; Worapanwisit et al., 2018). Similar trend of advanced age with higher risk of falls was observed in these studies. This can be explained by progressive decline in almost all bodily functions such as functional status, muscle strength, balance, immunity and perceptual ability with increased susceptibility to diseases that leaded to polypharmacy and multi comorbidities, which was strongly correlated to higher risk of falls in elderly (de Villiers & Kalula, 2015; Kim et al., 2020; Lord & Sturnieks, 2005; Navaratnarajah & Jackson, 2017; WHO, 2021). On the contrary, there were several studies which had incongruent findings with current study (Goh et al., 2021; Huang et al., 2015; Kuhirunyaratn et al., 2013; Ooi et al., 2021; Singh et al., 2019; Yeong et al., 2016).

Next, the findings of association between ethnicity and risk of falls in this study was in line with past local studies (Sazlina et al., 2018; Singh et al., 2019; Yeong et al., 2016). However, there were several studies that disagree with current findings (Goh et al., 2021; Ooi et al., 2021; Singh et al., 2019). This finding was similar to the study conducted at KL governmental clinic, where Malay had higher risk of fall (Alex et al., 2018). In the meantime, two studies found higher risk of falls among Indians in Malaysia, which could be explained by high disproportion of participants' ethnic proportion (Alex et al., 2018; Tan et al., 2019). Malay participants, which were 88.7% in current study outnumbered 9.1% Indians participants.

The current finding of significant association between educational level and risk of falls in were according to local studies (Alex et al., 2018; Singh et al., 2019) and international studies in Korea, Taiwan and Thailand (Kim et al., 2020; Lee et al., 2021; Worapanwisit et al., 2018). Different findings where education level was not associated with risk of falls among elderly were also commonly observed among past local studies (Ghazi et al., 2017; Goh et al., 2021). Lower educational level led to lack of learning ability on how to prevent injuries, hence the engagement to fall preventive behaviour were lower as some believe that falls was a natural occurring event (Li et al., 2013; Gill et al., 2005). Lower education level generally associated with poor cognitive status which were proven to increased risk of falls among elderly (Lee et al., 2017; Park et al., 2017).

Interestingly, the findings of demographic characteristics of no association between gender, marital status, living status and employment status in the current study was in line with a past study conducted in Malaysia (Goh et al., 2021). Surprisingly, another local study conducted among the elderly attending a government clinic in Kuala Lumpur also had consistent findings with this study in terms of demographic characteristics (Joyce et al., 2020).

Ha2: There are significant associations between body mass index (BMI) and risk of falls among community-dwelling elderly residents in Flat PPR Kuala Lumpur.

This finding of no significant association between body mass index (BMI) and risk of fall among community-dwelling elderly in this study was supported by one local and international study (Ooi et al., 2021; Lee et al., 2021). However, more studies reviewed opposite findings where BMI, specifically obesity, was significantly correlated to risk of falls among community-dwelling elderly (Goh et al., 2021;

Kuhirunyaratn et al., 2013; Lee et al., 2020; Pengpid & Peltzer, 2018; Singh et al., 2019; Song et al., 2021; Tan et al., 2019; Worapanwisit et al., 2018, Xu et al., 2019). Unlike current findings, some studies observed a significant U-shaped association between BMI and risk of falls among elderly, where obesity and underweight would increase risk of falls (Ogliari et al., 2021; Trevisan et al., 2018). There was possible explanation for higher occurrence of falls among obese elderly as they might have lower muscle strength and quality to control their posture and balance due to higher adiposity (Goh et al., 2021; Rossi-Izquierdo et al., 2015). Nevertheless, despite the strong association between cardiovascular diseases and other comorbidities with "obesity paradox" (Chapman, I. A., 2010), another study suggested that BMI alone couldn't be an effective indicator to predict obesity because the adiposity, muscle quality, visceral fat, waist circumference and cardio fitness should be considered as a whole to predict risk of falls (Bosello & Vanzo, 2019). (Bosello & Vanzo, 2019). In addition, some mediating factors such as sedentary behavior, chronic health conditions and medication use might affect and masked the real BMI (Mitchell et al., 2015). Some medications and health conditions might alter appetite regulating hormone, body metabolism and physical activity level that resulted in weight loss or weight gain among elderly, which explained the insignificant findings in current study.

Ha3: There are significant associations between body composition and risk of falls among community-dwelling elderly residents in Flat PPR Kuala Lumpur.

Current findings of no significant association between subcutaneous fat percentages with risk of falls was inconsistent with local study conducted among community-dwelling elderly in Malaysia which reviewed significant association between body fat percentage with risk of falls (Ooi et al., 2021). In opposite, there was

weak positive correlation between skeletal muscle percentage and risk of fall, which is statistically significant (r=0.204, p=0.045). This finding was congruent with several studies (Ngamsangiam & Suttanon, 2020; Ooi et al., 2021). Low skeletal muscle mass corresponded to aged-related muscle loss which also known as sarcopenia among elderly, which indicated overall muscle deterioration, leading to frailty syndrome (Schöne et al., 2017; Wilkinson et al., 2018). Not to add that frailty was significantly associated with falls, supported by systemic review and meta-analysis studies (Yeung et al., 2019; Zhang et al., 2020).

Next, the finding between handgrip strength and risk of falls among community-dwelling elderly was congruent with several local and foreign studies (Ooi et al., 2021; Pengpid and Peltzer, 2018; Singh et al., 2019; Song et al., 2021; Wahba et al., 2013; Xu et al., 2019). Past review study deduced handgrip strength as an effective biomarker correlated to lots of elderly's health status, body function and mortality, including upper limb strength and falls (Bohannon, R. W., 2019). Another study reviewed similar findings, where a 1 kg increase in handgrip strength lowered the risk of fall by 3%, and it might be moderately interlinked with improved balance among elderly (Arvandi et al., 2018). A study conducted among Taiwanese women, concluded stronger both hands' grip strength reduced risk of falls significantly (Yang et al., 2018), consistent with study in Brazilian women (Neri et al., 2021). Despite all the consistent findings with this study, there was a local study that obtained completely opposite results (Goh et al., 2021).

Ha4: There are significant associations between physical activity level and risk of falls among community-dwelling elderly residents in Flat PPR Kuala Lumpur.

There were a number of foreign including China, Thailand, Taiwan, Asia region and Australia which observed an established significant association between physical activity or exercise with risk of falls among elderly, where most of the studies reviewed lower risk of falls with increased physical activity (Huang et al., 2015; Kuhirunyaratn et al., 2013; Ngamsangiam & Suttanon, 2020; Wu & Ouyang, 2017; Xu et al., 2019; Yang et al., 2018). Generally, greater exercise intensity, more walking steps, ability to perform daily activities and longer duration is negatively associated with risk of falls in elderly (Ngamsangiam & Suttanon, 2020). Furthermore, increased recurrent falls had been observed among elderly with low physical activity level (Soares et al., 2019). However, current findings from this study opposed those studies, as insignificant association was found between physical activity level and risk of fall. This result was supported by current local studies (Low & Balaraman, 2017; Yeong et al., 2016). Nevertheless, the assessment tools used in both studies were different, suggesting that there might be some underestimation or overestimation in certain aspects of physical activity done (Strath et al., 2013), but the instrument used was aligned with the setting and populations.

Ha5: There are significant associations between health status and risk of falls among community-dwelling elderly residents in Flat PPR Kuala Lumpur.

Based on current findings from this study, the association of all the chronic diseases with risk of fall were reviewed to be statistically insignificant. Inadequate number of participants due to self-isolation following pandemic issues or mobility to reach physical data collection venues contributed to low response rate (Bahar Moni et

al., 2021). In addition, this study recruited a relatively low number of respondents who had those chronic diseases or taking relative medications, which led to insignificant association findings, probably affected by geographical selection. Medications for relative chronic diseases were not significantly associated with risk of falls in current findings due to low participants who actually took those medications. This might happen due to low economic status and accessibility of the elderly in PPR Kuala Lumpur to public health care service (Wahab et al., 2020). Nevertheless, there was still one study that found a significant relationship between anti diabetic drug usage and risk of falls in Kuala Lumpur (Joyce et al., 2020).

There were several local and foreign studies that generally found no association between comorbidities including diabetes, hypertension, heart disease, joint disease, respiratory disease, stroke, and chronic kidney disease with risk of falls among community-dwelling eldelry (Bakar et al., 2021; Lee et al., 2021; Nugraha et al., 2019; Singh et al., 2019). On the other hand, there was a study which obtained significant association among diabetes, stroke and joint disease with risk of falls, whereas no association between hypertension with risk of falls in elderly (Joyce et al., 2020). Interestingly, another local study found no significant association with comorbidities and risk of fall except stroke and joint disease (Ooi et al., 2021). This was probably due to impaired balance and muscle movement control related to both of the diseases that led to higher risk of fall. Current findings were incongruent with this, probably due to extreme insufficient sample size with stroke and joint disease in this study. In addition, several studies observed a significant association between diabetes and risk of falls among elderly (Joyce et al., 2020; Sahril et al., 2020; Singh et al., 2019), as supported by a systematic review and meta-analysis study conducted in China (Yang et al., 2016).

Number and present of comorbidities was revealed as not significantly associated with risk of falls in current findings, consistent with a few local studies that found no association between the two (Baker et al., 2021, Ghazi et al., 2017; Goh et al., 2021). Current findings, however, were incongruent with some foreign studies (Kuhirunyaratn et al., 2013; Ngamsangiam & Suttanon, 2020; Pengpid & Peltzer, 2018; Song et al., 2021; Tsai et al., 2020; Worapanwisit et al., 2018; Wu & Ouyang, 2017), where multimorbidity increased risk of falls among community-dwelling elderly due to declined mobility and sensory function (Barik et al., 2022). Similarly, some local studies observed no association between the number of medications with risk of falls, corresponding to current findings in the study (Ghazi et al., 2017; Goh et al., 2021; Singh et al., 2019). However, few foreign studies proved that there was a significant relationship between polypharmacy and risk of fall among community-dwelling elderly (Kuhirunyaratn et al., 2013; Ngamsangiam & Suttanon, 2020; Worapanwisit et al., 2018), specially when medication taken were known to further raised the risk of falls (Hammond & Wilson, 2013).

History of surgery was not significantly associated with risk of fall and the results were the same as vision impairment in this study. Incongruently, vision impairment was also not significantly associated with risk of falls from previous studies (Kuhirunyaratn et al., 2013; Sahril et al., 2020; Pengpid & Peltzer, 2018). On the other hand, poor vision was found significantly associated with increased risk of falls due to higher probability of tripping (Joyce et al., 2020; Nugraha et al., 2019; Singh et al., 2019; Tsai et al., 2020; Worapanwisit et al., 2018). Hearing impairment was found significantly associated with risk of falls among community-dwelling elderly, corresponding to past studies (Mugraha et al., 2019; Singh et al., 2019; Pengpid & Peltzer, 2018), inconsistent with several previous studies (Joyce et al., 2020;

Sahril et al., 2020; Worapanwisit et al., 2018). A systematic review study discovered significant association between hearing loss with increased risk of fall due to its possible effects on elderly's auditory system and postural control that increased difficulty in walking (Agmon et al., 2017), supported by previous studies (Bang et al., 2020; Berge et al., 2019; Thomas et al., 2018). In addition, cognitive measures and sensitivity to space perception reduced elderlys' attention during walking, which eventually increased risk of fall after experiencing postural imbalance (Amieva et al., 2015; Gabriel et al., 2022).

CHAPTER 6

CONCLUSION

6.1 Conclusion

From the current study, the proportion of falls among community-dwelling elderly in the past six months of time was 7.2% while the prevalence for risk of falls assessed using Berg Balance Scale was 14.4%. There was significant association between age, ethnicity and educational level with risk of falls in terms of demographic characteristics. There was significant weak positive correlation between skeletal muscle percentage and risk of fall. Handgrip strength was mediumly correlated with risk of falls, where the group with high risk of falls generally scored lower handgrip strength. On the other hand, only hearing impairment was significantly associated with risk of falls for health status. In the meantime, body mass index and physical activity level were not significantly associated with risk of falls in this study.

This study observed a significant percentage of falls and elderly with high risk of falls in flat PPR, indicating the need to plan and implement fall risk assessment among elderly living at flat PPR. Establishing a self-managed community health group that could perform early screening to identify those at risk of falls to monitor and deliver effective education and preventive measures was encouraged to develop standardised guidelines and policies which emphasise the overall health to reduce risk of falls among elderly at flat PPR Malaysia. More research can be done to determine the modifiable risk factors that can be improved to be included as part of the fall prevention intervention programmes in the future. Through continuous efforts, the injuries and healthcare costs due to falls among elderly could be reduced to the lowest level, promoting a healthier ageing population in Malaysia.

6.2 Strengths

This study was able to provide latest additional data and knowledge to the risk of falls among community-dwelling elderly in Malaysia. It pointed out significant association between some independent variables, which indicated that there could be more efforts done to modify the risk factors observed in order to minimise falls among elderly in flat PPR Malaysia, for example handgrip strength, hearing impairment and educational level. Despite the inadequate number of respondents, this study still provides an insight on the associated factors with risk of falls among elderly in Malaysia. Moreover, most of the variables were assessed using validated tools.

6.3 Limitations

There were several limitations presented in these studies. Firstly, the study included inadequate participants due to covid-19 pandemic related safety issues and mobility constraints to attend physical data collection. Next, setting the physical data collection venue at the ground floor of the PPR centre complicated the elderlies to travel to the venue since there were many tall blocks in each PPR. Resources limitation didn't allow revisitation of flat PPRs twice. Thirdly, the proportion of respondents with high risk of falls were smaller than 30%, where effective conclusion weas not able to be drawn. Other than that, despite purposive sampling used, all of the selected flat PPRs were located in Kuala Lumpur, where bias might exist, affecting the generalizability of the results to the general elderly population. Furthermore, there was some missing data in body composition that were treated with marginal mean substitution which affect standard deviation and statistical result of the data. Next, the risk of falls assessment tools using Berg Balance Scale could be enhanced with other tools to predict risk of falls more effectively among community-dwelling elderly.

