



UNIVERSITI PUTRA MALAYSIA

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

FOONG HUI FOH

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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
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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 ekstrim, 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 kognitif 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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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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TABLE OF CONTENTS

	Page
ABSTRACT	i
ABSTRAK	iii
ACKNOWLEDGEMENTS	v
APPROVAL	vi
DECLARATION	viii
LIST OF TABLES	xiv
LIST OF FIGURES	xv
LIST OF ABBREVIATIONS	xvi
CHAPTER	
1	
INTRODUCTION	1
1.1 Background of the Study	1
1.2 Problem Statement	3
1.3 Research Questions	4
1.4 Objective of the Study	4
1.5 Research Hypotheses	4
1.6 Conceptual and Operational Definition of Study Variables	5
1.6.1 Cognitive function (Dependent variable)	5
1.6.2 Metabolic syndrome (Independent variable)	5
1.6.3 Depression (Independent variable)	6
1.6.4 Chronic medical condition (Mediator)	6
1.6.5 Intrinsic religiosity (Moderator)	6
1.7 Significance of the Study	6
1.7.1 Contribution to the body of knowledge	6
1.7.2 Contribution to the practice	7
1.8 Theoretical Framework	7
1.9 Conceptual Framework	8
2	
LITERATURE REVIEW	10
2.1 Cognitive Function and Its Domains	10
2.1.1 Processing speed	10
2.1.2 Attention	11
2.1.3 Memory	11
2.1.4 Language	11
2.1.5 Visuospatial and constructional abilities	12
2.1.6 Executive functioning	12
2.1.7 Cognitive function domains and global cognitive function assessment	13
2.2 Outcomes of Cognitive Impairment in Old Age	13
2.3 Biopsychosocial Predictors of Cognitive Function	15
2.3.1 Metabolic syndrome	15
2.3.2 Depression	18
2.3.3 Sociodemographic and economic factors	22
2.4 Chronic Medical Condition as Mediator between Metabolic Syndrome and Cognitive Function	25
2.4.1 Metabolic syndrome and chronic medical	26

	condition	
	2.4.2 Cognitive function and chronic medical condition	27
2.5	Intrinsic Religiosity as Moderator between Depression and Cognitive Function	28
	2.5.1 Depression and intrinsic religiosity	29
	2.5.2 Cognitive function and intrinsic religiosity	30
2.6	Theoretical Framework	30
	2.6.1 Theory of Cognitive Ageing	30
	2.6.2 The Resource Theory	31
3	METHODOLOGY	33
	3.1 The Data	33
	3.1.1 Source of the data	33
	3.1.2 Study location and study design	33
	3.1.3 Sampling frame	34
	3.1.4 Sampling unit and sample size calculation	34
	3.1.5 Sampling technique	35
	3.1.6 Sampling criteria and data collection	36
	3.1.7 Data collection technique and quality control	36
	3.1.8 Ethical issue	36
	3.1.9 Response rate	36
	3.2 Sample of the Current Study	37
	3.3 Measurement in the Current Study	37
	3.3.1 Cognitive function (Dependent variable)	38
	3.3.2 Metabolic syndrome (Independent variable)	38
	3.3.3 Depression (Independent variable)	39
	3.3.4 Chronic medical condition (Mediator)	39
	3.3.5 Intrinsic religiosity (Moderator)	40
	3.4 Data Preparation in the Current Study	40
	3.4.1 Identifying outliers	41
	3.4.2 Handling of missing value	42
	3.4.3 Normality	44
	3.5 Data Analysis	45
	3.5.1 Statistical software and level of significance	45
	3.5.2 Descriptive statistics	45
	3.5.3 Pearson's correlation and chi-square test	46
	3.5.4 Multiple linear regression	46
	3.5.5 Structural equation modelling (SEM)	47
4	RESULTS AND DISCUSSION	49
	4.1 Sociodemographic and Economic Characteristics of the Sample	49
	4.2 General Description on the Cognitive Function and Prevalence of Mild Cognitive Impairment	49

4.2.1	Discussion on general description of the cognitive function and prevalence of mild cognitive impairment	52
4.3	General Description on the Metabolic Syndrome Markers, Depression, Chronic Medical Condition, and Intrinsic Religiosity	53
4.3.1	Discussion on the general description of metabolic syndrome markers, depression, chronic medical condition, and intrinsic religiosity	55
4.4	The Bivariate Correlations among Study Variables and Comparisons of Study Variables by Cognitive Status	57
4.4.1	Discussion on the associations between ethnicity, living arrangement and cognitive function	59
4.5	The Predictors of Cognitive Function	60
4.5.1	Discussions on predictors of cognitive function	61
4.6	The Mediating Role of Chronic Medical Condition on the Relationship between Metabolic Syndrome and Cognitive Function	66
4.6.1	Discussion on the mediating role of chronic medical condition on the relationship between metabolic syndrome and cognitive function	68
4.7	The Mediating Role of Chronic Medical Condition on the Relationship between Depression and Cognitive Function	70
4.7.1	Discussion on the mediating role of chronic medical condition on the relationship between depression and cognitive function	71
4.8	The Moderating Role of Intrinsic Religiosity on the Relationship between Depression and Cognitive Function	71
4.8.1	Discussion on the moderating role of intrinsic religiosity on the relationship between depression and cognitive function	74
4.9	The Moderating Effect of Intrinsic Religiosity on the Relationship between Metabolic Syndrome and Cognitive Function	77
4.9.1	Discussion on the moderating effect of intrinsic religiosity on the relationship between metabolic syndrome and cognitive function	77
4.10	The Full Biopsychosocial Model of Cognitive Function	78
5	SUMMARY, CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH	80
5.1	Summary and Conclusion	80
5.2	Implication of the Study	81
5.2.1	Theoretical implication	81
5.2.2	Practical implication	81

5.3	Limitation of the Study and Recommendation for Future Research	82
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REFERENCES	84
APPENDICES	109
BIODATA OF STUDENT	117
LIST OF PUBLICATIONS	118



LIST OF TABLES

Table		Page
3.1	Summary of measurements used in the present study	40
3.2	First quartile (Q1), third quartile (Q3), interquartile range (IQR), lower outer fence, upper outer fence, number and percentage of outliers identified in the dataset	42
3.3	Number and percentage of missing value present in the data	43
3.4	Absolute skewness values for variables that were normally distributed	44
3.5	The absolute skewness values before and after transformation, as well as the type of transformation used to normalise the non-normal variable	45
3.6	The categories of model fit, fit indices, and their level of acceptance	48
4.1	Sociodemographic and economic characteristics of the sample	50
4.2	General description on the MoCA score based on domains	51
4.3	Distribution of the sample based on the level of cognitive function	51
4.4	Distribution of the sample based on the cognitive function status (normal and mild cognitive impairment)	52
4.5	Descriptive statistics of the metabolic syndrome markers, number of chronic medical condition, depression, and intrinsic religiosity	53
4.6	Distribution of the sample based on the levels of metabolic syndrome markers, number of chronic medical condition, depression, and intrinsic religiosity	55
4.7	Respondents' characteristics based on chronic conditions	56
4.8	The prevalence of older adults at risk of depression	56
4.9	Bivariate correlations among study variables	58
4.10	The associations between gender, ethnicity, marital status, living arrangement and cognitive status	59
4.11	Unstandardised and standardised coefficients, t value and p value for metabolic syndrome markers, depression, chronic medical condition, and intrinsic religiosity in predicting cognitive function	61
4.12	Unstandardized and standardized coefficients, t value and p value for demographic variables, metabolic syndrome markers, depression, chronic medical condition, and intrinsic religiosity in predicting cognitive function	62
4.13	Standardised regression weights of measures on metabolic syndrome latent factor	67
4.14	Fitness indices of CFA	67
4.15	The mediating role of chronic medical condition in the relationship between depression and cognitive function	72
4.16	Hierarchical multiple regression analysis to predict cognitive function	75

LIST OF FIGURES

Figure		Page
1.1	The linkage between the domains of the theories and the variables of the present study	8
1.2	Conceptual framework of this study	9
3.1	The sampling technique of the original study	35
3.2	The process of sample selection of the original study	37
3.3	Data handling procedures of the current study	41
4.1	The measurement model of metabolic syndrome	67
4.2	The mediating role of chronic medical condition on the relationship between metabolic syndrome and cognitive function	69
4.3	The moderating effect of intrinsic religiosity on the relationship between depression and cognitive function.	76
4.4	The effect of intrinsic religiosity on the interaction between depression and cognitive function.	76
4.5	The biopsychosocial model of cognitive function	79

LIST OF ABBREVIATIONS

AD	Alzheimer's Disease
ADL	Activity of daily living
AGFI	Adjusted Goodness of Fit
AMOS	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 Edition
EFA	Exploratory factor analysis
FIML	Full information maximum likelihood
GDS	Geriatric Depression Scale
GFI	Goodness of Fit Index
HDL	High-density lipoprotein
IADL	Instrumental activity of daily living
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
IDF	International Diabetes Federation
IFI	Incremental Fit Index
IQR	Interquartile range
LRGS TUA	Longitudinal Study on Neuroprotective Model for Healthy 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
Q1	First quartile
Q3	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
χ^2/df	Relative chi-square

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 function in old age helps in enhancing quality of life, promoting 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 community-dwelling 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.
- H1l. 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.
- H1o. 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.

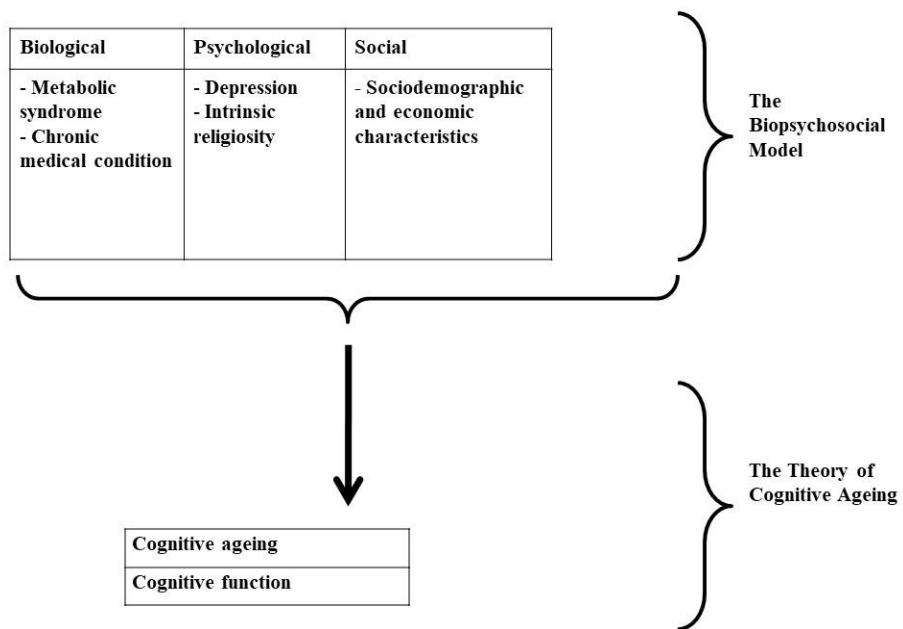


Figure 1.1: The linkage between the domains of the theories and the variables of the present study

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.

