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Socio-demographic, Cognitive Status and Comorbidity Determinants of Catastrophic Health Expenditure among Elderly in Malaysia

ROSHANIM KORIS[a,b,c], NORASHIDAH MOHAMED NOR[a,c,*], SHARIFAH AZIZAH HARON[a,d], NORMAZ WANA ISMAIL[a,c], SYED MOHAMED ALJUNID SYED JUNID[e], AMRIZAL MUHAMMAD NUR[e], ASRUL AKMAL SHAFIE[f], SURAYA YUSOFF[g] AND NAMAITIJIANG MAIMAITI[h]

[a]*School of Social and Economic Development, Universiti Malaysia Terengganu*
[b]*Malaysian Research Institute on Ageing (MyAgeing), Universiti Putra Malaysia*
[c]*Faculty of Economics and Management, Universiti Putra Malaysia*
[d]*Faculty of Human Ecology, Universiti Putra Malaysia.*
[e]*International Centre for Casemix and Clinical Coding (ITCC) Universiti Kebangsaan Malaysia.*
[f]*Universiti Sains Malaysia*
[g]*Hospital Sultan Ismail, Johor*
[h]*Department of Public Health, Faculty of Medicine, Ankara Yildirim Beyazit University, Turkey*

ABSTRACT

An ageing population has a significant impact in terms of health care costs to the elderly, their families and societies. The elderly consume a greater volume of health care facilities and bear out-of-pocket (OOP) health expenditure for their age-related diseases (ARD) physically or mentally. The most common ARD that relates to cognitive functions is mild cognitive impairment (MCI) and dementia. The purpose of this study was to examine the socio-demographic, cognitive status and comorbidities and hospital utilisation factors that affect the likelihood of catastrophic health expenditure (CHE) among the elderly in Malaysia. A survey using multi-stage random sampling techniques recruited 2274 elderly people (60 years and above) in Johor, Perak, Selangor and Kelantan. Overall, the incidence of CHE among the elderly is 2% and the highest is in the MCI category at 2.4%. Based on logistic regression analysis, the results suggest that CHE among elderly in Malaysia are affected by socio-demographic indicators at a 5% significance level. Among the comorbidities that we

*Corresponding author: norashidah@upm.edu.my

studied, cancer is the only comorbidity that influenced CHE among elderly. Findings from this study should prompt policy action to financially support the poor elderly who are at risk of CHE in Malaysia especially those with MCI and dementia.

Keywords: Catastrophic Health Expenditure (CHE), Dementia, Elderly, Mild Cognitive Impairment (MCI), Out-of-Pocket (OOP)

JEL Classification: I120, J140

INTRODUCTION

An ageing population is one of the main issues that has attracted the attention and been discussed by many researchers and policymakers worldwide recently. The number of old aged people is forecasted to increase continuously over the next 40 years with 1.5 million or 16 percent of the world's population ageing by 2050 (WHO,2011). In demographic terms, the causes of an ageing population are divided into three factors namely, a reduction in fertility and a decline in mortality that leads to the third factor which is life expectancy or longevity increases (Martin and Dirk, 2012). One of the indicators that are used to categorise a country as having an ageing population is when more than 15 percent of the people are aged 60 years and above. The age of 60 is the cutoff for the definition of elderly that was adopted by consensus by the United Nations during the World Assembly on Ageing 1982 held in Vienna, Austria. Meanwhile, in biological terms, the process of human ageing will affect the deterioration of human body strength physically and mentally. In addition, the ageing process also affects the human brain which shrinks and causes the cognitive functions to become impaired (Farooqui & Farooqui, 2009).

Undeniably, elderly people are very knowledgeable with all of the experiences that they have gained throughout their lifetimes. However, they are also facing the difficulties of learning new things and memory loss if they have brain-related health problems and age related diseases (ARD) i.e dementia or cognitive impairment. This could exacerbate their condition if they also suffer from other illnesses and would consume a greater volume of healthcare facilities than the young. Thus, they will spend more money on health care services to get treatment for their illnesses (Cutler, 2001; Moïse and Jacobzone, 2003). The elderly with major aged related diseases (ARD) i.e. dementia or mild cognitive impairment (MCI) and its comorbidity will need more special attention, assistance and facilities cause a significant impact in terms of health care costs to the patients, their families and societies.

According to Small (2001), over 40 years ago, the formal studies of cognitive impairment such as memory function and ageing were done to prove the existence of age-related memory decline. Meanwhile, Birren *et al*. (1963) stated that memory decline is generally associated with ageing and even the healthiest older men also face the problem. Among the most common diseases that relate to cognitive impairment is dementia. Besides that, people with memory impairment who were not demented are characterised as having MCI) and at a higher risk of developing dementia. MCI is a transition phase between normal ageing and dementia. Although

MCI causes a slight decline in memory or thinking skills, it is still noticeable and measurable but is not severe enough to affect the activities of daily life. Dementia is a serious damage to the brain caused by various diseases and will destroy mental ability. It is also described as a group of symptoms affecting memory, behaviour, thinking and social abilities that are severe enough to disturb daily functioning. There are at least two types of symptoms to be considered in dementia diagnosis aside from the difficulty in remembering, these are, impairments in language and communication and focusing or reasoning. The subtypes of dementia diseases are Alzheimer's disease (AD), vascular dementia (VaD), frontotemporal dementia (FTD), dementia with Lewy bodies (DLB), mixed dementia, Parkinson's disease (PD), Creutzfeldt-Jakob disease and normal pressure hydrocephalus.