6.4 Recommendations

There are several recommendations that can be noted to improve future studies with similar focus and methodology. First and foremost, the study should involve follow-up for the elderly across Malaysia to ensure generalizability and minimise bias. This can help to decide bias and trend of risk of falls to include not only specific time points. As Malaysia is currently shifting from Movement Control Order to normal routines, the information obtained during this period may not be a good representative of the population in future. Next, larger sample size that fulfils the minimum sample size requirement should be recruited from more of flat PPRs across Malaysia to ensure adequate study strength and power. To minimise missing data from the respondents, the researcher should do comprehensive reading and preparation to avoid this issue in future study. In addition, the Timed Up and Go (TUG) test should be included together with the Berg Balance Scale to be considered as a strong and reliable assessment of risk of falls among elderly in the future. Berg Balance Scale was usually used together with TUG test and gait speed as a complete risk of fall assessment tools among elderly, though TUG test alone wasn't a significant indicator of individual fall risk assessment (Barry et al., 2014; Kojima et al., 2015; Podsiadlo & Richardson, 1991).

On top of that, responsible health care setting should establish a risk assessment procedure to rule out elderly population with higher risk of falls specifically in flat PPR and general elderly community. Following this, flat PPR can organise more activity that encourage physical activity and social work for the elderly since skeletal muscle and handgrip strength were associated with risk of falls. It is crucial to provide knowledge to avoid behaviours leading to falls to increase awareness of falls occurrence in their daily life. Through continuous efforts, falls related injuries and hospitalisation among elderlies could be minimised.

REFERENCES

Abu Bakar, A. A. Z., Abdul Kadir, A., Idris, N. S., & Mohd Nawi, S. N. (2021). Older Adults with Hypertension: Prevalence of Falls and Their Associated Factors. *International Journal of Environmental Research and Public Health*, *18*(16), 8257. https://doi.org/10.3390/ijerph18168257

Agmon, M., Lavie, L., & Doumas, M. (2017). The association between hearing loss, postural control, and mobility in older adults: A systematic review. *Journal of the American Academy of Audiology*, *28*(6), 575–588. https://doi.org/10.3766/jaaa.16044

Akosile, C. O., Igwemmadu, C. K., Okoye, E. C., Odole, A. C., Mgbeojedo, U. G., Fabunmi, A. A., & Onwuakagba, I. U. (2021). Physical activity level, fear of falling and quality of life: a comparison between community-dwelling and assisted-living older adults. *BMC Geriatrics*, *21*(1). https://doi.org/10.1186/s12877-020-01982-1

Alex, D., Khor, H. M., Chin, A. V., Hairi, N. N., Othman, S., Khoo, S. P. K., Bahyah Kamaruzzaman, S., & Tan, M. P. (2018). Cross-sectional analysis of ethnic differences in fall prevalence in urban dwellers aged 55 years and over in the Malaysian Elders Longitudinal Research study. *BMJ Open*, *8*(7), e019579. https://doi.org/10.1136/bmjopen-2017-019579

Al-Aama, D. (2011, July). Falls in the elderly: Spectrum and prevention. *Can Fam Physician.*, *57*(7), 771–776. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3135440/

Almada, M., Brochado, P., & Portela, D. (2020). Prevalence of falls and associated factors among community-dwelling older adults: a cross-sectional study. *Journal of Frailty & Aging*, 1–7. https://doi.org/10.14283/jfa.2020.44

Ambrose, A. F., Cruz, L., & Paul, G. (2015). Falls and Fractures: A systematic approach to screening and prevention. *Maturitas*, *82*(1), 85–93. https://doi.org/10.1016/j.maturitas.2015.06.035

Amieva, H., Ouvrard, C., Giulioli, C., Meillon, C., Rullier, L., & Dartigues, J. F. (2015). Self-reported hearing loss, hearing aids, and cognitive decline in elderly adults: A 25-year study. *Journal of the American Geriatrics Society*, *63*(10), 2099–2104. https://doi.org/10.1111/jgs.13649

Aranyavalai, T., Jalayondeja, C., Jalayondeja, W., Pichaiyongwongdee, S., Kaewkungwal, J., & Laskin, J. J. (2020). Association between walking 5000 step/day and fall incidence over six months in urban community-dwelling older people. *BMC Geriatrics*, *20*(1). https://doi.org/10.1186/s12877-020-01582-z

Ariaratnam, S., Rodzlan Hasani, W. S., Krishnapillai, A. D., Abd Hamid, H. A., Jane Ling, M. Y., Ho, B. K., Shariff Ghazali, S., Tohit, N. M., & Mohd Yusoff, M. F. (2020). Prevalence of obesity and its associated risk factors among the elderly in Malaysia: Findings from The National Health and Morbidity Survey (NHMS)

2015. *PLOS ONE*, *15*(9), e0238566. https://doi.org/10.1371/journal.pone.0238566

Arvandi, M., Strasser, B., Volaklis, K., Ladwig, K. H., Grill, E., Matteucci Gothe, R., Horsch, A., Laxy, M., Siebert, U., Peters, A., Thorand, B., & Meisinger, C. (2018). Mediator Effect of balance problems on association between grip strength and falls in older adults: Results from the KORA-Age study. *Gerontology and Geriatric Medicine*, *4*, 233372141876012. https://doi.org/10.1177/2333721418760122

Bahar Moni, A. S., Abdullah, S., bin Abdullah, M. F. I. L., Kabir, M. S., Alif, S. M., Sultana, F., Salehin, M., Islam, S. M. S., Cross, W., & Rahman, M. A. (2021). Psychological distress, fear and coping among Malaysians during the COVID-19 pandemic. *PLOS ONE*, *16*(9), e0257304. https://doi.org/10.1371/journal.pone.0257304

Bang, S. H., Jeon, J. M., Lee, J. G., Choi, J., Song, J. J., & Chae, S. W. (2020). Association Between Hearing Loss and Postural Instability in Older Korean Adults. *JAMA Otolaryngology–Head & Neck Surgery*, *146*(6), 530. https://doi.org/10.1001/jamaoto.2020.0293

Barik, M., Panda, S. N., Tripathy, S. S., Sinha, A., Ghosal, S., Acharya, A. S., Kanungo, S., & Pati, S. (2022). Is multimorbidity associated with higher risk of falls among older adults in India? *BMC Geriatrics*, *22*(1). https://doi.org/10.1186/s12877-022-03158-5

Barry, E., Galvin, R., Keogh, C., Horgan, F., & Fahey, T. (2014). Is the Timed Up and Go test a useful predictor of risk of falls in community dwelling older adults: a systematic review and meta- analysis. *BMC Geriatrics*, *14*(1). https://doi.org/10.1186/1471-2318-14-14

Berg, K. (1989). Measuring balance in the elderly: preliminary development of an instrument. *Physiotherapy Canada*, *41*(6), 304–311. https://doi.org/10.3138/ptc.41.6.304

Berg, K. O., Wood-Dauphinee, S. L., Williams, J. I., & Maki, B. (1991). Measuring balance in the elderly: validation of an instrument. *Canadian Journal of Public Health*, *83*(Supplement 2), 7-11. https://www.researchgate.net/publication/21687774_Measuring_balance_in_the_elderly_Validation_of_an_instrument

Berge, J. E., Nordahl, S. H. G., Aarstad, H. J., & Goplen, F. K. (2019). Hearing as an independent predictor of postural balance in 1075 patients evaluated for dizziness. *Otolaryngology–Head and Neck Surgery*, *161*(3), 478–484. https://doi.org/10.1177/0194599819844961

Bianchi, A. B., Antunes, M. D., dos Santos, N. Q., Bulla, H. A., Silva, E. S., Marques, A. P., & and Bertolini, S. M. M. G. (2020, August). Posture and balance in elderly who practice and who do not practice physical activities. *J. Phys. Educ.*, *31*, e3163. https://doi.org/10.4025/jphyseduc.v31i1.3163

Brito, T. A., Coqueiro, R. D. S., Fernandes, M. H., & de Jesus, C. S. (2014). Determinants of Falls in Community-Dwelling Elderly: Hierarchical Analysis. *Public Health Nursing*, *31*(4), 290–297. https://doi.org/10.1111/phn.12126

Britting, S., Artzi-Medvedik, R., Fabbietti, P., Tap, L., Mattace-Raso, F., Corsonello, A., Lattanzio, F., ÄRnlöv, J., Carlsson, A. C., Roller-Wirnsberger, R., Wirnsberger, G., Kostka, T., Guligowska, A., Formiga, F., Moreno-Gonzalez, R., Gil, P., Martinez, S. L., Kob, R., Melzer, I., . . . Fabbietti, P. (2020). Kidney function and other factors and their association with falls. *BMC Geriatrics*, *20*(S1). https://doi.org/10.1186/s12877-020-01698-2

Bohannon, R. W. (2019). Grip Strength: An indispensable biomarker for older adults. *Clinical Interventions in Aging*, *Volume 14*, 1681–1691. https://doi.org/10.2147/cia.s194543

Bosello, O., & Vanzo, A. (2019). Obesity Paradox and Aging. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *26*(1), 27–35. https://doi.org/10.1007/s40519-019-00815-4

Burney, P., Jarvis, D., & Perez-Padilla, R. (2015). The global burden of chronic respiratory disease in adults. *The International Journal of Tuberculosis and Lung Disease*, *19*(1), 10–20. https://doi.org/10.5588/ijtld.14.0446

Carrasco, C., Tomas-Carus, P., Bravo, J., Pereira, C., & Mendes, F. (2019). Understanding fall risk factors in community-dwelling older adults: A cross-sectional study. *International Journal of Older People Nursing*, *15*(1). https://doi.org/10.1111/opn.12294

Centers for Disease Control and Prevention. (2020). *Deaths from Older Adult Falls*. Cdc.Goc. Retrieved November 5, 2021, from https://www.cdc.gov/falls/data/fall-deaths.html

Centers for Disease Control and Prevention. (2020, July 9). *Older Adult Falls Data*. CDC. https://www.cdc.gov/falls/data/index.html

Chang, V. C. & Do, M. T. (2014, September). Risk factors for falls among seniors: Implications of gender. *American Journal of Epidemiology*, *18*(7). https://doi.org/10.1093/aje/kwu268

Chapman, I. A. (2010). Obesity Paradox during Aging. *Interdiscipl Top Gerontol.*, *37*, 20–36. doi: 10.1159/000319992

Chateau, D., Doupe, M., Prior, H., Soodeen, R., Sarkar, J., Dragan, R., Stevenson, D., & Rajotte, L. (2019). *The Health Status of Community Dwelling Older Adults in Manitoba.* Winnipeg, MB. Manitoba Centre for Health Policy.

Chi, W., Graf, E., Hughes, L., Hastie, J., Khatutsky, G., Shuman, S. B., Jessup, E. A., Karon, S., & Lamont, H. (2019, January 29). *Community-Dwelling Older Adults with Dementia and Their Caregivers: Key Indicators from the National Health and Aging Trends Study*. Assistant Secretary for Planning and Evaluation (ASPE), U.S. Department of Health and Human Services on policy

development. https://aspe.hhs.gov/reports/community-dwelling-older-adults-dementia-their-caregivers-key-indicators-national-health-aging-0#execsum

Cho, B. Y., Seo, D. C., Lin, H. C., Lohrmann, D. K., & Chomistek, A. K. (2018). BMI and Central Obesity with Falls Among Community-Dwelling Older Adults. *American Journal of Preventive Medicine*, *54*(4), e59–e66. https://doi.org/10.1016/j.amepre.2017.12.020

Cole, T. J. (1997). *Sampling, study size and power. In B. M. Margettes & M. Nelson (Eds.), Design concepts in nutritional epidemiology.* Oxford University Press.

Currie, L. (2008). Fall and Injury Prevention. In *Patient Safety and Quality: An Evidence-Based Handbook for Nurses.* (Vol. 1, pp. 1–195). Rockville, MD.

Department of Economic and Social Affairs, United Nations. (2019). *World Population Ageing 2019 Highlights*. United Nations.