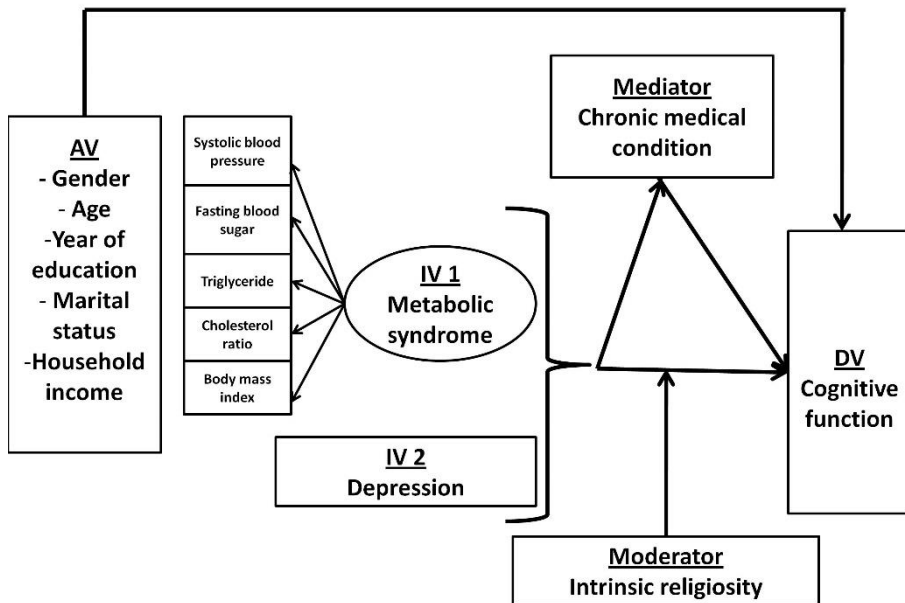


Figure 1.2: Conceptual framework of the study

Note: AV = antecedent variables, IV 1 = independent variable 1, IV 2 = independent variable 2, DV = dependent variable

REFERENCES

- Abolfathi Momtaz, Y., Hamid, T.-A., Ibrahim, R., Yahaya, N., & Tyng Chai, S. (2011). Moderating effect of religiosity on the relationship between social isolation and psychological well-being. *Mental Health, Religion & Culture*, 14(2), 141–156. <https://doi.org/10.1080/13674676.2010.497963>
- Alberti, K. G. M. M., Zimmet, P., & Shaw, J. (2005). The metabolic syndrome - A new worldwide definition. *Lancet*, 366(9491), 1059–1062. [https://doi.org/10.1016/S0140-6736\(05\)67402-8](https://doi.org/10.1016/S0140-6736(05)67402-8)
- Allen, P., & Bennett, K. (2012). *SPSS Statistics: A Practical Guide, version 20*. South Melbourne, Victoria: Cengage Learning Australia.
- Allerhand, M., Gale, C. R., & Deary, I. J. (2014). The dynamic relationship between cognitive function and positive well-being in older people: a prospective study using the English Longitudinal Study of Aging. *Psychology and Aging*, 29(2), 306–318. <https://doi.org/10.1037/a0036551>
- Alley, D., Suthers, K., & Crimmins, E. (2007). Education and Cognitive Decline in Older Americans Results From the AHEAD Sample. *Research on Aging*, 29(1), 73–94. <https://doi.org/10.1177/0164027506294245>
- Allison, P. D. (1987). Estimation of linear models with incomplete data. In *Sociological Methodology* (Vol. 17, pp. 71–103). San Francisco: Jossey-Bass. <https://doi.org/10.2307/271029>
- Allison, P. D. (2003). Missing data techniques for structural equation modeling. *Journal of Abnormal Psychology*, 112(4), 545–557. <https://doi.org/10.1037/0021-843X.112.4.545>
- Allport, G. W., & Ross, J. M. (1967). Personal religious orientation and prejudice. *Journal of Personality and Social Psychology*, 5(4), 432–443. <https://doi.org/10.1037/h0021212>
- American Heart Association. (2013). What Do My Cholesterol Levels Mean? Retrieved from http://www.heart.org/HEARTORG/Conditions/Cholesterol/AboutCholesterol/What-Your-Cholesterol-Levels-Mean_UCM_305562_Article.jsp
- Amrai, K., Zalani, H. A., Arfai, F. S., & Sharifian, M. S. (2011). The relationship between the religious orientation and anxiety and depression of students. *Social and Behavioral Sciences*, 15, 613–616. <https://doi.org/10.1016/j.sbspro.2011.03.150>

- Ansari, S., Soltero, E. G., Lorenzo, E., & Lee, R. E. (2017). The impact of religiosity on dietary habits and physical activity in minority women participating in the Health is Power (HIP) study. *Preventive Medicine Reports*, 5, 210–213. <https://doi.org/10.1016/j.pmedr.2016.12.012>
- Ardelt, M., & Koenig, C. S. (2007). The importance of religious orientation and purpose in life for dying well: evidence from three case studies. *Journal of Religion, Spirituality & Aging*, 19(4), 61–79. https://doi.org/10.1300/J496v19n04_05
- Arvanitakis, Z., Capuano, A. W., Bennett, D. A., & Barnes, L. L. (2018). Body Mass Index and Decline in Cognitive Function in Older Black and White Persons. *The Journals of Gerontology: Series A*, 73(2), 198–203. <https://doi.org/10.1093/gerona/glx152>
- Awang, Z. (2015). *SEM Made Simple: A Gentle Approach to Learning Structural Equation Modelling*. MPWS Rich Publication (Vol. 1). Bandar Baru Bangi: MPWS Rich Publication.
- Back, J. H., & Lee, Y. (2011). Gender differences in the association between socioeconomic status (SES) and depressive symptoms in older adults. *Archives of Gerontology and Geriatrics*, 52(3), e140–e144. <https://doi.org/10.1016/j.archger.2010.09.012>
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173–1182. <https://doi.org/10.1093/alcalc/34.2.197>
- Barua, A., Ghosh, M. K., Kar, N., & Basilio, M. A. (2011). Prevalence of depressive disorders in the elderly. *Annals of Saudi Medicine*, 31(6), 620–4. <https://doi.org/10.4103/0256-4947.87100>
- Baumgart, M., Snyder, H. M., Carrillo, M. C., Fazio, S., Kim, H., & Johns, H. (2015). Summary of the evidence on modifiable risk factors for cognitive decline and dementia: A population-based perspective. *Alzheimer's and Dementia*, 11(6), 718–726. <https://doi.org/10.1016/j.dadm.2015.08.003>
- Beal, C. (2006). Loneliness in older women: a review of the literature. *Issues in Mental Health Nursing*, 27(7), 795–813. <https://doi.org/10.1080/01612840600781196>
- Bechtold, M., Palmer, J., Valtos, J., Iasiello, C., & Sowers, J. (2006). Metabolic syndrome in the elderly. *Current Diabetes Reports*, 6(1), 64–71. <https://doi.org/10.1007/s11892-006-0054-3>
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107(2), 238–246. <https://doi.org/10.1037/0033-2909.107.2.238>

- Berry, D. M., & York, K. (2011). Depression and religiosity and/or spirituality in college: A longitudinal survey of students in the USA. *Nursing and Health Sciences, 13*(1), 76–83. <https://doi.org/10.1111/j.1442-2018.2011.00584.x>
- Beydoun, M. A., Beydoun, H. A., Gamaldo, A. A., Teel, A., Zonderman, A. B., & Wang, Y. (2014). Epidemiologic studies of modifiable factors associated with cognition and dementia: systematic review and meta-analysis. *BMC Public Health, 14*, 643. <https://doi.org/10.1186/1471-2458-14-643>
- Blair, M., Coleman, K., Jesso, S., Desbeaumes Jodoin, V., Smolewska, K., Warriner, E., ... Pasternak, S. H. (2016). Depressive Symptoms Negatively Impact Montreal Cognitive Assessment Performance: A Memory Clinic Experience. *Canadian Journal of Neurological Sciences, 43*(4), 513–517. <https://doi.org/10.1017/cjn.2015.399>
- Bollen, K. A. (1990). Overall fit in covariance structure models: Two types of sample size effects. *Psychological Bulletin, 107*(2), 256–259. <https://doi.org/10.1037/0033-2909.107.2.256>
- Borland, E., Nägga, K., Nilsson, P. M., Minthon, L., Nilsson, E. D., & Palmqvist, S. (2017). The Montreal Cognitive Assessment: Normative Data from a Large Swedish Population-Based Cohort. *Journal of Alzheimer's Disease, 59*(3), 893–901. <https://doi.org/10.3233/JAD-170203>
- Bunce, D., Batterham, P. J., Mackinnon, A. J., & Christensen, H. (2012). Depression, anxiety and cognition in community-dwelling adults aged 70 years and over. *Journal of Psychiatric Research, 46*(12), 1662–1666. <https://doi.org/10.1016/j.jpsychires.2012.08.023>
- Byers, A. L., Covinsky, K. E., Barnes, D. E., & Yaffe, K. (2012). Dysthymia and depression increase risk of dementia and mortality among older veterans. *The American Journal of Geriatric Psychiatry, 20*, 664–672. <https://doi.org/10.1097/JGP.0b013e31822001c1>
- Cagney, K. A., & Lauderdale, D. S. (2002). Education, wealth, and cognitive function in later life. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 57*(2), 163–172. <https://doi.org/10.1093/geronb/57.2.P163>
- Caracciolo, B., Gatz, M., Xu, W., Marengoni, A., Pedersen, N. L., & Fratiglioni, L. (2013). Relationship of subjective cognitive impairment and cognitive impairment no dementia to chronic disease and multimorbidity in a nation-wide twin study. *Journal of Alzheimer's Disease, 36*(2), 275–284. <https://doi.org/10.3233/JAD-122050>
- Carlson, M. C., Hasher, L., Zacks, R. T., & Connelly, S. L. (1995). Aging, distraction, and the benefits of predictable location. *Psychology and Aging, 10*(3), 427–36. <https://doi.org/10.1037//0882-7974.10.3.427>

