PUBLIC HEALTH RESEARCH

The Prevalence of Diabetes Mellitus and Hypertension and its Effects on Healthcare Demand among Elderly in Malaysia

Shamzaeffa Samsudin, Norehan Abdullah and Shri Dewi Applanaidu

School of Economics, Finance and Banking, Universiti Utara Malaysia, 06010 Sintok, Kedah.

**For reprint and all correspondence: Dr Shamzaeffa Samsudin Department of Economics & Agribusiness, School of Economics, Finance and Banking, UUM College of Business, Universiti Utara Malaysia, 06010 UUM Sintok, Kedah, Malaysia.*
Email : shamzaeffa@uum.edu.my

ABSTRACT

Received 19 January 2016
Accepted 23 May 2016

Introduction The prevalence of non-communicable diseases (NCDs) in Malaysia shows a rising trend that influences the society in many respects. Country specific evidence is vital for effective intervention. The aims of this study were to identify the role of gender and urbanisation status on NCDs prevalence and its effect on health care demand, specifically doctor visits among elderly in Malaysia. We focused on two of the highest occurrence NCDs in the country – diabetes mellitus and hypertension.

Methods A total of 1,414 respondents aged 60 years and above were selected using a multistage sampling for face-to-face interview. We started the analysis with descriptive analysis of the prevalence, taking the effect of gender and urbanisation status of residing area. We extended the study with parametric analysis to find the effect of these health problems on the likelihood of doctor visits as it reflects the equity for access and utilisation issues.

Results Results showed that there were no significant difference of prevalence by gender and urbanisation for hypertension and diabetes mellitus. By utilising probit model, we found that those with diabetes mellitus or hypertension, controlling for other variables, were more likely to utilise doctor services.

Conclusion This result implies that the prevalence of NCDs may further increase demand for health care, especially in the state with a high proportion of older age groups.

Keywords Diabetes mellitus - Elderly - Health care utilization - Hypertension - Non-communicable diseases.

INTRODUCTION

Non-communicable diseases (NCDs) are non-infectious and cannot be transferred from one person to another. Besides genetically inherited, it may be caused by economic and social conditions, gender, lifestyles, background and environment factors which many of them are modifiable risk factors.[1,2,3] NCDs may be of long duration chronic diseases that slowly progressed. In Malaysia, the major burden of NCDs are blood pressure which is a risk factor for cardiovascular diseases, diabetes mellitus, cancer and mental illness and these NCDs have shown a rising an alarming trend. The Ministry of Health (MOH) reports that 17 million (60.7 percent) Malaysians live with at least one NCDs and almost 15 percent of Malaysians aged above 30 suffers from diabetes mellitus and 42.6 percent has hypertension.[4] The increase in the prevalence of NCDs influences the society in many ways which include higher utilisation of health services. The World Organization (WHO) reports that NCDs to be the top cause of mortality in the world. They cause more than 36 million deaths each year, of which almost 80% are from low and middle income countries.[5] As in the South-East Asia Region (SEAR), 55% of the estimated total death in 2008 were caused by NCDs. The rate is believed to upsurge over the next decade.[6] It also claimed that major forces for social, economic and social change, which factors may increase the prevalence of NCDs, are population ageing, globalization and urbanisation. Elderly are vulnerable to chronic health problems, including NCDs.[7,8] They are among the high-risk group of having NCDs due to poor disease resistance, the ongoing effect of lifestyle, poor diet and less physical activities. By 2020, person aged 60 and over in Malaysia are projected to be 9.7 percent of total population. This indicates the potential increase in health care use in the future and the rapid process of urbanisation and rural development may exacerbate it.

Urbanisation was found to be a significant factors in low and developing countries.[9,10] City hectic lifestyle may restrain healthy activities and increase exposure to polluted environment. NCDs risk factors like physical inactivity, diet and smoking behaviour may be gender specific and relevant to policy makers. Without proper measures to control the prevalence rate, the economic situation will also suffer due to NCD-related high health expenditure and lower productivity. Country specific evidence for NCDs prevalence and its effect on health care utilisation is therefore vital. Though government reports on prevalence are generally available, the parametric approach to identify the prevalence effects on health care use are still very limited within Malaysian context.