Department of Statistics Malaysia. (2020). *Statistics on Cause of Death, Malaysia, 2020.* https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=401&bul_id=QTU5T0dKQ1g4MHYxd3ZpMzhEMzdRdz09&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09

Department of Statistic Malaysia. (2021). *Current Population Estimates, Malaysia, 2021*. https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=155&bul_id=ZjJOSnpJR21sQWVUcUp6ODRudm5JZz09&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09

de Villiers, L., & Kalula, S. Z. (2015). An approach to balance problems and falls in elderly persons. *South African Medical Journal*, *105*(8), 695. https://doi.org/10.7196/samjnew.8037

Dewan Bandaraya Kuala Lumpur. (2021). *Senarai Nombor Telefon Pejabat Zon Dan Perumahan Awam*. https://www.dbkl.gov.my/perkhidmatan/perumahan-awam/senarai-nombor-telefon-pejabat-zon-dan-perumahan-awam/

Dutil, M., Handrigan, G. A., Corbeil, P., Cantin, V., Simoneau, M., Teasdale, N., & Hue, O. (2012, February). The impact of obesity on balance control in community-dwelling older women. *AGE*, *35*(3), 883–890. https://doi.org/10.1007/s11357-012-9386-x

Filho, J. E., Borel, W. P., Diz, J. B. M., Barbosa, A. W. C., Britto, R. R., & Felício, D. C. (2019). Prevalence of falls and associated factors in community-dwelling older Brazilians: a systematic review and meta-analysis. *Cadernos de Saúde Pública*, *35*(8). https://doi.org/10.1590/0102-311x00115718

Florence, C. S., Bergen, G., Atherly, A., Burns, E., Stevens, J., & Drake, C. (2018, April). The medical costs of fatal falls and fall injuries among older adults. *J Am Geriatr Soc.*, *66*(4), 693–698. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6089380/

Fortunato, S., Forli, F., Guglielmi, V., De Corso, E., Paludetti, G., Berrettini, S., & Fetoni, A.R. (2016, June). A review of new insights on the association between hearing loss and cognitive decline in ageing. *Acta Otorhinolaryngol Ital.*, *36*(3), 155–166. https://doi.org/10.14639/0392-100X-993

Frankenthal, D., Saban, M., Karolinsky, D., Lutski, M., Sternberg, S., Rasooly, I., Laxer, I., & Zucker, I. (2021). Falls and fear of falling among Israeli community-dwelling older people: a cross-sectional national survey. *Israel Journal of Health Policy Research*, *10*(1). https://doi.org/10.1186/s13584-021-00464-y

Gabriel, G. A., Harris, L. R., Gnanasegaram, J. J., Cushing, S. L., Gordon, K. A., Haycock, B. C., Pichora-Fuller, M. K., & Campos, J. L. (2022). Vestibular perceptual thresholds in older adults with and without age-related hearing loss. *Ear & Hearing*, *43*(2), 420–435. https://doi.org/10.1097/aud.0000000000001118

Gadelha, A. B., Neri, S. G. R., Bottaro, M., & Lima, R. M. (2018). The relationship between muscle quality and incidence of falls in older community-dwelling women: An 18-month follow-up study. *Experimental Gerontology*, *110*, 241–246. https://doi.org/10.1016/j.exger.2018.06.018

Ghazi, H. F., Elnajeh, M., Abdalqader, M. A., Baobaid, M. F., Rahimah Rosli, N. S., & Syahiman, N. (2017). The prevalence of falls and its associated factors among elderly living in old folks home in Kuala Lumpur, Malaysia. *International Journal Of Community Medicine And Public Health*, *4*(10), 3524. https://doi.org/10.18203/2394-6040.ijcmph20174214

Gill, T., Taylor, A. W., & Pengelly, A. (2005). A Population-based survey of factors relating to the prevalence of falls in older people. *Gerontology*, *51*(5), 340–345. https://doi.org/10.1159/000086372

Goh, J. W., Singh, D. K. A., Mesbah, N., Hanafi, A. A. M., & Azwan, A. F. (2021). Fall awareness behaviour and its associated factors among community dwelling older adults. *BMC Geriatrics*, *21*(1). https://doi.org/10.1186/s12877-021-02122-z

Goto, N. A., Hamaker, M. E., Willems, H. C., Verhaar, M. C., & Emmelot-Vonk, M. H. (2018). Accidental falling in community-dwelling elderly with chronic kidney disease. *International Urology and Nephrology*, *51*(1), 119–127. https://doi.org/10.1007/s11255-018-1992-9

Hacıdursunoğlu Erbaş, D., ÇıNar, F., & Eti Aslan, F. (2021). Elderly patients and falls: a systematic review and meta-analysis. *Aging Clinical and Experimental Research*. Published. https://doi.org/10.1007/s40520-021-01843-w

Haddad, Y. K., Luo, F., Bergen, G., Legha, J. K., & Atherly, A. (2021). Special Report from the CDC Antidepressant subclass use and fall risk in community-dwelling older Americans. *Journal of Safety Research*, *76*, 332–340. https://doi.org/10.1016/j.jsr.2020.11.008

Halaweh, H., Willen, C., Grimby-Ekman, A., & Svantesson, U. (2015). Physical Activity and Health-Related Quality of Life Among Community Dwelling Elderly. *Journal of Clinical Medicine Research*, *7*(11), 845–852. https://doi.org/10.14740/jocmr2307w

Hammond, T., & Wilson, A. (2013). Polypharmacy and falls in the elderly: A literature review. *Nursing and Midwifery Studies*, *1*(4), 171–175. https://doi.org/10.5812/nms.10709

Handrigan, G. A., Maltais, N., Gagné, M., Lamontagne, P., Hamel, D., Teasdale, N., Hue, O., Corbeil, P., Brown, J. P., & Jean, S. (2016). Sex-specific association between obesity and self-reported falls and injuries among community-dwelling Canadians aged 65 years and older. *Osteoporosis International*, *28*(2), 483–494. https://doi.org/10.1007/s00198-016-3745-x

Helgadóttir, B., Laflamme, L., Monárrez-Espino, J., & Möller, J. (2014). Medication and fall injury in the elderly population; do individual demographics, health status and lifestyle matter? *BMC Geriatrics*, *14*(1). https://doi.org/10.1186/1471-2318-14-92

Hiol, A. N., Hurst, P. R. V., Conlon, C. A., & Beck, K. L. (2020). Body Composition and Associations with Muscle Strength in Older Adults Living in Auckland, New Zealand. *Proceedings*, *37*(1), 51. https://doi.org/10.3390/proceedings2019037051

Hooker, E. R., Shrestha, S., Lee, C. G., Cawthon, P. M., Abrahamson, M., Ensrud, K., Stefanick, M. L., Dam, T. T., Marshall, L. M., Orwoll, E. S., & Nielson, C. M. (2016). Obesity and Falls in a Prospective Study of Older Men: The Osteoporotic Fractures in Men Study. *Journal of Aging and Health*, *29*(7), 1235–1250. https://doi.org/10.1177/0898264316660412

Huang, L. K., Wang, Y. W., Chou, C. H., Liu, Y. L., & Hsieh, J. G. (2015). 21 *Tzu Chi Medical Journal*, *27*(3), 120–123. https://doi.org/10.1016/j.tcmj.2015.07.002

Institute for Public Health. (2019). *National Health and Morbidity Survey (NHMS) 2018: Elderly Health. Vol. I: Methodology and General Findings.* National Institutes of Health, Ministry of Health Malaysia.

Institute for Public Health. (2019). *National Health and Morbidity Survey (NHMS) 2018: Elderly Health. Vol. 2: Elderly Health Findings.* National Institutes of Health, Ministry of Health Malaysia.

Ismail, N., Hairi, F., Choo, W. Y., Hairi, N. N., Peramalah, D., & Bulgiba, A. (2015). The Physical Activity Scale for the Elderly (PASE). *Asia Pacific Journal of Public Health*, *27*(8_suppl), 62S-72S. https://doi.org/10.1177/1010539515590179

Jais, I. S. M., Nadkarni, N. V., NG, Y. S., Seow, D. C. C., & Wong, T. H. (2019). Investigating the functional grip strength of elderly fallers in Singapore.

Proceedings of Singapore Healthcare, *28*(4), 252–258. https://doi.org/10.1177/2010105819869361

Janakiraman, B., Temesgen, M. H., Jember, G., Gelaw, A. Y., Gebremeskel, B. F., Ravichandran, H., Worku, E., Abich, Y., Yilak, F., & Belay, M. (2019). Falls among community-dwelling older adults in Ethiopia; A preliminary cross-sectional study. *PLOS ONE*, *14*(9), e0221875. https://doi.org/10.1371/journal.pone.0221875

Jeon, Y. J., & Kim, G. M. (2017). Comparison of the Berg Balance Scale and Fullerton Advanced Balance Scale to predict falls in community-dwelling adults. *Journal of Physical Therapy Science*, *29*(2), 232–234. https://doi.org/10.1589/jpts.29.232

Jiam, N. T. L., Li, C., & Agrawal, Y. (2016). Hearing loss and falls: A systematic review and meta-analysis. *The Laryngoscope*, *126*(11), 2587–2596. https://doi.org/10.1002/lary.25927

Joyce L. W. S., Zukri, I. N. M., Siew Mooi Ching, S. M., & Devaraj, N. K. (2020, January). Factors associated with falls among the elderly attending a government clinic in Kuala Lumpur. *Mal J Med Health Sci*, *16*(1), 183-190. http://psasir.upm.edu.my/id/eprint/76933/1/2020011612120327_MJMHS_0243.pdf

Kang, H. (2013). The prevention and handling of the missing data. *Korean Journal of Anesthesiology*, *64*(5), 402. https://doi.org/10.4097/kjae.2013.64.5.402

Kamińska, M., Brodowski, J., & Karakiewicz, B. (2015). Fall Risk Factors in Community-Dwelling Elderly Depending on Their Physical Function, Cognitive Status and Symptoms of Depression. *International Journal of Environmental Research and Public Health*, *12*(4), 3406–3416. https://doi.org/10.3390/ijerph120403406

Kim, S., Leng, X. I., & Kritchevsky, S. B. (2017). Body Composition and Physical Function in Older Adults with Various Comorbidities. *Innovation in Aging*, *1*(1). https://doi.org/10.1093/geroni/igx008

Kim, T., Choi, S. D., & Xiong, S. (2020). Epidemiology of fall and its socioeconomic risk factors in community-dwelling Korean elderly. *PLOS ONE*, *15*(6), e0234787. https://doi.org/10.1371/journal.pone.0234787

Kioh, S. H. & Rashid A. (2018, August). The prevalence and the risk of falls among institutionalised elderly in Penang, Malaysia. *Med J Malaysia, 73*(4), 212-219. https://pubmed.ncbi.nlm.nih.gov/30121683/

Koris, R., Mohamed Nor, N., Haron, S. A., Hamid, T. A., Aljunid, S. M., Muhammad Nur, A., Ismail, I. W., Shafe, A. A., Yusuff, S., & Maimaiti., N. (2019). The Cost of Healthcare among Malaysian Community-Dwelling Elderly. *Jurnal Ekonomi Malaysia, 53*(1), 89–103. https://doi.org/10.17576/jem-2019-5301-8

Kojima, G., Masud, T., Kendrick, D., Morris, R., Gawler, S., Treml, J., & Iliffe, S. (2015). Does the timed up and go test predict future falls among British community-dwelling older people? Prospective cohort study nested within a randomised controlled trial. *BMC Geriatrics*, *15*(1). https://doi.org/10.1186/s12877-015-0039-7

Kramarow, E., Chen, L., Hedegaard, H., & Warner, M. (2015). QuickStats: Death Rates* from Unintentional Injury Among Adults Aged ≥65 Years, by Cause of Death and Sex — National Vital Statistics System, United States, 2012–2013. *MMWR. Morbidity and Mortality Weekly Report*, *64*(29), 807. https://doi.org/10.15585/mmwr.mm6429a13

Kuhirunyaratn, P., Prasomrak, P., & Jindawong, B. (2013, September). Factors related to falls among community dwelling elderly. *Southeast Asian J Trop Med Public Health, 44* (5). https://pubmed.ncbi.nlm.nih.gov/24437326/

Lee, J., Ham, M. J., Pyeon, J. Y., Oh, E., Jeong, S. H., Sohn, E. H., & Lee, A. Y. (2017). Factors affecting cognitive impairment and depression in the elderly who live alone: Cases in Daejeon metropolitan city. *Dementia and Neurocognitive Disorders*, *16*(1), 12. https://doi.org/10.12779/dnd.2017.16.1.12

Lee, J. J., Hong, D. W., Lee, S. A., Soh, Y., Yang, M., Choi, K. M., Won, C. W., & Chon, J. (2019). Relationship Between Obesity and Balance in the Community-Dwelling Elderly Population. *American Journal of Physical Medicine & Rehabilitation*, *99*(1), 65–70. https://doi.org/10.1097/phm.0000000000001292

Lee, K., Davis, M. A., Marcotte, J. E., Pressler, S. J., Liang, J., Gallagher, N. A., & Titler, M. G. (2020). Falls in community-dwelling older adults with heart failure: A retrospective cohort study. *Heart & Lung*, *49*(3), 238–250. https://doi.org/10.1016/j.hrtlng.2019.12.005

Lee, L. S. & Lee, A. C. (2019, December). Test-retest reliability of the Berg balance scale for elderly adult. *Journal of Educational Research & Indegenous Studies, 2*(1). https://www.researchgate.net/publication/338223428_Test-Retest_Reliability_Of_The_Berg_Balance_Scale_For_Elderly_Adult

Lee, S. Y. (2021). Handgrip Strength: An Irreplaceable Indicator of Muscle Function. *Annals of Rehabilitation Medicine*, *45*(3), 167–169. https://doi.org/10.5535/arm.21106

Lee, Y. Y., Chen, C. L., Lee, I. C., Lee, I. C., & Chen, N. C. (2021). History of Falls, Dementia, Lower Education Levels, Mobility Limitations, and Aging Are Risk Factors for Falls among the Community-Dwelling Elderly: A Cohort Study. *International Journal of Environmental Research and Public Health, 18*(17), 9356. https://doi.org/10.3390/ijerph18179356

Li, Y. H., Song, G. X., Yu, Y., Zhou, D. D., &Zhang, H. W. (2013). Study on age and education level and their relationship with fall-related injuries in Shanghai, China. *Biomed Environ Sci, 26*(2), 79-86. doi: 10.3967/0895-3988.2013.02.001

Logan, S., Gottlieb, B., Maitland, S., Meegan, D., & Spriet, L. (2013). The Physical Activity Scale for the Elderly (PASE) Questionnaire; Does It Predict Physical Health? *International Journal of Environmental Research and Public Health*, *10*(9), 3967–3986. https://doi.org/10.3390/ijerph10093967

Lord, S., & Sturnieks, D. (2005). The physiology of falling: Assessment and prevention strategies for older people. *Journal of Science and Medicine in Sport*, *8*(1), 35–42. https://doi.org/10.1016/s1440-2440(05)80022-2

Low, S. T., & Balaraman, T. (2017). Physical activity level and fall risk among community-dwelling older adults. *Journal of Physical Therapy Science*, *29*(7), 1121–1124. https://doi.org/10.1589/jpts.29.1121

Lwanga, S. K. & Lemeshow, S. (1991). *Sample size determination in health studies: A practical manual.* World Health Organization 1991.