- Chee, M. W. L., Chen, K. H. M., Zheng, H., Chan, K. P. L., Isaac, V., Sim, S. K. Y., ... Ng, T. P. (2009). Cognitive function and brain structure correlations in healthy elderly East Asians. *NeuroImage*, 46, 257–269. <https://doi.org/10.1016/j.neuroimage.2009.01.036>
- Chen, T. Bin, Yiao, S. Y., Sun, Y., Lee, H. J., Yang, S. C., Chiu, M. J., ... Wang, P. N. (2017). Comorbidity and dementia: A nationwide survey in Taiwan. *PLoS ONE*, 12(4). <https://doi.org/10.1371/journal.pone.0175475>
- Cherbuin, N., Kim, S., & Anstey, K. J. (2015). Dementia risk estimates associated with measures of depression: a systematic review and meta-analysis. *BMJ Open*, 5(12), e008853. <https://doi.org/10.1136/bmjopen-2015-008853>
- Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., ... Roccella, E. J. (2003). The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*, 289(19), 2560–72. <https://doi.org/10.1001/jama.289.19.2560>
- Chodosh, J., Reuben, D. B., Albert, M. S., & Seeman, T. E. (2002). Predicting cognitive impairment in high-functioning community-dwelling older persons: MacArthur Studies of Successful Aging. *Journal of the American Geriatrics Society*, 50(6), 1051–1060. <https://doi.org/jgs50260>
- Chua, Y. P. (2014). *Ujian Regresi, Analisis Faktor dan Analisis SEM*. McGrawHill Education. Shah Alam: McGrawHill Education.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. *Statistical Power Analysis for the Behavioral Sciences* (Vol. 2nd). Hillsdale, NJ: Erlbaum. <https://doi.org/10.1234/12345678>
- Coin, A., Perissinotto, E., Najjar, M., Girardi, A., Inelmen, E. M., Enzi, G., ... Sergi, G. (2010). Does Religiosity Protect Against Cognitive and Behavioral Decline in Alzheimers Dementia? *Current Alzheimer Research*, 7(5), 445–452. <https://doi.org/10.2174/156720510791383886>
- Cole, D. A. (1987). Utility of confirmatory factor analysis in test validation research. *Journal of Consulting and Clinical Psychology*, 55(4), 584–594. <https://doi.org/10.1037/0022-006X.55.4.584>
- Cole, M. G., & Dendukuri, N. (2003). Risk factors for depression among elderly community subjects: a systematic review and meta-analysis. *The American Journal of Psychiatry*, 160(6), 1147–1156. <https://doi.org/10.1176/appi.ajp.160.6.1147>
- Corrada, M. M., Brookmeyer, R., Paganini-Hill, A., Berlau, D., & Kawas, C. H. (2010). Dementia incidence continues to increase with age in the oldest old the 90+ study. *Annals of Neurology*, 67(1), 114–121. <https://doi.org/10.1002/ana.21915>

- Cragun, D., Cragun, R. T., Nathan, B., Sumerau, J. E., & Nowakowski, A. C. H. (2016). Do religiosity and spirituality really matter for social, mental, and physical health?: A tale of two samples. *Sociological Spectrum*, *36*(6), 359–377. <https://doi.org/10.1080/02732173.2016.1198949>
- Crichton, G. E., Elias, M. F., Buckley, J. D., Murphy, K. J., Bryan, J., & Frisardi, V. (2012). Metabolic syndrome, cognitive performance, and dementia. *Journal of Alzheimer's Disease*, *30*(SUPPL.2). <https://doi.org/10.3233/JAD-2011-111022>
- Daffner, K. R. (2010). Promoting successful cognitive aging: A comprehensive review. *Journal of Alzheimer's Disease*, *19*(4), 1101–1122. <https://doi.org/10.3233/JAD-2010-1306>
- Dandona, P., Aljada, A., Chaudhuri, A., Mohanty, P., & Garg, R. (2005). Metabolic syndrome: A comprehensive perspective based on interactions between obesity, diabetes, and inflammation. *Circulation*, *111*(11), 1448–1454. <https://doi.org/10.1161/01.CIR.0000158483.13093.9D>
- Darvyri, P., Galanakis, M., Avgoustidis, A. G., Pateraki, N., Vasdekis, S., & Darviri, C. (2014). The Revised Intrinsic / Extrinsic Religious Orientation Scale in a Sample of Attica's Inhabitants. *Psychology*, *5*, 1557–1567. <https://doi.org/10.4236/psych.2014.513166>
- Deary, I. J., Corley, J., Gow, A. J., Harris, S. E., Houlihan, L. M., Marioni, R. E., ... Starr, J. M. (2009). Age-associated cognitive decline. *British Medical Bulletin*. <https://doi.org/10.1093/bmb/ldp033>
- Decaria, J. E., Sharp, C., & Petrella, R. J. (2012). Scoping review report: Obesity in older adults. *International Journal of Obesity*, *36*(9), 1141–1150. <https://doi.org/10.1038/ijo.2012.29>
- Denys, K., Cankurtaran, M., Janssens, W., & Petrovic, M. (2009). Metabolic syndrome in the elderly: An overview of the evidence. *Acta Clinica Belgica*, *64*(1), 23–34. <https://doi.org/10.1179/acb.2009.006>
- Department of Statistics Malaysia. (2011). *Population Distribution and Basic Demographic Characteristics 2010*. Dept of Statistics, Malaysia. <https://doi.org/10.1094/ASBCMOA-StatisticalApp-1>
- Department of Statistics Malaysia. (2012). *Population Projections Malaysia 2010-2014*. Malaysia: Department of Statistics.
- Department of Statistics Malaysia. (2016). Selected Demographic Estimats Malaysia 2016. Retrieved August 9, 2017, from https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=397&bul_id=WVVQUnYrZkRwK1k1QXZMbEpuV1hNUT09&menu_id=L0pheU43NWJwRWVVSZklWdzQ4T1hUUT09#

- Díaz-Venegas, C., Downer, B., Langa, K. M., & Wong, R. (2016). Racial and ethnic differences in cognitive function among older adults in the USA. *International Journal of Geriatric Psychiatry*, 31(9), 1004–1012. <https://doi.org/10.1002/gps.4410>
- Din, N. C., Shahar, S., Zulkifli, B. H., Razali, R., Vyrn, C. A., & Omar, A. (2016). Validation and Optimal Cut-Off Scores of the Bahasa Malaysia Version of the Montreal Cognitive Assessment (MoCA-BM) for Mild Cognitive Impairment among Community Dwelling Older Adults in Malaysia (Keesahan dan Skor Titik Potong Optimum Versi Bahasa Malays. *Sains Malaysiana*, 45(9), 1337–1343.
- Diniz, B. S., Butters, M. A., Albert, S. M., Dew, M. A., & Reynolds, C. F. (2013). Late-life depression and risk of vascular dementia and Alzheimer's disease: systematic review and meta-analysis of community-based cohort studies. *The British Journal of Psychiatry*, 202(5), 329–335. <https://doi.org/10.1192/bjp.bp.112.118307>
- Dumas, J. A. (2015). What Is Normal Cognitive Aging? Evidence from Task-Based Functional Neuroimaging. *Current Behavioral Neuroscience Reports*, 2(4), 256–261. <https://doi.org/10.1007/s40473-015-0058-x>
- Duncan, T. E., Duncan, S. C., & Li, F. (1998). A comparison of model- and multiple imputation-based approaches to longitudinal analyses with partial missingness. *Structural Equation Modeling: A Multidisciplinary Journal*, 5(1), 1–21. <https://doi.org/10.1080/10705519809540086>
- Esiri, M. M. (2007). Ageing and the brain. *Journal of Pathology*, 211(2), 181–187. <https://doi.org/10.1002/path.2089>
- Esposito, K., Chiodini, P., Colao, A., Lenzi, A., & Giugliano, D. (2012). Metabolic syndrome and risk of cancer: A systematic review and meta-analysis. *Diabetes Care*, 35(11), 2402–2411. <https://doi.org/10.2337/dc12-0336>
- Fabbri, E., An, Y., Zoli, M., Simonsick, E. M., Guralnik, J. M., Bandinelli, S., ... Ferrucci, L. (2015). Aging and the burden of multimorbidity: Associations with inflammatory and anabolic hormonal biomarkers. *Journals of Gerontology - Series A Biological Sciences and Medical Sciences*, 70(1), 63–70. <https://doi.org/10.1093/gerona/glu127>
- Farris, W., Mansourian, S., Chang, Y., Lindsley, L., Eckman, E. a, Frosch, M. P., ... Guenette, S. (2003). Insulin-degrading enzyme regulates the levels of insulin, amyloid beta-protein, and the beta-amyloid precursor protein intracellular domain in vivo. *Proceedings of the National Academy of Sciences of the United States of America*, 100(7), 4162–4167. <https://doi.org/10.1073/pnas.0230450100>
- Fehring, R. J., Miller, J. F., & Shaw, C. (1997). Spiritual well-being, religiosity, hope, depression, and other mood states in elderly people coping with cancer. *Oncology Nursing Forum*, 24(4), 663–671.

