

UNIVERSITI PUTRA MALAYSIA

RELATIONSHIP BETWEEN SELECTED BIOPSYCHOSOCIAL FACTORS ON COGNITIVE FUNCTIONS AMONG MALAYSIAN COMMUNITY-DWELLING OLDER ADULTS

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By

FOONG HUI FOH

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

June 2018

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

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June 2018

Chairman: Professor Tengku Aizan Hamid, PhD Institute: Malaysian Research Institute on Ageing

Preservation of cognitive function is crucial to healthy ageing. Metabolic syndrome and depression are established risk factors for poor cognitive function in older adults. Nevertheless, there has been limited study exploring the mechanism underlying the relationship between metabolic syndrome and cognitive function as well as the variable that can moderate the negative effects of depression on cognitive function. Thus, the objectives of this study were to examine if chronic medical condition mediates the relationship between metabolic syndrome and cognitive function, and to investigate if intrinsic religiosity moderates the association between depression and cognitive function.

The data were obtained from a national study in Malaysia entitled "Longitudinal Study on Neuroprotective Model for Healthy Longevity." The original purpose of this study was to prospectively examine the degree of cognitive decline and its associated risk factors. However, only baseline data from the first wave of data collection were used in this study. Data analyses were carried out after examining the data for coding error, identifying and removing outliers, replacing missing values, and addressing normality issue. The main statistical analyses involved in the current study were Pearson's correlation, chi-square test, multiple linear regression, and structural equation modelling.

Results showed that age, year of education, household income, systolic blood pressure, body mass index, number of chronic medical condition, depression, intrinsic religiosity, gender, marital status, ethnicity, and living arrangement were significantly associated with cognitive function. Predictors of poorer cognitive function were being women, being older, being divorced or separated, lower year of education, lower household income, higher fasting blood sugar, higher cholesterol ratio, higher depressive symptoms, and lower intrinsic religiosity. Furthermore, chronic medical condition partially mediated the association between metabolic syndrome and cognitive function as well as intrinsic religiosity moderated the relationship between depression and cognitive function.

The findings of the study implied that metabolic syndrome might increase the likelihood of older adults to suffer more chronic medical conditions and consequently, these responses might reduce their cognitive function. Besides that, intrinsic religiosity might reduce the negative effects of depression on cognitive function. To promote good cognitive function, specific intervention to minimise the number of chronic medical conditions by reducing the vascular risk factors is warranted. Moreover, professionals who are working with depressed older adults should seek ways to improve their intrinsic religiosity as one of the strategies to promote good cognitive function.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

HUBUNGAN ANTARA FAKTOR-FAKTOR BIOPSIKOSOSIAL TERPILIH DAN FUNGSI KOGNITIF DALAM KALANGAN WARGA EMAS YANG TINGGAL DI KOMUNITI

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Pemeliharaan fungsi kognitif adalah penting untuk penuaan yang sihat. Sindrom metabolik dan kemurungan adalah faktor risiko bagi masalah fungsi kognitif dalam kalangan warga emas. Setakat ini, kajian yang mengkaji pengantara hubungan antara sindrom metabolik dan fungsi kognitif serta pemboleh ubah yang boleh menyederhanakan kesan negatif kemurungan pada fungsi kognitif adalah terhad. Oleh itu, objektif utama kajian ini adalah untuk mengkaji sama ada bilangan penyakit kronik menjadi pengantara antara hubungan sindrom metabolik dan fungsi kognitif serta untuk menyelidik jika keagamaan intrinsik menyederhanakan hubungan antara kemurungan dan fungsi kognitif.

Data diperoleh daripada kajian kebangsaan yang bertajuk "Model Perlindungan Neuro bagi Penuaan Sihat dalam Kalangan Warga Emas." Objektif asal kajian ini adalah untuk memeriksa tahap penurunan kognitif dan faktor-faktor yang berkaitan secara prospektif. Walau bagaimanapun, hanya data pada peringkat pertama sahaja yang digunakan dalam kajian ini. Analisis data dijalankan selepas memeriksa data untuk ralat pengkodan, mengenalpasti dan menghapuskan data extrim, menggantikan ketidaklengkapan data, dan menangani isu normaliti data. Prosedur statistik utama yang digunakan ialah korelasi *Pearson*, ujian *chi-square*, regresi linear berganda, dan pemodelan persamaan struktur.

