PREVALENCE OF FALLS AND ITS ASSOCIATED FACTORS AMONG ELDERLY IN KOTA BHARU, KELANTAN: RESULTS FROM THE ELDERLY HEALTH SCREENING PROGRAM

By

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ADL	Activity daily living
BI	Barthel Index
BMI	Body mass index
BSSK	'Borang Saringan Status Kesihatan'
CI	Confident interval
FOF	Fear of falling
TUG	Timed up and go test

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ABSTRAK

PREVALEN JATUH DAN FAKTOR-FAKTOR YANG MEMPENGARUHINYA DALAM KALANGAN WARGA EMAS DI KOTA BHARU, KELANTAN: PEROLEHAN DARIPADA PROGRAM SARINGAN STATUS KESIHATAN WARGA EMAS.

Terdapat peningkatan populasi warga emas di hampir semua negara di dunia termasuk Malaysia. Prevalens warga emas yang obesiti juga semakin meningkat. Kejadian jatuh dalam kalangan warga emas boleh menyebabkan mortaliti, morbiditi dan juga menjadi beban ekonomi. Objektif kajian hirisan lintang ini adalah untuk menentukan prevalen jatuh dan faktor-faktor yang mempengaruhinya termasuk indeks jisim badan dalam kalangan warga emas yang terlibat dalam program saringan kesihatan daripada Januari sehingga Disember 2014 di daerah Kota Bharu, Kelantan. Data diperolehi daripada Borang Saringan Status Kesihatan (BSSK) Warga Emas di semua klinik kesihatan kerajaan di Kota Bharu. Terdapat 434 warga emas yang menepati ciri-ciri kajian. Persampelan keseluruhan populasi digunakan dalam kajian ini. Kaedah deskriptif dan regresi logistik berganda telah digunakan untuk menjawab objektif kajian. Kajian ini menunjukkan prevalen jatuh dalam kalangan warga emas yang terlibat dalam program saringan kesihatan adalah 23.3% (95% CI 0.19, 0.27). Kajian ini menunjukkan obesiti dalam kalangan warga emas mempengaruhi kejadian jatuh (OR adj 2.55, 95% CI: 1.15, 5.68; p= 0.021). Faktor-faktor lain yang mempengaruhi kejadian jatuh adalah warga emas berumur 80 tahun dan ke atas (OR adj 36.14, 95% CI: 9.06, 144,13; p<0.001), wanita (OR adj 0.48, 95% CI: 0.25, 0.93; p= 0.030), masih bekerja (OR adj 0.05, 95% CI: 0.07, 0.29; p=0.001), pening (OR adj 6.90, 95% CI: 1.36, 35.06; p=0.020), ketidakseimbangan

(OR adj 11.65, 95% CI: 3,65, 37.20; p<0.001), pengambilan empat atau lebih jenis ubatan (OR adj 4.18, 95% CI: 1.46, 12.00; p=0.008) dan ukur lilit pinggang yang tinggi (OR adj 2.42, 95% CI: 1.22, 4.80; p=0.011). Kajian ini menunjukkan prevalen jatuh masih menjadi isu yang signifikan dan intervensi haruslah dijalankan bagi menangani faktor-faktor yang mempengaruhinya, terutama obesiti.

Kata Kunci : Warga emas, Jatuh, Faktor yang Mempengaruhi, Obesiti

ABSTRACT

PREVALENCE OF FALLS AND ITS ASSOCIATED FACTORS AMONG ELDERLY IN KOTA BHARU, KELANTAN: RESULTS FROM THE ELDERLY HEALTH SCREENING PROGRAM.

Population ageing is taking place globally including in Malaysia. Prevalence of obesity among the elderly is also increasing worldwide. Falls among the elderly lead to morbidity, mortality and is also an economic burden. The aim of this cross sectional study was to determine the prevalence of falls among the elderly and its associated factors especially of body mass index factor among elderly who participated in a health screening program between January and December 2014 in Kota Bharu, Kelantan. Data were obtained from the health screening form from all government health clinics in Kota Bharu. There were 434 elderly who fulfilled the inclusion and exclusion criteria. A whole population sampling was employed. The descriptive and multiple logistic regression was applied to answer the objectives of the study. The results showed that the prevalence of falls among elderly who participated in the health screening program was 23.3% (95% CI 0.19, 0.27). This study demonstrated that falls was associated with obesity (OR adj 2.55, 95% CI: 1.15, 5.68; p= 0.021). Other significant associated factors of falls were age more than 80 years old (OR adj 36.14, 95% CI: 9.06, 144,13; p<0.001), being female (OR adj 0.48, 95% CI: 0.25, 0.93; p= 0.030), being employed (OR adj 0.05, 95% CI: 0.07, 0.29; p=0.001), symptoms of dizziness (OR adj 6.90, 95% CI: 1.36, 35.06; p=0.020) imbalance and instability (OR adj 11.65, 95% CI: 3,65, 37.20; p<0.001), polypharmacy (OR adj 4.18, 95% CI: 1.46, 12.00 ; p=0.008) and high waist

circumference (OR adj 2.42, 95% CI: 1.22, 4.80; *p*=0.011). This study demonstrated that the prevalence of falls among elderly is still an issue and its associated factors especially obesity should be intervened.