Mack, K. A., Rudd, R. A., Mickalide, A. D., & Ballesteros, M. F. (2013). Fatal Unintentional Injuries in the Home in the U.S., 2000–2008. *American Journal of Preventive Medicine*, *44*(3), 239–246. https://doi.org/10.1016/j.amepre.2012.10.022

Ministry of Women, Family and Community Development, Malaysia. (2017). Ageing Phenomenon: Malaysia Towards 2030. [Information sheets/ newsletter]. http://familyrepository.lppkn.gov.my/id/eprint/708

Mitchell, R. J., Lord, S. R., Harvey, L. A., & Close, J. C. (2014). Associations between obesity and overweight and fall risk, health status and quality of life in older people. *Australian and New Zealand Journal of Public Health*, *38*(1), 13–18. https://doi.org/10.1111/1753-6405.12152

Mitchell, R. J., Lord, S. R., Harvey, L. A., & Close, J. C. (2015). Obesity and falls in older people: Mediating effects of disease, sedentary behavior, mood, pain and medication use. *Archives of Gerontology and Geriatrics*, *60*(1), 52–58. https://doi.org/10.1016/j.archger.2014.09.006

Mitchell-Fearon, K., James, K., Waldron, N., Holder-Nevins, D., Willie-Tyndale, D., Laws, H., & Eldemire-Shearer, D. (2014). Falls Among Community-Dwelling Older Adults in Jamaica. *SAGE Open*, *4*(4), 215824401456435. https://doi.org/10.1177/2158244014564351

Muangpaisan, W., Suwanpatoomlerd, S., Srinonprasert, V., Sutipornpalangkul, W., Wongprikron, A., & Assantchai, P. (2015, March). Causes and Course of Falls Resulting in Hip Fracture among Elderly Thai Patients. *J Med Assoc Thai*, *98* (3), 298-305. https://pubmed.ncbi.nlm.nih.gov/25920301/

Mutalib, Z. A. A., Ismail, M. F., & Miskiman, N. (2020, June). *Spatial Analysis: Ageing Population of Multi-ethnic in Rural Area, Malaysia.* Population and Demographic Statistics Division, Department of Statistics Malaysia. https://dosm.gov.my/v1/uploads/files/7_Publication/Technical_Paper/Paper_APES/2020/5_Spatial_Analysis_Ageing_Population_of_Multi-ethnic_in_Rural_Area_Malaysia.pdf

National Institutes of Health (NIH). (2018). *National Health and Morbidity Survey 2018: Elderly Health: Vol. 1: Methodology and General Findings*. Ministry of Health Malaysia.

Navaratnarajah, A., & Jackson, S. H. (2017). The Physiology of Ageing. *Medicine*, *45*(1), 6–10. https://doi.org/10.1016/j.mpmed.2016.10.008

New England Research Institutes. (1991). *PASE Physical Activity Scale for the Elderly: Administration and Scoring Instruction Manual*. New England Research Institutes.

Neri, S. G., Lima, R. M., Ribeiro, H. S., & Vainshelboim, B. (2021). Poor handgrip strength determined clinically is associated with falls in older women. *Journal of Frailty, Sarcopenia and Falls*, *06*(02), 43–49. https://doi.org/10.22540/jfsf-06-043

Ngamsangiam, P. & Suttanon, P. (2020). Risk factors for falls among community-dwelling elderly people in Asia: A systematic review. *Science & Technology Asia*, *25*(3). https://doi.org/10.14456/scitechasia.2020.40

NHS website. (2021, July 9). *Falls*. Nhs.Uk. https://www.nhs.uk/conditions/falls/

Nugraha, S., Hapsari, I., Sabarinah, Pengpid, S., & Peltzer, K. (2019). Multimorbidity increases the risk of falling among Indonesian elderly living in community dwelling and elderly home: A cross sectional study. *Indian Journal of Public Health Research & Development*, *10*(11), 2263. https://doi.org/10.5958/0976-5506.2019.03898.1

Nutrition Education Materials Online (NEMO). (2017, April). *Using Body Mass Index*. https://www.health.qld.gov.au/__data/assets/pdf_file/0031/147937/hphe_usingbmi.pdf

O, Y. M., & el Fakiri, F. (2015). Gender Differences in Risk Factors for Single and Recurrent Falls Among the Community-Dwelling Elderly. *SAGE Open*, *5*(3), 215824401560204. https://doi.org/10.1177/2158244015602045

Ogliari, G., Ryg, J., Andersen-Ranberg, K., Scheel-Hincke, L. L., & Masud, T. (2021). Association between body mass index and falls in community-dwelling men and women: A prospective, multinational study in the Survey of Health, Ageing and Retirement in Europe (SHARE). *European Geriatric Medicine*, *12*(4), 837–849. https://doi.org/10.1007/s41999-021-00485-5

Ooi, T. C., Singh, D. K. A., Shahar, S., Rajab, N. F., Vanoh, D., Sharif, R., & Tan, M. P. (2021). Incidence and multidimensional predictors of occasional and recurrent falls among Malaysian community-dwelling older persons. *BMC Geriatrics*, *21*(1). https://doi.org/10.1186/s12877-021-02103-2

Orimo, H., Ito, H., Suzuki, T., Araki, A., Hosoi, T., & Sawabe, M. (2006). Reviewing the definition of "elderly." *Geriatrics and Gerontology International*, *6*(3), 149–158. https://doi.org/10.1111/j.1447-0594.2006.00341.x

Park, S., Hwang, Y., Oh, B., Lee, J., Hong, S., Kim, S., & Kim, D. (2017). The relationship between socioeconomic vulnerability and cognitive impairment among aged people in Korea. *Korean Journal of Clinical Geriatrics*, *18*(2), 74–81. https://doi.org/10.15656/kjcg.2017.18.2.74

Pengpid, S., & Peltzer, K. (2018). Prevalence and risk factors associated with injurious falls among community-dwelling older adults in Indonesia. *Current Gerontology and Geriatrics Research, 2018*, 1–8. https://doi.org/10.1155/2018/5964305

Pereira, C. L. N., Baptista, F., & Infante, P. (2013). Role of physical activity in the occurrence of falls and fall-related injuries in community-dwelling adults over 50 years old. *Disability and Rehabilitation*, *36*(2), 117–124. https://doi.org/10.3109/09638288.2013.782355

Podsiadlo, D., & Richardson, S. (1991). The Timed "Up & Go": A test of basic functional mobility for frail elderly persons. *Journal of the American Geriatrics Society*, *39*(2), 142–148. https://doi.org/10.1111/j.1532-5415.1991.tb01616.x

Pope, J., Helwig, K., Morrison, S., Estep, A., Caswell, S., Ambegaonkar, J., & Cortes, N. (2019). Multifactorial exercise and dance-based interventions are effective in reducing falls risk in community-dwelling older adults: A comparison study. *Gait & Posture, 70*, 370–375. https://doi.org/10.1016/j.gaitpost.2019.03.030

Public Service Delivery and Local Government Malaysia. (2021). *Vulnerable Groups: The Elderly/Senior Citizens*.

Qian, X. X., Chau, P. H., Kwan, C. W., Lou, V. W. Q., Leung, A. Y. M., Ho, M., Fong, D. Y. T., & Chi, I. (2020). Investigating Risk Factors for Falls among Community-Dwelling Older Adults According to WHO's Risk Factor Model for Falls. *The Journal of Nutrition, Health & Aging*, *25*(4), 425–432. https://doi.org/10.1007/s12603-020-1539-5

Rahman, K. A., Ahmad, S. A., Che Soh, A., Ashari, A., Wada, C., & Gopalai, A. A. (2021). The association of falls with instability: An analysis of perceptions and expectations toward the use of fall detection devices among older adults in Malaysia. *Frontiers in Public Health*, *9*. https://doi.org/10.3389/fpubh.2021.612538

Rossi-Izquierdo, M., Santos-Pérez, S., Faraldo-García, A., Vaamonde-Sánchez-Andrade, I., Gayoso-Diz, P., Del-Río-Valeiras, M., Lirola-Delgado, A., & Soto-Varela, A. (2015). Impact of obesity in elderly patients with postural instability. *Aging Clinical and Experimental Research*, *28*(3), 423–428. https://doi.org/10.1007/s40520-015-0414-4

Rothenbacher, D., Klenk, J., Denkinger, M. D., Herbolsheimer, F., Nikolaus, T., Peter, R., Boehm, B. O., Rapp, K., Dallmeier, D., & Koenig, W. (2013). Prospective evaluation of renal function, serum vitamin D level, and risk of fall and fracture in community-dwelling elderly subjects. *Osteoporosis International*, *25*(3), 923–932. https://doi.org/10.1007/s00198-013-2565-5

Rumsfeld, J. S. (2002). Health Status and Clinical Practice. *Circulation*, *106*(1), 5–7. https://doi.org/10.1161/01.cir.0000020805.31531.48

Salari, N., Darvishi, N., Ahmadipanah, M., Shohaimi, S., & Mohammadi, M. (2022, June 28). Global prevalence of falls in the older adults: A comprehensive systematic review and meta-analysis. *Journal of Orthopaedic Surgery and Research*, *17*(1). https://doi.org/10.1186/s13018-022-03222-1

Saliba-Serre, B., Davin, B., & Ferrandez, A. (2020). Which factors are associated with body mass index among elderly people living at home in France? *Bulletins et Mémoires de La Société d'Anthropologie de Paris*, *32*(3–4), 133–146. https://doi.org/10.3166/bmsap-2020-0073

Saltzman, E. & Mogensen, K. M. (2013). Chapter 3 - Physical and Clinical Assessment of Nutrition Status. In Coulston, A. M., Boushey, C. J. & Ferruzzi, M. G. (Eds.), *Nutrition in the Prevention and Treatment of Disease* (Third Edition, 65-79). Academic Press. https://doi.org/10.1016/C2010-0-69615-5

Sampaio, P. Y. S., Sampaio, R. A. C., Coelho Júnior, H. J., Teixeira, L. F. M., Tessutti, V. D., Uchida, M. C., & Arai, H. (2015). Differences in lifestyle, physical performance and quality of life between frail and robust Brazilian community-dwelling elderly women. *Geriatrics & Gerontology International*, *16*(7), 829–835. https://doi.org/10.1111/ggi.12562

Sahril, N., Shahein, N. A., Yoep, N., Mahmud, N. A., Sooryanarayana, R., Maw Pin, T., Muhamad, N. A., & Ismail, H. (2020). Prevalence and factors associated with falls among older persons in Malaysia. *Geriatrics & Gerontology International*, *20*(S2), 33–37. https://doi.org/10.1111/ggi.13980

Sazlina, S., Chan, Y. M., Hamid, T. A., Suzana, S., & Singh, D. K. A. (2018). Associations between falls and psychosocial factors, self-rated health, disability and sleep among community dwelling older people in Malaysia. *Journal of Clinical Gerontology & Geriatrics*, *9*(3), 85-90. DOI: 10.24816/jcgg.2018.v9i3.03

Schöne, D., Freiberger, E., & Sieber, C. C. (2017). Influence of skeletal muscles on the risk of falling in old age. *Der Internist*, *58*(4), 359–370. https://doi.org/10.1007/s00108-017-0212-5

Shaharudin, M. I. (2020). Prevalence of Falls and Its Characteristics among Malaysian Older Adults: A Review. *Medicine & Health*, *15*(1), 18–33. https://doi.org/10.17576/mh.2020.1501.03

Sheehan, K. J., O'Connell, M. D., Cunningham, C., Crosby, L., & Kenny, R. A. (2013). The relationship between increased body mass index and frailty on falls in community dwelling older adults. *BMC Geriatrics*, *13*(1). https://doi.org/10.1186/1471-2318-13-132

Singh, D. K. A., Ab. Rahman, N. N. A., Rajaratnam, B. S., Yi, T. C., & Shahar, S. (2018). Validity and reliability of physical activity scale for elderly in Malay language (PASE-M). *Malaysian Journal of Public Health Medicine, Special*

Volume (1), 116-123. https://www.researchgate.net/publication/324441822_Validity_and_reliability_of_physical_activity_scale_for_elderly_in_Malay_language_PASE-M

Singh, D. K. A., Shahar, S., Vanoh, D., Kamaruzzaman, S. B., & Tan, M. P. (2019). Diabetes, arthritis, urinary incontinence, poor self-rated health, higher body mass index and lower handgrip strength are associated with falls among community-dwelling middle-aged and older adults: Pooled analyses from two cross-sectional Malaysian datasets. *Geriatrics & Gerontology International*, *19*(8), 798–803. https://doi.org/10.1111/ggi.13717

Soares, W. J., Lopes, A. D., Nogueira, E., Candido, V., de Moraes, S. A., & Perracini, M. R. (2019). Physical activity level and risk of falling in community-dwelling older adults: Systematic review and meta-analysis. *Journal of Aging and Physical Activity*, *27*(1), 34–43. https://doi.org/10.1123/japa.2017-0413

Soley-Bori, M. (2013, May 6). *Dealing with missing data: Key assumptions and methods for applied analysis*. https://www.researchgate.net/publication/323266125

Song, C. Y., Tsauo, J. Y., Fang, P. H., Fang, I. Y., & Chang, S. H. (2021). Physical Fitness among Community-Dwelling Older Women with and without Risk of Falling—The Taipei Study, Taiwan. *International Journal of Environmental Research and Public Health*, *18*(14), 7243. https://doi.org/10.3390/ijerph18147243

Soriano, T., DeCherrie, L. V., & Thomas, D. C. (2008). Falls in the community-dwelling older adult: A review for primary-care providers. *Clinical Interventions in Aging*, *Volume 2*, 545–553. https://doi.org/10.2147/cia.s1080

Stahl, S. T., & Albert, S. M. (2015). Gender differences in physical activity patterns among older adults who fall. *Preventive Medicine*, *71*, 94–100. https://doi.org/10.1016/j.ypmed.2014.12.016

Starr, K. N. P., & Bales, C. W. (2015). Excessive Body Weight in Older Adults. *Clinics in Geriatric Medicine*, *31*(3), 311–326. https://doi.org/10.1016/j.cger.2015.04.001

Steultjens, E. M. J., Dekker, J., Bouter, L. M., Jellema, S., Bakker, E. B., & van den Ende, C. H. M. (2004). Occupational therapy for community dwelling elderly people: a systematic review. *Age and Ageing*, *33*(5), 453–460. https://doi.org/10.1093/ageing/afh174

Strandkvist, V., Larsson, A., Pauelsen, M., Nyberg, L., Vikman, I., Lindberg, A., Gustafsson, T., & Röijezon, U. (2021). Hand grip strength is strongly associated with lower limb strength but only weakly with postural control in community-dwelling older adults. *Archives of Gerontology and Geriatrics*, *94*, 104345. https://doi.org/10.1016/j.archger.2021.104345

Strath, S. J., Kaminsky, L. A., Ainsworth, B. E., Ekelund, U., Freedson, P. S., Gary, R. A., Richardson, C. R., Smith, D. T., & Swartz, A. M. (2013). Guide to the

assessment of physical activity: Clinical and research applications. *Circulation, 128*(20), 2259–2279. https://doi.org/10.1161/01.cir.0000435708.67487.da

Susilowati, I. H., Nugraha, S., Sabarinah, S., Peltzer, K., Pengpid, S., & Hasiholan, B. P. (2020, March 18). Prevalence and risk factors associated with falls among community-dwelling and institutionalized older adults in Indonesia. *Malays Fam Physician, 15*(1), 30-38.