- Feng, L., Ng, X.-T., Yap, P., Li, J., Lee, T.-S., Håkansson, K., ... Ng, T.-P. (2014). Marital status and cognitive impairment among community-dwelling Chinese older adults: The role of gender and social engagement. *Dementia and Geriatric Cognitive Disorders Extra*, 4(3), 375–384. <https://doi.org/10.1159/000358584>
- Fillit, H. M., Butler, R. N., O'Connell, A. W., Albert, M. S., Birren, J. E., Cotman, C. W., ... Tully, T. (2002). Achieving and maintaining cognitive vitality with aging. In *Mayo Clinic proceedings*. (Vol. 77, pp. 681–696). <https://doi.org/10.4065/77.7.681>
- Finch, J. F., West, S. G., & MacKinnon, D. P. (1997). Effects of sample size and nonnormality on the estimation of mediated effects in latent variable models. *Structural Equation Modeling*, 4(2), 87–107. <https://doi.org/10.1080/10705519709540063>
- Fiske, A., Wetherell, J. L., & Gatz, M. (2009). Depression in Older Adults. *Annual Review of Clinical Psychology*, 5(1), 363–389. <https://doi.org/10.1146/annurev.clinpsy.032408.153621>
- Ford, E. S., Li, C., & Sattar, N. (2008). Metabolic syndrome and incident diabetes: current state of the evidence. *Diabetes Care*, 31(9), 1898–904. <https://doi.org/10.2337/dc08-0423>
- Forlani, C., Morri, M., Ferrari, B., Dalmonte, E., Menchetti, M., De Ronchi, D., & Atti, A. R. (2014). Prevalence and gender differences in late-life depression: A population-based study. *American Journal of Geriatric Psychiatry*, 22(4), 370–380. <https://doi.org/10.1016/j.jagp.2012.08.015>
- Forti, P., Pisacane, N., Rietti, E., Lucicesare, A., Olivelli, V., Mariani, E., ... Ravaglia, G. (2010). Metabolic syndrome and risk of dementia in older adults. *Journal of the American Geriatrics Society*, 58(3), 487–492. <https://doi.org/10.1111/j.1532-5415.2010.02731.x>
- Fratiglioni, L., & Wang, H.-X. (2007). Brain reserve hypothesis in dementia. *Journal of Alzheimer's Disease*, 12, 11–22.
- Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology*, 51(1), 115–134. <https://doi.org/10.1037/0022-0167.51.1.115>
- Freitas, S., & Simoes, M. R. (2014). Montreal cognitive assessment (MoCA): Cutoff points for mild cognitive impairment, Alzheimer's disease, frontotemporal dementia and vascular dementia. *Sinapse*, 14(1), 18–30.
- Garson, G. D. (2015). *Missing values analysis and data imputation*. Asheboro, NC: Statistical Associates Publishers.

- Geda, Y. E., Roberts, R. O., Mielke, M. M., Knopman, D. S., Christianson, T. J. H., Pankratz, V. S., ... Rocca, W. A. (2014). Baseline neuropsychiatric symptoms and the risk of incident mild cognitive impairment: A population-based study. *American Journal of Psychiatry*, *171*(5), 572–581. <https://doi.org/10.1176/appi.ajp.2014.13060821>
- Gerstorf, D., Hoppmann, C. A., Kadlec, K. M., & McArdle, J. J. (2009). Memory and depressive symptoms are dynamically linked among married couples: longitudinal evidence from the AHEAD study. *Developmental Psychology*, *45*(6), 1595–1610. <https://doi.org/10.1037/a0016346>
- Girgus, J., Yang, K., & Ferri, C. (2017). The Gender Difference in Depression: Are Elderly Women at Greater Risk for Depression Than Elderly Men? *Geriatrics*, *2*(4), 35. <https://doi.org/10.3390/geriatrics2040035>
- Glaesmer, H., Riedel-Heller, S., Braehler, E., Spangenberg, L., & Lippa, M. (2011). Age- and gender-specific prevalence and risk factors for depressive symptoms in the elderly: a population-based study. *International Psychogeriatrics*, *23*(8), 1294–1300. <https://doi.org/10.1017/S1041610211000780>
- Goodman, R. A., Posner, S. F., Huang, E. S., Parekh, A. K., & Koh, H. K. (2013). Defining and Measuring Chronic Conditions: Imperatives for Research, Policy, Program, and Practice. *Preventing Chronic Disease*, *10*, 120239. <https://doi.org/10.5888/pcd10.120239>
- Gorelick, P. B. (2010). Role of inflammation in cognitive impairment: Results of observational epidemiological studies and clinical trials. *Annals of the New York Academy of Sciences*, *1207*, 155–162. <https://doi.org/10.1111/j.1749-6632.2010.05726.x>
- Gorsuch, R. L., & McPherson, S. E. (1989). Intrinsic/extrinsic measurement: I/E-revised and single-item scales. *Journal for the Scientific Study of Religion*, *28*(3), 348–354. <https://doi.org/10.2307/1386745>
- Grundy, S. M. (2007). Metabolic syndrome: a multiplex cardiovascular risk factor. *The Journal of Clinical Endocrinology and Metabolism*, *92*(2), 399–404. <https://doi.org/10.1210/jc.2006-0513>
- Grundy, S. M., Cleeman, J. I., Daniels, S. R., Donato, K. A., Eckel, R. H., Franklin, B. A., ... Costa, F. (2005). Diagnosis and management of the metabolic syndrome: An American Heart Association/National Heart, Lung, and Blood Institute scientific statement. *Circulation*, *112*(17), 2735–2752. <https://doi.org/10.1161/CIRCULATIONAHA.105.169404>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis. Vectors*. New Jersey: Pearson Prentice Hall. <https://doi.org/10.1016/j.ijpharm.2011.02.019>

- Håkansson, K., Rovio, S., Helkala, E.-L., Vilska, A.-R., Winblad, B., Soininen, H., ... Kivipelto, M. (2009). Association between mid-life marital status and cognitive function in later life: population based cohort study. *BMJ*, *339*, b2462. <https://doi.org/10.1136/bmj.b2462>
- Hamilton, J. L., Brickman, A. M., Lang, R., Byrd, G. S., Haines, J. L., Pericak-Vance, M. A., & Manly, J. J. (2014). Relationship between depressive symptoms and cognition in older, non-demented African Americans. *Journal of the International Neuropsychological Society*, *20*(7), 756–763. <https://doi.org/10.1017/S1355617714000423>
- Harada, C. N., Natelson Love, M. C., & Triebel, K. L. (2013). Normal cognitive aging. *Clinics in Geriatric Medicine*, *29*(4), 737–752. <https://doi.org/10.1016/j.cger.2013.07.002>
- Hartlage, S., Alloy, L. B., Vázquez, C., & Dykman, B. (1993). Automatic and effortful processing in depression. *Psychological Bulletin*, *113*(2), 247–278. <https://doi.org/10.1080/16506070500466865>
- Hayden, K. M., & Welsh-Bohmer, K. A. (2012). Epidemiology of cognitive aging and Alzheimer's disease: contributions of the cache county utah study of memory, health and aging. *Current Topics in Behavioral Neurosciences*, *10*, 3–31. https://doi.org/10.1007/7854_2011_152
- He, Q., Li, Q., Zhao, J., Wu, T., Ji, L., Huang, G., & Ma, F. (2016). Relationship between plasma lipids and mild cognitive impairment in the elderly Chinese: A case-control study. *Lipids in Health and Disease*, *15*(1), 146. <https://doi.org/10.1186/s12944-016-0320-6>
- Hebert, L. E., Weuve, J., Scherr, P. A., & Evans, D. A. (2013). Alzheimer disease in the United States (2010–2050) estimated using the 2010 census. *Neurology*, *80*(19), 1778–1783. <https://doi.org/10.1212/WNL.0b013e31828726f5>
- Helms, S. W., Gallagher, M., Calhoun, C. D., Choukas-Bradley, S., Dawson, G. C., & Prinstein, M. J. (2015). Intrinsic Religiosity Buffers the Longitudinal Effects of Peer Victimization on Adolescent Depressive Symptoms. *Journal of Clinical Child and Adolescent Psychology*, *44*(3), 471–479. <https://doi.org/10.1080/15374416.2013.865195>
- Hosseini, S., Chaurasia, A., & Oremus, M. (2017). The Effect of Religion and Spirituality on Cognitive Function: A Systematic Review. *The Gerontologist*. <https://doi.org/10.1093/geront/gnx024>
- Hovey, J. D., Hurtado, G., Morales, L. R. A., & Seligman, L. D. (2014). Religion-based emotional social support mediates the relationship between intrinsic religiosity and mental health. *Archives of Suicide Research*, *18*(4), 376–391. <https://doi.org/10.1080/13811118.2013.833149>

- Howell, D. (2007). *Statistical methods for psychology*. Belmont, CA: Thomson Wadsworth.
- Howieson, D. B., Holm, L. A., Kaye, J. A., Oken, B. S., & Howieson, J. (1993). Neurologic function in the optimally healthy oldest old. *Neuropsychological evaluation*. *Neurology*, *43*(10), 1882–6.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Huo, D., Wang, W., Li, X., Gao, Q., Wu, L., Luo, Y., ... Guo, X. (2013). Evaluation of two single-factor models of metabolic syndrome: a confirmatory factor analysis for an adult population in Beijing. *Lipids in Health and Disease*, *12*(1), 61. <https://doi.org/10.1186/1476-511X-12-61>
- Jagust, W., Harvey, D., Mungas, D., & Haan, M. (2005). Central obesity and the aging brain. *Archives of Neurology*, *62*(10), 1545–1548. <https://doi.org/10.1001/archneur.62.10.1545>
- Jekel, K., Damian, M., Wattmo, C., Hausner, L., Bullock, R., Connelly, P. J., ... Frölich, L. (2015). Mild cognitive impairment and deficits in instrumental activities of daily living: a systematic review. *Alzheimer's Research & Therapy*, *7*(1), 17. <https://doi.org/10.1186/s13195-015-0099-0>
- Jia, J., Zhou, A., Wei, C., Jia, X., Wang, F., Li, F., ... Dong, X. (2014). The prevalence of mild cognitive impairment and its etiological subtypes in elderly Chinese. *Alzheimer's and Dementia*, *10*(4), 439–447. <https://doi.org/10.1016/j.jalz.2013.09.008>
- Johari, S. M., & Shahar, S. (2014). Metabolic Syndrome: The Association of Obesity and Unhealthy Lifestyle among Malaysian Elderly People. *Archives of Gerontology and Geriatrics*, *59*(2), 360–366. <https://doi.org/10.1016/j.archger.2014.04.003>
- Jones, J. D., Malaty, I., Price, C. C., Okun, M. S., & Bowers, D. (2012). Health comorbidities and cognition in 1948 patients with idiopathic Parkinson's disease. *Parkinsonism and Related Disorders*, *18*(10), 1073–1078. <https://doi.org/10.1016/j.parkreldis.2012.06.004>
- Jöreskog, K. G., & Sörbom, D. (1996). *LISREL 8: user's reference guide*. Chicago: Scientific Software.
- Jorm, A. F., & Jolley, D. (1998). The incidence of dementia: A meta-analysis. *Neurology*, *51*(3), 728–733. <https://doi.org/10.1212/WNL.51.3.728>

