

**UNIVERSITI PUTRA MALAYSIA**

***FACTORS ASSOCIATED WITH METABOLIC SYNDROME IN SEVERE  
MENTAL ILLNESS PATIENTS AT SELECTED GOVERNMENT  
HOSPITALS  
IN THE KLANG VALLEY, MALAYSIA***

**NUR SABRINA ZULKEFLI**

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**By**

**NUR SABRINA ZULKEFLI**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfilment of the Requirements for the Degree of Master of Science**

**December 2016**

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

**FACTORS ASSOCIATED WITH METABOLIC SYNDROME IN SEVERE MENTAL ILLNESS PATIENTS AT SELECTED GOVERNMENT HOSPITALS IN THE KLANG VALLEY, MALAYSIA**

By

**NUR SABRINA ZULKEFLI**

**December 2016**

**Chair : Gan Wan Ying, PhD**  
**Faculty : Medicine and Health Sciences**

Mental illness is a huge public health burden in the modern world. It has a broad range of illness with different symptoms, in which it is generally characterized by a combination of abnormal thoughts, emotions, behaviors and relationships with others. Mental illness exists on a continuum of severity ranging from mild, moderate to severe. Severe mental illness includes schizophrenia, bipolar disorder, and major depressive disorder (MDD). Patients with severe mental illness are at risk of developing metabolic syndrome (MetS). Metabolic syndrome is a cluster of cardiovascular risk factors, including insulin resistance, abdominal obesity, dyslipidemia, and hypertension. Few research have examined MetS and the contributing factors to its development among severe mental illness patients in Malaysia. This cross-sectional study aimed to determine factors associated with MetS in severe mental illness patients attending psychiatric outpatient clinics in Hospital Kuala Lumpur and Hospital Kajang.

A total of 151 outpatients (45.0% males and 55.0% females) with a mean age of  $41.84 \pm 12.19$  years fulfilled the selection criteria participated in this study. The diagnosis of severe mental illness was based on the Mini International Neuropsychiatric Interview (MINI) which was performed by a psychiatrist at the selected clinics. Information on socio-demographic background (age, sex, ethnicity, marital status, level of education, personal and household income), clinical characteristics (types and duration of illness and family history of mental illness and other MetS risk factors), medication consumptions (type and duration of taking medication), lifestyle factors (physical activity level, smoking behavior, alcohol consumption and dietary intake) were collected using a face-to-face interview. Body weight, height, waist circumference, percentage of body fat and blood pressure were measured by the researcher. Fasting glucose, triglycerides and HDL levels of the patients were taken from their respective medical records.

Among the 151 outpatients, nearly half of them (48.3%) fulfilled the harmonized criteria for MetS. The prevalence of MetS was high among males (48.5%), married (61.5%), older age group (66.7%) and patients with schizophrenia (50.7%). Age groups ( $\chi^2=6.878$ ,  $p=0.032$ ), marital status ( $\chi^2=4.752$ ,  $p=0.029$ ), duration of illness ( $\chi^2=4.215$ ,  $p=0.040$ ), Vitamin A ( $\chi^2=4.159$ ,  $p=0.041$ ) and body weight status ( $\chi^2=29.117$ ,  $p<0.001$ ) were significantly associated with MetS. Those middle (36–55 years old) and older patients (>55 years old), married, who had been suffering for mental illness for more than 10 years, with inadequate intake of vitamin A, and overweight and obese were more likely to develop MetS than their counterparts. There were no significant associations between sex, ethnicity, educational level, income level, types of illness, physical activity level, smoking behavior, alcohol consumption, social support and social engagement with MetS ( $p>0.05$ ).

Binary logistic regression results showed that only two predictors were significantly associated with MetS, namely the body weight status and age groups. Severe mental illness patients who were overweight (OR=3.8, 95% CI=1.6-9.1) and obese (OR=14.4, 95% CI=4.9-42.6) were approximately 4 times and 14 times more likely to develop MetS, respectively. On the other hand, being a middle and older adult was 3 times (OR=3.0, 95% CI=1.2-7.8) and 5.3 times (OR=5.3, 95% CI=1.4-20.3) more likely to develop MetS, respectively as compared to younger adults.