Hasil kajian menunjukkan umur, tahun pendidikan, pendapatan isi rumah, tekanan darah sistolik, indeks jisim badan, bilangan penyakit kronik, kemurungan, keagamaan intrinsik, jantina, status perkahwinan, etnik, dan susunan tempat tinggal berkorelasi dengan fungsi kognitif. Wanita, usia tua, diceraikan atau berpisah, tahap pendidikan yang rendah, pendapatan rumahtangga yang rendah, gula darah puasa yang tinggi,

nisbah kolesterol yang tinggi, gejala kemurungan yang tinggi, dan keagamaan intrinsik yang rendah ialah peramal fungsi kognitif yang rendah. Selain itu, bilangan penyakit kronik mengantarakan hubungan antara sindrom metabolik dan fungsi kognitif secara sebahagian serta keagamaan intrinsik menyederhanakan hubungan antara kemurungan dan fungsi kognitif.

Hasil kajian menunjukkan sindrom metabolik meningkatkan bilangan penyakit kronik dalam kalangan warga emas; respons ini seterusnya mengurangkan fungsi kognitif mereka. Di samping itu, keagamaan intrinsik mengurangkan kesan negatif kemurungan pada fungsi kognitif. Untuk memelihara fungsi kogniif pada usia tua, intervensi untuk meminimumkan bilangan penyakit kronik dengan mengurangkan faktor risiko vaskular harus dilaksanakan. Selain itu, para profesional yang merawat warga emas yang mengalami masalah kemurungan harus meningkatkan tahap keagamaan intrinsik mereka sebagai salah satu strategi untuk memelihara fungsi kognitif.



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I certify that a Thesis Examination Committee has met on 5 June 2018 to conduct the final examination of Foong Hui Foh on his thesis entitled "Relationship between Selected Biopsychosocial Factors on Cognitive Functions among Malaysian Community- Dwelling Older Adults" 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 Doctor of Philosophy.

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LIST OF ABBREVIATIONS

	AD	Alzheimer's Disease
	ADL	Activity of daily living
AGFI AMOS		Adjusted Goodness of Fit
		Analysis of Moment Structures
	APOE e4	Apolipoprotein allele 4
	BMI	Body mass index
	CFA	Confirmatory factor analysis
	CFI	Comparative Fit Index
	CSDD	The Cornell Scale for Depression in Dementia
	DOSM	Department of Statistics Malaysia
	DSM-IV	Diagnostic and Statistical Manual of Mental Disorders-Fourth
	Domin	Edition
	FFA	Exploratory factor analysis
	EIMI	Full information maximum likelihood
	GDS	Geristric Depression Scale
	GEI	Goodnass of Fit Inday
		High density lineprotein
		Instrumental activity of daily living
	ICD 0 CM	International Classification of Diseases, Ninth Pavision, Clinical
	ICD-9-CIVI	Medification
	IDE	Modification
	IDF	International Diabetes Federation
		Incremental Fit Index
	IQK	Interquartile range
	LKGS IUA	Longevity
	MCAR	Missing completely at random
	MCI	Mild cognitive impairment
	MMSE	Mini-Mental State Examination
	MoCA	Montreal Cognitive Assessment
	NCEP ATP III	National Cholesterol Education Program Adult Treatment Panel III
	01	First quartile
	03	Third quartile
	RMSEA	Root Mean Square of Error Estimation
	SEM	Structural equation modelling
	TG/HDL	Triglyceride and high-density lipoprotein ratio
	WHO	World Health Organisation
	z-score	Standardised score
	γ^2/df	Relative chi-square
	χ,	

CHAPTER 1

INTRODUCTION

This chapter presents the study background, problem statement, objectives, and proposed hypotheses of the study. It also covers the conceptual and operational definitions of all variables in this study. Last but not least, the elucidation of the study's significance, theoretical framework, and conceptual framework are also presented.