Key words: Elderly, Falls, Risk Factor, Obesity

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Population ageing is taking place in all countries of the world. United Nation defines elderly as those who age 60 years and above based on the chronological context (World Health Organization, 1989). In the Malaysia National Policy for the Elderly, the elderly were also defined chronologically as those aged 60 years old and above, adapting from the World Assembly on Ageing in Vienna in 1982 (Ministry of Women, Family and Community Development). One of the contributory factors to population ageing is the advancement of medicine resulting in increased life expectancy. According to the World Health Statistics (2014), the average life expectancy for a female infant in 2012 was approximately 73 years and for a male infant, it was approximately 68 years. This was six years longer than the average global life expectancy for an infant born in 1990. The life expectancy at birth in Malaysia has also increased from 70.4 years in 2002 to 72.5 years in 2014 for males, and 75.3 years to 77.2 years for females (Department of Statistic Malaysia, 2014).

According to the World Population Ageing 2013 Report, the global elderly population has increased from 9.2% in 1990 to 11.7% in 2013, and will continue to increase to 21.1% by 2050. The oldest old, defined as those aged 80 years old and above, currently makes up 14% of world elderly population and is estimated to increase to 19% in 2050. Currently, it is estimated that two third of the world older person live in developing countries. By 2047, the elderly population is projected to exceed the children's population for the first time (United Nations, 2013).

The elderly population in Malaysia is following the world trend. In 1970, approximately 5.7% of Malaysia's population were 60 years and above, and this is expected to rise to 9.8% by year 2020 (Karim, 1997). By the year 2040, the elderly population is projected to increase more than three folds from the 2010 figure, as shown in Figure 1.1. Malaysia will have an ageing population by 2021 when the population aged 60 years and over reach 7.1% of the population (Department of Statistic, 2012).

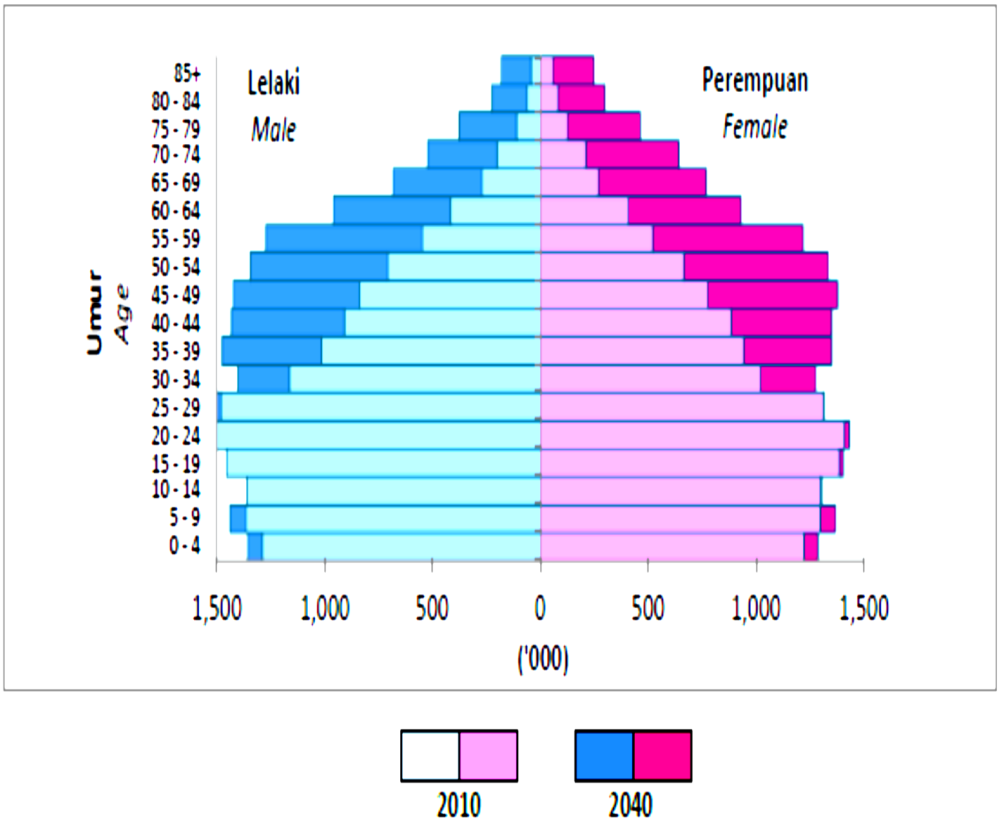

Figure 1.1: Malaysia Population Pyramid, 2010 and 2040 (Adapted from Population Projection of Malaysia 2010-2040, Department of Statistic, Malaysia, 2012, page 9, chart 2)

In terms of ethnic breakdown, the number of elderly will be higher among the Chinese followed by the Indian and Bumiputra. This is not in line with the current ethnic demography breakdown where the majority is Bumiputra followed by Chinese and Indian, thus suggesting differences in ethnic health status. Selvaratnam and Tin (2007) suggested that this may be due to differences in lifestyle and health practices such as food consumption, consuming health supplement and pattern of exercise. In Kelantan, 8.8% of population were made up of elderly in 2010 with 30% of the elderly living in the Kota Bharu area (Department of Statistic, 2010).

The elderly are recognized for their rich skills and experience. Some of them may still able to contribute to their family, society and nation. A changing social structure of modern Malaysian society also sees the elderly living independent of their children. However, some elderly with disability and chronic illness are not receiving adequate assistance with regards to daily activity which in turn may increase their risk of falls (Momtaz *et al.*, 2012). This group should be identified and supported with better community-based services.

Ageing is a natural phenomenon in which the body fails to maintain and preserve the normal structure and function of tissues and cells (Holliday, 1997). For example, failure to maintain neuron cells leads to dementia while failure to maintain bone structure leads to osteoporosis. This ageing process is due to a lifelong accumulation of molecular damage and increase in the fraction of cells carrying these defects. Age-related frailty, disability and disease are consequences of interferences of performance and functional reserves of tissue and organs by these defects. These might also be worsened by factors such as stress, adverse environment, poor nutrition, life style and socioeconomic status (Kirkwood, 2008).