In conclusion, the present study showed a high prevalence of MetS among severe mental illness patients. Age and BMI were found to be the risk factors in the development of MetS. Findings of this study highlight the need of regularly assessing and monitoring MetS and BMI among severe mental illness patients. Intervention programs targeted at preventing and reducing MetS should be planned for severe mental illness patients, especially among those who are overweight and obese and those in middle and older age groups.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Ijazah Master Sains

**FAKTOR-FAKTOR BERKAITAN DENGAN SINDROM METABOLIK DALAM  
KALANGAN PESAKIT PENYAKIT MENTAL TERUK DI HOSPITAL  
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Penyakit mental merupakan beban kesihatan awam yang besar dalam dunia moden ini. Ia terdiri daripada pelbagai penyakit dengan gejala yang berbeza, di mana ia biasanya dicirikan oleh gabungan pemikiran, emosi, tingkah laku dan hubungan dengan orang lain yang tidak normal. Penyakit mental berada pada siri tahap keterukan di mana tahap keterukan boleh dibahagi kepada ringan, sederhana dan teruk. Penyakit mental yang teruk termasuklah *schizophrenia*, *bipolar disorder*, *major depressive disorder (MDD)*. Pesakit dengan penyakit mental yang teruk ini berisiko untuk menghadapi sindrom metabolik (MetS). Sindrom metabolik merupakan kelompok faktor risiko kardiovaskular, termasuk kerintangan insulin, obesiti abdomen, dislipidemia, dan tekanan darah tinggi. Kajian yang dijalankan untuk mengkaji MetS dan faktor-faktor yang menyumbang kepada perkembangannya dalam kalangan pesakit mental teruk di Malaysia adalah terhad. Kajian keratan rentas ini bertujuan untuk menentukan faktor-faktor yang berkaitan dengan MetS dalam kalangan pesakit penyakit mental teruk yang menerima rawatan di Klinik Pesakit Luar Psikiatri di Hospital Kuala Lumpur dan Hospital Kajang.

Seramai 151 pesakit luar (45.0% lelaki dan 55.0% perempuan) dengan purata umur  $41.84 \pm 12.19$  tahun yang memenuhi kriteria pemilihan telah mengambil bahagian dalam kajian ini. Diagnosis penyakit mental yang teruk adalah berdasarkan *Mini International Neuropsychiatric Interview (MINI)* yang telah dilakukan oleh pakar psikiatri di klinik yang terpilih. Maklumat mengenai latar belakang sosio-demografi (umur, jantina, etnik, status perkahwinan, tahap pendidikan, pendapatan individu dan isi rumah), ciri-ciri klinikal (jenis dan tempoh penyakit dan sejarah keluarga penyakit mental dan faktor-faktor risiko MetS yang lain), pengambilan ubat (jenis dan tempoh pengambilan ubat), faktor-faktor gaya hidup (tahap aktiviti fizikal, tingkah laku merokok, pengambilan alkohol dan pengambilan diet) telah dikumpulkan dengan menggunakan teknik temubual muka-ke-muka. Manakala berat badan, ketinggian, lilitan pinggang, peratusan lemak badan dan tekanan darah diukur oleh penyelidik. Tahap glukosa (puasa), trigliserida dan paras HDL pesakit diambil daripada rekod perubatan mereka.

Daripada 151 pesakit luar, hampir separuh daripada mereka (48.3%) memenuhi kriteria *Harmonized* untuk MetS. Prevalen MetS adalah tinggi dalam kalangan lelaki (48.5%), yang berkahwin (61.5%), kumpulan umur tua (66.7%) dan pesakit *schizophrenia* (50.7%). Kumpulan umur ( $\chi^2=6.878$ ,  $p=0.032$ ), status perkahwinan ( $\chi^2=4.752$ ,  $p=0.029$ ), tempoh penyakit ( $\chi^2=4.215$ ,  $p=0.040$ ), Vitamin A ( $\chi^2=4.159$ ,  $p=0.041$ ) dan status berat badan ( $\chi^2=29.117$ ,  $p<0.001$ ) adalah berkaitan secara signifikan dengan MetS. Mereka yang berumur pertengahan (36-55 tahun) dan berumur lebih tua (> 55 tahun), berkahwin, yang telah menderita penyakit mental selama lebih daripada 10 tahun, pengambilan vitamin A yang tidak mencukupi serta berlebihan berat badan dan obesiti adalah lebih cenderung untuk menghidapi MetS. Tiada perkaitan yang signifikan didapati di antara jantina, etnik, tahap pendidikan, tahap pendapatan, jenis-jenis penyakit, tahap aktiviti fizikal, tingkah laku merokok, pengambilan alkohol, sokongan sosial dan penglibatan sosial dengan MetS ( $p>0.05$ ).

Hasil keputusan regresi logistik binari menunjukkan bahawa hanya terdapat dua faktor yang berkaitan dengan MetS, iaitu status berat badan dan kumpulan umur. Pesakit mental teruk yang mempunyai berat badan berlebihan (OR = 3.8, 95% CI = 1.6-9.1) dan obes (OR = 14.4, 95% CI = 4.9-42.6) adalah masing-masing 4 dan 14 kali lebih cenderung untuk menghidapi MetS. Selain itu, umur pertengahan dan umur yang lebih tua pula adalah masing-masing 3 (OR = 3.0, 95% CI = 1.2-7.8) dan 5.3 kali (OR = 5.3, 95% CI = 1.4-20.3) lebih cenderung untuk menghidapi MetS berbanding dengan orang dewasa yang muda.