Therefore, MCI and dementia diseases, if not curbed, will affect a person's quality of life and they may even need special care and live dependently which is expected to have an impact on the rising cost of healthcare (Salthouse, 2004).

OUT-OF-POCKET AND CATASTROPHIC HEALTH EXPENDITURE

Out-of-Pocket (henceforth OOP) health expenditure is defined as any direct expenses incurred by households, including payments to health practitioners and suppliers of pharmaceuticals, therapeutic appliances, and other goods and services whose main purpose is to restore or enhance the treatment or the health status of individuals or population groups, and it is a part of private health expenditure. In addition, the WHO defined OOP as direct payments made by individuals to healthcare facilities, but excludes any prepayment for health services, such as insurance premiums or contributions and any reimbursements to the individual who made the payments.

High OOP payments for health care can cause households to incur catastrophic health expenditures (CHE). CHE is the term that has been used widely to show a households' circumstances when the OOP payments exceed a certain threshold share of wealth, either, total income, total expenditure or non-food expenditure or total consumption. The choice of threshold is arbitrary, but commonly used thresholds are 10–25% of total income or consumption, or 25–40% of non-food expenditure (Arsenijevic *et al*., 2016). When OOP payments are unavoidable, households with elderly, handicapped, or chronically ill members are generally more likely to be trapped with CHE than other households (Xu (2005); Wagstaff and van Doorslear (2003); and Somkotra and Lagrada (2009). Numerous studies have been conducted to examine the impact of high OOP on catastrophic expenditure and the impoverishment of life. For instance, a study by Xu *et al*. (2003) found that in 59 countries in various stages of development, that the catastrophic payments varied widely between the countries. For example, the Czech Republic and Slovakia had less than 0·01% of catastrophic expenditure, whereas Vietnam had 10.5%. Most developed countries have advanced social security institutions such as social insurance or tax-funded health systems that can protect households from CHE. However, there were still a few countries, namely Portugal, Greece, Switzerland, and the USA that had more than 0·5% of households facing CHE. In addition, the study indicated among developing countries, the lower limit was less than 0·5% in Namibia and Djibouti, and ten countries had more than 3% of households that suffered from CHE.

Meanwhile, Malaysia reportedly still has the lowest medical expenditure risk among the selected Asian countries by van Doorslaer *et al*. (2007) and Flores and O'Donnell (2012) who studied using data from the 1998/1999 Household Expenditure Survey and the World Health Surveys (WHS) which were conducted by the WHO in 2002-2003 respectively. The authors concluded that Malaysia and a few other low-middle income countries namely Thailand, Sri Lanka, and the Philippines have managed to contain the OOP health financing share compared to others and all of these countries have a relatively low incidence of catastrophic payments. In addition, the studies found that the majority of households who suffered from chronic illness were also trapped with the CHE problem.

Recent findings from Ng CW (2015) using data from 2004, indicated that the incidence of CHE in Malaysia affected households in the middle-income class more when compared to poorer households. This is because poorer households mainly use public services which have minimal costs. Meanwhile, households in the upper-income class may choose private care and are willing to spend more for OOP. The empirical results showed that only 1.44% of households who incurred OOP payments for health care as a percentage of household consumption expenditure exceeded the 10% threshold. Thus, despite all of the evidence that shows the minimal impact of OOP due to CHE in Malaysia, it should be remembered that all these findings are based on data that are more than a decade old. Consequently, judging from the current upward trend of Malaysians' OOP payments, Health Minister Datuk Seri Dr S. Subramaniam said in a Press Conference on June 2, 2016, that over one third of Malaysians are directly paying for medical services and with an excessive figure that can lead to financial catastrophe (Boo, 2016). Boo reported in the Malay Mail Online that Subramaniam was also worried that the total of the OOP were approximately 35 percent of the country's overall health expenditure totalling between RM44 billion to RM45 billion annually. Because of that, Malaysia was advised by the WHO and the World Bank to reduce the OOP health expenditure to less than 15 or 20 percent. If left unattended, it will increase and will lead to financial catastrophe.

This issue becomes more important if the OOP health expenditure is incurred by the elderly. Löfgren (2014) proved that households with elderly in Vietnam suffer more than others since they bear a higher burden of CHE. The finding showed that the average ratio of OOP health expenditure to household capacity to pay among all households is 8%. Meanwhile, the average ratio of OOP health expenditure among all-elderly households is more than double at around 18%. With those results, Löfgren found that the percentage of all-elderly households is higher than all households who had catastrophic health expenditure, which is 13% compared to 4%. In addition, about 3% of all households were estimated to have been impoverished due to health care spending, and again among the all-elderly households, this ratio is higher at 8%. Due to financial hardship, living alone and having specific illnesses which need health care utilisation, the elderly spend more in health expenditure compared to others and face CHE (Jacobs, de Groot & Antunes, 2016; Yang *et al*., 2016; Arsenijevic *et al*., 2016)

One study that investigated the socioeconomic and medical correlation of health expenditure among the rural elderly in South India was done by Brinda *et al* (2012). They found that a few diseases such as diabetes, tuberculosis, malaria, respiratory ailments, gastrointestinal disease, dementia, depression, and disability were associated with higher out-of-pocket expenditures among the elderly. Dementia is a disease which results in increased risk for CHE as well as tuberculosis and diabetes.