To highlight, the aims of this study were divided into two-fold, which were to (1) analyse the distribution of diabetes mellitus and hypertension among the elderly in Malaysia by gender and urbanisation status of residing state and (2) identify the effect of these two diseases on the likelihood of healthcare utilisation, specifically doctor visits.

METHODS

Data and sampling design

A total of 1,414 respondents from the northern states of Malaysia aged 60 and above, were interviewed face-to-face using a structured questionnaire between September 2012 and February 2013. In this study states were divided into developed and less developed states based on Growth Domestic Product (GDP) per capita by states in 2012-2013.[11] The division acts as a proxy for urbanisation level where developed states are expected to face rapid urbanisation process and otherwise. Pulau Pinang and Perak are considered as developed states while Perlis and Kedah as less developed states. For each state, all districts were first divided into three strata which were based on the status of the municipal council of the district - City, Municipal and District Councils. Next, at least one district was randomly selected from each stratum.

Second, stratified sampling was applied. For each of the three chosen areas in stage one, it was further stratified into two sub-areas which are majority Malay and majority non-Malay housing estates. This was to ensure sufficient representative of non-Malay in the sample. We randomly chose at least one Majority-Malay and Majority-Non-Malay housing estate from each area. Finally, snowball sampling was applied for each chosen housing estate. All the respondents (elderly – aged 60 and over) in the chosen housing estates were the targeted respondents. We conveniently approached an elderly to invite him or her to be interviewed. Then, the interviewed elderly was asked to recommend other elderly in the housing estate to us. This process continues until the availability of elderly in the housing estate was exhausted at the time of interviews.

Descriptive Analysis

This section begins by presenting the distribution of NCDs prevalence among the respondents. Respondents were asked whether they have been suffering from any longstanding illness or disabilities. If so, the respondents were given a list of health problems that they may have suffered. Respondents were also asked whether they have been receiving regular treatment for the disease(s) they reported and whether the disease(s) interferes with their daily activities. The distribution of two common NCDs (hypertension and diabetes mellitus) were cross tabulated by selected socio-

economic factors – gender and urbanisation status of residing state. A Pearson chi square (X^2) statistic was used to investigate the difference in distribution with one degree of freedom. Although the prevalence of NCDs is more meaningful if it was analysed by NCDs' risk factors like physical activities, diet and smoking status, but these factors may be endogenous in cross-sectional data, thus was not considered in this paper.

Empirical specification-Probit Model

The probit model[12] was used in determining the effects of having diabetes mellitus or hypertension on health care demand, specifically on formal doctor visits. The respondents were asked whether they had visited a doctor in the past one month before the interview which may also include the regular visits. Assume that for each elderly, there was a latent variable that represents his or her unobserved demand on health care. This unobserved demand was associated with variables such as socio-demographic characteristics of the elderly and other considered variables (x_i). Let y^* represent this latent variable and assume that y^* is a linear function of x_i, then,

$$y_i^* = \sum_{i=1}^{n} \beta x_i + u_i \quad (1)$$

where

y^* = unobserved demand on health care

x = independent variables

u = error term

Let y be the random variable that represents the observed outcomes such that value of y is observed as:

y = 1 if the elderly have had doctor visits in the last one month

= 0 if otherwise

Assume that the error term in the latent equation (1) follows a normal distribution, we have the probit model. The probability that the elderly have observed outcome of demand for health care (y=1) or otherwise (y=0) is given as below:

$$\text{Prob}(y=1) = \text{Prob}(y^* > 1) = \text{Prob}(x'\beta + u > 0) = \text{Prob}(u < x'\beta) = \Phi(x'\beta)$$

$$\text{Prob}(y=0) = 1 - \text{Prob}(y=1) = 1 - \Phi(x'\beta)$$

The Φ is the cumulative standard normal distribution function. The maximum likelihood parameter estimates (MLE) are obtained by maximizing the following log likelihood function with respect to β:

$$LF(\beta) = \sum_{i=1}^{n} y_i \ln(\Phi(x'\beta)) + (1 - y_i)\ln(1 - \Phi(x'\beta))$$

The model will be estimated with the robust variance estimates (Huber/White/sandwich estimator of variance).