Kesimpulannya, kajian ini menunjukkan prevalen MetS yang tinggi dalam kalangan pesakit penyakit mental teruk. Umur dan indeks jisim tubuh (IJT) didapati merupakan faktor risiko dalam peningkatan MetS. Hasil kajian ini mencadangkan keperluan menilai dan memantau MetS dan IJT dengan lebih kerap dalam kalangan pesakit penyakit mental teruk. Program intervensi yang bertujuan untuk mencegah dan mengurangkan MetS perlu dirancang untuk pesakit penyakit mental teruk, terutamanya dalam kalangan pesakit yang mempunyai berat badan berlebihan dan obes dan juga pesakit yang berumur pertengahan dan lebih tua.

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I certify that a Thesis Examination Committee has met on 8 December 2018 to conduct the final examination of Nur Sabrina binti Zulkefli on her thesis entitled “Factors Associated with Metabolic Syndrome in Severe Mental Illness Patients at Selected Government Hospitals in Klang Valley, Malaysia” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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## LIST OF ABBREVIATIONS

AUDIT	Alcohol Use Disorders Identification Test
BMI	Body Mass Index
BMR	Basal Metabolic Rate
BPS	Bipolar Spectrum
CHD	Coronary Heart Disease
CIDI	Composite International Diagnostic Interview
CIQ	Community Integration Questionnaire
CRC	Clinical Research Centre
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
DSM-IV	Diagnostic and Statistical Manual of Mental Disorder IV
HDL	High Density Lipoprotein Level
HKL	Hospital Kuala Lumpur
IDF	International Diabetes Federation
IPAQ-SF	International Physical Activity Questionnaire-Short Form
IPH	Institute of Public Health
IPSR	Indirect Standardized Prevalence Ratio
JIS	Joint Interim Statement
MDD	Major Depressive Disorder
MDE	Major Depressive Episodes
MetS	Metabolic Syndrome
MINI	Mini International Neuropsychiatry Interview
MOH	Ministry of Health
NCEP ATP-III	National Cholesterol Education Program's Adult Treatment Panel III
NHANES	National Health and Nutrition Examination Survey
NHMS	National Health and Morbidity Survey
NIH	National Institute of Health
NMRR	National Medical Register Research
OCD	Obsessive-Compulsive Disorder
OR	Odd Ratio
PTSD	Posttraumatic Stress Disorder
RNI	Recommended Nutrient Intake
TG	Triglycerides
UKMMC	Universiti Kebangsaan Malaysia Medical Centre
WC	Waist Circumference
WHO	World Health Organization

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Anxiety and mood disorders are common mental illnesses in adults (Kessler et al., 2005). Mental illness is a huge public health burden in the modern world. There are various definitions of mental illnesses. According to The National Alliance on Mental Illness (NAMI, 2013), mental illnesses are medical conditions that disrupt a person's thinking, feeling, mood, ability to relate to others and daily functioning. Depression, schizophrenia, bipolar disorder, obsessive-compulsive disorder (OCD), posttraumatic stress disorder (PTSD), anxiety, and borderline personality disorder are examples of mental illnesses.

On the other hand, the Centers for Disease Control and Prevention (2011) defines mental illnesses as the disorders generally characterized by dysregulation of mood, thought, and/or behavior, as recognized by the American Psychiatric Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV). The World Health Organization (2013) defines mental illnesses as a broad range of problems, with different symptoms, in which they are generally characterized by some combinations of abnormal thoughts, emotions, behaviors and relationships with others. Mental illness exists on a continuum of severity ranging from mild, moderate to severe. Severe mental illness includes schizophrenia, major depressive disorder (MDD) and bipolar disorder (WHO, 2013). Most of these disorders can be treated successfully.

Mental illness is common across all continents and cultural groups. For example, in the United States, approximately one fourth of adults suffer from mental illness, and nearly half will develop at least one mental illness during their lifetime (Reeves et al., 2011). In Ireland, there were 39.1% of the adults aged 18 to 65 years old who were diagnosed with some kind of disorders including anxiety and mood disorders (Bunting, Murphy, O'Neill, & Ferry, 2012). In South Africa, 30.3% of the adults aged 18 years and above had mental disorder with anxiety disorders as the most prevalent lifetime disorders (Herman et al., 2009). In Malaysia, the National Health and Morbidity Survey (NHMS) 2011 showed that the prevalence of lifetime depression was 2.4% and current depression was 1.8% (IPH, 2011).

In 2014, about 1 in 5 adults aged 18 or older (18.1% or 43.6 million adults) had any mental illness (AMI) in the past year, and 4.1% (9.8 million adults) had serious mental illness (SMI) (Abuse, 2016). Severe mental illness (SMI) is defined in National Survey on Drug Use and Health (NSDUH) as adults who in the past year have had a diagnosable mental, behavioral, or emotional disorder (excluding developmental and substance use disorders) of sufficient duration to meet diagnostic criteria and has resulted in serious functional impairment substantially interferes with their major life activities. It includes the most

disabling psychiatric disorders that typically require inpatient treatment, such as schizophrenia, bipolar disorder, and severe depression (Uher, 2014).