- Katon, W., Lyles, C. R., Parker, M. M., Karter, A. J., Huang, E. S., & Whitmer, R. A. (2012). Association of depression with increased risk of dementia in patients with Type 2 Diabetes: The Diabetes and Aging Study. *Archives of General Psychiatry*, 69(4), 410–417. <https://doi.org/10.1001/archgenpsychiatry.2011.154>
- Katon, W., Pedersen, H. S., Ribe, A. R., Fenger-Gron, M., Davydow, D., Waldorff, F. B., & Vestergaard, M. (2015). Effect of depression and Diabetes Mellitus on the risk for dementia: a national population-based cohort study. *JAMA Psychiatry*, 72(6), 612–619. <https://doi.org/10.1001/jamapsychiatry.2015.0082>
- Katsumata, Y., Todoriki, H., Higashiuesato, Y., Yasura, S., Willcox, D. C., Ohya, Y., ... Dodge, H. H. (2012). Metabolic syndrome and cognitive decline among the oldest old in Okinawa: In search of a mechanism. The KOCO project. *Journals of Gerontology - Series A Biological Sciences and Medical Sciences*, 67A(2), 126–134. <https://doi.org/10.1093/gerona/67a254>
- Kerti, L., Witte, A. V., Winkler, A., Grittner, U., Rujescu, D., & Flöel, A. (2013). Higher glucose levels associated with lower memory and reduced hippocampal microstructure. *Neurology*, 81(20), 1746–1752. <https://doi.org/10.1212/01.wnl.0000435561.00234.ee>
- Kierzyńska, A., Kazmierski, R., & Kozubski, W. (2011). Educational level and cognitive impairment in patients with Parkinson disease. *Neurologia I Neurochirurgia Polska*, 45(1), 24–31.
- Kline, P. (2013). *The handbook of psychological testing. The handbook of psychological testing*. New York: Routledge.
- Kline, R. B. (2010). *Principles and Practice of Structural Equation Modeling*. New York: The Guilford Press.
- Koenig, H. G. (2007). Religion and depression in older medical inpatients. *The American Journal of Geriatric Psychiatry*, 15(4), 282–291. <https://doi.org/10.1097/01.JGP.0000246875.93674.0c>
- Koenig, H. G., George, L. K., & Titus, P. (2004). Religion, Spirituality, and Health in Medically Ill Hospitalized Older Patients. *Journal of the American Geriatrics Society*, 52(4), 554–562. <https://doi.org/10.1111/j.1532-5415.2004.52161.x>
- Koziol, N., & Arthur, A. (2012). *An Introduction to Secondary Data Analysis. Research Methodology Series*. United Kingdom: Cambridge University Press.
- Krause, N. (2003). Religious meaning and subjective well-being in late life. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 58(3), S160–S170. <https://doi.org/10.1093/geronb/58.3.S160>

- Langa, K. M., Larson, E. B., Karlawish, J. H., Cutler, D. M., Kabeto, M. U., Kim, S. Y., & Rosen, A. B. (2008). Trends in the prevalence and mortality of cognitive impairment in the United States: Is there evidence of a compression of cognitive morbidity? *Alzheimer's and Dementia*, 4(2), 134–144. <https://doi.org/10.1016/j.jalz.2008.01.001>
- Langa, K. M., Llewellyn, D. J., Lang, I. a, Weir, D. R., Wallace, R. B., Kabeto, M. U., & Huppert, F. a. (2009). Cognitive health among older adults in the United States and in England. *BMC Geriatrics*, 9(23), 1–11. <https://doi.org/10.1186/1471-2318-9-23>
- Laudisio, A., Marzetti, E., Pagano, F., Cocchi, A., Franceschi, C., Bernabei, R., & Zuccalà, G. (2008). Association of metabolic syndrome with cognitive function: The role of sex and age. *Clinical Nutrition*, 27(5), 747–754. <https://doi.org/10.1016/j.clnu.2008.07.001>
- Lederman, N. G., & Lederman, J. S. (2015). What Is A Theoretical Framework? A Practical Answer. *Journal of Science Teacher Education*, 26(7), 593–597. <https://doi.org/10.1007/s10972-015-9443-2>
- Lee, G. R., DeMaris, A., Bavin, S., & Sullivan, R. (2001). Gender differences in the depressive effect of widowhood in later life. *Journals of Gerontology: Social Sciences*, 56(1), S56–S61. <https://doi.org/10.1093/geronb/56.1.S56>
- Lee, J., Shih, R., Feeney, K., & Langa, K. M. (2014). Gender disparity in late-life cognitive functioning in India: findings from the longitudinal aging study in India. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 69(4), 603–611. <https://doi.org/10.1093/geronb/gbu017>
- Lee, L. K., Shahar, S., Chin, A. V., Mohd Yusoff, N. A., Rajab, N., & Aziz, S. A. (2012). Prevalence of gender disparities and predictors affecting the occurrence of mild cognitive impairment (MCI). *Archives of Gerontology and Geriatrics*, 54(1), 185–191. <https://doi.org/10.1016/j.archger.2011.03.015>
- Lee, M., Saver, J. L., Hong, K.-S., Wu, Y.-L., Liu, H.-C., Rao, N. M., & Ovbiagele, B. (2014). Cognitive impairment and risk of future stroke: a systematic review and meta-analysis. *Canadian Medical Association Journal*, 186(14), E536–E546. <https://doi.org/10.1503/cmaj.140147>
- Lee, S., Buring, J. E., Cook, N. R., & Grodstein, F. (2006). The relation of education and income to cognitive function among professional women. *Neuroepidemiology*, 26(2), 93–101. <https://doi.org/10.1159/000090254>
- Lei, X., Hu, Y., McArdle, J. J., Smith, J. P., & Zhao, Y. (2012). Gender differences in cognition among older adults in China. *The Journal of Human Resource*, 47(4), 951–971. <https://doi.org/http://jhr.uwpress.org/archive/>

- Lezak, M. D., Howieson, D. B., Loring, D. W., Hannay, H. J., & Fischer, J. S. (2004). *Neuropsychological assessment (4th ed.)*. Neuropsychological assessment (4th ed.). (4th ed.). New York: Oxford University Press.
- Lin, N. (1982). Social Resources and Instrumental Action. In *Social structure and network analysis* (pp. 131–147). Los Angeles: Sage Publications.
- Little, R. J. A. (1988). A Test of Missing Completely at Random for Multivariate Data with Missing Values. *Journal of the American Statistical Association*, 83(404), 1198–1202. <https://doi.org/10.1080/01621459.1988.10478722>
- Liu, H., Gao, S., Hall, K. S., Unverzagt, F. W., Lane, K. A., Callahan, C. M., & Hendrie, H. C. (2013). Optimal blood pressure for cognitive function: Findings from an elderly African-American cohort study. *Journal of the American Geriatrics Society*, 61(6), 875–881. <https://doi.org/10.1111/jgs.12259>
- Llewellyn, D. J., Lang, I. A., Langa, K. M., & Huppert, F. A. (2008). Cognitive function and psychological well-being: Findings from a population-based cohort. *Age and Ageing*, 37(6), 685–689. <https://doi.org/10.1093/ageing/afn194>
- Lloyd-Sherlock, P., Beard, J., Minicuci, N., Ebrahim, S., & Chatterji, S. (2014). Hypertension among older adults in low- and middle-income countries: prevalence, awareness and control. *International Journal of Epidemiology*, 43(1), 116–128. <https://doi.org/10.1093/ije/dyt215>
- Lu, J., Li, D., Li, F., Zhou, A., Wang, F., Zuo, X., ... Jia, J. (2011). Montreal cognitive assessment in detecting cognitive impairment in chinese elderly individuals: A population-based study. *Journal of Geriatric Psychiatry and Neurology*, 24(4), 184–190. <https://doi.org/10.1177/0891988711422528>
- Lucchetti, G., Lucchetti, A. L. G., Badan-Neto, A. M., Peres, P. T., Peres, M. F. P., Moreira-Almeida, A., ... Koenig, H. G. (2011). Religiousness affects mental health, pain and quality of life in older people in an outpatient rehabilitation setting. *Journal of Rehabilitation Medicine*, 43(4), 316–322. <https://doi.org/10.2340/16501977-0784>
- Luo, L., Yang, M., Hao, Q., Yue, J., & Dong, B. (2013). Cross-Sectional Study Examining the Association Between Metabolic Syndrome and Cognitive Function Among the Oldest Old. *Journal of the American Medical Directors Association*, 14(2), 105–108. <https://doi.org/10.1016/j.jamda.2012.10.001>
- Ma, C., Yin, Z., Zhu, P., Luo, J., Shi, X., & Gao, X. (2017). Blood cholesterol in late-life and cognitive decline: A longitudinal study of the Chinese elderly. *Molecular Neurodegeneration*, 12(24), 5341475. <https://doi.org/10.1186/s13024-017-0167-y>

- Marengoni, A., Angleman, S., Melis, R., Mangialasche, F., Karp, A., Garmen, A., ... Fratiglioni, L. (2011). Aging with multimorbidity: A systematic review of the literature. *Ageing Research Reviews*, 10(4), 430–439. <https://doi.org/10.1016/j.arr.2011.03.003>
- Marioni, R. E., Strachan, M. W. J., Reynolds, R. M., Lowe, G. D. O., Mitchell, R. J., Fowkes, F. G. R., ... Price, J. F. (2010). Association between raised inflammatory markers and cognitive decline in elderly people with type 2 diabetes: The Edinburgh Type 2 Diabetes Study. *Diabetes*, 59(3), 710–713. <https://doi.org/10.2337/db09-1163>
- Marsh, H. W., & Hocevar, D. (1985). Application of confirmatory factor analysis to the study of self-concept: First- and higher-order factor models and their invariance across groups. *Psychological Bulletin*, 97(3), 562.
- Masters, K. S., Hill, R. D., Kircher, J. C., Lensegrav Benson, T. L., & Fallon, J. A. (2004). Religious orientation, aging, and blood pressure reactivity to interpersonal and cognitive stressors. *Annals of Behavioral Medicine*, 28(3), 171–178. https://doi.org/10.1207/s15324796abm2803_5
- Masters, K. S., Lensegrav-Benson, T. L., Kircher, J. C., & Hill, R. D. (2005). Effects of religious orientation and gender on cardiovascular reactivity among older adults. *Research on Aging*, 27(2), 221–240. <https://doi.org/10.1177/0164027504270678>
- Mazzucco, S., Meggiolaro, S., Ongaro, F., & Toffolutti, V. (2017). Living arrangement and cognitive decline among older people in Europe. *Ageing and Society*, 37(6), 1111–1133. <https://doi.org/10.1017/S0144686X16000374>
- McEvoy, L. K., Laughlin, G. A., Barrett-Connor, E., Bergstrom, J., Kritz-Silverstein, D., Der-Martirosian, C., & von Muhlen, D. (2012). Metabolic syndrome and 16-year cognitive decline in community-dwelling older adults. *Ann Epidemiol*, 22(5), 310–317. <https://doi.org/10.1016/j.annepidem.2011.12.003>
- Miller, M., Stone, N. J., Ballantyne, C., Bittner, V., Criqui, M. H., Ginsberg, H. N., ... Pennathur, S. (2011). Triglycerides and cardiovascular disease: A scientific statement from the American Heart Association. *Circulation*, 123(20), 2292–2333. <https://doi.org/10.1161/CIR.0b013e3182160726>
- Miller, N. B., Smerglia, V. L., & Bouchet, N. (2004). Women's adjustment to widowhood: does social support matter? *Journal of Women & Aging*, 16(3–4), 149–67. https://doi.org/10.1300/J074v16n03_11
- Moonen, J. E. F., de Craen, A. J. M., Comijs, H. C., Naarding, P., de Ruijter, W., & van der Mast, R. C. (2015). In depressed older persons higher blood pressure is associated with symptoms of apathy. The NESDO study. *International Psychogeriatrics*, 27(9), 1485–1493. <https://doi.org/10.1017/S1041610215000253>