A recent study showed that older people with diagnosed chronic diseases such as diabetes mellitus and cardiovascular diseases were more likely to experience CHE. This happens even in comparatively wealthy countries with a developed risk-pooling mechanism (Arsenijevic *et al*, 2016). As proved, in some existing literature, diabetes mellitus and cardiovascular diseases increase the risk of dementia especially vascular dementia and Alzheimer's disease (Biessels *et al*., 2006; Peila *et al*., 2002; Fan *et al*., 2017). In addition, the risk of dementia and vascular dementia is particularly high when diabetes mellitus occurs together with severe hypertension or heart disease in older people (Xu W.L *et al*., 2004; Strachan *et al*., 2011).

Therefore, in this study, we aim to assess the level of CHE incurred by private OOP payments among the elderly with different levels of cognitive status and income groups. Also, we analysed the determinants of CHE among the elderly in Malaysia by using socio-demographic, level of cognitive status, comorbidity and hospital utilisation variables. To the best of our knowledge, this is the first study of CHE among the elderly that also compares the level of cognitive status. It is important to highlight this issue in determining the factors that could influence the financial conditions among the elderly due to the burden of health care costs.

RESEARCH METHODOLOGY

Study Design and Sample Size

The data used in this study were obtained from a national survey entitled "Identifying Psychosocial and Identifying Economic Risk Factors of Cognitive Impairment among Elderly". The survey employed a cross-sectional design, using a multi-stage proportional cluster random sampling technique to obtain a representative sample of community-dwelling Malaysian older adults from four states in Malaysia that have the highest numbers of older adults aged 60 years and above, namely Johor, Perak, Selangor and Kelantan. In the next stage, 35 Census Circle (CC) clusters were sampled from each state. Finally, 20 Living Quarters (LQs) were selected from each CC cluster selected in the second stage. Elderly in these LQs were randomly interviewed. Only one resident aged 60 years and above from each household was interviewed, and if more than one person in a household qualified, the person interviewed was randomly chosen. The interviews were conducted at places such as school halls, mosques or community halls in their LQ area. The date, time and venue were stated on the invitation card that was given during the first visit at the respondent's house. A phone call was made as a reminder a day before the interview session was to be held. A face to face interview with respondents using a questionnaire form was conducted by the trained enumerators. Data collection was conducted from May 2013 to April 2014. This multi-stage design resulted in a final sample of 2274 out of the 2322 older adults who were recruited for this study, after we excluded the incomplete questionnaires.

Inclusion and exclusion criteria were employed during the data collection process in the community setting. The inclusion criteria for the sample were at least 60 years old and above, and Malaysian. The exclusion criteria for the sample were respondents less than 60 years old, those diagnosed as having MCI, dementia or other cognitive disorders, alcohol abuse, serious physical disabilities (bedridden, wheelchair) and the terminally ill.

Data Collection

After informed consent was obtained, a pre-tested questionnaire was used to interview the respondents in the community setting. This questionnaire was modified, adjusted and customised from UNU-IIGH Malaysia (currently known as the International Centre for Casemix and Clinical Coding (ITCC) Universiti Kebangsaan Malaysia) research team led by Prof. Dato' Dr Syed Mohamed Aljunid (Principle Investigator for Provider Cost in LRGS-TUA) . It was tested and established to estimate the direct and indirect cost for health care utilisation (M Dahlui *et al*., 2007; Ezat SW *et al*., 2013). The questionnaire contained the socio-economic background, information on morbidity that had been diagnosed by the medical practitioners, outpatient care for the past six months and inpatient care for the past one year. All costs for outpatient care were multiplied by two (2) to estimate the annual patients' costs. Outpatient care is the treatment received by the elderly in terms of daily visits to the health care services without being hospitalised. Meanwhile, inpatient care is admission to hospital under the care of a medical practitioner for at least 24 hours and formally admitted (Takaful Malaysia, 2016).

The outpatient and inpatient care data were detailed from the frequency rate for treatment or admission at healthcare facilities like government hospitals and clinics, private hospitals and clinics, traditional medicine healers and alternative health care providers. In addition, the type of referral disease, the reason for admission, time spent in the facility, length of stay, the number of days absent from work after discharge, cost of transportation, meal expenditure, clinic charges and other related expenditure were also included in the questionnaire. All of the costs are important to get the total cost of health care utilisation from the respondents in a community setting. The total cost of health care utilisation including direct and non-direct medical costs.

Direct Medical Costs. Clinic charges and hospital charges including prescription charges, consultation, diagnostic and procedure charges.