According to the National Institute of Mental Health (NIMH; 2015), schizophrenia is a serious mental disorder that affects how a person thinks, feels, and behaves. People with schizophrenia may seem like they have lost touch with reality. They may hear voices other people don't hear. They may think other people are trying to hurt them. Sometimes they don't make any sense when they talk. The prevalence of schizophrenia is approximately 1.1% of the population over the age of 18 or, in other words, at any one time as many as 51 million people worldwide suffer from schizophrenia. Schizophrenia is a serious, complex brain disorder, with a reported median incidence of 15.2 per 100,000 persons (McGrath, Saha, Chant, & Welham, 2008) and a pooled lifetime prevalence of 0.40% (Saha, Chant, Welham, & McGrath, 2005).

Bipolar disorder is a clinically severe, episodic, lifelong mood disorder (Fagiolini et al., 2009; Judd et al., 2002; Perlis et al., 2006). The defining characteristic of bipolar disorder is the appearance of episodes of mania or hypomania alternating with, or more commonly occurring concomitantly with depressive episodes (Oswald et al., 2007). In the World Mental Health Survey Initiative, they found that the aggregate lifetime prevalence were 0.6% for bipolar type I disorder (BP-I), 0.4% for BP-II, 1.4% for subthreshold BP, and 2.4% for BPS, while for 12-month prevalence were 0.4% for BP-I, 0.3% for BP-II, 0.8% for subthreshold BP, and 1.5% for BPS (Merikangas et al., 2011). Merikangas et al. (2010) found that epidemiological data indicated a 3% to 5% lifetime prevalence of bipolar disorder in the United States and many other countries throughout the world.

Major depressive disorders (MDDs) are considered to be the most frequently encountered form of mental illness (Wittchen & Jacobi, 2005). The Global Burden of Disease study identified depression as having the third greatest impact in terms of disability-adjusted life-years in Europe and the greatest impact of all physical and mental diseases in the Americas (Üstün, Ayuso-Mateos, Chatterji, Mathers, & Murray, 2004). It is estimated that each year 38.2% of the European Unions population suffers from a mental disorder (Wittchen & Jacobi, 2005). They also found that the three most frequent disorders are anxiety disorders (14.0%), insomnia (7.0%) and major depression (6.9%).

In recent years, metabolic syndrome (MetS) has gained attention in the medical field. MetS is a common condition that goes by many names such as dysmetabolic syndrome, insulin resistance syndrome, obesity syndrome and Reaven's syndrome (Simonson & Kendall, 2005). It refers to the co-occurrence of several known cardiovascular risk factors, in which the individual components of MetS included abdominal obesity, dyslipidemia, insulin resistance, and hypertension (Huang, 2009). These conditions are interrelated and shared underlying mediators, mechanisms and pathways.

Various diagnostic criteria for MetS have been proposed by different organizations (Alberti & Zimmet, 1998; National Institute of Health, 2002; Zimmet, Magliano, Matsuzawa, Alberti, & Shaw, 2005). A Joint Interim Statement (JIS) or known as the

Harmonized criteria on MetS offers an advantage of identifying a larger number of individuals with MetS, as compared to other definitions, due to the presence of other multiple risk factors, despite having waist circumference of less than the recommended cut-points (Ramli et al., 2013). This Harmonized definition is also suitable for diagnosing MetS in any populations with similar socio-demographic characteristics (Heng, Hejar, Rushdan, & Loh, 2013). Heng et al. (2013) suggested that harmonized criteria are suitable for Malaysian population. Therefore, harmonized criteria were used to define risk factors of MetS in this study.

The National Health and Nutrition Examination Survey (NHANES) in the United States found that the prevalence of MetS among the American population had increased from 21.8% in the Third NHANES to 35.0% in the 2003 to 2006 NHANES (E.S Ford, Li, & Zhao, 2010). In Asian countries, the prevalence of MetS was high, with 31.3% in Korea (Lim et al., 2011), 33.5% in Southern India (Prasad, Kabir, Dash, & Das, 2012), 33.9% in China (Wang et al., 2013), and 43.4% in Malaysia (Ramli et al., 2013).