RESULTS

Descriptive Statistics

From the analysis it was found that 67.6 percent were suffering from at least one longstanding illness of which diabetes mellitus and hypertension were among the top three reported as shown in Figure 1. Of 1,414 respondents, 23.8 percent have reported of having diabetes mellitus while 42.4 percent reported of hypertension. There are 17.5 percent suffer both diabetes mellitus and hypertension. Among those who suffer from diabetes mellitus, 92.56 percent have regular visit to health centre while 88.67 percent applied for hypertension.

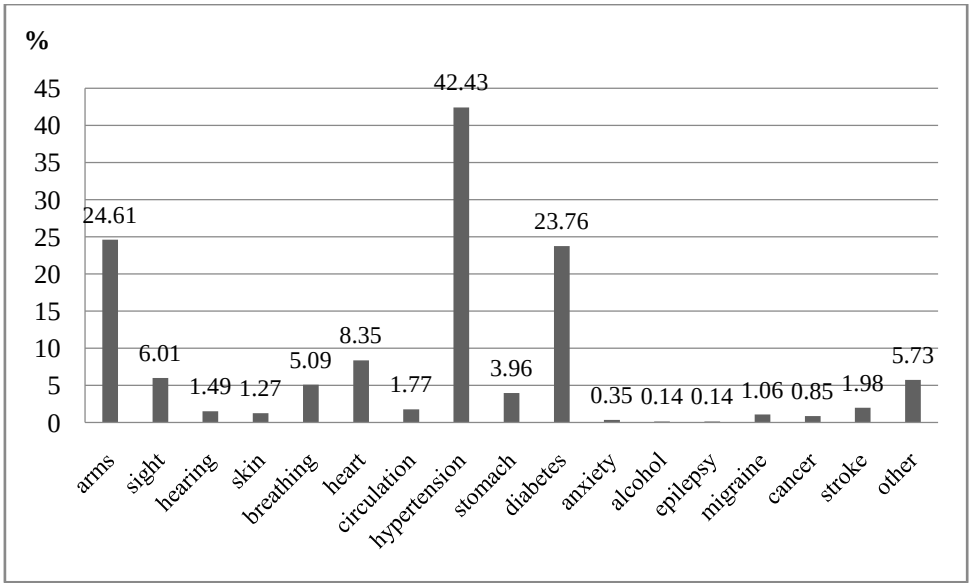

Figure 1 The distribution of longstanding illness

Figure 2 shows the distribution of diabetes mellitus and hypertension by gender indicating the prevalence were higher among women. However, at 5 percent significance level, the difference was not statistically significant for both diabetes mellitus (p=0.282) and hypertension (p=0.059).