Direct Non-Medical Costs. Cost of transportation, meal expenditure and other related expenditure (supplement foods or other alternative treatment). For transportation costs, we use the fare costs which were self-reported by respondents or a mileage cost of (RM0.50[1] x kilometres (distance from home)).

Out-of-Pocket (OOP). This study used the total direct costs, containing direct medical cost and direct non-medical costs as out of pocket health expenditure. This health expenditure was incurred by the elderly to health care facilities for their treatment.

Catastrophic Health Expenditure (CHE). This study determined that the elderly incurred CHE when their OOP or total direct costs exceeded 10% of household income (Wagstaff and van Doorslaer, 2003). The main issue here is that no one ought to spend more than a given fraction or threshold level (z) of their income on health care. According to Wagstaff and Van Doorslaer (2003), the threshold level z is arbitrary, and it would clearly depend on whether income was defined in terms simply of pre-payment income, x, or in terms of some measure of "ability to pay" y=x-D(x), where

[1] Refer to Malaysia Treasury Circular Letter, WP 1.4/2013 for class C where vehicle cylinder capacity (cc) lower than 1,000cc.

D(x) are "deductions" that are allowed in determining a household's ability to pay (e.g. spending on food and other necessities). This study used the total household income approach which is the OOP payments (Ti) as a proportion of household income (xi). Those elderly spending greater than 10 percent of their income on OOP health care are classified as catastrophic. Alternative catastrophic thresholds ranging from 2.5 percent to 15 percent are presented in this study to demonstrate the sensitivity of different measures.

Assessment of Cognitive Status

Besides the health care utilisation questionnaire, another instrument was used to determine the level of cognitive impairment among the respondents. The instrument is the Malay Version of the Mini-Mental State Examination (M-MMSE). The MMSE is a cognitive screening instrument that measures item recognition, orientation, memory, attention or concentration, calculation, language, and sentence formation capacity. The MMSE is a valid test and is the most widely used screening instrument for cognitive impairment. Folstein *et al*. (1975) established this instrument with a score of 0.83 test-retest on its reliability. Meanwhile, the M-MMSE (Malay-MMSE version) was validated by Razali *et al*. (2014) with a Cronbach's alpha of 0.76. The maximum score of the MMSE test is 30 points. For determination of cognitive impairment among the elderly, this study used the classification from our main project LRGS-TUA (Suzana Sahar *et al*. (2015) and Clinical Practice Guidelines-Management of Dementia (MOH, 2009) A M-MMSE score greater than 27 and above is classified as normal cognitive impairment. A M-MMS score in the range 19-26 points is MCI, and a score between 15-18 is considered mild dementia and a score in the range 10-14 is considered moderate dementia. Meanwhile, a score of less than 10 points is considered as severe dementia. Among the studies in Malaysia which have used the M-MMSE to detect possible MCI and dementia among the elderly are Razali *et al*. (2012) and Arabi *et al*. (2013) respectively.

Statistical Analysis

In order to analyse the determinants of CHE among the elderly, the logistic regression model is employed. Logistic regression is used to predict a categorical (dichotomous dependent variable) variable from a set of predictor or independent variables. Logistic regression is often chosen if the predictor variables are a mix of continuous and categorical variables and/or if they are not normally distributed where there can be no assumptions about the distribution of the dependent and the predictor variables. However, three basic assumptions namely sample size, multicollinearity and outliers are considered to obtain a goodness of fit model. All statistical analysis was performed using SPSS version 20.0.

The basic function for the logistic regression model is as follows:

$$\log [P/(1-P)] = \alpha + \sum \beta_i X_i + \varepsilon \quad (1)$$

where α is the constant, X_i the predictor variables that hypothesised to determine the probability P as listed below. β_i is the coefficient of independent variables X_i. The dependent variable is a dummy variable on catastrophic health expenditure (1, with catastrophic health expenditure

at a 10% threshold and 0, without catastrophic health expenditure). The P/(1-P) the ratio of the probability or the odds that respondents have incurred CHE. The main predictor variables are socio-demographic indicators, cognitive status and comorbidities and hospital utilisation.

Socio-demographic variables such as age (continuous data), male (female as reference), Malay (dichotomous variable), single/widow/divorcee (dichotomous variable), no formal education (dichotomous variable), household income (continuous data), and urban (rural as reference). Cognitive status is divided into three categories namely normal, MCI and dementia. We also used the interaction term (cognitive status x age) to test the moderating effects of age on the relationship between cognitive status and CHE among the elderly in Malaysia. Meanwhile, a list of comorbidities such as hypertension, diabetes mellitus, cardiovascular disease, kidney problems and cancer are dichotomous variables respectively. Outpatient and inpatient services, the number of diseases, the number of visits and admissions annually are continuous data for hospital utilisation.

The associated odds ratio can be written as follows:

$$OR = \frac{Pi}{1-Pi} = \exp(\alpha + \beta i X_i) \quad (2)$$

Where P_i is the predicted probability of the event which is coded with 1 (with catastrophic expenditure) rather than with 0 (without catastrophic expenditure). 1-P_i is the predicted probability of the other decision, and X is our predictor as mentioned above.