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Ageing is also associated with fat redistribution and accumulation. Studies have also shown ageing affects the body fat-muscle composition with increase in fat mass and decrease in muscle mass. The body fat distribution is also affected by increased in visceral abdominal fat and waist circumference (Zamboni *et al.*, 2005). The condition of excess fat in the body is also called obesity. Although the definition of obesity is still debatable, the body mass index (BMI) is well accepted and used to measure obesity (Elia, 2001; Zamboni *et al.*, 2005). Excess amount of fat storage is associated with elevated health problem in the elderly such as diabetes and coronary heart disease.

Besides chronic diseases, acute condition such as injuries due to trauma has also been associated with high morbidity and mortality among the elderly. Falls-related deaths are the common cause of mortality among the elderly. A study in Malaysia showed that 37% of elderly who experienced falls sustained fracture, 37% sustained soft tissue injury and 25% had head injuries (Tan *et al.*, 2015). The same study also showed that mortality rates at five and 10 years of those who fell were 49% and 80% respectively.

The pattern of morbidity among the elderly can be divided into three categories: i) progressive illness such as cancer and Alzheimer, ii) catastrophic event such as hip fracture and stroke and, iii) minor changes in activity of daily living due to acute minor illness and stress such as restricted movement (Vellas *et al.*, 1992). According to the National Cancer Patient Registration, 58% of patients with colon rectal cancer 2008-2013 were elderly (Muhammad Radzi Abu Hassan, 2014). For degenerative neuron disease, a nationwide study showed prevalence of dementia was 14.3% among the elderly and it is associated with the increased of age (Hamid *et al.*, 2010).

Apart from progressive illness, catastrophic events and minor changes among the elderly might change their functional level and independence. One of the geriatric health issues is injuries due to falls which might lead to both catastrophic events and minor changes.

Falls is not a normal ageing process. Falls is defined as *inadvertently coming to rest on the ground, floor or other lower level, excluding unintentional change in the position to rest in furniture, wall or other things* (World Health Organization, 2007). It is estimated that about 30-40% of elderly will fall at least once (Ambrose *et al.*, 2013). Of those elderly who either experienced falls, one fifth will sustain two or more injuries (Clemson *et al.*, 2014) consequently leading to morbidity and mortality. Falls in the elderly is the most common unintentional injury and also the fifth leading cause of death among the elderly in the United States (Fjeldstad *et al.*, 2008). The risk of injury due to falls is higher among the older elderly as compared to those of younger age group elderly (Soriano *et al.*, 2007)

Falls may result in three types of consequences: physical, functional and seeking health or medical services. After a fall, almost 70% of the elderly suffered from physical injury, one-quarter sought health and medical treatment, and more than one-third had decline in physical function (Stel *et al.*, 2004). In Malaysia, the most common cause of physical injuries among the elderly is fall, which leads to hospital admissions and dependency on others for daily activities. Of those who fell, 13% of injured elderly were admitted to the hospital and 30% of them have limited ability to perform daily activities (Lim *et al.*, 2013). Another study in Malaysia showed that 40-60% of elderlies who fell end up with physical injuries. Most of the elderly who fell down develops dependency and had lower Barthel Index after one year (Tan *et*

al., 2015). Around 1% of falls among elderly resulted in hip fracture which might lead to morbidity and mortality (Rizawati and Mas Ayu, 2012).

After a fall, 13.7% of the elderly developed fear of falling (FOF). A majority of them do not revert back to non FOF (Clemson *et al.*, 2014). The FOF is a consequence of psychological trauma of the fall, leading to a reduced activity and subsequent loss in physical capabilities (Legters, 2002). This has a negative cycle where FOF leads to inactivity and decreased strength, agility and poor balance which further exacerbate occurrence of fall (Soriano *et al.*, 2007).

Falls not only lead to morbidity and mortality but is also an economic burden to the elderly. For each episode of fall, the economic burden of injuries due to falls are increasing in the United States with an estimated US$ 17,483 spent for hospitalisation, US$ 236 spent for emergency department treatment and US$412 spent for outpatient treatment (Roudsari *et al.*, 2005). With higher morbidity due to falls, the elderly may also require more medication, treatment and regular medical follow up. This may add further financial burden on the elderly in Malaysia where most of them already live below the poverty line (Selvaratnam and Tin, 2007).

Falls is preventable and some effective intervention should be applied to reduce this burden. It is often believed that falls is a part of ageing process hence the elderly may neglect to report the event. In addition, elderly may not be aware of the risk factors of falls. Therefore, there may be missed opportunities for fall prevention if there is no screening program for falls among the elderly (Soriano *et al.*, 2007). Screening programmes allow for early detection and interventions to be put in place in the prevention of falls (Bueno-Cavanillas *et al.*, 2000).

In 2008, the Ministry of Health of Malaysia introduced a screening program for the elderly aiming at providing early detection of age-related medical and mental

illnesses. The screening program is offered in all primary health clinics in Malaysia. Regular medical check-ups can help determine the health status of an elderly (Selvaratnam *et al.*, 2012). In addition, physiotherapy and occupational therapy services have also been added in primary health care in order to meet the need of the elderly population, especially regarding falls prevention.

1.2 Rationale of Study

Malaysia is undergoing an epidemiological transition. The transition has resulted in an increase in the elderly population and with it, burden of chronic diseases. Falls in the elderly is an acute condition which is usually due to existing conditions associated with ageing. This may add to the long term chronic conditions of the elderly, thus limiting their quality of life and physical health. The prevalence of obesity has also increased among elderly in the world in general, and specifically, in Malaysia. Obesity is also a risk factor for both chronic diseases and fall.