Previous studies have explored the prevalence of MetS in the general population (Earl S Ford, Giles, & Dietz, 2002; Lim et al., 2011; Motala, Esterhuizen, Pirie, & Mahomed, 2011; Prasad et al., 2012; Wang et al., 2013). However, the prevalence of MetS in severe mental illness patients should not be neglected. In recent years, many studies have investigated the prevalence of MetS among severe mental illness patients (Bly et al., 2014; Charnsil, Pilakanta, & Panikul, 2015; Chien & Lin, 2016; Hajian-Tilaki et al., 2014; Hung, Liu, Hsiao, Yu, & Chu, 2014; Kamkar, Sanagoo, Zargarani, Jouybari, & Marjani, 2016; Said et al., 2013; Saloojee, Burns, & Motala, 2016; Song et al., 2015; Zhao et al., 2014). Several studies clearly revealed that MetS is an increasing health problem in severe mental illness patients, not only in the western societies (Cardenas et al., 2008; Hägg, Lindblom, Mjörndal, & Adolfsson, 2006; John, Koloth, Dragovic, & Lim, 2009; Joukamaa et al., 2006; Shahda, Elsayed, & El Boraie, 2010) but also in the Asian populations (Bressington et al., 2013; Charnsil et al., 2015; N. Lee et al., 2011; Suttajit & Pilakanta, 2013), including the Malaysians population (Abdul Hamid, Holifa, Azlin, & Hatta, 2009; Hat et al., 2011; Said et al., 2013).

The rate of MetS among severe mental illness patients is high. Despite numerous studies done in this field, evidence suggest that researchers are still unable to fully comprehend this problem. Therefore, it is a situation that warrants further investigation. By studying patients with severe mental illness, researchers might be able to identify early characteristics that could be the risk factors of MetS. Early detection of MetS in severe mental illness patients leads to a successful treatment outcome.

## **1.2 Problem Statement**

Patients with severe mental illness faced a higher risk of developing MetS as compared to the general healthy population (Bly et al., 2014). This is due to the illness itself that has a strong association with MetS (Abdul Hamid et al., 2009). In addition, many medications for severe mental illness patients are associated with the individual risk factors of MetS

(Malhotra & McElroy, 2003; Newcomer, 2007). A comparison study conducted by Bly et al. (2014) reported that the prevalence of MetS was higher in patients with bipolar disorder (33%) and schizophrenia (47%) compared to the general population (17% and 11%, respectively). Another study in Hong Kong reported that the prevalence of MetS among patients with a diagnosis of severe mental illness was 35%, in which the relative risk of MetS in comparison with the general Hong Kong population was 2.008 (Bressington et al., 2013). Similarly, the prevalence of MetS in Australian patients with schizophrenia was almost double than that in the general Australian population (John et al., 2009). Hence, more information is needed to understand the etiology of MetS in order to reduce its prevalence, particularly among patients with severe mental illness.

The effects of mental illness range from minor disruptions in daily functioning to incapacitating personal, social, and occupational impairments and premature death (Colton & Mandersheid, 2006). Globally, unipolar depressive disorders are responsible for a greater burden of disease than chronic lung disease, ischemic heart disease, diabetes, vision or hearing loss, or stroke (Mathers & Loncar, 2006). In an Australian study, death from ischemic heart disease was linked to most mental disorders, especially schizophrenia and other psychoses (Prince et al., 2007). Besides, unipolar depressive disorders, schizophrenia, bipolar disorder and alcohol use disorders are placed among the top ten causes of disability due to health-related conditions in all countries, as well as in low and middle income countries, where they represent a total of 19.1% of all disability related to health conditions (WHO, 2009).

The cost of mental health care is considered as one of the greatest burdens to the whole world (Whiteford et al., 2013). Results of the Global Burden of Disease 2010 for year 1990 to 2010 showed that the total burden of mental and substance use disorders increased by 37.6%, from 133.6 million disability-adjusted life years (DALYs) in 1990 to 183.9 million in 2010 (Whiteford et al., 2013). A study done by Bloom et al. (2012) undertaken for the World Economic Forum estimated that the cumulative global effect of mental disorders in terms of lost economic output could amount to USD 47 trillion in the next 20 years, which was 75% of the global GDP in 2010 (USD 63 trillion).

According to the 2005 National Claims Database, the average monthly increase paid by Medicare in 2005 over previous years' expenses for individuals with depression or anxiety was USD 560 and USD 710, respectively (Melek & Norris, 2008). In Europe, the total annual cost per disorder (in billion) was as follows: anxiety disorders EUR 74.4, mental retardation EUR 43.3, mood disorders EUR 113.4, personality disorders EUR 27.3 and psychotic disorders EUR 93.9 (Olesen, Gustavsson, Svensson, Wittchen, & Jönsson, 2012). Most of the countries spent substantial amount of budget for mental illness problem. Therefore, massive effort must be exerted to reduce the budget and burden of mental illness problems.

There are various effects of drug or medication consumed related to early metabolic adverse effect such as weight gain, hyperglycemia, hypertension, dyslipidemia, type 2 diabetes mellitus and cardiovascular disease (Mitchell et al., 2013; Newcomer, 2007; Shahda et al., 2010). For example, the second generations anti-psychotic medications also

known as atypical antipsychotic has high association with MetS, especially Olanzapine 55.4% and Clozapine 66.6% (Shahda et al., 2010). Mitchell et al. (2013) also found that MetS was most prevalent in patients taking Clozapine (49.7%). Conversely, a study conducted in Hong Kong found that only first generation antipsychotics were significantly associated with MetS (Bressington et al., 2013). Thus, further study is needed to investigate if medication is a predictive factor of MetS.