RESULTS AND DISCUSSION

Descriptive Statistics

The general finding was that 404 (17.8%) of the people sampled were in the dementia classification, 1318 (58.0%) are in the MCI category and the rest, 552 older persons, are classified as normal (24.3%). The descriptive analysis on the social demographic, economic status and health status by cognitive status among the elderly are presented in Table 1, Table 2 and Table 3 respectively. Relative to the sample who are classified as having "normal" cognition, those with dementia are 6.1 years older, female, live in a rural area, more likely to have had no formal education, and living alone with a level of significance at 1%. Individuals with dementia also have a lower socioeconomic status, as indicated by the lowest average household income (RM749.00) and have a higher incidence of not working compared to the elderly with a normal cognitive status. There are also differences by cognitive status in the likelihood of having certain comorbidities, such as hypertension, diabetes and cancer. Besides that, the elderly with different cognitive status also have differences in hospital utilisation as outpatients. The elderly with dementia are the lowest number in reporting their health status as healthy compared to those with a normal or MCI status and higher than those in the normal category in reporting an unhealthy status at a 1% level of significance. This shows that the elderly with dementia are significantly different when compared to those with a normal cognitive status in most of the socioeconomic and health status variables. Meanwhile, for certain characteristics such as ethnicity, marital status, no children and no working adult, the elderly with MCI are relatively higher compared to normal and dementia status.

Table 1 Descriptive Analysis on Demographic Profile among Elderly by Cognitive Status

Variables	ALL (n=2274)			NORMAL (n=552)			MCI (n=1318)			DEMENTIA (n=404)			*P* value
	n	%	Mean (S.D)	n	%	Mean (S.D)	n	%	Mean (S.D)	n	%	Mean (S.D)	
Strata													
Rural	1099	48.3		200	36.2		664	50.4		235	58.2		
Urban	1175	51.7		352	63.8		654	49.6		169	41.8		<0.001
Gender													
Male	1088	47.8		307	55.6		665	50.5		116	28.7		
Female	1186	52.2		245	44.4		653	49.5		288	71.3		<0.001
Ethnicity													
Malay	1430	62.9		278	50.4		880	66.8		272	67.3		
Chinese	725	31.9		236	42.8		381	28.9		108	26.7		
Indian	114	5.0		36	6.5		55	4.2		23	5.7		
Others	5	0.2		2	0.4		2	0.2		1	0.2		<0.001
Marital Status													
Single	37	1.6		12	2.2		19	1.4		6	1.5		
Married	1555	68.4		448	81.2		918	69.7		189	46.8		
Widow/Widower/													
Divorcee	682	30.0		92	16.7		381	28.9		209	51.7		<0.001
Age Group			69.0 (6.23)			67.2 ((5.37)			68.5 (5.77)			73.3 (6.81)	
YoungOld													
(60-69)	1305	57.4		388	70.3		797	60.5		120	29.7		
Old-Old (70-79)	833	36.6		151	27.4		469	35.6		213	52.7		
OldestOld (80+)	136	6.0		13	2.4		52	3.9		71	17.6		<0.001
Education													
No Formal Education	475	20.9		32	5.8		218	16.5		225	55.7		
Less Than High School	1316	57.9		281	50.9		864	65.6		171	42.3		
High School Graduate	372	16.4		168	30.4		198	15.0		6	1.5		
More Than High School	111	4.9		71	12.9		38	2.9		2	0.5		<0.001
Number of Children			5.41 (2.88)			4.71 (2.77)			5.55 (2.83)			5.88 (3.01)	
None	67	2.9		20	3.6		35	2.7		12	3.0		
1 to 3 Children	533	23.4		184	33.3		274	20.8		75	18.6		
4 to 6 Children	955	42.0		230	41.7		562	42.6		163	40.3		
7 to 9 Children	510	22.4		83	15.0		320	24.3		107	26.5		
10 to 12 Children	170	7.5		26	4.7		107	8.1		37	9.2		
More than 13 Children	39	1.7		9	1.6		20	1.5		10	2.5		<0.001
Living Arrangement													
Alone	239	10.5		41	7.4		134	10.2		64	15.8		<0.001
With Spause	1421	62.5		412	74.6		842	63.9		167	41.3		<0.001
With Children	1308	57.5		313	56.7		765	58.0		230	56.9		0.837
With Others	444	19.5		106	19.2		244	18.5		94	23.3		0.106

Abbreviations: MCI, Mild Cognitive Impairment.
Note: *P* value refers to differences across cognitive status categories.

Table 2 Descriptive Analysis on Economic Profile among Elderly by Cognitive Status