Falls is a preventable condition in the majority of cases. An aspect of falls which has received little attention in Malaysia is the association of falls with overweight and obesity among the elderly. Therefore there is a need to embark on a study to ascertain the factors which may influence falls in elderly with weight issues.

CHAPTER TWO

LITERATURE REVIEW

2.1 Prevalence of Fall among the Elderly

Falls is a unique geriatric syndrome and a health problem. Physiological and pathological changes in ageing increase the risk to fall. A study among Malaysians elderly by Azhar and Yusof (2013) showed that 76% of the elderly have high risk of falls. Falls may cause significant morbidity and mortality.

Prevalence of falls among the elderly varies from 14.1% to 50.5% (Azidah *et al.*, 2012; Bergland and Wyller, 2004; Bueno-Cavanillas *et al.*, 2000; Chu *et al.*, 2005; Lin *et al.*, 2014; Rizawati and Mas Ayu, 2012; Sazlina *et al.*, 2008; Soriano *et al.*, 2007). In Malaysia, a study by Azidah *et al.*, (2012) found that the elderly in a diabetic clinic in a tertiary hospital showed a lower prevalence of falls (18.8%) as compared to the study by Sazlina *et al.*, (2008) which was carried out in a primary care clinic of a tertiary hospital with a prevalence of 47%. However, a study by Rizawati and Mas Ayu (2012) found that in the community, a lower prevalence of falls among elderly (27.3%) when compared to studies in clinical settings. When comparing the prevalence of fall among elderly who came to hospitals, prevalence of falls among the elderly in Malaysia was higher than those in Taiwan (36%) (Lin *et al.*, 2014). The prevalence of falls among the elderly in the community may varies, ranging from 14.1% in Hong Kong (Chu *et al.*, 2005), to 27.3% in Malaysia and 50.5% in Norway (Bergland and Wyller, 2004). The lowest prevalence of falls reported was among the Chinese community in Hong Kong. The study was a prospective cohort study and recall bias was minimized. The higher prevalence reported by Bergland and Wyller (2004) was due to the study population selected

where by only women aged 75 years old and above were selected. However, a cross-sectional study among those 90 years old and above showed that the prevalence of falls was 45.7% (Formiga *et al.,* 2008). A study in Spain also showed high prevalence of falls (37.9%), but this study was conducted in an institutional centre (Bueno-Cavanillas *et al.*, 2000). Occurrences of falls in institutional were three times higher than falls among community dwelling (Ambrose *et al.*, 2013).

Types of study designs may influence the reported prevalence, depending on the reliability and recall bias in giving information regarding experience of falls among the elderly. Muir *et al.*, (2012) suggested that falls among the elderly may be under-reported thus giving a lower prevalence. What is reported may well be just the tip of the iceberg. Information from spouse and other family members might also help in minimizing the recall bias.

2.2 Factors Associated with Falls among the Elderly

Falls among the elderly are often multifactorial and involve complex interactions between individuals and their environment. The risk factors for falls can be divided into intrinsic and extrinsic factors. Intrinsic factors are those relating to characteristics of the person which may lead to impaired stability such as age, gender, chronic disease, mental illness, sensory impairment, physical disability and symptoms such as dizziness. Obesity has also been suggested as an intrinsic factor (Fjeldstad *et al.*, 2008; Himes and Reynolds, 2012). A study in Malaysia showed fall among the elderly were mostly associated with intrinsic factors rather than extrinsic factors (Azhar and Yusof, 2013). This was further supported by other studies which showed that an increased age, female gender, medical illness such as diabetes mellitus and arthritis, medications and impaired sensory were associated with fall

among the elderly (Azidah *et al.*, 2012; Sazlina *et al.*, 2008). Central nervous system medications such sedatives, anti depressants and anxiolytics, glucose lowering agents and cardiovascular agents have all been associated with higher risk of falls among the elderly (Kuschel *et al.*, 2014; Soriano *et al.*, 2007). Mental illness such as depression and sleeping disorder were also some of the intrinsic factors of fall among the elderly (Clemson *et al.*, 2014; Lin *et al.*, 2014).

Extrinsic factors are situational risk of the host, activity and physical environment that are present at the time of fall such as slippery surfaces, stumbling and external forces. A study by Bueno-Cavanillas et al., (2000) which was carried out among the elderly in institutions in Spain showed that falls due to extrinsic factors were more common than intrinsic factors. Slipping, uneven floor surface, external force (such as being pushed) and insufficient illuminations were the most common causes of extrinsic factors.

2.2.1 Sociodemographic Factors

Occurrences of falls and injuries as a consequence of falls are associated with increasing age due to the decline of several physiological and pathological changes (Ambrose *et al.*, 2013). Multiple studies reported falls was associated with increased age (Azhar and Yusof, 2013; Azidah *et al.*, 2012; Bueno-Cavanillas *et al.*, 2000; Clemson *et al.*, 2014; Mitchell *et al.*, 2014b). The elderly has impaired balance which increased the risk of falls (Lin *et al.*, 2014). A study in Florida suggested that cut-offs near age 77 might be important for identifying higher and lower risk groups for falls among the elderly (Yamashita *et al.*, 2012). However, some studies have shown that age was not associated with risk of falls (Hu *et al.*, 2015; Sazlina *et al.*, 2008; Stahl and Albert, 2015; Taylor *et al.*, 2012). Although the mean age difference

was not statistically significant, mean age for elderly who falls was higher than non-falls except for study by Sazlina et al. (2008), where the mean age for falls was 69.77 and mean age for non falls group was 70.04.