Duration of illness was found to be associated with MetS (Hat et al., 2011; Lee et al., 2011; Shahda et al., 2010; Srisurapanont, Likhitsathian, Boonyanaruthee, Charnsilp, & Jaruraisin, 2007). For instance, previous study in Kuala Lumpur revealed that depressed patients who had suffered the illness for more than 10 years were three times more likely to develop MetS than those with shorter illness duration (Hat et al., 2011). Another study carried out among Korean patients with schizophrenia by Lee et al. (2011) found that patients who used monotherapy of Aripiprazole, Olanzapine or Risperidone for more than three months were more likely to have MetS than the general population. Therefore, early screening and identification can be beneficial to be incorporated in the management of medication for future complications.

Obesity is becoming a significant and growing health crisis, affecting both developed and developing countries, in which people with obesity have a shorter life spans and are at a higher risk to contract a number of general medical conditions, including type 2 diabetes mellitus, cardiovascular disease, dyslipidemia and hypertension (De Hert et al., 2011). Both obesity and mental health contributed to a significant proportion of the global burden of disease (Abdul Hamid et al., 2009). There was a high prevalence of obesity detected among severe mental illness patients. For instance, 55% of American adults with serious and persistent mental illness (SPMI) were obese (De Hert, Schreurs, Vancampfort, & Winkel, 2009). In Australia, the percentage of obesity in severe mental illness patients (30.3%) was much higher than that of the general population (21.4%) (Stanley, Laugharne, Addis, & Sherwood, 2013).

Similarly, in Malaysia, the prevalence of overweight condition among schizophrenia patients was 39.2% and the prevalence of obesity was 35.1% (Salmi, Aisah, Osman, & Shamsul, 2007). However, studies of the relationship between obesity and mental health disorders yielded mixed findings. Some researchers reported that obesity could lead to mental health problems (Luppino et al., 2010), whilst others have found that mental illness patients were more prone to obesity (De Hert et al., 2009; Mather, Cox, Enns, & Sareen, 2009; Stanley et al., 2013). Other studies have found no association between obesity and mental health (Remigio-Baker et al., 2014; Swallen, Reither, Haas, & Meier, 2005). Therefore, more research is required to confirm these findings.

Physical activity is an important issue that needs to be investigated for its association with MetS in mental illness patients. Having a low physical activity has been recognized as a prominent behavioural risk factor for MetS and CVD and an independent risk factor of comparable importance with diabetes for all-cause mortality (Nyboe & Lund, 2013; Vancampfort et al., 2011). Patients who were sitting more than 10.4 hours per day had a higher BMI, waist circumference and fasting glucose concentration than those sitting less

than 5.8 hours per day (Vancampfort, Probst, Knapen, Carraro, & De Hert, 2012). Most of the previous studies focused on general population but not severe mental illness patients. Therefore, the association between physical activity level and MetS among severe mental illness patients should be investigated.

Smoking was found to be another significant risk factor in both men and women with MetS (Park et al., 2003). With regard to the number of cigarettes smoked per day, schizophrenic patients tended to smoke a significantly higher number compared to normal population (Fountoulakis et al., 2010). Smokers were also found to have a higher rate of MetS compared with non-smokers (Lamberti et al., 2006; Rezaei, Khodaie-Ardakani, Mandegar, Dogmehchi, & Goodarzynejad, 2009; Schorr, Slooff, Bruggeman, & Taxis, 2009). However, various studies yielded inconsistent findings. Some studies found that there were no significant association between smoking behaviour and MetS risk factors (Hat et al., 2011; Said et al., 2012). Therefore, more research is required to confirm these findings.

There are limited local studies on MetS among psychiatric patients and the contributing factors of MetS in Malaysia (Abdul Hamid et al., 2009; Hat et al., 2011; Said et al., 2012). The situation and prevalence of MetS among patients with severe mental illness in Malaysia remain doubtful. Thus, a comprehensive study on MetS is needed to explore the situation among severe mental illness patients in Malaysia and to determine the factors contributing to this syndrome. Consequently, this study was designed to examine the associations between personal, health, lifestyle and social relationship factors with MetS among mental illness patients in the Klang Valley. This study aims to answer all the following research questions:

- a) What is the prevalence of MetS among severe mental illness patients?
- b) What factors contribute to the likelihood that severe mental illness patient would have the problem of metabolic syndrome?

### **1.3 Significance of the Study**

There is an alarming prevalence rate of MetS among severe mental illness patients. More information is needed to understand the mechanisms behind MetS in order to reduce its pervasiveness. Hence, it is important to explore the prevalence of MetS in this group of population. Research in the area of MetS among mental illness patients in Malaysia is still new and limited. This study can provide latest data on the metabolic risks of mental illness patients. It can also serve as baseline data for future research.