Tan, M. P. (2019). Could obesity be linked to falls in older adults? *Biomedical Journal of Scientific & Technical Research, 13*(1). https://doi.org/10.26717/bjstr.2019.13.002345

Tan, M. P., Mat, S., Alex, D., & Kamaruzzaman, S. B. (2019). 150 falls in Malaysia: magnitude, risk, disparities, and solutions. *Age and Ageing, 48*(Supplement_4), iv34–iv39. https://doi.org/10.1093/ageing/afz164.150

Terroso, M., Rosa, N., Torres Marques, A., & Simoes, R. (2013). Physical consequences of falls in the elderly: a literature review from 1995 to 2010. *European Review of Aging and Physical Activity, 11*(1), 51–59. https://doi.org/10.1007/s11556-013-0134-8

Tew, M. M., Hatah, E., Arif, F., Abdul Wahid, M. A., Makmor-Bakry, M., & Abdul Maulad, K. N. (2021). Geospatial analysis of distribution of community pharmacies and other health care facilities providing minor ailments services in Malaysia. *Journal of Pharmaceutical Policy and Practice, 14*(1). https://doi.org/10.1186/s40545-021-00308-9

The Royal Children's Hospital Melbourne. (2017, August). *Clinical Guidelines (Nursing): Falls prevention*. Retrieved November 6, 2021, from https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Falls_prevention/

Thomas, E., Martines, F., Bianco, A., Messina, G., Giustino, V., Zangla, D., Iovane, A., & Palma, A. (2018). Decreased postural control in people with moderate hearing loss. *Medicine, 97*(14), e0244. https://doi.org/10.1097/md.0000000000010244

Thomas, S., Reading, J., & Shephard, R. J. (1992, December). Revision of the physical activity readiness questionnaire (PAR-Q). *Can J Sport Sci.,17*(4), 338-45. https://pubmed.ncbi.nlm.nih.gov/1330274/

Trevisan, C., Crippa, A., Ek, S., Welmer, A. K., Sergi, G., Maggi, S., Manzato, E., Bea, J. W., Cauley, J. A., Decullier, E., Hirani, V., LaMonte, M. J., Lewis, C. E., Schott, A. M., Orsini, N., & Rizzuto, D. (2019). Nutritional Status, Body Mass Index, and the Risk of Falls in Community-Dwelling Older Adults: A Systematic Review and Meta-Analysis. *Journal of the American Medical Directors Association, 20*(5), 569–582.e7. https://doi.org/10.1016/j.jamda.2018.10.027

Tsai, Y. J., Yang, P. Y., Yang, Y. C., Lin, M. R., & Wang, Y. W. (2020). Prevalence and risk factors of falls among community-dwelling older people: Results from

three consecutive waves of the national health interview survey in Taiwan. *BMC Geriatrics*, *20*(1). https://doi.org/10.1186/s12877-020-01922-z

United Nations. (2021). *World Population Ageing 2020 Highlights: Living Arrangements of Older Persons*. United Nations.

Wahab, S. N. A., Satar, N. M., & Tumin, M. (2020). Socio-demographic factors and structural barrier in accessing public clinics among the urban poor in Malaysia. *Journal of Social Sciences and Humanities*, *17*(3), 71-81. ISSN: 1823-884x

Wahba, H., Abdul-Rahman, S., & Mortagy, A. (2013). Handgrip strength and falls in community-dwelling Egyptian seniors. *Advances in Aging Research*, *02*(04), 109–114. https://doi.org/10.4236/aar.2013.24016

Washburn, R. A., Smith, K. W., Jette, A. M., & Janney, C. A. (1993). The physical activity scale for the elderly (PASE): Development and evaluation. *Journal of Clinical Epidemiology*, *46*(2), 153–162. https://doi.org/10.1016/0895-4356(93)90053-4

Wilkinson, D., Piasecki, M., & Atherton, P. (2018). The age-related loss of skeletal muscle mass and function: Measurement and physiology of muscle fibre atrophy and muscle fibre loss in humans. *Ageing Research Reviews*, *47*, 123–132. https://doi.org/10.1016/j.arr.2018.07.005

Winter, J. E., MacInnis, R. J., & Nowson, C. A. (2016). The influence of age on the BMI and all-cause mortality association: A meta-analysis. *The Journal of Nutrition, Health & Aging*, *21*(10), 1254–1258. https://doi.org/10.1007/s12603-016-0837-4

Winter, J. E., MacInnis, R. J., Wattanapenpaiboon, N., & Nowson, C. A. (2014). BMI and all-cause mortality in older adults: a meta-analysis. *The American Journal of Clinical Nutrition*, *99*(4), 875–890. https://doi.org/10.3945/ajcn.113.068122

Wołoszyn, N., Wiśniowska-Szurlej, A., & Sozański, B. (2018). An assessment of the relationship between the level of physical activity and the risk of falls and depression in elderly adults aged 60 - 75 years from the Podkarpackie region. *Advances in Rehabilitation*, *32*(2), 41–48. https://doi.org/10.5114/areh.2018.77936

Woo, M. T., Davids, K., Liukkonen, J., Chow, J. Y., & Jaakkola, T. (2017). Falls, cognitive function, and balance profiles of Singapore community-dwelling elderly individuals: Key risk factors. *Geriatric Orthopaedic Surgery & Rehabilitation*, *8*(4), 256–262. https://doi.org/10.1177/2151458517745989

Worapanwisit, T., Prabpai, S., & Rosenberg, E. (2018). Correlates of Falls among Community-Dwelling Elderly in Thailand. *Journal of Aging Research*, *2018*, 1–10. https://doi.org/10.1155/2018/8546085

Worldmeter. (2021, November 29). *Malaysia Population (2021) - Worldometer*. Worldometers.Info. https://www.worldometers.info/world-population/malaysia-population/

World Health Organization. (2008). *WHO Global Report on Falls Prevention in Older Age* (1st ed.). World Health Organization.

World Health Organization. (2020, November 26). *Physical activity*. https://www.who.int/news-room/fact-sheets/detail/physical-activity

World Health Organization. (2021). *Ageing*. https://www.who.int/health-topics/ageing#tab=tab_3

World Health Organization. (2021). *Body mass index - BMI*. WHO Europe. https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

World Health Organization. (2021, April 13). *Non communicable diseases*. Retrieved November 4, 2021, from https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

World Health Organization. (2021, April 26). *Falls*. https://www.who.int/news-room/fact-sheets/detail/falls

World Health Organization. (2021, October 4). *Ageing and health*. WHO. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

World Health Organization. (n.d.). *GHE: Life expectancy and healthy life expectancy*. The Global Health Observatory. Retrieved November 4, 2021, from https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-life-expectancy-and-healthy-life-expectancy

Wu, H., & Ouyang, P. (2017). Fall prevalence, time trend and its related risk factors among elderly people in China. *Archives of Gerontology and Geriatrics*, *73*, 294–299. https://doi.org/10.1016/j.archger.2017.08.009

Xu, C., Ebeling, P. R., & Scott, D. (2019). Body composition and falls risk in older adults. *Current Geriatrics Reports*, *8*(3), 210–222. https://doi.org/10.1007/s13670-019-00294-6

Yang, N. P., Hsu, N. W., Lin, C. H., Chen, H. C., Tsao, H. M., Lo, S. S., & Chou, P. (2018). Relationship between muscle strength and fall episodes among the elderly: the Yilan study, Taiwan. *BMC Geriatrics*, *18*(1). https://doi.org/10.1186/s12877-018-0779-2

Yang, Y., Hu, X., Zhang, Q., & Zou, R. (2016). Diabetes mellitus and risk of falls in older adults: a systematic review and meta-analysis. *Age and Ageing*, *45*(6), 761–767. https://doi.org/10.1093/ageing/afw140

Yeong, U. Y., Tan, S. Y., Yap, J. F., & Choo, W. Y. (2016). Prevalence of falls among community-dwelling elderly and its associated factors: A cross-sectional study in Perak, Malaysia. *Malaysian Family Physician, 11*(1), 7-11. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5405326/

Yeung, S. S., Reijnierse, E. M., Pham, V. K., Trappenburg, M. C., Lim, W. K., Meskers, C. G., & Maier, A. B. (2019). Sarcopenia and its association with falls

and fractures in older adults: A systematic review and meta-analysis. *Journal of Cachexia, Sarcopenia and Muscle*, *10*(3), 485–500. https://doi.org/10.1002/jcsm.12411

Zhang, L., Ding, Z., Qiu, L., & Li, A. (2019). Falls and risk factors of falls for urban and rural community-dwelling older adults in China. *BMC Geriatrics*, *19*(1). https://doi.org/10.1186/s12877-019-1391-9

Zhang, X., Huang, P., Dou, Q., Wang, C., Zhang, W., Yang, Y., Wang, J., Xie, X., Zhou, J., & Zeng, Y. (2020). Falls among older adults with sarcopenia dwelling in nursing home or community: A meta-analysis. *Clinical Nutrition*, *39*(1), 33–39. https://doi.org/10.1016/j.clnu.2019.01.002

ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS
(JKEUPM)
UNIVERSITI PUTRA MALAYSIA

Research title	:	**Nutrition Education and Exercise Intervention in Preventing Frailty Among Pre-Frail Malaysian Elderly in PPR Flats Kuala Lumpur.**
Study Site	:	**PPR flat in Kuala Lumpur**
JKEUPM Ref No.	:	**JKEUPM-2019-335**
Researcher	:	**Nurul Izzati Binti Mohd Suffian**
Supervisor	:	**Dr. Siti Nur'Asyura Binti Adznam**

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 21/8/2019
2. Respondent Information Sheet & Consent (English), Version 2 dated 24/12/2019 *(Phase 1: Elderly)*
3. Respondent Information Sheet & Consent (Malay), Version 2 dated 24/12/2019 (*Phase 1: Elderly)*
4. Respondent Information Sheet & Consent (English), Version 2 dated 24/12/2019 *(Phase 1: Health Practitioner)*
5. Respondent Information Sheet & Consent (Malay), Version 2 dated 24/12/2019 *(Phase 1: Health Practitioner)*
6. Respondent Information Sheet & Consent (English), Version 2 dated 24/12/2019 *(Phase 2: Screening)*
7. Respondent Information Sheet & Consent (Malay), Version 2 dated 24/12/2019 *(Phase 2: Screening)*
8. Respondent Information Sheet & Consent (English), Version 2 dated 24/12/2019 *(Phase 2: Intervention group)*
9. Respondent Information Sheet & Consent (Malay), Version 2 dated 24/12/2019 *(Phase 2: Intervention group)*
10. Respondent Information Sheet & Consent (English), Version 3 dated 6/2/2020 *(Phase 2: Control group)*
11. Respondent Information Sheet & Consent (Malay), Version 3 dated 6/2/2020 *(Phase 2: Control group)*
12. Proposal (English), Version 2 dated 24/12/2019
13. Questionnaires/ Interviews (Malay), Version 1 dated 21/8/2019 *(Phase 1: Elderly)*
14. Questionnaires/ Interviews (Malay), Version 1 dated 21/8/2019 *(Phase 1: Health Practitioner)*
15. Questionnaires/ Interviews (Malay), Version 1 dated 21/8/2019 *(Phase 1: Screeening)*
16. Questionnaires/ Interviews (Malay), Version 2 dated 24/12/2019 *(Phase 2: Intervention program)*
17. Curriculum Vitae of:
    a. Dr. Siti Nur'Asyura Binti Adznam
    b. Assoc. Prof. Dr. Hazizi Bin Abu Saad

c. Dr. Zuriati Binti Ibrahim
d. Dr. Noraida Binti Omar
e. Nurul Izzati Binti Mohd Suffian

18. Good Clinical Practice Certificate:
    a. Dr. Siti Nur'Asyura Binti Adznam
    b. Assoc. Prof. Dr. Hazizi Bin Abu Saad
    c. Dr. Zuriati Binti Ibrahim
    d. Dr. Noraida Binti Omar
    e. Nurul Izzati Binti Mohd Suffian

19. Insurance Statement
20. Modul senaman dan pemakanan bagi mencegah sindrom keuzuran dalam kalangan warga emas di Malaysia, Version 1 dated 24/12/2019

The University Research Ethics Committee, Universiti Putra Malaysia (JKEUPM) operates in accordance to the ICH-GCP Guidelines.
Decision by JKEUPM:

[X] Approved

[X] **Permission MUST BE OBTAINED from the respective hospitals/ institutions before conducting the research**

[ ] Disapproved

Please note that the approval is **VALID UNTIL 12 FEBRUARY 2021**

Researchers should comply with the following:

I. Complete a Study Final Report upon study completion (Form 3.2).

II. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.