The older population is predominantly female because they tend to live longer than male. In 2013, globally, the ratio of male to female are 85:100 at the age group 60 years or over, and 61:100 at the age group 80 years or over (United Nations, 2013). In many studies, elderly women risk of falls was higher as compared to men (Azhar and Yusof, 2013; Azidah *et al.*, 2012; Bueno-Cavanillas *et al.*, 2000; Yamashita *et al.*, 2012). However there are still some studies that reported no significant difference in the risk of falls between men and women (Rizawati and Mas Ayu, 2012; Sazlina *et al.*, 2008; Stahl and Albert, 2015). Risk of falls between different genders was not confirmed in both studies by Sazlina *et al.* (2008) and Rizawati and Mas Ayu (2012) because the numbers of male in the studies were relatively small. No studies have reported that men have higher risk of falls as compared to women. Although women have higher risk than men for non fatal injury, men are at higher risk of death related to falls (Ambrose *et al.*, 2013).

Several studies in western countries have reported the association between ethnicity and the risk of falls among the elderly. Caucasians have a higher risk of falls which is 28% higher as compared to the African American (Himes and Reynolds, 2012). However, this contradicts the study by Yamashita *et al.* (2012) that showed no significant association between ethnicity and falls among the elderly. A study in Australia showed that non-English, non-Australian or non-European backgrounds are predictors of fear of falling (Clemson *et al.*, 2014). In Malaysia, the reported proportions of falls for each race were 25% for Malay, 48% for Chinese and 54% for Indians (Rizawati and Mas Ayu, 2012) with no significant association

between ethnicity and falls among the elderly (Rizawati and Mas Ayu, 2012; Sazlina *et al.*, 2008).

Many elderly still have to work and earn a living, especially in developing countries. In 2010, around 31% of the elderly in less developed countries and 8% of elderly in more developed countries were involved in the labour force. Despite their numbers, men were the majority of the total labour force among the elderly (United Nations, 2013). There are only limited studies that discussed on association between occupational status and falls; those that do concentrated on the association between income, education status with falls among the elderly. There were no association between income and fall (Rizawati and Mas Ayu, 2012). Education levels have been associated with falls among the elderly. A lower level of education was associated with falls and also frequency of falls (Hu *et al.*, 2015; Stahl and Albert, 2015) through one's health literacy level. Among community-dwelling older adults, inadequate health literacy is a risk factor for poorer physical and mental health through understanding risks association for health (Wolf *et al.*, 2005).

2.2.2 Medical and Mental Illness

Medical and chronic conditions are the most common risk factors for falls among the elderly. Chronic illnesses are the most common morbidity (48%) among the elderly in Malaysia. They are prone to get one or more chronic diseases because of the physiological and pathological changes caused by ageing. Elderly with medical disease have ten times higher risk of falls as compared to those with no medical disease (Azhar and Yusof, 2013). In addition, elderly might also be affected by multiple chronic illnesses such as diabetes, hypertension and coronary heart disease (Ambigga *et al.*, 2011). The numbers of chronic diseases that affect the

elderly are also associated with the risk of falls. Previous studies showed the risk of falls increase with the number of diseases (Hu *et al.*, 2015; Stahl and Albert, 2015). However, a study in a tertiary hospital primary care clinic in the urban area in Malaysia with a relatively smaller sample size reported that there was no significant association between falls and the number of medical disease (Sazlina *et al.*, 2008). Majority of the sample in this study had chronic diseases.

Among elderly with medical disease, those with diabetes mellitus have the higher risk of fall (Bueno-Cavanillas *et al.*, 2000). Complications such as retinopathy, neuropathy, orthostatic hypotension, diabetic foot and hypoglycemia have been associated with fall among diabetic elderly (Azidah *et al.*, 2012; Malabu *et al.*, 2014). These conditions might lead to imbalance and poor gait. Elderly with diabetic are also at risk of fracture after a fall due to lower bone quality (Malabu *et al.*, 2014). Azidah *et al.* (2012) found that level of fasting blood sugar and HbA1c in those who fell were lower than those who did not fall, but they were not the important factor associated with falling.

Besides diabetes, heart disease has also been suggested as one of the associated factors of falls among the elderly (Mitchell *et al.*, 2014b). A prospective cohort study among cognitively impaired elderly found cardiac arrhythmias and lower limbs claudication were significantly associated with falls (Taylor *et al.*, 2012). This is also supported by another study in an emergency department which showed that atrial fibrillation is an independent risk factor for non accidental fall among the elderly (Sanders *et al., 2012).* The underlying mechanisms may be due to the decrease of cardiac output, co-existing sinus-nodes disease and impaired baro-reflex among patient with arrhythmias (Ambrose *et al.*, 2013).

Hypertension is another factor which may contribute to the risk of falls among the elderly (Ambrose *et al.,* 2013). A case control study shows that elderly with hypertension have poorer gait stability and poorer postural control as compared to normotensive elderly (Hausdorff *et al.,* 2003). Problems with postural control and instability may lead to falls. The same study also noted that people with hypertension have blood pressure regulation impairment leading to transient reduction in blood pressure and increased risk of falls.

Osteoarthritis is a chronic condition due to breaking down of cartilage. This leads the bones to rub against each other and lead to joint stiffness and pain. Hip and knee osteoarthritis are the important factor of lower limbs disability and postural instability among the elderly. Thus, they face a higher risk for falling (Khalaj *et al.,* 2014). A case control study among patient with knee osteoarthritis found that there are differences in stability and balance (Piva *et al.,* 2004).