Additionally, findings of this study can contribute to the growing body of research on mental illness in Malaysia by providing valuable knowledge and in-depth information on factors contributing to the epidemic of MetS. By examining the potential factors including personal, health, lifestyle and social relationship factors, this study may help to identify the key factors related to MetS among mental illness patients in Malaysia. An extensive understanding of the factors associated with MetS is important to help other researchers, healthcare practitioners, nutritionists, and dietitians to develop an effective and appropriate

nutrition-driven intervention program to promote healthy lifestyle among severe mental illness patients in order to improve their quality of life.

## **1.4 Research Objectives**

### **1.4.1 General Objective**

To determine factors associated with MetS among severe mental illness patients at government hospitals in the Klang Valley.

### **1.4.2 Specific Objectives**

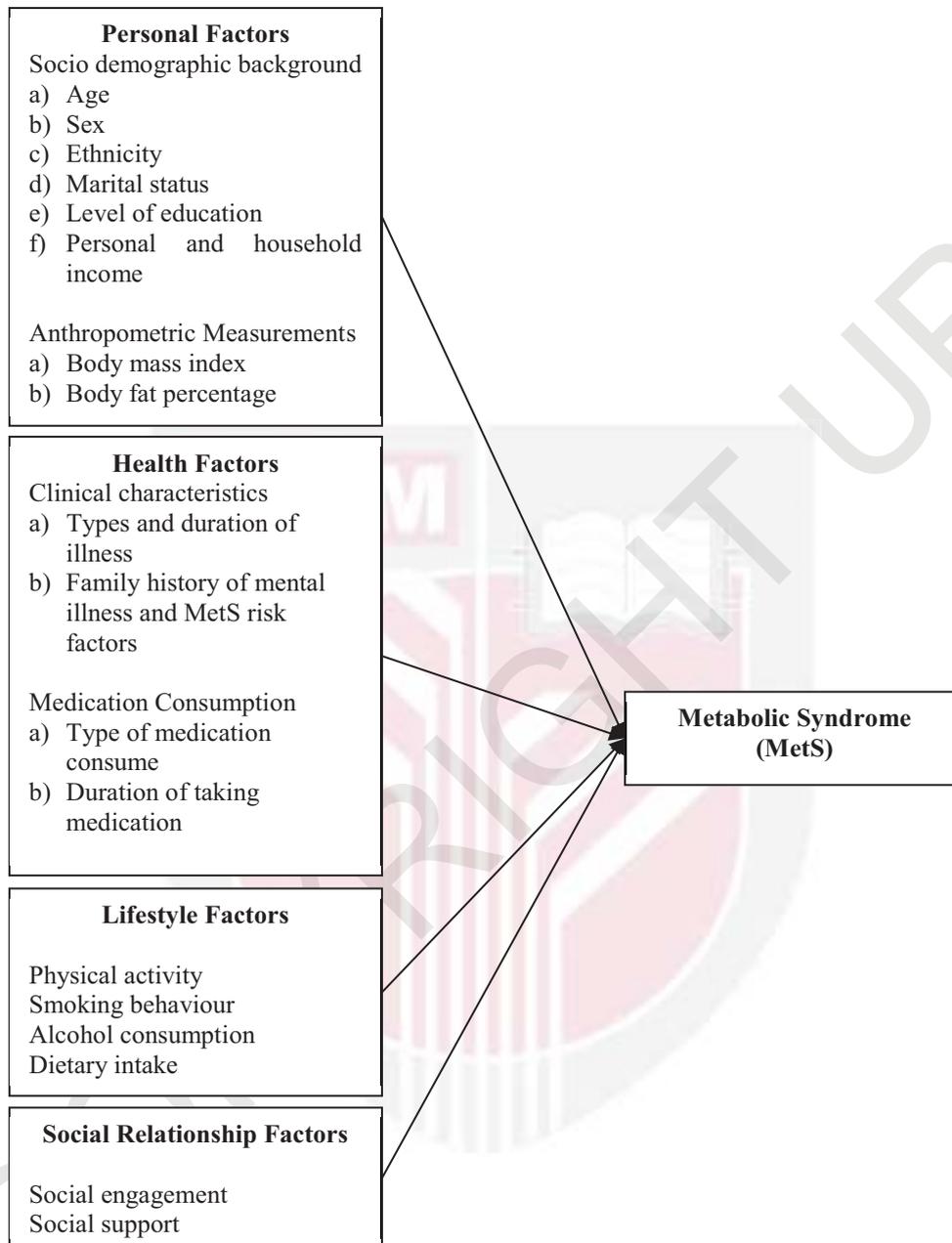
- a) To examine personal factors (socio demographic background and anthropometric measurement), health factors (clinical characteristics and medication consumption), lifestyle factors (physical activity, smoking behaviour, alcohol consumption and dietary intake), and social relationship factors (social engagement and social support) among severe mental illness patients.
- b) To assess metabolic risk factors (waist circumference, blood glucose, blood pressure, triglycerides and high-density lipoprotein cholesterol) among severe mental illness patients.
- c) To determine the prevalence of MetS among severe mental illness patients.
- d) To determine the associations between personal, health, lifestyle and social relationship factors with MetS among severe mental illness patients.
- e) To determine the contributions of personal, health, lifestyle and social relationship factors towards MetS among severe mental illness patients.