III. Applicable for Clinical Trial Studies and Clinical interventional Studies only: Progress Report has to be submitted to JKEUPM at every 6 months from the date of approval (Form 3.1). Report occurrences of all Serious Adverse Events (SAEs), Suspected Unexpected Serious Adverse Reaction (SUSARs) and Protocol Deviation/ Violation at all JKEUPM approved sites to JKEUPM. SAEs are to be reported within 15 calendar days from awareness of event by investigator. Initial report of SUSARs are to be reported as soon as possible but not later than 7 calendar days from awareness of event by investigator, followed by a complete report within 8 additional calendar days.

The required forms can be obtained from the Ethics Committee for Research Involving Human Subjects (JKEUPM) website (http://www.tncpi.upm.edu.my/faildokumen).

Approved at JKEUPM Meeting on 25 September 2019, attended by:

NAME	DESIGNATION	GENDER	TICK IF PRESENT
Prof. Dr. Zamberi Sekawi	Professor of Medical Microbiology, Department of Medical Microbiology and Parasitology, Faculty of Medicine and Health Sciences.	Male	
Prof. Dr. Johnson Stanslas	Professor of Pharmacology, Department of Medicine, Faculty of Medicine and Health Sciences.	Male	√
Assoc. Prof. Dr. Normala Ibrahim	Associate Professor of Psychiatry, Department of Psychiatry, Faculty of Medicine and Health Sciences.	Female	√
Assoc. Prof. Dr. Wan Aliaa Wan Sulaiman	Associate Professor of Neurology, Department of Medicine, Faculty of Medicine and Health Sciences.	Female	√
Assoc. Prof Dr. Shamala Paramasivam	Associate Professor of English Language, Department of English, Faculty of Modern Languages and Communication.	Female	
Prof. Dr. Ahmad Nazrun Shuid (Independent member)	Professor of Pharmacology, Faculty of Medicine, Universiti Kebangsaan Malaysia.	Male	√
Dr. Salmiah Md. Said	Senior Lecturer of Public Health Medicine Specialist, Department of Community Health, Faculty of Medicine and Health Sciences	Female	√
Dr. Hayati Kadir@Shahar	Senior Lecturer of Public Health Medicine Specialist, Department of Community Health, Faculty of Medicine and Health Sciences	Female	√
Assoc Prof. Dr. Rosliza Abdul Manaf	Associate Professor of Public Health Medicine Specialist, Department of Community Health, Faculty of Medicine and Health Sciences.	Female	√
Dr. Rojanah Kahar	Senior Lecturer of Family Law Specialist, Department of Human Development and Family Studies, Faculty of Human Ecology.	Female	√
Dr. Nur Surayyah Madhubala Abdullah	Senior Lecturer of Moral and Citizenship Education, Department of Language and Humanities Education, Faculty of Educational Studies	Female	√
Assoc. Prof. Dr. Syamsiah Mashohor	Associate Professor of Computer Engineering, Department of Computer and Communication Systems, Faculty of Engineering	Female	√
Dr. Zatul Himmah Binti Adnan	Lecturer of Politics and Policy, Department of Government and Civilisation Studies, Faculty of Human Ecology	Female	
Assoc. Prof. Dr Chew Boon How	Senior Lecture of Family Medicine Specialist, Department of Family Medicine, Faculty of Medicine and Health Sciences.	Male	√
Pn. Mimi Nora Binti Mansor (Independent Member/Layperson)	Retired Government Staff	Female	√

Appendix C Respondent's Information Sheet and Informed Consent Form

KOD RESPONDENT:

BORANG 2.4: PENERANGAN DAN PERSETUJUAN RESPONDEN

Sila baca maklumat berikut dengan teliti. Sekiranya anda mempunyai sebarang pertanyaan, sila kemukakan kepada penyelidik.

1.TAJUK KAJIAN

Penilaian perubahan status keuzuran dan saringan kelayakan untuk menyertai program intervensi mencegah keuzuran dalam kalangan warga emas di flat Projek Perumahan Rakyat (PPR), Kuala Lumpur

2. PENGENALAN

Proses penuaan berkait rapat dengan pelbagai isu geriatrik, termasuk sindrom *frailty*. Sindrom *frailty* adalah istilah yang biasa digunakan oleh professional kesihatan untuk menggambarkan keadaan warga tua yang mempunyai penyakit kronik, limitasi fungsian serta risiko untuk menjadi lebih teruk. Kini, pencegahan sindrom *frailty* menjadi kebimbangan disebabkan prevalen yang tinggi dan pelbagai kesan buruk terhadap kesihatan di kalangan populasi warga tua.

Satu kajian dijalankan untuk membentuk, melaksana dan menilai keberkesanan program intervensi frailty dalam kalangan warga tua pre-frail Malaysia di flat PPR Kuala Lumpur. Kajian ini mempunyai 2 fasa:

Fasa 1: Pembentukan dan tahap penerimaan modul intervensi frailty dan bahan pendidikan dalam kalangan professional kesihatan dan warga tua
Fasa 2: Penilaian keberkesanan program intervensi mecegah keuzuran dalam kalangan warga emas

Oleh itu, kajian kecil yang dijalankan ini merupakan sebahagian daripada fasa kedua kajian yang bertujuan untuk menyaring status pra-uzur dan kelayakan sebagai prasyarat untuk menyertai program intervensi mencegah keuzuran dalam kalangan warga emas di flat PPR Kuala Lumpur

3. APAKAH YANG PERLU ANDA LAKUKAN?

Sila ambil masa yang secukupnya untuk membaca dan pertimbangkan dengan teliti penerangan yang diberikan sebelum anda bersetuju untuk menyertai penyelidikan ini. Jika ada sebarang kemusykilan atau memerlukan maklumat lanjut yang anda ingin tahu, anda boleh bertanya dengan penyelidik yang terlibat dalam penyelidikan ini. Setelah anda berpuas hati dengan maklumat yang diberi dan memahami penyelidikan ini, dan anda juga berminat untuk turut serta, anda dikehendaki untuk menandatangani Borang Persetujuan ini (muka surat 4).

Penyertaan anda dalam penyelidikan ini adalah secara sukarela. Anda tidak perlu menyertai penyelidikan ini jika anda tidak bersetuju. Anda juga mempunyai hak untuk tidak menjawab mana-mana soalan yang anda tidak mahu jawab. Anda juga boleh menarik diri daripada penyelidikan ini pada bila-bila masa sahaja tanpa dikenakan sebarang penalti atau apa – apa yang berkenaan dengannya..

Sila tandatangan di sini sekiranya anda telah membaca dan memahami kandungan halaman ini

_____

KOD RESPONDENT:

Dalam kajian ini, anda akan ditemu bual oleh penyelidik atau pembantu penyelidik terlatih menggunakan borang soal-selidik. Ia terbahagi kepada tujuh (7) bahagian iaitu bahagian A (latar belakang responden), bahagian B (pengukuran antropometri), bahagian C (tahap aktiviti fizikal), bahagian D (status *frailty*), bahagian E (status kesihatan), bahagian F (status kognitif) dan bahagian G (tahap kesediaan untuk bersenam). Jangkaan masa yang diperlukan untuk temubual adalah hampir 45 - 50 minit sahaja .

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Berumur bawah 60 tahun, mempunyai masalah pendengaran serta penglihatan, mempunyai masalah mental (alzheimer atau dementia), terlantar, tidak mampu bergerak tanpa sokongan dan tidak mendiami di flat PPR Kuala Lumpur

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Hasil daripada kajian ini juga, anda berpeluang mengetahui status keuzuran anda dan mengetahui sekiranya anda layak untuk menyertai program intervensi mencegah sindrom keuzuran. Di akhir kajian ini, anda akan menerima sumbangan berbentuk makanan yang berkhasiat dan peralatan rumah (contoh: perkakas dapur) yang jumlah keseluruhan bernilai RM10

b) KEPADA PENYELIDIK?

Berdasarkan dapatan daripada kajian ini, penyelidik dapat mengetahui status keuzuran warga emas di flat PPR Kuala Lumpur. Seterusnya, data yang diperoleh dapat digunakan sebagai rujukan untuk mencari peserta untuk menyertai program intervensi mencegah keuzuran.

6. ADAKAH IA BERISIKO?

Kajian ini adalah tidak berbahaya dan tidak menyebabkan kesan buruk terhadap emosi dan fizikal warga tua. Setiap sesi temu bual akan dijalankan oleh penyelidik dan pembantu penyelidik yang terlatih.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Segala maklumat yang diberikan adalah sulit dan hanya akan digunakan untuk tujuan kajian sahaja. Anda akan diberikan ID unik dalam rekod kajian

8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEMASA MENGIKUTI PENYELIDIKAN INI?

Jika anda mempunyai sebarang masalah atau soalan berkaitan dengan kajian ini, anda boleh terus menghubungi penyelidik:

Nurul Izzati binti Mohd Suffian (Pelajar Pasca-Siswazah)
No. Tel : 017-3821050
Email : nurulizzatisuffian@gmail.com

Sila tandatangan di sini sekiranya anda telah membaca dan memahami kandungan halaman ini

_____

KOD RESPONDENT:

Prof. Madya Dr. Siti Nur'Asyura Binti Adznam (Pensyarah/ Pengerusi Jawatankuasa Penyeliaan)
No. Tel : 03-89472481
Email : asyura@upm.edu.my

Prof. Madya Dr. Hazizi Bin Abu Saad (Pensyarah/ Ahli Jawatankuasa Penyeliaan)
No. Tel : 03-89472434
Email : hazizi@upm.edu.my

Dr. Zuriati Ibrahim (Pensyarah/ Ahli Jawatankuasa Penyeliaan)
No. Tel : 03-8947 2464
Email : zuriatiib@upm.edu.my

Dr. Noraida Omar (Senior Lecturer/ Co-Investigator)
No. Tel : 03-8947 2463
Email : noraidaomar@upm.edu.my

Sila tandatangan di sini sekiranya anda telah membaca dan memahami kandungan halaman ini

_____

Appendix D Questionnaire

KOD RESPONDENT:

No.	Details	Tick
1	Phone call A+C+G	
2	B+D	
3	E+F	
4	G	

Fakulti Perubatan dan Sains Kesihatan
Jabatan Pemakanan dan Dietetik

BORANG SOAL SELIDIK KAJIAN FASA 2
(SARINGAN STATUS *FRAILTY* & KELAYAKAN KEMASUKAN KE PROGRAM INTERVENSI *FRAILTY*)

TAJUK KAJIAN:
INTERVENSI PENDIDIKAN PEMAKANAN DAN SENAMAN UNTUK MENCEGAH *FRAILTY* DALAM KALANGAN WARGA TUA *PRE-FRAIL* MALAYSIA DI FLAT PPR KUALA LUMPUR

PENYELIDIK:
NURUL IZZATI BINTI MOHD SUFFIAN

PENYELIA PROJEK:
PROF. MADYA DR. SITI NUR 'ASYURA BINTI ADZNAM

TARIKH: | | | | | | | | |

KOD RESPONDEN: | | | | | |

Borang soal selidik ini mengandungi **TUJUH** bahagian iaitu bahagian A (latar belakang responden), bahagian B (pengukuran antropometri), bahagian C (tahap aktiviti fizikal), bahagian D (status *frailty*), bahagian E (status kesihatan), bahagian F (status kognitif) dan bahagian G (tahap kesediaan untuk bersenam). Bahagian E, F dan G hanya perlu dilengkapkan sekiranya peserta mendapat skor *frailty* 1 – 2 (*pre-frail*) pada bahagian C.