A study in Australia reported that there is an association between arthritis and falls among the elderly (Mitchell *et al.,* 2014b). Two cross sectional studies in Malaysia previously showed that a minority of elderly with osteoarthritis also experienced falls (Rizawati and Mas Ayu, 2012; Sazlina *et al.,* 2008). The studies in Malaysia only took sample from patients with lower limbs osteoarthritis as compared to the Australian study which looked at all arthritis types.

Depression is a co-morbidity of chronic diseases. A study in an outpatient clinic in Malaysia reported that 14% were found to have depression (Imran *et al.,* 2009). The prevalence of depression was higher in elderly with chronic diseases as compared to the elderly without chronic diseases (Mohd Sidik *et al.,* 2003). Depression might be associated with falls among the elderly through the direct effect, or mediated by, chronic illness, psychotrophic medications or cognitive decline (Lin

et al., 2014). Elderly with depression may have impaired executive function and poor balance (Clemson *et al.*, 2014). Rizawati and Mas Ayu (2012) reported that the elderly with depressive symptoms has significant risk factor for falls in contrast to non-depressed elderly. The result was also consistent with other studies (Bueno-Cavanillas *et al.*, 2000; Clemson *et al.*, 2014; Stahl and Albert, 2015). However, most of the studies looked at depressive symptoms or mood rather than diagnosis of major depressive disorder. Clemson *et al.*, (2014) had suggested that there is a need to screen for depressive symptoms of all elderly that had experienced fall episodes.

The role of cognitive impairment such as dementia as a risk of falls is understood. The sensory and motor systems are connected by the higher order cortical process, which is necessary for planning movement, attention, problem solving and responding to changes and challenges within the environment (Ambrose *et al.*, 2013). A cross sectional study in Malaysia showed the prevalence of falls among elderly with dementia was 17% (Eshkoor *et al.*, 2014). Other studies reported that dementia is a risk factor of falls (Bueno-Cavanillas *et al.*, 2000; Hu *et al.*, 2015). A meta-analysis of 27 studies identified risk of falls increased by 20% for every point decrease in the Mini Mental State Exam (Muir *et al.*, 2012). Falls among cognitively impaired elderly are still under diagnosed and under reported due to the nature of dementia itself (Muir *et al.*, 2012). However, this contradicts a study by Otaki *et al* (2014) which showed that a high concordance rate (0.84) for patient's memories of falling.

Studies have also shown that there is a relationship between vestibular dysfunction and falls (Kristinsdottir *et al.*, 2000; Kristinsdottir *et al.*, 2001). Vestibular dysfunction is due to attrition of neural and sensory hair cell. Postural instability and a broad-based, staggering gait pattern with unstable turn are

characteristic of vestibular dysfunction (Ambrose *et al.*, 2013). In most of the studies, impaired vestibular functions was the most common cause of dizziness and vertigo in elderly and often results in impairment of posture and gait (Iwasaki and Yamasoba, 2015).

2.2.3 Medications

Medications are known to be one of the risk factors of falls. Not only do the types of medication play a role, but even the numbers or combination of medications may have an effect on the elderly falling. Polypharmacy is defined as the usage of multiple medications, even when defined according to the number of medications, no consensus exists how polypharmacy being categorised (Fried *et al.*, 2014). However Azidah *et al* (2012) and Rizawati and Mas Ayu (2012) have categorised polypharmacy as "use of four or more types of medications". The association between medications and falls is divided between specific drugs which can cause falls versus polypharmacy. Previous studies suggested that polypharmacy only come into effect in the presence of at least one of the drugs which has been associated with risk of falls. A case control study in Sweden found that the numbers of medications that the elderly took were associated with falls. Interestingly, the strength of the association remained valid after considering the use of fall risk increasing drugs (FRIDs) which consist of vasodilators used in cardiac disease, antihypertensive drugs, diuretics, beta blocking agents, calcium channel blocker, agents acting on rennin-angiotensin system, alpha-adrenoceptor antagonist, opiod, dopaminergic agents, antidepressant, anti-psychotic, anxiolytic and hypnotic and sedatives (Helgadottir *et al.*, 2014). Another study by Mitchell et al.(2014) also reported that polypharmacy (take four or more types of medications) were associated with falls

among the elderly. On top of that, a case control study in Sweden looks at the association between type of medications and falls reported that among 20 most commonly prescribed medications, central nervous system drugs (include anti-depression and hypnotic and sedatives drugs), glucose lowering drugs, anti thrombotic agents increased the risk of falls. The association remained the same after adjustment with number of medications (Kuschel *et al.*, 2014). A systematic review of 17 studies provided mixed evidence regarding association between polypharmacy and falls after adjusting for comobidities (Fried *et al.*, 2014). The adjustment was made because individual who take more medications are likely to have poorer health status. Elderly with cognitive problems were also likely to falls if they take more medications (Taylor *et al.*, 2012). However two studies, in the community and the hospital, based in Malaysia did not find any association between polypharmacy (take four or more medications) and fall (Rizawati and Mas Ayu, 2012; Sazlina *et al.*, 2008). Both of these studies did not mention the types of medications used by the samples.

Drugs that act on the central nervous systems such as antipsychotic, antidepressants, anxiolytic, hypnotic and drugs for dementia have been shown to increase the risk of falls by 47% and this is further compounded if consuming two or more of these drugs (Ambrose *et al.*, 2013). The association was also found in other studies by Bueno-Cavanillas *et al.*, (2000) and Mitchell *et al.*, (2014). Central nervous systems side effect such as dizziness, sedation, extrapyramidal adverse effect and anticholinergic properties can cause falls (Hartikainen *et al.*, 2007).