Variables	ALL (n=2274)			NORMAL (n=552)			MCI (n=1318)			DEMENTIA (n=404)			*P* value
	n	%	Mean (S.D)	n	%	Mean (S.D)	n	%	Mean (S.D)	n	%	Mean (S.D)	
Employment Status													
Not Working	176	7.7		30	5.4		99	7.5		47	11.6		
Employed Full Time	135	5.9		34	6.2		88	6.7		13	3.2		
Employed Part Time	95	4.2		28	5.1		56	4.2		11	2.7		
Self Employed	289	12.7		75	13.6		171	13.0		43	10.6		
Help Family Members	9	0.4		3	0.5		5	0.4		1	0.2		
Students, Trainiees or Vocational School	1	0.0					1	0.1					
Retired	1309	57.6		330	59.8		749	56.8		230	56.9		
Housewife	257	11.3		50	9.1		149	11.3		58	14.4		
Others	3	0.1		2	0.4					1	0.2		0.002
No of Earner			1 (1)			1 (2)			1 (1)			1 (1)	
None	830	37.1		180	32.8		489	37.8		161	40.7		
1 to 3 Households	1309	58.5		333	60.8		751	58.0		225	56.8		
4 to 6 Households	85	3.8		31	5.7		45	3.5		9	2.3		
7 to 9 Households	11	.5		2	.4		8	.6		1	.3		
More than 10 Households	3	0.1		2	0.4		1	0.1		0	0.0		0.033
Household Income (Monthly)			1310 (2367)			1991 (2749)			1197 (2037)			749 (2590)	
Less than RM400	700	30.8		96	17.4		384	29.1		220	54.5		
RM400 - RM499	101	4.4		17	3.1		62	4.7		22	5.4		
RM500 - RM699	291	12,8		63	11.4		179	13.6		49	12.1		
RM700 - RM999	188	8.3		39	7.1		123	9.3		26	6.4		
RM1000 - RM1999	539	23.7		146	26.4		338	25.6		55	13.6		
RM2000 - RM2999	208	9.1		72	13.0		120	9.1		16	4.0		
RM3000 - RM3999	119	5.2		52	9.4		56	4.2		11	2.7		
RM4000 - RM4999	42	1.8		22	4.0		18	1.4		2	.5		
RM5000 and above	86	3.8		45	8.2		38	2.9		3	.7		<0.001

Note: *P* value refers to differences across cognitive status categories.

Table 3 Descriptive Analysis on Health Profile among Elderly by Cognitive Status

Variables	ALL (n=2274)		NORMAL (n=552)		MCI (n=1318)		DEMENTIA (n=404)		*P* value
	n	%	n	%	n	%	n	%	
Health Status (Self Report)									
Healthy	2034	89.4	510	92.4	1175	89.2	349	86.4	
Unhealthy	240	10.6	42	7.6	143	10.8	55	13.6	0.01
Outpatient	1376	60.5	333	60.3	817	62	226	55.9	0.093
Inpatient	128	5.6	25	4.5	82	6.2	21	5.2	0.321
Comorbidities									
Hypertension	1042	45.8	232	42	630	47.8	180	44.6	0.063
Diabetes Mellitus	540	23.7	123	22.3	342	25.9	75	18.6	0.006
Cardiovascular Disease	199	8.8	46	8.3	115	8.7	38	9.4	0.884
Cancer	26	1.1	11	2	13	1	2	0.5	0.07
Kidney Problem	31	1.4	3	0.5	23	1.7	5	1.2	0.12

Note: *P* value refers to differences across cognitive status categories.

Annual OOP Health Spending by Cognitive Status

Annual OOP health expenditure and health care utilisation by cognitive status are presented in Table 4. The findings clearly show that OOP health expenditure in health care facilities as an inpatient and total annual OOP are significantly different between cognitive status dementia compared to normal cognitive status (0.085 and 0.037 at 10% and 5% significant level). But, the average annual OOP health expenditure as an outpatient, inpatient and total OOP among those with dementia are the lowest compared to others with RM82.95, RM70.82 and RM86.47 respectively. Most elderly with dementia utilised the government health care facilities that provide free registration charges as an outpatient and a 50% discount for the third class ward charges or a maximum charge of RM250 for every admission as an inpatient for the elderly aged 60 years and above (Utusan Online, 2014).

Table 4 Annual OOP Health Expenditure and Health Care Utilization among Elderly by Cognitive Status

Variables	ALL (n=2274)			NORMAL (n=552)			MCI (n=1318)			DEMENTIA (n=404)			*P* value
	n	%	Mean (S.D)	n	%	Mean (S.D)	n	%	Mean (S.D)	n	%	Mean (S.D)	
Annual OOP health expenditure as outpatient	1376	60.5	141.24 (1433.47)	333	60.3	264.96 (2763.4)	817	62	106.94 (567.26)	226	55.9	82.95 (303.39)	0.325
Annual OOP health expenditure as inpatient	128	5.6	2527.23 (10379.84)	25	4.5	4508.36 (12344.24)	82	6.2	2552.31 (10999.43)	21	5.2	70.82 (236.9)	0.085
Total annual OOP health expenditure	1419	62.4	364.93 (3482.65)	342	62	587.55 (4402.02)	843	64	351.91 (3536.97)	234	57.9	86.47 (307.94)	0.037

Note: *P* value refers to differences across cognitive status categories (Normal vs Dementia)

Incidence of Catastrophic Health Expenditure (CHE) by Cognitive Status and Household Income

Table 5 displays the incidence of CHE by cognitive status among elderly persons. For all the thresholds, the incidences of CHE are declining and the dementia category is the highest only at the 2.5% threshold with 8.4%. But, for other thresholds, the incidence of CHE for the dementia category is not a worry. Nevertheless, the MCI category is the highest at the thresholds of 5%, 7% and the cut-off 10% and also 15% with the range of incidence of CHE between 2% to 5%. The MCI category is the condition between normal cognitive status and dementia, and those with MCI have an increased risk of eventually developing dementia or its subtypes if there is no early treatment. Our findings indicated that the prevalence of MCI was 58%, which is a concern because of the increased risk of developing dementia. Razali *et al*. (2012) also found that the prevalence of MCI was 64.7% from studying the elderly who came to medical clinics and the only factor significantly associated with MCI was the level of education.