- Mosqueiro, B. P., Da Rocha, N. S., & Fleck, M. P. D. A. (2015). Intrinsic religiosity, resilience, quality of life, and suicide risk in depressed inpatients. *Journal of Affective Disorders*, *179*, 128–133. <https://doi.org/10.1016/j.jad.2015.03.022>
- Mottillo, S., Filion, K. B., Genest, J., Joseph, L., Pilote, L., Poirier, P., ... Eisenberg, M. J. (2010). The metabolic syndrome and cardiovascular risk: A systematic review and meta-analysis. *Journal of the American College of Cardiology*, *56*(14), 1113–1132. <https://doi.org/10.1016/j.jacc.2010.05.034>
- Muir, S. W., Gopaul, K., & Montero Odasso, M. M. (2012). The role of cognitive impairment in fall risk among older adults: A systematic review and meta-analysis. *Age and Ageing*, *41*(3), 299–308. <https://doi.org/10.1093/ageing/afs012>
- Nasreddine, Z. S., Phillips, N. A., Bédirian, V., Charbonneau, S., Whitehead, V., Collin, I., ... Chertkow, H. (2005). The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society*, *53*(4), 695–699. <https://doi.org/10.1111/j.1532-5415.2005.53221.x>
- Oates, G. L. (2016). Effects of Religiosity Dimensions on Physical Health across Non-elderly Black and White American Panels. *Review of Religious Research*, *58*(2), 249–270. <https://doi.org/10.1007/s13644-015-0239-9>
- O'Neill, S., & O'Driscoll, L. (2015). Metabolic syndrome: A closer look at the growing epidemic and its associated pathologies. *Obesity Reviews*, *16*(1), 1–12. <https://doi.org/10.1111/obr.12229>
- Obisesan, T. O., Obisesan, O. A., Martins, S., Alamgir, L., Bond, V., Maxwell, C., & Gillum, R. F. (2008). High blood pressure, hypertension, and high pulse pressure are associated with poorer cognitive function in persons aged 60 and older: The Third National Health and Nutrition Examination Survey. *Journal of the American Geriatrics Society*, *56*(3), 501–509. <https://doi.org/10.1111/j.1532-5415.2007.01592.x>
- Odden, M. C., Peralta, C. A., Haan, M. N., & Covinsky, K. E. (2012). Rethinking the association of high blood pressure with mortality in elderly adults: The impact of frailty. *Archives of Internal Medicine*, *172*(15), 1162–1168. <https://doi.org/10.1001/archinternmed.2012.2555>
- Oh, H.-M., Kim, S.-H., Kang, S.-G., Park, S.-J., & Song, S.-W. (2011). The Relationship between Metabolic Syndrome and Cognitive Function. *Korean J Fam Med*, *32*(6), 358–66. <https://doi.org/10.4082/kjfm.2011.32.6.358>
- Onadja, Y., Atchessi, N., Soura, B. A., Rossier, C., & Zunzunegui, M.-V. (2013). Gender differences in cognitive impairment and mobility disability in old age: a cross-sectional study in Ouagadougou, Burkina Faso. *Archives of Gerontology and Geriatrics*, *57*(3), 311–318. <https://doi.org/10.1016/j.archger.2013.06.007>

- Oosterman, J. M., Vogels, R. L. C., van Harten, B., Gouw, A. A., Poggesi, A., Scheltens, P., ... Scherder, E. J. A. (2010). Assessing mental flexibility: neuroanatomical and neuropsychological correlates of the Trail Making Test in elderly people. *The Clinical Neuropsychologist*, 24(2), 203–19. <https://doi.org/10.1080/13854040903482848>
- Pan, A., Sun, Q., Okereke, O. I., Rexrode, K. M., & Hu, F. B. (2011). Depression and risk of stroke morbidity and mortality: a meta-analysis and systematic review. *JAMA*, 306(11), 1241–9. <https://doi.org/10.1001/jama.2011.1282>
- Paradise, M., McCade, D., Hickie, I. B., Diamond, K., Lewis, S. J. G., & Naismith, S. L. (2015). Caregiver burden in mild cognitive impairment. *Aging & Mental Health*, 19(1), 72–78. <https://doi.org/10.1080/13607863.2014.915922>
- Park, D. C., Lautenschlager, G., Hedden, T., Davidson, N. S., Smith, A. D., & Smith, P. K. (2002). Models of visuospatial and verbal memory across the adult life span. *Psychology and Aging*, 17(2), 299–320. <https://doi.org/10.1037/0882-7974.17.2.299>
- Parthasarathy, V., Frazier, D. T., Bettcher, B. M., Jastrzab, L., Chao, L., Reed, B., ... Kramer, J. H. (2017). Triglycerides are negatively correlated with cognitive function in nondemented aging adults. *Neuropsychology*, 31(6), 682–688. <https://doi.org/10.1037/neu0000335>
- Peltzer, K., & Phaswana-Mafuya, N. (2013). Depression and associated factors in older adults in South Africa. *Global Health Action*, 6(s6), 18871. <https://doi.org/10.3402/gha.v6i0.18871>
- Perkins, J. M., Lee, H., James, K. S., Oh, J., Krishna, A., Heo, J., ... Subramanian, S. V. (2016). Marital status, widowhood duration, gender and health outcomes: a cross-sectional study among older adults in India. *BMC Public Health*, 16(1), 1032. <https://doi.org/10.1186/s12889-016-3682-9>
- Perneczky, R., Pohl, C., Sorg, C., Hartmann, J., Komossa, K., Alexopoulos, P., ... Kurz, A. (2006). Complex activities of daily living in mild cognitive impairment: Conceptual and diagnostic issues. *Age and Ageing*, 35(3), 240–245. <https://doi.org/10.1093/ageing/afj054>
- Petersen, R. C. (2004). Mild cognitive impairment as a diagnostic entity. *Journal of Internal Medicine*, 256(3), 183–194. <https://doi.org/10.1111/j.1365-2796.2004.01388.x>
- Petersen, R. C., Smith, G. E., Waring, S. C., Ivnik, R. J., Tangalos, E. G., & Kokmen, E. (1999). Mild cognitive impairment: clinical characterization and outcome. *Archives of Neurology*, 56(3), 303–308. <https://doi.org/10.1001/archneur.56.3.303>

- Pirutinsky, S., Rosmarin, D. H., Holt, C. L., Feldman, R. H., Caplan, L. S., Midlarsky, E., & Pargament, K. I. (2011). Does social support mediate the moderating effect of intrinsic religiosity on the relationship between physical health and depressive symptoms among Jews? *Journal of Behavioral Medicine*, *34*(6), 489–496. <https://doi.org/10.1007/s10865-011-9325-9>
- Pistell, P. J., Morrison, C. D., Gupta, S., Knight, A. G., Keller, J. N., Ingram, D. K., & Bruce-Keller, A. J. (2010). Cognitive impairment following high fat diet consumption is associated with brain inflammation. *Journal of Neuroimmunology*, *219*(1–2), 25–32. <https://doi.org/10.1016/j.jneuroim.2009.11.010>
- Plassman, B. L., Langa, K. M., Fisher, G. G., Heeringa, S. G., Weir, D. R., Ofstedal, M. B., ... Wallace, R. B. (2007). Prevalence of Dementia in the United States: The Aging, Demographics, and Memory Study. *Neuroepidemiology*, *29*(1–2), 125–132. <https://doi.org/10.1159/000109998>
- Pool, L. R., Weuve, J., Wilson, R. S., Bültmann, U., Evans, D. A., & Mendes De Leon, C. F. (2016). Occupational cognitive requirements and late-life cognitive aging. *Neurology*, *86*(15), 1386–1392. <https://doi.org/10.1212/WNL.0000000000002569>
- Prince, M., Wimo, A., Guerchet, M., Gemma-Claire, A., Wu, Y. T., & Prina, M. (2015). *World Alzheimer Report 2015: The Global Impact of Dementia - An analysis of prevalence, incidence, cost and trends*. Retrieved from <https://www.alz.co.uk/research/WorldAlzheimerReport2015.pdf>
- Pusswald, G., Tropper, E., Kryspin-Exner, I., Moser, D., Klug, S., Auff, E., ... Lehrner, J. (2015). Health-Related Quality of Life in Patients with Subjective Cognitive Decline and Mild Cognitive Impairment and its Relation to Activities of Daily Living. *Journal of Alzheimer's Disease*, *47*(2), 479–486. <https://doi.org/10.3233/JAD-150284>
- Qiu, C., Sigurdsson, S., Zhang, Q., Jonsdottir, M. K., Kjartansson, O., Eiriksdottir, G., ... Launer, L. J. (2014). Diabetes, markers of brain pathology and cognitive function: The Age, Gene/Environment Susceptibility-Reykjavik Study. *Annals of Neurology*, *75*(1), 138–146. <https://doi.org/10.1002/ana.24063>
- Raffaitin, C., Féart, C., Le Goff, M., Amieva, H., Helmer, C., Akbaraly, T. N., ... Barberger-Gateau, P. (2011). Metabolic syndrome and cognitive decline in French elders: The three-city study. *Neurology*, *76*(6), 518–525. <https://doi.org/10.1212/WNL.0b013e31820b7656>
- Rao, A., Suliman, A., Vuik, S., Aylin, P., & Darzi, A. (2016). Outcomes of dementia: Systematic review and meta-analysis of hospital administrative database studies. *Archives of Gerontology and Geriatrics*, *66*, 198–204. <https://doi.org/10.1016/j.archger.2016.06.008>