Although cardiovascular agents are commonly used among the elderly, only a handful of studies have looked into their association with falls. A systematic review found that there were association between blood pressure lowering drugs and falls.

However it was suggested that studies on drugs and risk of falls need to be specific to their groups as they have different mechanism of actions (Hartikainen *et al.*, 2007). A literature review by Ambrose *et al.*, (2013) also mentioned that cardiovascular medications such as digoxin, type A anti-arryhtmia and diuretics have been implicated with falls.

Anti-diabetic medications may also contribute to falls among the elderly. Studies specifically in the elderly diabetic population by Azidah *et al.*, (2012) found that a majority (85.2%) of patient who fall were polypharmacy. A clinical review among elderly with diabetic showed risk of fall also increased with the numbers of medications and usage on insulin (Malabu *et al.*, 2014). The same study found that risk of fall among diabetic patient who was on insulin was about 68% - 97%, and the risk increased further, almost four times if on insulin with the HbA1c was less than 6%. This is due to increased risk of hypoglycemia event which lead to falls. A literature review found that there is no direct relation between metformin and falls, but metformin may caused neuropathy (Berlie and Garwood, 2010). The same study also mentioned that there was no specific link between fall and insulin secretagogues although hypoglycemia is a risk factor.

2.2.4 Lifestyle

Level of physical activities is associated with falls (Mitchell *et al.*, 2014a; Stahl and Albert, 2015). Mitchell *et al.* (2014) measured physical activity status by using sedentary behavior variable which includes frequency of activities in one week, sitting time per day on weekdays, walking times in last week and problems doing usual activities. The study found that falls among the elderly was associated with sedentary lifestyle. Stahl and Albert (2015) used Community Healthy Activities

Model Program for Seniors (CHAMPS) to measure daily physical activities. CHAMPS assessed weekly frequency and duration of 40 different activities which divided into five domain recreational/leisure activities, household/yard work, walking activities, aerobic/exercise activities and non-mobility activities. This study found frequency of falls among the elderly was associated with decline in leisure, household and walking activities. Physical activities may increase muscle strength and improves balance. It was associated with decreased mortality by lowering body fat and improved cardiovascular fitness (Zamboni *et al.*, 2005). However, there were also studies that found no association between physical activity and falls (Azhar and Yusof, 2013; Hu *et al.*, 2015). In a study by Hu *et al.*, (2015) physical study was scaled by the number of times in an average week, as none (0), low (1-3 times), moderate (4-6 times) and high (everyday). Almost half of the samples did not perform any physical activity in a week.

Smoking and alcohol intake are examples of unhealthy lifestyle. Although prevalence of smokers among elderly have increased, the prevalence of alcohol consumption among elderly have decreased (Zhang and Wu, 2015). Limited studies have looked into an association between smoker, alcohol with fall among elderly. Although smokers have elevated mortality than non-smoker (Zamboni *et al.*, 2005), a study by Hu *et al.*, (2015) showed no association between falls and smoking among the elderly. The same study also found no association between falls among the elderly and alcohol consumption which supported with a study by (Sohng *et al.*, 2004). However, a study among 4,275 elderly in England showed a dose–response relationship between alcohol consumption and fall related fractures in both sexes (Scholes *et al.*, 2014).

2.2.5 Barthel Index and Get Up and Go Test

The Barthel Index (BI) is a commonly used instrument in assessing activity of daily living (ADL) among the elderly. It assesses a patient's capacity to perform ten daily tasks and provides a final sum of score. The ten daily tasks were bowels activity, bladder activity, grooming, toilet use, feeding, transfer, mobility, dressing, using stairs and bathing. A proxy assessment by an informed nurse or relative has been found to be just as reliable and is quicker (Collin *et al.*, 1988). Score of overall Barthel Index reflects the patient's level of independence while doing daily activities and is a valid measure of disability. Some studies have used the Barthel Index as an outcome of fall (Gonzalez *et al.*, 2014; Orive *et al.*, 2015) while others have used it as an indicator. A study by Azidah *et al.* (2012) among diabetic elderly showed no association between Barthel Index and falls. Another study among nonagenarian also found no association between Barthel Index score and falls (Formiga *et al.*, 2008). A study of Barthel Index score among stroke patient at baseline and at 6 months follow-up showed a lower score in the fall group as compared to the non-fall group although both group showed improvement at the 6 months follow up assessment. The score improved from 67.2 to 76.6 in the fall group, and from 73.9 to 89.4 in the non-fall group (Jalayondeja *et al.*, 2014).

They are multiple methods to assess balance and instability among elderly. One of the methods that has been commonly used is the 'Get up and go' test. The 'Get up and go' test was developed by Mathias *et al.*, (1986). In this test, subjects were required to rise from a chair, walk 3 metres, turn around, return to the chair, and sit down. Balance function was graded on a 5-point Likert scale. There was a consensus among observers who were from different medical backgrounds on the subjective scoring of the clinical test, and found good correlation with laboratory

tests of gait and balance. They also proved that the test is a satisfactory clinical measure of balance in elderly people (Mathias *et al.,* 1986). At 1991, this test was modified to include the time taken to complete the test by Podsiadlo and Richardson, (1991) in overcoming the subjectivity involved in giving a scale of score. The results indicated that the 'Time up and go test' is reliable (inter-rater and intra-rater), correlates well with scores on the Berg Balance Scale, gait speed and Barthel Index and was able to predict the patient's ability to be independent. It is also useful in quantifying functional mobility among the elderly although it may change over time. The test is simple, quick, requires no special equipment or training, and is easy to practice in routine medical examination (Podsiadlo and Richardson, 1991). A descriptive meta-analysis study had suggested a cut of point for times based on average time: 9.0 seconds for 60 to 69 years old, 10.2 seconds for 70 to 79 years old, and 12.7 seconds for individuals 80 to 99 years old. An elderly who has a slower time may warrant interventions to improve their strength, balance, or mobility (Bohannon, 2006).