In addition, when comparing the incidence of CHE by household income group, the majority of the elderly who are in the B40 group experience CHE for all thresholds. Table 5 reported that the percentages are declining as thresholds increasing for the B40 group. This is true because of more than 50% of the elderly have a household income of less than RM1000 and risk slipping into poverty and hard core poverty. Despite this, the incidence of CHE is not high, but if this problem is not taken seriously, the elderly with CHE will be impoverished during their life due to spending in health expenditure. However, none of elderly in the M40 and T20 groups are in the 10% cut-off threshold. Briefly, the B40 income group is the bottom 40 percent of households with an income of less than RM3,860. Meanwhile, the M40 group is the middle 40 percent of households with an income between RM3,861 to RM8,319. The T20 income group is the top 20 percent of households with an income of more than RM8,319 (Household Income and Expenditure Survey 2014, 2015). Refer Table 6.

Table 5 Incidence of Catastrophic Health Expenditure among Elderly by Cognitive Status

Thresholds	ALL (n=2274)		NORMAL (n=552)		MCI (n=1318)		DEMENTIA (n=404)	
	n	%	n	%	n	%	n	%
OOP health expenditure as share of household income								
2.5%	181	8.0	37	6.7	110	8.3	34	8.4
5%	104	4.6	26	4.7	64	4.9	14	3.5
7%	66	2.9	17	3.1	41	3.1	8	2.0
10%	46	2.0	10	1.8	31	2.4	5	1.2
15%	37	1.6	8	1.4	25	1.9	4	1.0

Table 6 Incidence of Catastrophic Health Expenditure among Elderly by Household Income

Thresholds	Household Income Group							
OOP health expenditure as share of household income	B40		M40		T20		Total	
	n	%	n	%	n	%	n	%
2.5%	173	8.1	6	5.9	2	7.1	181	8.0
5%	101	4.7	3	3.0	0	0.0	104	4.6
7%	65	3.0	1	1.0	0	0.0	66	2.9
10%	46	2.1	0	0.0	0	0.0	46	2.0
15%	37	1.7	0	0.0	0	0.0	37	1.6

Determinants of CHE for Elderly

The results from the logistic regression that was performed to show the determinants of CHE for the elderly in Malaysia are detailed in Table 7. The model contained 3 main independent variables namely socio-demographic, cognitive status and comorbidities and hospital utilisation. The full model indicated that all predictors were statistically significant, χ^2 (21, N=2272) = 143.25, ρ <0.001, showing that the model was able to distinguish between the respondents who incurred CHE and those who did not incur CHE at the 10% threshold. The model, as a whole, explained between 6.1% (Cox and Snell R^2) and 35.1% (Nagelkerke R^2) of the variance in CHE status, and correctly classified 98.2% of cases.

As shown in Table 7, the independent variables for socio-demographics, namely, age, urban, Malay, male and household income are statistically significant at the 5 percent level. The odds ratio (OR) for ethnicity indicated that when holding all other variables constant, a Malay is 4.8 times more likely to experience CHE than a non-Malay. Inverting the odds ratio for strata and gender variables, urban has a 2.3 times and male has a 2.8 times greater chance than rural and female respectively to experiences CHE among the elderly. In addition, a negative value for the coefficients means that the odds of CHE decrease for males and those who live in urban areas. The effect of the household income variable is stronger than for other variables, with a one-point decrease in the household income among elderly being associated with the odds of the elderly experiencing CHE increasing by a multiplicative factor of 0.999.

Table 7 Logistic Regression Predicting Likelihood of Reporting a Catastrophic Health Expenditure among Elderly

Variables	B	S.E.	ρ	Odd Ratio	95% C.I. for Odd Ratio	
					Lower	Upper
Socio Demographic						
Age	.131**	.064	.040	1.140	1.006	1.291
Urban	-.841**	.386	.029	.431	.202	.918
Malay	1.570*	.416	.000	4.807	2.127	10.864
Male	-1.040**	.436	.017	.353	.150	.831
Single/Widow/Widower	-.264	.414	.524	.768	.341	1.729
No Formal Education	-.188	.448	.674	.828	.344	1.992
Household Income (Monthly)	-.001*	.000	.005	.999	.998	1.000

Table 7 (Cont.)