1.1 Background of the Study

An increase in overall life expectancy and the reduction of fertility rate are the two principal factors contributing to worldwide population ageing. According to World Health Organisation [WHO], (2015), the population of older adults worldwide (adults aged 60 and above) is expected to grow from 900 million to 2 billion by the year 2050. In 2016, 6.0% (1.9 million) of Malaysia's population consisted of adults aged 65 and above (Department of Statistics Malaysia [DOSM], 2016), and the number is expected to increase to 5.6 million in 2035. As a result, Malaysia will be labelled as an ageing nation by 2035, with an estimated 15% (5.6 million) of its population comprising adults aged 60 and above (DOSM, 2012).

An important determinant of successful ageing is the preservation and retainment of one's cognitive function (Rowe & Kahn, 1997). The term "cognitive function" is to be understood as a system of mental faculties that can be categorised into different domains, namely memory, attention, language, executive function, perception, and spatial ability (Harada, Natelson Love, & Triebel, 2013). Preservation and retainment of cognitive function in old age are important because high capacity of cognitive functional independence, and preventing risk for fall (Jekel et al., 2015; Muir, Gopaul, & Montero Odasso, 2012; Pusswald et al., 2015).

Cognitive function of an individual tends to experience substantial reduction with advancing age and declining of cognitive function happens as early as in the age range of 20 to 30 (Salthouse, 2009). The healthy and non-pathological decline of cognitive function, however, occurs at a normal pace. The cognitive changes in ageing compromise several cognitive domains such as processing speed, attention, memory, visuospatial abilities, and executive functioning. Nevertheless, despite the effects of cognitive ageing, one's vocabulary (language) and general knowledge tend to show gradual improvement by the time one reaches the age range of 60 to 70 (Salthouse, 2012). The pathological decline of cognitive function causes mild cognitive impairment and dementia. Dementia is a serious mental health condition affecting older adults. It is understood as a severe decline in a person's cognitive abilities in a way that

compromises the brain's overall functionality and causes disabilities in its patients (WHO, 2016).

Majority of empirical research on cognitive function in older adults was conducted to identify individual variation. According to Baumgart et al. (2015), there is strong evidence which suggests that there are certain aspects of one's lifestyle which can help alleviate the risks of poor cognitive function. Healthy lifestyle habits such as being physically active, maintaining good cardiovascular health, eating a healthy diet, and also life-long learning can promote intact cognitive function. Concomitantly, another meta-analysis reported that low education attainment, high level of homocysteine in the blood, and an inactive lifestyle are strongly linked to the poor cognitive function in old age (Beydoun et al., 2014). Randomised controlled trial study also concluded that engaging in exercise and cognitively stimulating activities tend to promote higher levels of cognitive function in old age (Daffner, 2010). According to a systematic review reported by Fillit et al. (2002), factors such as lifelong learning, mentally stimulating activity, exercise, social engagement, stress-free, and good nutritional status are the factors promoting good cognitive function, whereas medical comorbidity, binge drinking, and smoking tend to promote poor cognitive function.

Aside from above-mentioned correlates of cognitive function, recent studies showed that metabolic syndrome and multiple chronic medical conditions were also negatively associated with cognitive function in older adults (Chen et al., 2017; Viscogliosi, Donfrancesco, Palmieri, & Giampaoli, 2017). Raffaitin et al. (2011) reported that metabolic syndrome was associated with lower Mini-Mental Examination score among community-dwelling older adults, while Vassilaki et al. (2015) reported that older adults with more than one chronic medical condition had 38% increased risk of cognitive impairment.

Besides factors related to physical health as mentioned above, psychosocial factors are also important predictors of cognitive function in older adults (Llewellyn, Lang, Langa, & Huppert, 2008). Depression is an established risk factor for poor cognitive function in old age as older adults living with late-life depression had 85% higher odds to experience dementia (Diniz, Butters, Albert, Dew, & Reynolds, 2013). Intrinsic religiosity refers to an orientation of religiosity when someone chooses to see the religion as an end in itself and it may serve as a protective factor against depression as evidence suggests that intrinsic religiosity is associated with lower level of depressive symptoms (Amrai, Zalani, Arfai, & Sharifian, 2011). Furthermore, intrinsic religiosity is also associated with higher level of cognitive function in older adults (Coin et al., 2010).