The Timed up and go (TUG) test was the common determinants of quality of life as it is associated with mobility, self care, usual activities and anxiety or depression (Lin *et al.,* 2014). A study had shown that there was a statistical association between 'Timed up and go test' times and history of fall (Thrane *et al.,* 2007). In a study among elderly post-stroke, the test time in the fall group was twice longer than in the non-fall group (Jalayondeja *et al.,* 2014). Another study suggested a 'Timed Up and Go test' score of less than 15 seconds may suggest a lower risk of falls (Nordin *et al.,* 2008).

2.3 Obesity among the Elderly

Prevalence of obesity among the elderly is increasing worldwide (Zamboni *et al.,* 2005). Economic growth may have led to new health risks such as lack of physical activities and increased fast food consumption. A cohort study in the United States found that the prevalence of obesity, which is a body mass index of 30kg/m² or more, among the elderly was 23.6% in year 1990 and increased to 32% in year 2000. The same study also projected that 37.4% of elderly will be obese by the year 2010 (Arterburn *et al.*, 2004). However by 2010, prevalence of obesity almost higher than the projected value which was 36.6% for men and 42.3% for women (Flegal *et al.*, 2012). It has been suggested that the environment has become more obesogenic across the population and the risk of obesity is higher today than twenty years ago (Keating *et al.*, 2015). These factors of obesity will continue to rise with time and will become the predictor of obesity prevalence (Flegal *et al.*, 2012).

Malaysia is currently seeing an increased in industrialization and economic growth. Despite of rising prevalence of overweight and obesity among whole population, the prevalence of obesity among the elderly alone is also increasing (Khambalia and Seen, 2010). Currently, the prevalence of obesity among the elderly in Malaysia is ranging from 11.1% to 18.6 %, while the prevalence of overweight among the elderly in Malaysia is from 12.3% to 45.7% (Khambalia and Seen, 2010). Although the elderly in this country were found generally to be risk of being overweight and obese, the elderly in the public funded shelter homes were at risk of being underweight (Ambigga *et al.*, 2011).

Obesity is a risk factor for multiple diseases and contributes to other morbidities which lead to increase health costs and deaths each year. Issues with regards to obesity, morbidity and mortality among the elderly, and definition of

obesity in the elderly and its clinical relevance have been widely discussed. Currently, there is still a lack of consensus on the definition of obesity among the elderly and the application of anthropometric data to define obesity in the elderly. Obesity is a condition with elevated fat masses in the body and has been linked to poorer health status (Bjorntorp *et al.*, 2002). The Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity. Although there are arguments about the reliability of BMI use among the elderly because the numerator (weight) and denominator (height) may change during old age, BMI is still a well accepted and used to measure obesity (Elia, 2001; Zamboni *et al.*, 2005). An alternative to BMI is by using waist circumference as an alternative to the measurement of obesity. Waist circumference and excess fatness among the elderly has been shown to be easy to measure and strongly associated with both visceral and total fat (Zamboni *et al.*, 2005). It has been suggested that elevated waist circumference alone or together with increased BMI might be a better definition of obesity in elderly (Zamboni *et al.*, 2005). However the cut of point for waist circumference still need to be validated.

The relationship between BMI and mortality in the elderly showed a 'U – shape' curve (Heiat *et al.*, 2001; Zamboni *et al.*, 2005) with mortality risk the lowest at BMI 24 – 31 kg/m². The relationship between BMI and mortality among the elderly remained after adjusting for smoking status, pre-existing disease, geographical location and early death.

2.4 Falls among Obese Elderly

The BMI generally increases with age until age 60 to 65 years old, followed by a gradual decline (Elia, 2001). This may be due to the energy turnover and muscle loss which is replaced by body fat. BMI and fat mass are directly related to ambulatory stumbling and disability by having abnormal distribution of fat (Fjeldstad *et al.*, 2008; Jeon, 2013). This is supported by other studies which showed that, in older subjects with higher BMI, a greater amount of fat was distributed inside the muscle tissue (Zamboni *et al.*, 2005). Body weight was a strong predictor of postural stability and was confirmed by a study which a postural stability was assessed using a force platform (Hue *et al.*, 2007).

Obesity is also associated with greater level of pain, postural imbalance and vitamin D deficiency (Himes and Reynolds, 2012). It is also associated with increased risk of exhaustion, low physical activity and weakness which may increase the risk of fall (Garcia-Esquinas *et al.*, 2015). Overweight and obesity are associated with impairment in functional outcomes irrespective of physical activities (Vasquez *et al.*, 2014). Obesity may also lead to medical illness such as diabetes which itself is a known risk factor for fall (Azidah *et al.*, 2012; Malabu *et al.*, 2014).

A study in the United States showed that the prevalence of falls was higher among the obese elderly group. The prevalence of falls was 27% in obese group as compared to 15% in the non-obese group. The obese elderly were more likely to have a fall and a lower quality of life (Fjeldstad *et al.*, 2008) because they were more likely to be frail (Garcia-Esquinas *et al.*, 2015). This is supported by a study among community dwelling elderly in Ireland found a significant association between BMI categories and frail which was described by *weight loss, exhaustion, weakness, reduced walking velocity and decreased activity level (Blaum et al., 2005a).* With