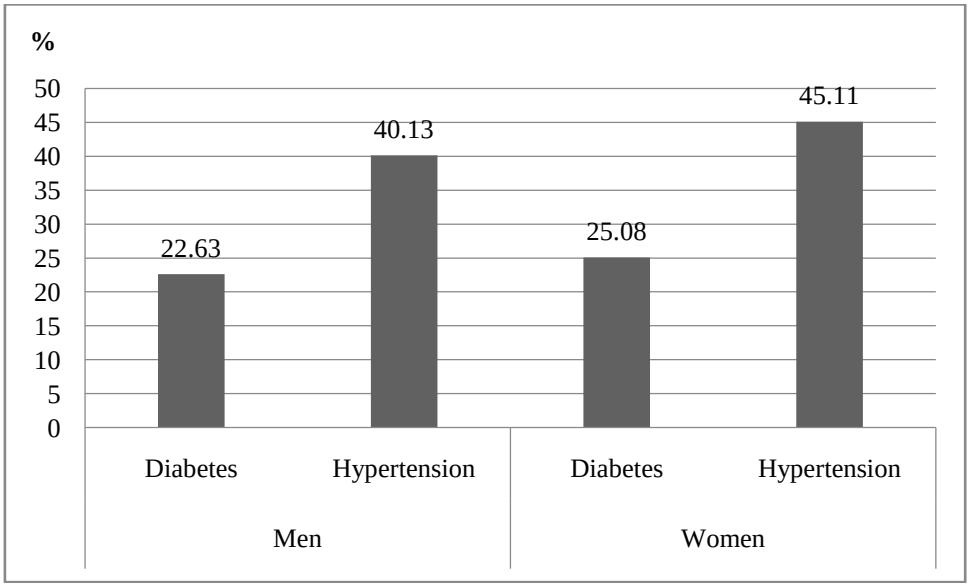

Figure 2 The prevalence of NCDs by gender

Figure 3 shows the prevalence of NCDs by developed-less developed setting in order to pick up the effect of urbanisation status. The division was based on the GDP by states[11], supported by The Third Outline Perspective Plan (Malaysia), 2001-2010.[13] The percentage of urban population was higher in the developed states that of the less-developed. The data shows that 57.64 percent of the respondents were from developed states and the remaining 42.36 percent were from less developed states. Result showed that the occurrence of both diabetes mellitus and hypertension were higher in developed states as compared to less developed one. However, the difference was not statistically significant for diabetes mellitus (p=0.423) and hypertension (p=0.650) respectively.

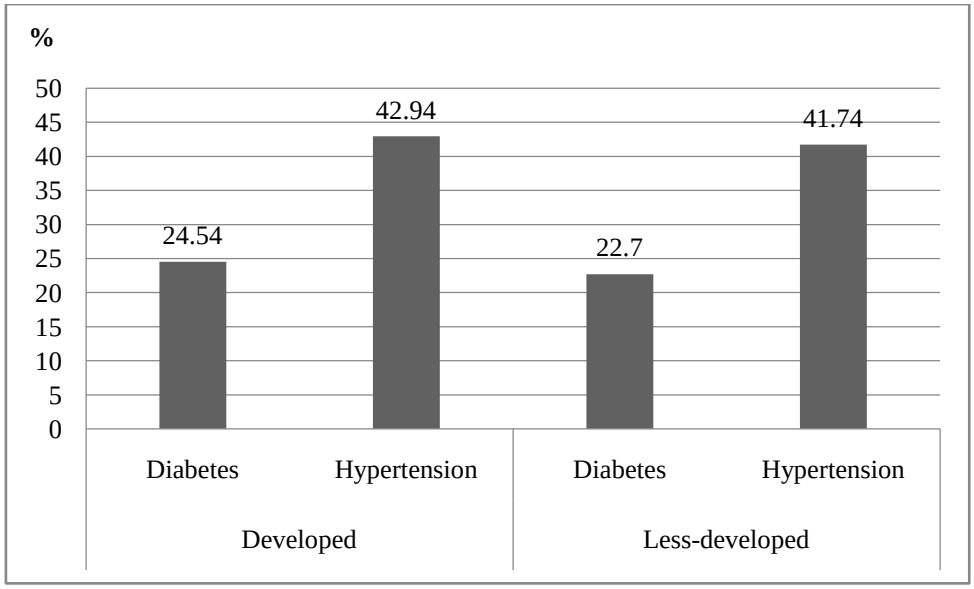

Figure 3 The prevalence of NCDs by developed-less developed setting

Empirical analysis – Probit Model

This section aimed to determine the effect of the prevalence of hypertension (hp) and diabetes mellitus (diabetes) on doctor visits by using Probit model. With this model one may identify the net effect of diabetes and hp by controlling the effect of demographic, socioeconomic and other health factors. List of variables with the summary statistics of independent variables used for empirical analysis is presented in Table 1.