- Rao, D. P., Dai, S., Lagace, C., & Krewski, D. (2014). Metabolic syndrome and chronic disease. *Chronic Diseases and Injuries in Canada*, 34(1), 36–45. <https://doi.org/10.1111/j.1753-0407.2009.00042.x>
- Razali, R., Jean-Li, L., Jaffar, A., Ahmad, M., Shah, S. A., Ibrahim, N., ... Ahmad, S. (2014). Is the Bahasa Malaysia version of the Montreal Cognitive Assessment (MoCA-BM) a better instrument than the Malay version of the Mini Mental State Examination (M-MMSE) in screening for mild cognitive impairment (MCI) in the elderly? *Comprehensive Psychiatry*, 55, S70–S75. <https://doi.org/http://dx.doi.org/10.1016/j.comppsy.2013.04.010>
- Read, J. R., Sharpe, L., Modini, M., & Dear, B. F. (2017). Multimorbidity and depression: A systematic review and meta-analysis. *Journal of Affective Disorders*, 221, 36–46. <https://doi.org/10.1016/j.jad.2017.06.009>
- Richard, E., Reitz, C., Honig, L. H., Schupf, N., Tang, M. X., Manly, J. J., ... Luchsinger, J. A. (2013). Late-life depression, mild cognitive impairment, and dementia. *JAMA Neurology*, 70(3), 374–382. <https://doi.org/10.1001/jamaneurol.2013.603>
- Richards, M., & Sacker, A. (2010). Lifetime Antecedents of Cognitive Reserve. *J Clin Exp Neuropsychol*, 25(5), 614–24. <https://doi.org/10.1076/jcen.25.5.614.14581>
- Roberts, R. O., Knopman, D. S., Mielke, M. M., Cha, R. H., Pankratz, V. S., Christianson, T. J., ... Petersen, R. C. (2014). Higher risk of progression to dementia in mild cognitive impairment cases who revert to normal. *Neurology*, 82(4), 317–325. <https://doi.org/10.1212/WNL.0000000000000055>
- Rodríguez-Fernández, J. M., Danies, E., Martínez-Ortega, J., & Chen, W. C. (2017). Cognitive Decline, Body Mass Index, and Waist Circumference in Community-Dwelling Elderly Participants. *Journal of Geriatric Psychiatry and Neurology*, 30(2), 67–76. <https://doi.org/10.1177/0891988716686832>
- Rönnlund, M., Nyberg, L., Bäckman, L., & Nilsson, L.-G. (2005). Stability, growth, and decline in adult life span development of declarative memory: cross-sectional and longitudinal data from a population-based study. *Psychology and Aging*, 20(1), 3–18. <https://doi.org/10.1037/0882-7974.20.1.3>
- Rowe, J. W., & Kahn, R. L. (1997). Successful Aging. *Gerontologist*, 37(4), 433. <https://doi.org/10.1093/geront/37.4.433>
- Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: J. Wiley & Sons.
- Ruitenbergh, A., Ott, A., Van Swieten, J. C., Hofman, A., & Breteler, M. M. B. (2001). Incidence of dementia: Does gender make a difference? *Neurobiology of Aging*, 22(4), 575–580. [https://doi.org/10.1016/S0197-4580\(01\)00231-7](https://doi.org/10.1016/S0197-4580(01)00231-7)

- Sachdev, P. S., Lipnicki, D. M., Kochan, N. A., Crawford, J. D., Thalamuthu, A., Andrews, G., ... Lobo, E. (2015). The prevalence of mild cognitive impairment in diverse geographical and ethnocultural regions: The COSMIC Collaboration. *PLoS ONE*, *10*(11), e0142388. <https://doi.org/10.1371/journal.pone.0142388>
- Salive, M. E. (2013). Multimorbidity in older adults. *Epidemiologic Reviews*, *35*(1), 75–83. <https://doi.org/10.1093/epirev/mxs009>
- Salthouse, T. (1985). *A theory of cognitive aging*. Amsterdam: Elsevier.
- Salthouse, T. (2012). Consequences of Age-Related Cognitive Declines. *Annual Review of Psychology*, *63*, 201–226. <https://doi.org/10.1146/annurev-psych-120710-100328>
- Salthouse, T. A. (2009). When does age-related cognitive decline begin? *Neurobiology of Aging*, *30*(4), 507–514. <https://doi.org/10.1016/j.neurobiolaging.2008.09.023>
- Salthouse, T. A., Fristoe, N. M., Lineweaver, T. T., & Coon, V. E. (1995). Aging of attention: does the ability to divide decline? *Memory & Cognition*, *23*, 59–71. <https://doi.org/10.3758/BF03210557>
- Salthouse, T. A., Mitchell, D. R., Skovronek, E., & Babcock, R. L. (1989). Effects of adult age and working memory on reasoning and spatial abilities. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *15*(3), 507–516.
- Schäfer, I., Kaduszkiewicz, H., Wagner, H. O., Schön, G., Scherer, M., & Van Den Bussche, H. (2014). Reducing complexity: A visualisation of multimorbidity by combining disease clusters and triads. *BMC Public Health*, *14*, 1285. <https://doi.org/10.1186/1471-2458-14-1285>
- Schulz, R., Beach, S. R., Ives, D. G., Martire, L. M., Ariyo, A. A., & Kop, W. J. (2000). Association Between Depression and Mortality in Older Adults. *Archives of Internal Medicine*, *160*(12), 1761. <https://doi.org/10.1001/archinte.160.12.1761>
- Scott, S. B., Graham-Engeland, J. E., Engeland, C. G., Smyth, J. M., Almeida, D. M., Katz, M. J., ... Sliwinski, M. J. (2015). The effects of stress on cognitive aging, physiology and emotion (ESCAPE) project. *BMC Psychiatry*, *15*(146), 1–14. <https://doi.org/10.1186/s12888-015-0497-7>
- Seeman, T. E., Miller-Martinez, D. M., Stein Merkin, S., Lachman, M. E., Tun, P. a, & Karlamangla, A. S. (2011). Histories of social engagement and adult cognition: midlife in the U.S. study. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *66B*(S1), 141–152. <https://doi.org/10.1093/geronb/gbq091>
- Seo, S. (2006). *A review and comparison of methods for detecting outliers in univariate data sets*. Department of Biostatistics, Graduate School of Public Health. University of Pittsburgh.

- Shahar, S., Omar, A., Vanoh, D., Hamid, T., Mukari, S., Din, N., ... Razali, R. (2016). Approaches in methodology for population-based longitudinal 3 study on neuroprotective model for healthy longevity (TUA) among Malaysian Older Adults. *Aging Clinical and Experimental Research*, 28(6), 1089–1104. <https://doi.org/DOI 10.1007/s40520-015-0511-4>.
- Sharp, E. S., & Gatz, M. (2011). Relationship between education and dementia: an updated systematic review. *Alzheimer Disease and Associated Disorders*, 25(4), 289–304. <https://doi.org/10.1097/WAD.0b013e318211c83c>
- Sheikh, J., & Yesavage, J. (1986). 9/Geriatric Depression Scale (GDS) recent evidence and development of a shorter version. *Clinical Gerontologist*, 5(1–2), 165–173. https://doi.org/10.1300/J018v05n01_09
- Shen, B.-J., Todaro, J. F., Niaura, R., McCaffery, J. M., Zhang, J., Spiro, A., & Ward, K. D. (2003). Are metabolic risk factors one unified syndrome? Modeling the structure of the metabolic syndrome X. *American Journal of Epidemiology*, 157(8), 701–711. <https://doi.org/10.1093/aje/kwg045>
- Sherina, M. S., Rampal, L., & Mustaqim, A. (2004a). Cognitive Impairment Among the Elderly in a Rural Community in Malaysia. *Medical Journal of Malaysia*, 59(2), 252–257.
- Sherina, M. S., Rampal, L., & Mustaqim, A. (2004b). The prevalence of depression among the elderly in Sepang, Selangor. *The Medical Journal of Malaysia*, 59(1), 45–49.
- Shimada, H., Makizako, H., Doi, T., Yoshida, D., Tsutsumimoto, K., Anan, Y., ... Suzuki, T. (2013). Combined prevalence of frailty and mild cognitive impairment in a population of elderly Japanese people. *Journal of the American Medical Association*, 14(7), 518–524. <https://doi.org/10.1016/j.jamda.2013.03.010>
- Singh-Manoux, A., Kivimaki, M., Glymour, M. M., Elbaz, A., Berr, C., Ebmeier, K. P., ... Dugravot, A. (2012). Timing of onset of cognitive decline: results from Whitehall II prospective cohort study. *BMJ*, 344, d7622. <https://doi.org/10.1136/bmj.d7622>
- Smith, D. J., Court, H., McLean, G., Martin, D., Martin, J. L., Guthrie, B., ... Mercer, S. W. (2014). Depression and multimorbidity: A cross-sectional study of 1,751,841 patients in primary care. *Journal of Clinical Psychiatry*, 75(11), 1202–1208. <https://doi.org/10.4088/JCP.14m09147>
- Solfrizzi, V., Scafato, E., Capurso, C., D'Introno, A., Colacicco, A. M., Frisardi, V., ... Carbonin, P. (2011). Metabolic syndrome, mild cognitive impairment, and progression to dementia. The Italian Longitudinal Study on Aging. *Neurobiology of Aging*, 32(11), 1932–1941. <https://doi.org/10.1016/j.neurobiolaging.2009.12.012>

- Solomon, A., Dobranici, L., Kåreholt, I., Tudose, C., & Lăzărescu, M. (2011). Comorbidity and the rate of cognitive decline in patients with Alzheimer dementia. *International Journal of Geriatric Psychiatry*, 26(12), 1244–51. <https://doi.org/10.1002/gps.2670>
- Spira, A. P., Rebok, G. W., Stone, K. L., Kramer, J. H., & Yaffe, K. (2012). Depressive symptoms in oldest-old women: risk of mild cognitive impairment and dementia. *The American Journal of Geriatric Psychiatry*, 20(12), 1006–15. <https://doi.org/10.1097/JGP.0b013e318235b611>
- Stern, Y. (2002). What is cognitive reserve? Theory and research application of the reserve concept. *Journal of the International Neuropsychological Society*, 8(3), 448–460. <https://doi.org/10.1017/S1355617702813248>
- Stern, Y. (2003). The concept of cognitive reserve: a catalyst for research. *Journal of Clinical and Experimental Neuropsychology*, 25(5), 589–593. <https://doi.org/10.1016/j.jns.2009.02.069>
- Stevenson, J. E., Wright, B. R., & Boydston, A. S. (2012). The metabolic syndrome and coronary artery disease: A structural equation modeling approach suggestive of a common underlying pathophysiology. *Metabolism: Clinical and Experimental*, 61(11), 1582–1588. <https://doi.org/10.1016/j.metabol.2012.04.010>
- Strandberg, T. E., & Pitkala, K. (2003). What is the most important component of blood pressure: systolic, diastolic or pulse pressure? *Current Opinion in Nephrology and Hypertension*, 12(3), 293–297. <https://doi.org/10.1097/01.mnh.0000069868.94246.ef>
- Sun, F., Park, N. S., Roff, L. L., Klemmack, D. L., Parker, M., Koenig, H. G., ... Allman, R. M. (2012). Predicting the trajectories of depressive symptoms among southern community-dwelling older adults: The role of religiosity. *Aging and Mental Health*, 16(2), 189–198. <https://doi.org/10.1080/13607863.2011.602959>
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics (5th ed.)*. Boston: Allyn and Bacon. <https://doi.org/10.1037/022267>
- Tanaka, J. S., & Huba, G. J. (1985). A fit index for covariance structure models under arbitrary GLS estimation. *British Journal of Mathematical and Statistical Psychology*, 38(2), 197–201. <https://doi.org/10.1111/j.2044-8317.1985.tb00834.x>
- Taylor, V. H., & MacQueen, G. M. (2007). Cognitive dysfunction associated with metabolic syndrome. *Obesity Reviews*, 8(5), 409–418. <https://doi.org/10.1111/j.1467-789X.2007.00401.x>
- Teh, J. K. L., Tey, N. P., & Ng, S. T. (2014). Ethnic and gender differentials in non-communicable diseases and self-rated health in Malaysia. *PLoS ONE*, 9(3), e91328. <https://doi.org/10.1371/journal.pone.0091328>