BAHAGIAN A: LATAR BELAKANG RESPONDEN

ARAHAN: Sila tandakan (/) pada jawapan yang berkenaan

		CATATAN
1.	**JANTINA:** 1.☐ Lelaki 2.☐ Perempuan	
2.	**UMUR:** _____ tahun	
3.	**BANGSA:** 1.☐ Melayu 2.☐ Cina 3.☐ India 4.☐ Lain-Lain :_____	
4.	**STATUS PERKAHWINAN:** 1.☐ Bujang 2.☐ Berkahwin 3.☐ Bercerai 4.☐ Balu/Duda	
5.	**TAHAP PENDIDIKAN:** 1.☐ Tidak pernah bersekolah 2.☐ Sekolah agama/ pondok 3.☐ Sekolah rendah 4.☐ Sekolah menengah 5.☐ Sekolah menengah atas 6.☐ Sijil/ diploma/ ijazah	
6.	**HAMPIR BERAPA LAMA PAKCIK/MAKCIK MENDIAMI DI FLAT PPR INI?** ____ Tahun _____ Bulan	

7.	**TINGGAL DIRUMAH BERSAMA:** 1. ☐ Sendirian 2. ☐ Dengan suami/isteri 3. ☐ Dengan suami/isteri dan anak 4. ☐ Dengan anak atau cucu 5. ☐ Lain – lain (sila nyatakan: _____) **ALAMAT:** _____	
8.	**STATUS PEKERJAAN:** 1. ☐ Tidak bekerja/surirumah 2. ☐ Pesara (sila nyatakan pekerjaan dahulu _____) 3. ☐ Pesara tetapi masih bekerja (sila nyatakan pekerjaan sekarang _____) 4. ☐ Bekerja (Sila nyatakan: _____)	

BAHAGIAN B: PENGUKURAN ANTROPOMETRI

Parameter	Alat Ukuran	Bacaan 1	Bacaan 2	Catatan
Tinggi (cm)	*SECA Stadiometer*			
Panjang depa tangan (cm)*	*Lufkin measuring tape W606PM*			*Hanya diambil sekiranya perlu
Berat (kg)	*Omron BIA (HBF-375)*			
Indeks Jisim Tubuh (IJT)(kg/m^2)				
Jisim Otot (%)				
Jisim Lemak (%)				
Kekuatan Genggaman Tangan (kg)	*Jamar Hand Dynamometer*			

Formula anggaran ketinggian menggunakan panjang depa tangan (Ngoh et al., 2012):

Wanita:
Anggaran ketinggian berdiri (cm) = 67.51 + (1.29 x *demi-span* dalam cm) - (0.12 x umur)

Lelaki:
Anggaran ketinggian berdiri (cm) = 67.51 + (1.29 x *demi-span* dalam cm) – (0.12 x umur) + 4.13

BAHAGIAN C: TAHAP AKTIVITI FIZIKAL

Physical Activity Scale for the Elderly-Malay version (PASE-M), (Ismail et al., 2015)

ARAHAN: Sila tandakan [/] pada jawapan yang berkenaan.

AKTIVITI MASA LAPANG	
1	**Dalam tempoh 7 hari yang lepas, berapa kerapkah anda melakukan aktiviti dalam keadaan duduk (cth: membaca, menonton TV atau melakukan kraftangan)?** 0. ☐ Tidak pernah **(Terus ke soalan 2)** 1. ☐ Jarang (1-2 hari) 2. ☐ kadang-kadang (3-4 hari) 3. ☐ Selalu (5-7 hari) **Apakah aktiviti-aktiviti ini? Senaraikan:** _____ _____ _____ **Secara purata, berapa jam dalam sehari anda terlibat dalam aktiviti keadaan duduk tersebut?** 1. ☐ < 1 jam 2. ☐ 1- < 2 jam 3. ☐ 2- < 4 jam 4. ☐ ≥ 4 jam
2	**Dalam tempoh 7 hari yang lepas, berapa kerapkah anda berjalan di luar rumah atau halaman rumah atas apa jua sebab (cth: untuk bersenang-senang atau sebagai senaman, berjalan ke tempat kerja, membeli-belah, berjalan bersama cucu atau berjalan bersama binatang peliharaan seperti anjing)?** 0. ☐ Tidak pernah **(Terus ke soalan 3)** 1. ☐ Jarang (1-2 hari) 2. ☐ kadang-kadang (3-4 hari) 3. ☐ Selalu (5-7 hari) **Apakah aktiviti-aktiviti ini? Senaraikan:** _____ _____ _____ **Secara purata, berapa jam dalam sehari anda terlibat dalam aktiviti keadaan tersebut?**

	1. □ < 1 jam 2. □ 1- < 2 jam 3. □ 2- < 4 jam 4. □ ≥ 4 jam
3	**Dalam tempoh <u>7 hari yang lepas</u>, berapa kerapkah anda melibatkan diri dalam aktiviti sukan intensiti ringan dan rekreasi (cth: boling, bermain golf menggunakan kereta golf, senaman rengangan, tai chi, memancing, menyanyi, bermain alat-alat muzik atau seumpamanya)?** 0. □ Tidak pernah **(Terus ke soalan 4)** 1. □ Jarang (1-2 hari) 2. □ kadang-kadang (3-4 hari) 3. □ Selalu (5-7 hari) **Apakah aktiviti-aktiviti ini? Senaraikan:** _____ _____ _____ **Secara purata, berapa <u>jam dalam sehari</u> anda terlibat dalam aktiviti keadaan tersebut?** 1. □ < 1 jam 2. □ 1- < 2 jam 3. □ 2- < 4 jam 4. □ ≥ 4 jam
4	**Dalam tempoh <u>7 hari yang lepas</u>, berapa kerapkah anda melibatkan diri dalam aktiviti sukan intensiti sederhana atau rekreasi yang kurang lasak (cth: tenis secara beregu, bermain golf tanpa memandu kereta golf, menari, bermain bola lisut atau seumpamanya)?** 0. □ Tidak pernah **(Terus ke soalan 5)** 1. □ Jarang (1-2 hari) 2. □ kadang-kadang (3-4 hari) 3. □ Selalu (5-7 hari) **Apakah aktiviti-aktiviti ini? Senaraikan:** _____ _____ _____ **Secara purata, berapa <u>jam dalam sehari</u> anda terlibat dalam aktiviti keadaan tersebut?** 1. □ < 1 jam 2. □ 1- < 2 jam 3. □ 2- < 4 jam 4. □ ≥ 4 jam

5	**Dalam tempoh <u>7 hari yang lepas</u>, berapa kerapkah anda melibatkan diri dalam aktiviti sukan lasak atau riadah (cth: berjoging, mendaki bukit, bermain bola sepak, tenis perseorangan, menaiki tangga, tarian aerobik, berenang, berbasikal atau seumpamanya)?** 0. ☐ Tidak pernah **(Terus ke soalan 6)** 1. ☐ Jarang (1-2 hari) 2. ☐ kadang-kadang (3-4 hari) 3. ☐ Selalu (5-7 hari) **Apakah aktiviti-aktiviti ini? Senaraikan:** _____ _____ _____ **Secara purata, berapa <u>jam dalam sehari</u> anda terlibat dalam aktiviti keadaan tersebut?** 1. ☐ < 1 jam 2. ☐ 1- < 2 jam 3. ☐ 2- < 4 jam 4. ☐ ≥ 4 jam	
6	**Dalam tempoh <u>7 hari yang lepas</u>, berapa kerapkah anda melakukan senaman khusus untuk meningkatkan kekuatan otot dan daya tahan (cth: mengangkat berat, melakukan tekan tubi dan seumpamanya)?** 0. ☐ Tidak pernah **(Terus ke soalan 7)** 1. ☐ Jarang (1-2 hari) 2. ☐ kadang-kadang (3-4 hari) 3. ☐ Selalu (5-7 hari) **Apakah aktiviti-aktiviti ini? Senaraikan:** _____ _____ _____ **Secara purata, berapa <u>jam dalam sehari</u> anda terlibat dalam aktiviti keadaan tersebut?** 1. ☐ < 1 jam 2. ☐ 1- < 2 jam 3. ☐ 2- < 4 jam 4. ☐ ≥ 4 jam	
AKTIVITI KERJA RUMAH		
7	**Dalam tempoh <u>7 hari yang lepas</u>, adakah anda melakukan sebarang kerja rumah yang ringan (cth: mencuci pinggan mangkuk, menyapu lantai atau membersihkan debu)?**	0. ☐ Tidak 1. ☐ Ya

8	**Dalam tempoh 7 hari yang lepas, adakah anda melakukan sebarang kerja rumah yang berat (cth: menyental lantai, mengelap tingkap, memvakum)?**	0. □ Tidak 1. □ Ya
9a	**Dalam tempoh 7 hari yang lepas, adakah anda terlibat dalam aktiviti membaik pulih rumah (cth: mengecat rumah, memasang kertas dinding, kerja-kerja membaiki elektrik dan seumpamanya)?**	0. □ Tidak 1. □ Ya
9b	**Dalam tempoh 7 hari yang lepas, adakah anda terlibat dalam aktiviti penjagaan halaman rumah (cth: memotong rumput, membersihkan dedaun, memotong kayu, menanam bunga dan sebagainya)?**	0. □ Tidak 1. □ Ya
9c	**Dalam tempoh 7 hari yang lepas, adakah anda terlibat dalam aktiviti berkebun di luar rumah?**	0. □ Tidak 1. □ Ya
9d	**Dalam tempoh 7 hari yang lepas, adakah anda terlibat dalam penjagaan orang lain (cth: menjaga pasangan sendiri, kanak-kanak, atau orang dewasa lain)?**	0. □ Tidak 1. □ Ya
AKTIVITI BERKAITAN PEKERJAAN		
10	**Dalam tempoh 7 hari yang lepas, adakah anda bekerja secara bergaji atau sukarelawan?** 0. □ Tidak **(Soalan tamat)** 1. □ Ya **Berapa jam dalam seminggu anda bekerja secara makan gaji atau sukarelawan?** _____ jam **Antara kategori berikut yang manakah menerangkan dengan tepat jumlah aktiviti fizikal yang diperlukan di tempat kerja anda dan/ atau kerja sukarela anda?** 1. □ Kebanyakan waktu adalah duduk dengan melibatkan sedikit pergerakan tangan (pekerja pejabat, pembaiki jam, pekerja kilang yang bekerja sambal duduk, pemandu bas) 2. □ Duduk atau berdiri dengan sedikit pergerakan berjalan (juruwang, pekerja am pejabat, pekerja operasi jentera) 3. □ Berjalan dengan pengendalian bahan dengan berat kurang 23kg (posmen, pelayan restoran, pekerja binaan, pekerja operasi jentera dan alat berat) 4. □ Berjalan dan kerja manual yang berat sering memerlukan pengendalian bahan-bahan berat lebih 23kg (pembalak, tukang batu, pekerja lading, buruh am)	

BAHAGIAN D: STATUS KESIHATAN

ARAHAN: Sila tandakan [/] pada ruang jawapan yang disediakan

<table>
<tr><th colspan="2"></th><th>CATATAN</th></tr>
<tr><td>1.</td><td>ADAKAH PAKCIK/MAKCIK MEMPUNYAI PENYAKIT KRONIK ATAU AKUT YANG TELAH DISAHKAN OLEH DOKTOR? (Boleh ditanda lebih daripada satu)
<table>
<tr><th>Penyakit</th><th>Ya</th><th>Tidak</th><th>Preskripsi ubat</th></tr>
<tr><td>Kencing manis</td><td></td><td></td><td></td></tr>
<tr><td>Tekanan darah tinggi</td><td></td><td></td><td></td></tr>
<tr><td>Penyakit jantung</td><td></td><td></td><td></td></tr>
<tr><td>Sakit sendi (gout/atritis)</td><td></td><td></td><td></td></tr>
<tr><td>Penyakit salur penafasan (COPD, tibia atau asma)</td><td></td><td></td><td></td></tr>
<tr><td>Strok</td><td></td><td></td><td></td></tr>
<tr><td>Kegagalan buah pinggang</td><td></td><td></td><td></td></tr>
<tr><td>Lain – lain
Nyatakan:
_____</td><td></td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>2.</td><td>ADAKAH PAKCIK/MAKCIK MEMPUNYAI SEJARAH PATAH TULANG TEMPOH 6 BULAN YANG LEPAS?
0. ☐ Tidak 1. ☐ Ya
Sekiranya ya, sila nyatakan:
i) Bahagian kecederaan: _____
ii) Bulan/Tahun kecederaan berlaku: _____
iii) Punca kecederaan: _____</td><td></td></tr>
<tr><td>3.</td><td>ADAKAH PAKCIK/MAKCIK MEMPUNYAI SEJARAH PEMBEDAHAN DALAM TEMPOH 6 BULAN YANG LEPAS?
0. ☐ Tidak 1. ☐ Ya
Sekiranya ya, sila nyatakan:</td><td></td></tr>
</table>

	i) Bahagian pembedahan: _____ ii) Bulan/Tahun pembedahan dijalankan: _____ iii) Sebab pembedahan dijalankan: _____	
4.	**ADAKAH PAKCIK/MAKCIK MEMPUNYAI MASALAH PENGLIHATAN?** 1. ☐ Ya 2. ☐ Tidak	
5.	**ADAKAH PAKCIK/MAKCIK MEMPUNYAI MASALAH PENDENGARAN?** 1. ☐ Ya 2. ☐ Tidak	

BAHAGIAN E: RISIKO JATUH

SEGMEN I: SEJARAH JATUH

		Catatan
1.	**Pernah anda mengalami jatuh 6 bulan yang lalu? Jika pernah jatuh, berapa kali anda jatuh dalam 6 bulan yang lalu?**	☐ Tidak pernah ☐ 1 kali ☐ 2 kali ☐ ≥ 3 kali
2.	**Mengapakah anda jatuh?** _____ _____	
3.	**Adakah anda mengalami apa-apa kecederaan selepas jatuh?** _____ _____	

SEGMEN II: RISIKO JATUH

Berg Balance Scale (BBS), (Berg, Maki, Williams, Holliday, & Wood-Dauphinee, 1992; Tousignant et al., 2013)

ARAHAN: Sila tandakan [/] pada jawapan yang berkenaan

1	**DUDUK KE BERDIRI**

Arahan: Sila berdiri. Cuba untuk tidak gunakan tangan untuk sokongan.

0. □ Perlukan bantuan yang sederhana atau kuat untuk berdiri
1. □ Perlukan bantuan yang sedikit untuk berdiri atau stabil
2. □ Boleh berdiri menggunakan tangan selepas beberapa percubaan
3. □ Boleh berdiri sendiri dengan menggunakan tangan
4. □ Boleh berdiri tanpa menggunakan tangan dan stabil dengan sendiri

2	**BERDIRI TANPA SOKONGAN**

Arahan: Sila berdiri selama dua minit tanpa memegang sesuatu.

0. □ Tidak dapat berdiri selama 30 saat tanpa sokongan
1. □ Perlukan beberapa kali percubaan untuk berdiri selama 30 saat tanpa sokongan
2. □ Boleh berdiri selama 30 saat tanpa sokongan
3. □ Boleh berdiri selama 2 minit dengan pengawasan
4. □ Boleh berdiri dengan selamat selama 2 minit [Scores (4) in question no 4]

3	**BERDIRI KE DUDUK**

Arahan: Sila duduk.