Table 1 Independent Variables for Health Care Demand Models

Variables	Definitions	Mean	s.d	Min	Max
age	Age in year	69.307	7.187	60	98
male	Gender; 1 if gender is male, 0 female	0.537	0.499	0	1
malay	Ethnicity; 1 if Malay, 0 otherwise	0.612	0.487	0	1
edu	Highest Education level 1 - No formal school to 10 - Post - degree	2.730	1.870	1	10
no_work	Main economic activity; 1if not working, 0 otherwise	0.705	0.456	0	1
smoker	Whether currently a smoker; 1 if Yes, 0 if No	0.194	0.400	0	1
vegetarian	Whether a full-time vegetarian; 1 if Yes, 0 if No	0.023	0.149	0	1
exercise	Time allocation for exercising 1 = 0 hour to 5 = >3 hours	2.482	1.603	1	5
income	Total of individual income from all sources	985.013	1417.827	0	20000
insurance	Own medical insurance; 1if Yes, 0 if No	0.120	0.325	0	1
married	Marital status; 1if Married, 0 if otherwise	0.724	0.447	0	1
live	Number of individuals aged 18 and above that are currently living together	1.74611	1.260161	0	9
chat	Informal interaction with the society (past two weeks);1 if Yes, 0 if No	0.762	0.426	0	1
trust	Living in trusted community; 1 if Yes, 0 if No	0.904	0.295	0	1
developed	Living in developed states; 1if lives is developed states, 0 if in less developed states	0.723	0.447	0	1

Variables	Definitions	Mean	s.d	Min	Max
otc	Utilisation of over the counter market for health care; 1 if Yes, 0 if No	0.430	0.495	0	1
alt	Utilisation of alternative health services or traditional healers; 1if Yes, 0 if No	0.079	0.270	0	1
sah	Self-assessed health 1 - Good, 2 - Average, 3 - Poor	1.521	0.615	1	3
long_ill	Having longstanding health problems; 1if Yes, 0 if No	0.676	0.468	0	1
hp	Reported of having hypertension (blood pressure); 1if Yes, 0 if No	0.424	0.494	0	1
diabetes	Reported of having diabetes mellitus; 1if Yes, 0 if No	0.238	0.426	0	1
hpdiabetes	Reported of having both hypertension and diabetes; 1if Yes, 0 if No	0.175	0.010	0	1
arms	Reported of having problems with arms, legs, hands, feet, back, neck; 1if Yes, 0 if No	0.246	0.431	0	1

This section reports the influence of hypertension and diabetes mellitus prevalence, controlling for demographic, socioeconomic and other health related factors, on the probability of doctor visits as shown in Table 2. Apart from being vegetarian and engaging in informal interactions, other significant variables were all health related factors. Suffering from hypertension, has increased the likelihood of doctor visits among the respondents at 1 percent significance level. The prevalence of from diabetes mellitus has also influenced the likelihood for doctor visits.

Table 2 The estimated probit model for doctor visit (n=1414)

Variables	Coefficient	p-value
age	-0.014	0.012***
male	0.060	0.480
ethnic	0.029	0.730
edu	-0.005	0.861
no_work	0.052	0.586
smoker	-0.128	0.042***
vegetarian	0.166	0.547
exercise	-0.020	0.420
income	0.000	0.113
insurance	-0.043	0.743
married	-0.118	0.192
live	0.000	0.998
chat	-0.116	0.202
trust	0.070	0.602
developed	0.165	0.136
Otc	-0.121	0.123
Alt	0.242	0.087*
sah	0.332	0.000***
long_ill	0.825	0.000***
hp	0.399	0.000***
diabetes	0.298	0.001***
arms	0.116	0.211
_cons	-0.219	0.633

LogLikelihood	-774.01047

The symbol ***, ** and * denote 1%, 5% and 10% level of significance, respectively

DISCUSSION

From the analysis on 1,414 respondents age 60 and over, we found that the prevalence of diabetes mellitus and hypertension were among the top three longstanding health problems reported by respondents. This finding was parallel to that of a nationwide cross-sectional study by the Institute for Public Health Malaysia[14] which suggests that hypertension and diabetes mellitus as the most common non-communicable diseases in Malaysia. Despite the high prevalence, most of respondents with these diseases have regular visits to health centre, which suggests that health care are quite accessible as compared to some areas in low and middle income countries.[15,16]