The objectives of this study were to examine the relationships between selected biopsychosocial factors and cognitive function in later life. The biopsychosocial variables involved were demographic variables, metabolic syndrome, chronic medical condition, depression, and intrinsic religiosity.

1.2 Problem Statement

Preservation of cognitive function is crucial to healthy ageing. Reduced cognitive function can adversely affect the health of ageing populations and is associated with mild cognitive impairment (MCI) and dementia which subsequently affects the quality of life and functional independence of older adults (Jekel et al., 2015; Pusswald et al., 2015).

MCI and dementia are two forms of cognitive impairment which frequently occurs during old age. Across the United States, Europe, Asia, and Australia, MCI prevalence ranges from 5.0% to 36.7% (Sachdev et al., 2015). Due to population ageing, these numbers are expected to rise in the future. In the year 2010, about 35.6 million older persons all over the world were suffering from dementia, and the number is expected to increase to 65.7 million in 2030 and 115.4 million in 2050 (Prince et al., 2013). According to the Alzheimer Disease International (2006), the prevalence of dementia in Malaysia was 0.063% with the annual incidence rate of 0.020% in 2005. This number is projected to increase to 0.126% and 0.454% in 2020 and 2050 respectively.

Studies showed that metabolic syndrome and chronic medical condition are risk factors for poor cognitive function in older adults (Chen et al., 2017; Viscogliosi et al., 2017). Also, metabolic syndrome is known to be highly associated with various chronic medical conditions such as cardiovascular disease, type two diabetes, (Ford, Li, & Sattar, 2008; Mottillo et al., 2010) cancer and chronic kidney disease (Esposito, Chiodini, Colao, Lenzi, & Giugliano, 2012; Thomas et al., 2011). Older adults living with metabolic syndrome are at risk of having multiple chronic medical conditions (Schäfer et al., 2014). However, to the best of knowledge, there was no empirical study examined on how metabolic syndrome and chronic medical condition work together in accounting for variation in cognitive function. Therefore, one of the main objectives of this study was to investigate if chronic medical condition mediates the relationship between metabolic syndrome and cognitive function in older adults.

The negative impacts of depression on cognitive function in older adults are frequently discussed (Diniz et al., 2013). Older adults living with late-life depression have 98% higher risk to develop dementia in later life (Cherbuin, Kim, & Anstey, 2015). People with high levels of intrinsic religiosity find the religion to be the most important aspect of life and seek to contextualise other aspects of life through religion (Whitley & Kite, 2010). Greater intrinsic religiosity is a powerful mechanism to cope with stress (Wong-McDonald & Gorsuch, 2000). Older adults with greater intrinsic religiosity have lower depressive symptoms (Fehring, Miller, & Shaw, 1997; Koenig, 2007). Although the negative impact of depression in older adults' cognitive function and the positive impact of intrinsic religiosity on depression coping are frequently discussed, little is known about the influence of intrinsic religiosity on the relationship between depression and cognitive function. Therefore, another objective of this study was to investigate the moderating role of intrinsic religiosity on the relationship between depression and cognitive function in older adults. Both of these gaps in the literature

need to be addressed before interventions to improve cognitive function in communitydwelling older adults can be implemented.

1.3 Research Questions

The present study attempted to answer the following research questions:

1. Are there statistically significant relationships between cognitive function and selected biopsychosocial factors (age, year of education, household income, gender, marital status, ethnicity, living arrangement, systolic blood pressure, fasting blood sugar, triglyceride, cholesterol ratio, body mass index, chronic medical condition, depression, and intrinsic religiosity)?

2. What are the biopsychosocial predictors of cognitive function?

3. Does the chronic medical condition mediate the association between metabolic syndrome and cognitive function?

4. Does intrinsic religiosity moderate the association between depression and cognitive function?

1.4 Objectives of the Study

The general objective of this research work was to investigate the relationships between cognitive function and selected biopsychosocial factors in Malaysian community-dwelling older adults and the specific objectives of the study were as follows:

1. To examine the relationships between cognitive function and selected biopsychosocial factors (age, year of education, household income, gender, marital status, ethnicity, living arrangement, systolic blood pressure, fasting blood sugar, triglyceride, cholesterol ratio, body mass index, chronic medical condition, depression, and intrinsic religiosity).