0. □ Perlu bantuan untuk duduk
1. □ Duduk sendiri tetapi turun secara tidak terkawal

2. ☐ Menggunakan bahagian belakang kaki ke atas kerusi untuk mengawal penurunan.

3. ☐ Mengawal penurunan dengan menggunakan tangan

4. ☐ Duduk dengan selamat dengan menggunakan tangan secara minimum

4	**DUDUK DENGAN BAHAGIAN BELAKANG TANPA SOKONGAN TETAPI KAKI DISOKONG OLEH LANTAI ATAU BANGKU**

Arahan: Sila duduk dengan lengan bersilang selama 2 minit.

0. ☐ Tidak dapat duduk tanpa sokongan selama 10 saat

1. ☐ Boleh duduk selama 10 saat

2. ☐ Boleh duduk selama 30 saat

3. ☐ Boleh duduk selama 2 minit di bawah pengawasan

4. ☐ Boleh duduk dengan selamat dan stabil selama 2 minit

5	**PEMINDAHAN**

Arahan: Susun kerusi-kerusi untuk berpindah. Minta subjek berpindah sekali ke arah kerusi yang mempunyai tempat letak tangan dan sekali ke arah kerusi tanpa tempat letak tangan. Anda perlu menggunakan dua kerusi (satu dengan tempat letak tangan dan satu tanpa tempat letak tangan)

0. ☐ Perlukan dua orang untuk membantu dan mengawasi untuk keselamatan

1. ☐ Perlukan seorang untuk membantu

2. ☐ Boleh berpindah dengan arahan lisan dan/ atau pengawasan

3. ☐ Boleh berpindah dengan selamat menggunakan tangan

4. ☐ Boleh berpindah dengan selamat dengan sedikit menggunakan tangan

6	**BERDIRI TANPA SOKONGAN DENGAN MATA TERPEJAM**

Arahan: Sila tutup mata anda dan berdiri tegak selama 10 saat.

0. ☐ Perlu bantuan untuk mengelak dari terjatuh

1. ☐ Tidak dapat memejam mata selama 3 saat tetapi masih berdiri dengan selamat

2. ☐ Boleh berdiri selama 3 saat

3. ☐ Boleh berdiri selama 10 saat dengan pengawasan

4. ☐ Boleh berdiri selama 10 saat dengan selamat

7	**BERDIRI TANPA SOKONGAN DENGAN MERAPATKAN KAKI**

Arahan: Rapatkan kaki anda dan berdiri tanpa memegang sesuatu.

0. ☐ Perlukan bantuan untuk mengekalkan posisi dan tidak dapat kekal selama 15 saat

1. ☐ Perlukan bantuan untuk mengekalkan posisi tetapi boleh berdiri selama 15 saat dengan merapatkan kaki

2. ☐ Boleh merapatkan kaki dengan sendiri tetapi tidak dapat kekal selama 30 saat

3. ☐ Boleh merapatkan kaki dengan sendiri dan berdiri selama 1 minit dengan pengawasan

4. ☐ Boleh merapatkan kaki dengan sendiri dan berdiri selama 1 minit dengan selamat

8	**CAPAI KE HADAPAN DENGAN LENGAN TERENTANG SEMASA BERDIRI**

Arahan: Angkat lengan sehingga 90 darjah. Rentangkan jari anda dan capai ke hadapan sejauh yang anda boleh.

Nota untuk penyelidik: *Penilai meletakkan satu pembaris pada hujung jari apabila lengan pada 90 darjah. Jari sepatutnya tidak menyentuh pembaris apabila mencapai ke hadapan. Ukuran yang direkodkan adalah jarak ke hadapan yang jari-jari itu capai apabila subjek dalam posisi yang paling ke hadapan. Jika boleh, minta subjek untuk menggunakan kedua-dua lengan apabila mencapai untuk mengelakkan terseliuh tulang belakang badan.*

0. ☐ Hilang keseimbangan apabila mencuba/ memerlukan sokongan luar

1. ☐ Capai ke hadapan tetapi memerlukan pengawasan

2. ☐ Boleh mencapai ke hadapan 5 cm (2 inci)

3. ☐ Boleh mencapai ke hadapan 12 cm (5 inci)

4. ☐ Boleh mencapai ke hadapan 25 cm (10 inci)

9	MENGAMBIL OBJEK DARI LANTAI DARI POSISI BERDIRI

Arahan: Ambil botol yang berada di hadapan kaki anda

0. ☐ Tidak dapat untuk mencuba/ perlukan bantuan bagi mengelakkan ketidakstabilan atau terjatuh
1. ☐ Tidak dapat mengambil dan perlukan pengawasan semasa mencuba
2. ☐ Tidak dapat mengambil tetapi menghampiri 2-5 cm (1-2 inci) dari botol dan mengekalkan keseimbangan dengan sendiri
3. ☐ Boleh mengambil botol tetapi perlukan pengawasan
4. ☐ Boleh mengambil botol dengan selamat dan mudah

10	BERPUSING UNTUK MELIHAT BELAKANG MELEPASI BAHU KIRI DAN KANAN SEMASA BERDIRI

Arahan: Pusing untuk melihat belakang anda melepasi bahu kiri. Ulang dengan sebelah kanan.

Nota untuk penyelidik: *Penilai boleh mengambil satu objek untuk dilihat secara terus di belakang subjek untuk menggalakkan pusingan yang lebih baik.*

0. ☐ Perlu bantuan untuk mengelak daripada ketidakseimbangan atau terjatuh
1. ☐ Perlu pengawasan apabila berpusing
2. ☐ Berpusing pada sisi sahaja tetapi mengekalkan keseimbangan
3. ☐ Melihat belakang pada sebelah sahaja, sebelah lagi menunjukkan kurang pertukaran berat
4. ☐ Melihat belakang dari kedua-dua belah dan pertukaran berat adalah baik

11	BERPUSING 360 DARJAH

Arahan: Pusing dalam satu bulatan lengkap. Berhenti seketika. Kemudian pusing dalam satu bulatan lengkap dalam arah yang satu lagi.

0. ☐ Perlukan bantuan apabila berpusing
1. ☐ Perlukan pengawasan yang rapat atau bantuan lisan.
2. ☐ Boleh berpusing 360 darjah dengan selamat tetapi perlahan
3. ☐ Boleh berpusing 360 darjah dengan selamat pada satu arah selama hanya 4 saat atau kurang
4. ☐ Boleh berpusing 360 darjah dengan selamat selama 4 saat atau kurang

12	**MELETAKKAN KAKI SECARA BERSELANG-SELI DI ATAS TANGGA ATAU BANGKU SEMASA BERDIRI TANPA SOKONGAN**

Arahan: Letakkan satu kaki secara berselang-seli di atas tangga/ bangku. Teruskan sehingga satu kaki mencecah tangga/ bangku sebanyak 4 kali.

0. ☐ Perlukan bantuan untuk mengelak daripada jatuh/ tidak dapat mencuba
1. ☐ Boleh menghabiskan >2 langkah, perlukan sedikit bantuan
2. ☐ Boleh menghabiskan 4 langkah tanpa bantuan dengan pengawasan
3. ☐ Boleh berdiri dengan sendiri dan menghabiskan 8 langkah dalam masa > 20 saat
4. ☐ Boleh berdiri dengan sendiri dan selamat dan menghabiskan 8 langkah dalam masa 20 saat

13	**BERDIRI TANPA SOKONGAN DENGAN SATU KAKI DI HADAPAN**

Arahan: Letakkan satu kaki betul-betul di hadapan satu kaki lagi. Jika anda rasa anda tidak dapat meletakkan kaki betul-betul di hadapan satu kaki lagi, cuba untuk melangkah sejauh yang boleh ke hadapan, yang mana tumit kaki hadapan anda melepasi kaki yang sebelah lagi.

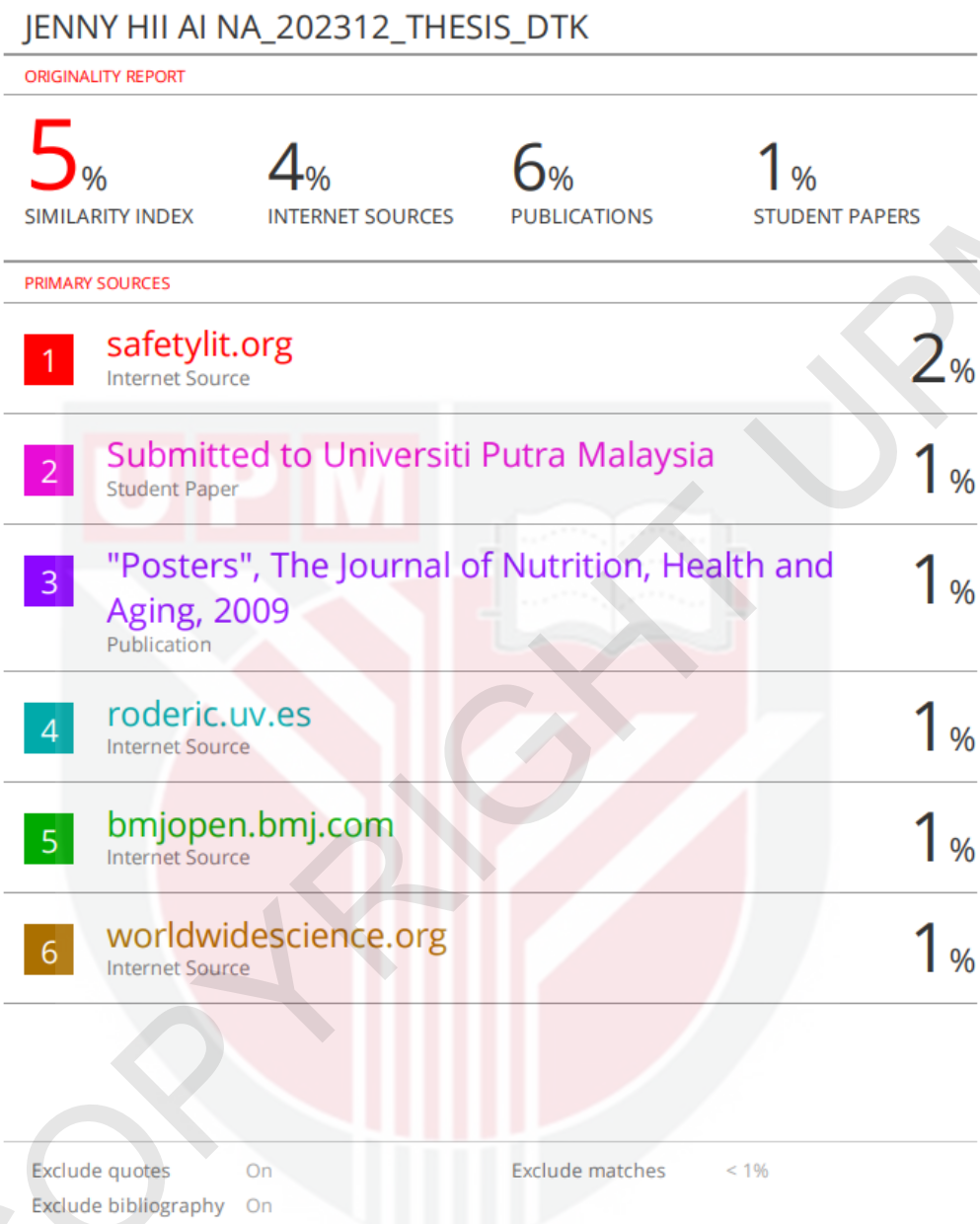
Nota untuk penyelidik: *Untuk skor 3 poin, panjang langkah perlu melepasi panjang kaki yg sebelah lagi dan lebar jarak itu perlu lebih kurang lebar langkah normal subjek.*

0. ☐ Hilang keseinbangan ketika melangkah atau berdiri

1. □ Perlu bantuan untuk melangkah tetapi boleh bertahan selama 15 saat 2. □ Boleh melangkah sedikit dengan sendiri dan bertahan selama 30 saat 3. □ Boleh meletakkan kaki di hadapan dengan sendiri dan bertahan selama 30 saat 4. □ Boleh meletakkan tapak kaki dengan sendiri dan bertahan selama 30 saat	
14	**BERDIRI ATAS SATU KAKI**
Arahan: Berdiri atas satu kaki selama mana yang anda boleh tanpa memegang sesuatu. 0. □ Tidak dapat mencuba atau memerlukan bantuan untuk mengelak dari terjatuh 1. □ Cuba untuk mengangkat kaki, tidak dapat bertahan selama 3 saat tetapi kekal berdiri dengan sendiri 2. □ Boleh mengangkat kaki dengan sendiri dan bertahan selama ≥ 3 saat 3. □ Boleh mengangkat kaki dengan sendiri dan bertahan selama 5-10 saat 4. □ Boleh mengangkat kaki dengan sendiri dan bertahan selama >10 saat	
Jumlah skor BBS	**/ 56**
BBS scale score: < 45 = Risiko jatuh ≥ 45 = Normal	

---------- End of questionnaire / *Soalan Tamat*----------

Appendix E Plagiarism Report



JENNY HII AI NA_202312_THESIS_DTK

ORIGINALITY REPORT

5%	4%	6%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	safetylit.org Internet Source	2%
2	Submitted to Universiti Putra Malaysia Student Paper	1%
3	"Posters", The Journal of Nutrition, Health and Aging, 2009 Publication	1%
4	roderic.uv.es Internet Source	1%
5	bmjopen.bmj.com Internet Source	1%
6	worldwidescience.org Internet Source	1%

Exclude quotes On
Exclude bibliography On
Exclude matches < 1%