In getting the overview of the prevalence distribution, we tabulated the frequency by gender and urbanisation setting. It is found that the prevalence rate of diabetes and hypertension were higher among women than men but with no significant difference. As mention before, the prevalence rate in this study was self-reported and there may be cases of hidden incidences. Perhaps men were less likely to have formal medical check-up and let their diseases go undetected. To further investigate this, the data were tabulated and we found that of total men who have reported no longstanding illnesses, 83% perceived their health status as good and 94% claimed that their daily activities were not refrained due to health problems. Based on this, the risk of underreported, if any, may be very minimum. Even so, it gives some indication that NCDs risk factors among women in Malaysia should be given attention. These result was consistent, for instance, with Miszkurka et al.[17] that found the prevalence rate of all NCDs under study in Burkina Faso were higher for women. Women may be less likely to involve in physical activities[18] and thus measures to promote women involvement in physical activities may be heightened.

Studies also suggest that urbanisation was among the determinants of NCDs prevalence.[9, 10] In this study, we found that the prevalence of diabetes and hypertension were higher in developed states setting (represents higher level of urbanisation) than the less developed one but statistically indifference. Nevertheless, it implies that the process to transform less developed states must be accompanied with specific actions that could control the prevalence of NCDs. Although urbanisation has been associated with better facilities concerning education, health, housing, transportation and sanitation, but the prevalence of NCDs risk factors may be also higher due to less healthy lifestyles and polluted environment. Therefore, health promotion and prevention activities for all age groups should be enhanced. Although at this point, the difference of prevalence was not statistically significant, measures can still be taken to control health behaviours that have been associated with urbanisation process and later the prevalence of NCDs. As suggested by some studies, there were connection between urbanisation and individual risk factors that cause NCDs.[19,20]

In the second part of the analysis, we attempted to establish the connection between NCDs prevalence and health care utilisation. We found that the prevalence of diabetes mellitus and hypertension contributes to the increased probability of utilising health care services, specifically doctor visits. We look at this finding from two perspectives. First, it shows that NCDs may increase health care demand which inevitably has financial implication to the government or even the users. Although the model indicated the potential increase in health care use among elderly due to NCDs, but from an equity-in-access standpoint, it was promising. This is because the utilisation was largely determined by the need factors[21,22] rather than other socio-economic factors. Need variables capture the need for health care utilisation and are measured by symptom of illnesses perceived by individuals. Income and insurance ownership, which represent the ability to pay, on the other hand, do not significantly influence the likelihood of doctor visits, although it may influence the choice of providers.

CONCLUSION

The aim of this paper was to identify the distribution of two non-communicable diseases which were diabetes mellitus and hypertension among the elderly in Malaysia by gender and urbanisation status of residing state and determine its effect on doctor visits. Focus was given to the elderly group not only because its proportion to population has been increasing over time, but the probability to be diagnosed with longstanding illnesses that include NCDs has also swelled with age. Although the distribution of diabetes mellitus and hypertension by gender was not significantly different, it was higher among women than men which require policymakers' attention. Similarly, focus should be given to urbanisation process since it has been associated with health risk though we cannot statistically prove it in this study. From logit model, it showed that demographic, socioeconomic and ability to pay contributed insignificantly in

determining doctor visits except for health condition. Since financing health care has become an important agenda in public finance, measures to improve health status such as health promotion, early intervention and detection are vital to reduce unnecessary costs in the future.

ACKNOWLEDGEMENT

Our appreciation goes to Universiti Utara Malaysia for the research grant (PBIT S/O Code: 123182) and support. The draft of the paper has been presented at ASEAN Consortium on Department of Economics Conference 2015.