2. To identify the biopsychosocial predictors of cognitive function.

3. To examine if the chronic medical condition mediates the association between metabolic syndrome and cognitive function.

4. To examine the moderating role of intrinsic religiosity in the relationship between depression and cognitive function.

5. To develop the full biopsychosocial model of cognitive function in older adults.

1.5 Research Hypotheses

The alternative hypotheses of this study were:

H1. There are significant correlations and associations between cognitive function and selected biopsychosocial factors.

H1a. Age is negatively correlated with cognitive function.

H1b. Year of education is positively correlated with cognitive function.

H1c. Household income is positively correlated with cognitive function.

H1d. There is an association between gender and cognitive function.

H1e. There is an association between marital status and cognitive function.

H1f. There is an association between ethnicity and cognitive function.

H1g. There is an association between living arrangement and cognitive function.

H1h. Systolic blood pressure is negatively correlated with cognitive function.

H1i. Fasting blood sugar is negatively correlated with cognitive function.

H1j. Triglyceride is negatively correlated with cognitive function.

- H1k. Cholesterol ratio is negatively correlated with cognitive function.
- H11. Body mass index is positively correlated with cognitive function.
- H1m.Chronic medical condition is negatively correlated with cognitive function.
- H1n. Depression is negatively correlated with cognitive function.

H10. Intrinsic religiosity is positively correlated with cognitive function

H2. There are significant predictions of cognitive function by selected biopsychosocial factors.

H3. Chronic medical condition mediates the association between metabolic syndrome and cognitive function.

H4. Intrinsic religiosity moderates the association between depression and cognitive function.

1.6 Conceptual and Operational Definitions of Study Variables

1.6.1 Cognitive function (Dependent variable)

Cognitive function refers to cerebral activities that lead to knowledge, including all mechanisms of acquiring information. Cognitive function provides a mental faculty that allows a conscious being to carry out both simple and complex tasks (Harada et al., 2013). Cognitive function was operationalised by "score on Montreal's Cognitive Assessment (MoCA) (Nasreddine et al., 2005)." Higher scores indicate higher cognitive function. Scores lower than 17 indicate mild cognitive impairment (Din et al., 2016).

1.6.2 Metabolic syndrome (Independent variable)

Metabolic syndrome is a risk factor when an individual is presented with a cluster of conditions including elevated blood pressure, high blood fasting sugar, excess fat around the waist, and abnormal cholesterol and triglyceride levels, that occur together will increase the risk of diabetes, heart disease, and stroke (Bechtold, Palmer, Valtos, Iasiello, & Sowers, 2006). Metabolic syndrome was operationalised by "reading on body mass index, systolic blood pressure, cholesterol ratio, triglyceride and fasting blood sugar (Huo et al., 2013; Shen et al., 2003; Stevenson et al., 2012)." Higher readings of body mass index, systolic blood pressure, cholesterol ratio, triglyceride and fasting blood sugar indicate higher metabolic risk.

1.6.3 Depression (Independent variable)

Depression is a medical illness that negatively affects how a person feels, thinks and acts. It causes a feeling of overwhelming sadness and loss of interest in favourite activities that reduce the functionality of a person at work and home (Weissman, 2009). Depression was operationalised by "score on Geriatric Depression Scale (Sheikh & Yesavage, 1986)." Higher scores indicate higher depressive symptoms. Scores higher than 5 indicate at risk of depression (Sheikh & Yesavage, 1986).

1.6.4 Chronic medical condition (Mediator)

Chronic medical condition refers to the summation of the chronic medical conditions experienced by an individual at the same time (Vassilaki et al., 2015). In the current study, chronic medical condition was operationalised by "the total chronic medical conditions experienced by each of the respondent from eight types of chronic medical conditions (hypertension, hypercholesterolemia, stroke, diabetes, heart disease, cancer, chronic kidney disease and gout) which were highly associated with metabolic syndrome (Wang et al., 2015)." Multimorbidity is commonly defined as the presence of two or more chronic medical conditions in an individual and morbidity is known as the presence of only one chronic medical condition.