Cognitive Status						
Normal (Ref.)			.038			
MCI	11.610	5.273	.028	110146	3.576	3393127395
Dementia	15.643	6.947	.024	6218089	7.599	508828
						205887
Normal * Age (Ref.)			.029			
MCI * Age	-.170**	.075	.024	.843	.727	.978
Dementia * Age	-.235**	.100	.019	.790	.650	.961
Comorbidities and Hospital Utilization						
Number of Diseases	.024	.219	.912	1.024	.667	1.572
Hypertension	-.124	.485	.799	.884	.342	2.287
Diabetes	-.317	.502	.527	.728	.272	1.947
Cardiovascular Disease	-.164	.718	.819	.848	.208	3.464
Kidney Problem	1.314	.925	.156	3.719	.607	22.806
Cancer	2.331*	.781	.003	10.288	2.228	47.504
Outpatient	.129	.584	.826	1.137	.362	3.569
Inpatient	1.997*	.573	.000	7.366	2.396	22.644
Number of Visit (Annual)	.136**	.057	.018	1.146	1.024	1.283
Number of Admitted (Annual)	.855*	.293	.004	2.350	1.324	4.173
Constant	-13.263	4.504	.003	.000		

* $\rho < 0.01$
** $\rho < 0.05$

The cognitive status variable initially appeared to be insignificant in determining the elderly with CHE. We suspected that the effect of age differed between cognitive statuses such as normal, MCI and dementia, thus we created the interaction term as presented in Table 7. The results were strongly significant at the 5% level where dementia interacted with age rather than normal with age or MCI with age. The inverted odds ratios for these categorical predictor variables indicated that the odds of experiencing CHE for MCI and dementia when interacted with age were 1.2 times and 1.3 times higher than with normal cognitive status with age. According to Grady and Craik (2000), with increasing age, recall, recognition of new facts and events as well as memory performance will be impaired because the ageing process produces several changes in the human brain such as shrinking. Whether aging by natural processes (senescence) or pathological (senility), the elderly will suffer from cognitive decline in terms of three categories namely (i) little cognitive decline (for "healthy" or "successful" aging), (ii) memory declines significantly with age, but does not prevent the performance of daily activities (called "mild cognitive impairment") and (iii) aging is associated with severe cognitive deficits that impede the ability to live independently (known as "dementia") (Schaie & Willis, 2002; Kensinger, 2009).

For the comorbidities variables, only cancer significantly influenced the elderly with CHE at the 5% significance level. An elderly person with cancer is 10.3 times more likely to experience CHE than a person without cancer or other comorbidities. The high cost of cancer treatment leads the elderly to incur catastrophic health expenditure rather than other diseases

like hypertension, diabetes mellitus and cardiovascular disease. However, Arsenijevic *et al*. (2016) in their treatment-effect model showed that the elderly with diagnosed cancer were not found to be a significant predictor for catastrophic health expenditure. This happened because of the low incidence of the elderly diagnosed with cancer rather than diabetes mellitus and cardiovascular disease and those who were diagnosed with cancer were exempted from official co-payments for interventions or therapies. In addition, some empirical evidence has shown that households with elderly, living in rural areas who are chronically ill are more likely to suffer financial hardship and to be at risk to experience the CHE problem as found by Barros, Bastos & Dâmaso, (2011), Van Minh, Phuong, Saksena, James & Xu (2013), Li, Wu, Liu, Kang, Xie *et al*. (2014) and Jacobs, de Groot & Antunes (2016).

Meanwhile, the number of visits and number of admitted in health care facilities as well as hospital utilisation as inpatient variables were statistically significant in influencing the elderly with CHE at the 10% threshold. Admission into private hospitals and a longer length of stay, may increase the OOP health expenditure and consequently will increase the probability to incur CHE among the elderly with lower income.

CONCLUSION

This paper has investigated the existence and determinants of CHE among the elderly in Malaysia. The identified important determinants of CHE among this vulnerable group can be addressed through policies that help to support household budgets. Noticeably, more attention is required for the poor elderly who live in urban areas and who have MCI and comorbidities with expensive treatments such as cancer to reduce the CHE problem. We found that common diseases amongst elderly are hypertension, diabetes and cardiovascular disease which highly increase the risk of getting cognitive problems in later life. Consequently, those with MCI have an increased risk of eventually developing dementia or its subtypes if not treated early. Even though our health care system for the elderly is subsidised by the government, some treatments and medications have to be paid from their own pockets which affect household budgets. The costs would be higher if the elderly obtained their treatment in private care facilities. All costs that relate to getting treatment also influence the high OOP health expenditure for the elderly such as the cost of transportation.

The findings from this study are expected to attract the attention of policy makers and act as a wake-up call for them to become more concerned about the elderly who are at high risk to have cognitive problems and comorbidities. Financial support to the elderly for their treatment such as by providing national insurances that have holistic coverage whether in government or private care facilities. This study also attempts to emphasise that health is a valuable asset that should be taken care of from an early age. The authorities should provide information and knowledge on the importance of physical and cognitive health, emphasise the practice of good eating habits and establish health and social care centres as one-stop locations in every district of Malaysia. An aggressive program to keep healthy physically and mentally in later age should be started as early as possible, whilst people are still young. Good behaviour and a healthy diet would reduce the risk of non-communicable diseases (NCD) such as diabetes

mellitus, cardiovascular diseases and some cancers (Ezzati and Reboli, 2013). Therefore, the risk factors of cognitive impairment also would be decreased. The main impact is that healthcare costs would be minimised whether on the side of providers or the OOP health expenditure from the households side. Consequently, the vision to generate a healthy and productive society as it ages would be achieved.

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