## **1.5 Study Hypotheses**

- a) Personal, health, lifestyle and social relationship factors are significantly associated with MetS among severe mental illness patients.
- b) Personal, health, lifestyle and social relationship factors are significant contributing factors of MetS among severe mental illness patients.

## **1.6 Conceptual Framework**

Figure 1.1 shows the conceptual framework of this study. In this study, MetS in severe mental illness patients is viewed as being affected by multiple factors, consisting of



**Figure 1.1: Conceptual framework of the study**

personal, health, lifestyle and social relationship factors. Personal factors included socio-demographic background (Abdul Hamid et al., 2009; Al-Daghri et al., 2014; Bhanushali et al., 2013; Buckland, Salas-Salvadó, Roure, Bulló, & Serra-Majem, 2008; Chung, Kim, Choi, & Kim, 2010; Hägg et al., 2006; Hajian-Tilaki et al., 2014; Hat et al., 2011; Kamkar et al., 2016; Saloojee et al., 2016) and anthropometric measurements (BMI and body fat percentage) (Hung et al., 2014; Lee, Nurjono, Wong, & Salim, 2012). Health factors included clinical characteristics (Abdul Hamid et al., 2009; Bressington et al., 2013; Fountoulakis et al., 2010; Hat et al., 2011; Shahda et al., 2010) and medication consumption (Malhotra & McElroy, 2003; Newcomer, 2007). Lifestyle factors included physical activity (Bhanushali et al., 2013; Hat et al., 2011; Kinder, Carnethon, Palaniappan, King, & Fortmann, 2004; Vancampfort et al., 2012; Yamamoto et al., 2011), smoking behaviour (Bhanushali et al., 2013; Buckland et al., 2008; Calo et al., 2013; Dedinská et al., 2014; Delavar et al., 2009; Slagter et al., 2013), alcohol consumption (Alkerwi et al., 2009; Bhanushali et al., 2013; Chen et al., 2012; Xiao et al., 2015) and dietary intake (Bly et al., 2014; Cunha et al., 2016; Li, Guo, Wu, & Liu, 2013; Park, Ahn, & Lee, 2015; Wei et al., 2015). Lastly, social relationship factors included social engagement (Ikeda et al., 2011; Tweendy, 2009; Yang, Li, & Ji, 2013) and social support (Pakalska-Korcala et al., 2008; Prescott, Godtfredsen, Osler, Schnohr, & Barefoot, 2007). All the aforementioned factors are hypothesized to be contributing factors of MetS in severe mental illness patients.

Sex, age and educational level were found to be related to MetS in severe mental illness patients (Abdul Hamid et al., 2009). A weak relationship was found between marital status and risk of MetS (Bressington et al., 2013). The Indian was more likely to have MetS than the Malay and Chinese (Hat et al., 2011). Previous studies showed that household income was negatively associated with MetS (Dallongeville et al., 2005; Salmi et al., 2007). Increasing body mass index (BMI) was identified to be significantly associated with the prevalence of MetS (Hung et al., 2014; Lee et al., 2012). The duration of illness and treatment as well as family history were associated with MetS (Shahda et al., 2010). Types of illness such as schizophrenia and mood disorders were also found to be associated with MetS (Abdul Hamid et al., 2009; Bly et al., 2014). In terms of medication prescribed for mental health, antipsychotic medications increased weight gain, WC, fasting triglyceride level, and glucose levels in patients with schizophrenia (Riordan, Antonini, & Murphy, 2011). Atypical antipsychotic drugs seem to have a stronger diabetogenic risk than conventional antipsychotic drugs (De Hert et al., 2011).

Physical activity during leisure time was found to be negatively correlated to MetS (Dallongeville et al., 2005). Besides, the numbers of cigarettes smoked (Calo et al., 2013; Vancampfort et al., 2012) and alcohol consumption (Alkerwi et al., 2009; Chen et al., 2012; Slagter et al., 2014; Xiao et al., 2015) were found to be related to MetS risk factors. Adequate intake of antioxidant micronutrients such as vitamins A, C, E, selenium and zinc, decreased the risk of MetS (Cunha et al., 2016; Li, Guo, Wu, & Liu, 2013; Wei et al., 2015). However, there were studies found that no association between nutrient intake and MetS (Bian et al., 2013; Motamed et al., 2013). In term of social support, schizophrenia patients with low level of social support showed increased risk of MetS (Tweendy, 2009). High social integration has been found to lower the risk of MetS (Yang, Li, & Ji, 2013).

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