1.6.5 Intrinsic religiosity (Moderator)

Intrinsic religiosity refers to taking religion as an end in itself. People with high intrinsic religiosity often assume the religion as their framework of living and always take religiosity as the master motive in their life (Allport & Ross, 1967). Intrinsic religiosity was operationalised by "score on intrinsic religiosity subscale of Religious Orientation Scale (Gorsuch & McPherson, 1989)." Higher scores indicate higher intrinsic religiosity.

1.7 Significance of the Study

1.7.1 Contribution to the body of knowledge

This study develops the first biopsychosocial model of cognitive function in older adults. Therefore, this study helps to extend the biopsychosocial model by showing that the biopsychosocial model is able to explain the old age cognitive function. The demographic correlates of cognitive function contribute to the literature by providing complete risk profiling of poor cognitive function among Malaysian older adults. The findings of this study contribute to the literature by exploring another mechanism underlying the relationship between metabolic syndrome and old age cognitive function, aside from the known factors such as vascular disease, inflammation, insulin resistance and adiposity. The findings of this study also contribute to the literature about the moderating role of specific religiosity orientation in the relationship between depression and cognitive function.

1.7.2 Contribution to the practice

This study identifies demographic correlates of cognitive function in older adults. Therefore, the comprehensive risk profiling enables policymaker and clinician to identify the high-risk group. The study also highlights the mediating role of chronic medical condition in the association between metabolic syndrome and cognitive function. Therefore, the findings guide healthcare providers about the importance of maintaining metabolic health of older adults, not only to prevent multimorbidity, but also to maintain cognitive vitality. This study identifies the moderating role of intrinsic religiosity in the association between depression and cognitive function. Thus, the findings emphasise if intrinsic religiosity should be integrated into the interventions to care for older adults living with stress or depression to maintain their cognitive function.

1.8 Theoretical Framework

The Cognitive Ageing Theory (Salthouse, 1985) and The Biopsychosocial Model (Engel, 1977) built the theoretical frameworks of the study. The Cognitive Ageing Theory explains the phenomena of cognitive function in older persons. The theory emphasises domains of cognitive function that will deteriorate across ageing and domains that will maintain or even improved over the lifespan. Fluid intelligence such as executive function and memory tend to deteriorate across ageing, while crystallised intelligence such as language and general knowledge tend to maintain or even improved over the lifespan (Salthouse, 1985). In the current study, cognitive function of older persons was the dependent variable and it was measured by MoCA, a global cognition assessment tool that combines several domains of cognitive function to assess for the crystallised and fluid intelligence of the older persons.

The Biopsychosocial Model (Engel, 1997) describes that biological, psychological, and social factor, must be taken into account in human functioning, especially in the context of illness and health. It posits health is best explained in terms of a joining of biological, psychological, and social factors (Engel, 1997). In the current study, biological factors such as metabolic syndrome and chronic medical conditions as well as psychological factor such as depression are hypothesised to negatively associate with cognitive function (Diniz et al., 2013; Solfrizzi et al., 2011; Vassilaki et al., 2015). Certain social factors such as being men, higher educational level and higher household income are hypothesised to positively associate with cognitive function (Lee, Shih, Feeney, & Langa, 2014). Figure 1.1 demonstrated the linkage between the domains of the theories and the variables of the current study.



Figure 1.1: The linkage between the domains of the theories and the variables of the present study

1.9 Conceptual Framework

Figure 1.2 depicts the conceptual framework of the study. In this conceptual framework, metabolic syndrome and depression are purported to have a direct relationship with cognitive function. Chronic medical condition that is associated with both metabolic syndrome and cognitive function may act as a mediator between metabolic syndrome and cognitive function. In addition, intrinsic religiosity that is associated with lower levels of depression may act as a moderator in influencing cognitive function.

Chapter Summary

This study aims to examine if chronic medical condition mediates the relationship between metabolic syndrome and cognitive function as well as to investigate the moderating role of intrinsic religiosity in the relationship between depression and cognitive function among Malaysian community-dwelling older adults by using probability sampling and representative sample. Background of the study, problem statement, research objectives and hypotheses, conceptual and operational definition of study variables, significance of the study, theoretical framework, and conceptual framework have been discussed in this chapter.



Figure 1.2: Conceptual framework of the study Note: AV = antecedent variables, IV 1 = independent variable 1, IV 2 = independent

variable 2, DV = dependent variable

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