REFERENCES

1. Negin J, Cumming R, de Ramirez SS, Abimbola S, Sachs SE. Risk factors for non-communicable diseases among older adults in rural Africa. Trop. Med. Int. Health. 2011;16(5):640-646.
2. Promthet S, Saranrittichai K, Kamsa-ard S, Senarak W, Vatanasapt P, Wiangnon S. Situation analysis of risk factors related to non-communicable diseases in Khon Kaen Province, Thailand. Asian Pac. J. Cancer Prev. 2011;12(5):1337-1340.
3. Silva-Matos C, Beran D. Non-communicable diseases in Mozambique: Risk factors, burden, response and outcomes to date. Global and Health. 2012;8.
4. MOH. National strategic plan for non-communicable disease: Medium term strategic plan to further strengthen the cardiovascular diseases & diabetes prevention & control program in Malaysia (2010-2014). Putrajaya: Ministry of Health Malaysia (MOH) 2010.
5. WHO. Global status report on non-communicable disease. Geneva: World Health Organization; 2010.
6. WHO. Noncommunicable diseases in the South-East Asia Region: World Health Organization; 2011.
7. Ayernor P. Diseases of ageing in Ghana. Ghana Med J. 2012;46(2 Suppl):18-22.
8. Sazlina SG, Zaiton A, Nor Afiah MZ, Hayati KS. Predictors of health related quality of life in older people with non-communicable diseases attending three primary care clinics in Malaysia. J Nutr Health Aging. 2012;16(5):498-502.
9. Angkurawaranon C, Wattanatchariya N, Doyle P, Nitsch D. Urbanization and non-communicable disease mortality in Thailand: an ecological correlation study. Trop. Med. Int Health. 2013;18(2):130-40.
10. Boutayeb A, Boutayeb S. The burden of non-communicable diseases in developing countries. Int J Equity Health. 2005;4(1):2.
11. Department of Statistics Malaysia, GDP by State 2010-2014. [Internet]. 2015 [cited 2016 May 10]. Available from: https://www.statistics.gov.my.
12. Amemiya T. Qualitative response models: A survey. J Econ Lit. 1981;19(4):1483-1536.
13. EPU. The Third Outline Perspective Plan, 2001-2010. Putrajaya: Economic Planning Unit (EPU), Malaysia; 2001.
14. Institute for Public Health. National Health and Morbidity Survey 2011: Health facts [Internet]. 2015 [cited 2016 may 10]. Available from http://www.moh.gov.my/index.php/pages/view/115.
15. Edwards R, Unwin N, Mugusi F, Whiting D, Rashid S, Kissima J et al. Hypertension prevalence and care in an urban and rural area of Tanzania. J Hypertens. 2000;18(2):145-152.
16. Peters DH, Garg A, Bloom G, Walker DG, Brieger WR, Rahman MH. Poverty and Access to Health Care in Developing Countries. Ann N Y Acad Sci. 2008;1136(1):161-171.
17. Miszkurka M, Haddad S, Langlois ÉV, Freeman EE, Kouanda S, Zunzunegui MV. Heavy burden of non-communicable diseases at early age and gender disparities in an adult population of Burkina Faso: World Health Survey. BMC Public Health. 2012;12.
18. Cheah YK. Influence of socio-demographic factors on physical activity participation in a sample of adults in Penang, Malaysia. Malays J Nutr. 2011;17(3):385-91.
19. Angkurawaranon C, Lerssrimonkol C, Jakkaew N, Philalai T, Doyle P, Nitsch D. Living in an urban environment and non-communicable disease risk in Thailand: Does timing matter? Health Place. 2015;33:37-47.
20. Angkurawaranon C, Wisetborisut A, Rerkasem K, Seubsman SA, Sleigh A, Doyle P et al. Early life urban exposure as a risk factor for developing obesity and impaired fasting glucose in later adulthood: results from two cohorts in Thailand. BMC Public Health. 2015;15:902.
21. Aday LA, Andersen R. A Framework for the Study of Access to Medical Care. Health Serv Res 1974;9(3):208-20.
22. Atella V, Brindisi F, Deb P. Rosati FC. Determinants of access to physician services in Italy: A latent class seemingly

unrelated probit approach. Health Economics, 2004;13(7): 657-668.