- Teng, E., Tassniyom, K., & Lu, P. H. (2012). Reduced quality-of-life ratings in mild cognitive impairment: analyses of subject and informant responses. *Am J Geriatr Psychiatry*, 20(12), 1016–1025. <https://doi.org/10.1097/JGP.0b013e31826ce640>
- Thomas, G., Sehgal, A. R., Kashyap, S. R., Srinivas, T. R., Kirwan, J. P., & Navaneethan, S. D. (2011). Metabolic syndrome and kidney disease: A systematic review and meta-analysis. *Clinical Journal of the American Society of Nephrology*, 6(10), 2364–2373. <https://doi.org/10.2215/CJN.02180311>
- Thompson, B. (1998). Five methodological errors in educational research: The pantheon of statistical significance and other faux pas. In *Annual Meeting of the American Educational Research Association*. San Diego, CA.
- Trzepacz, T., Hochstetler, H., Wang, S., Walker, B., & Saykin, J. (2015). Relationship between the Montreal Cognitive Assessment and Mini-mental State Examination for assessment of mild cognitive impairment in older adults. *BMC Geriatrics*, 15, 107. <https://doi.org/10.1186/s12877-015-0103-3>
- Tukey, J. W. (1977). *Exploratory Data Analysis. Analysis* (Vol. 2). Reading, MA: Addison-Wesley. <https://doi.org/10.1007/978-1-4419-7976-6>
- Umegaki, H. (2014). Type 2 diabetes as a risk factor for cognitive impairment: Current insights. *Clinical Interventions in Aging*, 9, 1011–1019. <https://doi.org/10.2147/CIA.S48926>
- United Nations Statistics Division. (2005). *Designing Household Survey Samples: Practical Guidelines. United Nations* (Vol. ST/ESA/STA). New York: United Nations Publication. <https://doi.org/10.1177/0193841X07311993>
- Van der Kooy, K., van Hout, H., Marwijk, H., Marten, H., Stehouwer, C., & Beekman, A. (2007). Depression and the risk for cardiovascular diseases: Systematic review and meta analysis. *International Journal of Geriatric Psychiatry*, 22(7), 613–626. <https://doi.org/10.1002/gps.1723>
- Van Der Musselle, S., Fransen, E., Struyfs, H., Luyckx, J., Mariën, P., Saerens, J., ... Engelborghs, S. (2014). Depression in mild cognitive impairment is associated with progression to alzheimer's disease: A longitudinal study. *Journal of Alzheimer's Disease*, 42(4), 1239–1250. <https://doi.org/10.3233/JAD-140405>
- van Gelder, B. M., Tijhuis, M., Kalmijn, S., Giampaoli, S., Nissinen, A., & Kromhout, D. (2006). Marital Status and Living Situation During a 5-Year Period Are Associated With a Subsequent 10-Year Cognitive Decline in Older Men: The FINE Study. *The Journals of Gerontology: Series B*, 61(4), P213–P219. <https://doi.org/10.1093/geronb/61.4.P213>

- Vassilaki, M., Aakre, J. A., Cha, R. H., Kremers, W. K., St. Sauver, J. L., Mielke, M. M., ... Roberts, R. O. (2015). Multimorbidity and risk of mild cognitive impairment. *Journal of the American Geriatrics Society*, 63(9), 1783–1790. <https://doi.org/10.1111/jgs.13612>
- Vink, D., Aartsen, M. J., & Schoevers, R. A. (2008). Risk factors for anxiety and depression in the elderly: A review. *Journal of Affective Disorders*, 106(1–2), 29–44. <https://doi.org/10.1016/j.jad.2007.06.005>
- Viscogliosi, G., Donfrancesco, C., Palmieri, L., & Giampaoli, S. (2017). The metabolic syndrome and 10-year cognitive and functional decline in very old men. A population-based study. *Archives of Gerontology and Geriatrics*, 70(2017), 62–66. <https://doi.org/10.1016/j.archger.2016.12.008>
- Warshaw, G. (2006). Introduction: Advances and Challenges in Care of Older People with Chronic Illness. *Generations*, 3(6), 5–10.
- Wecker, N. S., Kramer, J. H., Wisniewski, a, Delis, D. C., & Kaplan, E. (2000). Age effects on executive ability. *Neuropsychology*, 14(3), 409–414. <https://doi.org/10.1037/0894-4105.14.3.409>
- Weisenbach, S. L., Boore, L. A., & Kales, H. C. (2012). Depression and cognitive impairment in older adults. *Current Psychiatry Reports*, 14(4), 280–288. <https://doi.org/10.1007/s11920-012-0278-7>
- Weissman, M. (2009). Depression. *Annals of Epidemiology*, 19(4), 264–267. <https://doi.org/10.1016/j.annepidem.2009.01.021>
- Whitley, B. E., & Kite, M. E. (2010). *The psychology of prejudice and discrimination*. Belmont, CA.: Wadsworth.
- WHO. (1998). Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. *Diabetic Medicine*, 15(7), 539–553. [https://doi.org/10.1002/\(sici\)1096-9136\(199807\)15:7<539::aid-dia668>3.0.co;2-s](https://doi.org/10.1002/(sici)1096-9136(199807)15:7<539::aid-dia668>3.0.co;2-s)
- WHO. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*, 363(9403), 157–163. [https://doi.org/10.1016/S0140-6736\(03\)15268-3](https://doi.org/10.1016/S0140-6736(03)15268-3)
- Wilson, R. S., Capuano, A. W., Boyle, P. A., Hoganson, G. M., Hizek, L. P., Shah, R. C., ... Bennett, D. A. (2014). Clinical-pathologic study of depressive symptoms and cognitive decline in old age. *Neurology*, 83(8), 702–709. <https://doi.org/10.1212/WNL.0000000000000715>
- Wilson, R. S., Hebert, L. E., Scherr, P. A., Barnes, L. L., De Leon, C. F. M., & Evans, D. A. (2009). Educational attainment and cognitive decline in old age. *Neurology*, 72(5), 460–465. <https://doi.org/10.1212/01.wnl.0000341782.71418.6c>

- Wong-McDonald, A., & Gorsuch, R. L. (2000). Surrender to God: An Additional Coping Style? *Journal of Psychology and Theology*, 28(2), 149–161.
- World Health Organization. (2015). Ageing and health. Retrieved from <http://www.who.int/mediacentre/factsheets/fs404/en/>
- World Health Organization. (2016). Dementia. <https://doi.org/9789241564458>
- Wysocki, M., Luo, X., Schmeidler, J., Dahlman, K., Lesser, G. T., Grossman, H., ... Beerli, M. S. (2012). Hypertension is associated with cognitive decline in elderly people at high risk for dementia. *The American Journal of Geriatric Psychiatry*, 20(2), 179–87. <https://doi.org/10.1097/JGP.0b013e31820ee833>
- Yaffe, K. (2007). Metabolic syndrome and cognitive disorders: Is the sum greater than its parts? *Alzheimer Disease & Associated Disorders*, 21(2), 167–171. <https://doi.org/10.1097/WAD.0b013e318065bfd6>
- Yaffe, K., Blackwell, T., Whitmer, R. A., Krueger, K., & Barrett Connor, E. (2006). Glycosylated hemoglobin level and development of mild cognitive impairment or dementia in older women. *The Journal of Nutrition, Health & Aging*, 10(4), 293–295.
- Yaffe, K., Kanaya, A., Lindquist, K., Simonsick, E. M., Harris, T., Shorr, R. I., ... Newman, A. B. (2004). The metabolic syndrome, inflammation, and risk of cognitive decline. *JAMA*, 292(18), 2237–2242. <https://doi.org/10.1016/j.accreview.2004.12.135>
- Yates, K. F., Sweat, V., Yau, P. L., Turchiano, M. M., & Convit, A. (2012). Impact of metabolic syndrome on cognition and brain: A selected review of the literature. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 32(9), 2060–2067. <https://doi.org/10.1161/ATVBAHA.112.252759>
- Yeh, S.-C. J., & Liu, Y.-Y. (2003). Influence of social support on cognitive function in the elderly. *BMC Health Services Research*, 3(1), 9. <https://doi.org/10.1186/1472-6963-3-9>
- Zec, R. F., Markwell, S. J., Burkett, N. R., & Larsen, D. L. (2005). A longitudinal study of confrontation naming in the “normal” elderly. *Journal of the International Neuropsychological Society: JINS*, 11(6), 716–726. <https://doi.org/10.1017/S1355617705050897>
- Zhang, M., Gale, S. D., Erickson, L. D., Brown, B. L., Woody, P., & Hedges, D. W. (2015). Cognitive function in older adults according to current socioeconomic status. *Neuropsychology, Development, and Cognition. Section B, Aging, Neuropsychology and Cognition*, 22(5), 534–543. <https://doi.org/10.1080/13825585.2014.997663>

Zhang, S., Zhang, C., & Yang, Q. (2003). Data preparation for data mining. *Applied Artificial Intelligence*, 17(5–6), 375–381. <https://doi.org/10.1080/713827180>

Zhang, Z. (2006). Gender differentials in cognitive impairment and decline of the oldest old in China. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 61(2), 107–115.

