DEMAND SIDE INFLUENCES ON THE CONSUMPTION OF ALCOHOL, TOBACCO AND PHYSICAL ACTIVITY IN MALAYSIA

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**THESIS SUBMITTED IN FULFILMENT
OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY**

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UNIVERSITY OF MALAYA
KUALA LUMPUR**

2014

ABSTRACT

In light of alarming evidence of non-communicable diseases and solvable health risk factors, the aim of this study is to examine the relationship between health affecting variables, and demand for alcohol, tobacco and physical activity among adults in Malaysia. Data from the Third National Health and Morbidity Survey (NHMS III) consisting of 30992 respondents and detailed information on individual's socio-demographic, health and lifestyle profiles is deployed for this purpose. Logit models are applied to examine the factors that influence individuals' likelihood of consuming alcohol, tobacco and being physically active. The results show that age, income, gender, ethnicity, education, marital status, residing area and employment status are significantly associated with demand for alcohol, tobacco and physical activity.

Three main findings can be drawn from this study. Firstly, young individuals, high income earners, males, Chinese, the well-educated, urban dwellers, civil servants, private sector employees, the self-employed and students are more likely to consume alcohol than others. Secondly, young individuals, low income earners, males, Malays, the less-educated, widowed or divorced individuals, rural dwellers, private sector employees and the self-employed are more likely to consume tobacco than others. Thirdly, old individuals, high income earners, females, Indian or others, the well-educated, widowed or divorced individuals, urban dwellers and the unemployed are less likely to participate in physical activity than others. Based on the findings of this study, numerous population-based interventionist measures toward promoting a healthy lifestyle are recommended.

ABSTRAK

Berasaskan bukti meluas berkenaan faktor penyakit berjangkit yang boleh dielakkan, tesis ini bermatlamat meninjau hubungan antara pembolehubah penyebab kesihatan, dan penggunaan arak, tembakau dan kegiatan jasmani dikalangan orang dewasa di Malaysia. Data daripada The Third National Health and Morbidity Survey (NHMS III) yang mengandungi 30992 responden dan maklumat terperinci sosio-demografi, kesihatan and profil gaya hidup individu digunakan untuk memenuhi matlamat ini. Model Logit digunakan untuk menganalisis faktor-faktor yang mempengaruhi kemungkinan penggunaan arak, merokok dan menjalankan kegiatan jasmani secara aktif oleh individu. Keputusan memperlihatkan umur, pendapatan, jantina, suku kaum, pendidikan, taraf perkahwinan, tempat kediaman dan taraf pekerjaan berkorelasi dengan penggunaan arak, tembakau dan kegiatan jasmani.

Tiga penemuan utama dapat dirumuskan daripada kajian ini. Pertamanya, individu muda, berpendapatan tinggi, lelaki, kaum China, berpendidikan tinggi, yang menetap di kawasan bandar, kakitangan sektor swasta, pekerja persendirian dan pelajar menunjukkan kemungkinan yang lebih untuk menggunakan arak berbanding dengan yang lain. Keduanya, individu muda, berpendapatan rendah, lelaki, kaum Melayu, berpendidikan rendah, janda dan duda, telah dicerai, yang menetap dikawasan luar bandar, kakitangan swasta dan pekerja persendirian lebih cenderung menggunakan tembakau berbanding dengan orang dewasa lain. Ketiganya, individu tua, berpendapatan tinggi, wanita, kaum India dan yang lain, berpendidikan tinggi, janda dan duda dan yang telah dicerai, yang menetap di kawasan bandar dan penganggur kurang cenderung terlibat dalam kegiatan jasmani berbanding dengan yang lain. Berpandukan

penemuan tesis ini, beberapa langkah kependudukan boleh diambil untuk mendorong gaya hidup yang sihat.

ACKNOWLEDGEMENTS

Firstly, I would like to thank the Director General of Health, Malaysia for his permission to use the data from National Health and Morbidity Survey III (NHMS III). Secondly, I am extremely grateful to Ministry of Higher Education, Malaysia for granting me the scholarship to pursue my Ph.D programme. Thirdly, I would like to express my sincerest gratitude to my supervisor, Professor Dr. Rajah Rasiah. He has guided me throughout my thesis with his effort and knowledge. In other words, this thesis would not have been completed or written without his guidance. Fourthly, I wish to express my gratitude to Mr. Tang Chor Foon and Professor Dr. Goh Kim Leng, who have provided me with lots of support along with their knowledge of thesis writing, and Mr. Danesh Chandran, who have proofread the Malay version of my abstract. Lastly, I owe my deepest gratitude to my family for supporting me throughout all my years of study.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

The World Health Organization (WHO) defines health as a state of physical and mental well-being that is free of illnesses (Callahan, 1973). Since a healthy life can lead to happiness and a better quality of life, people have a tendency to stay healthy throughout their lifetime (Clark and Oswald, 1994; Theodossiou, 1998; Gredtham and Johannesson, 2001; Subramanian et al., 2005). From the country's perspective, health capital plays an important role in economic development since good health is necessary to raise productivity (Strauss and Thomas, 1998; Bloom et al., 2004; Weil, 2007). Healthy people tend to have more healthy time for market activities and are less likely to be absent from work (Grossman, 1972). Likewise, as emphasised by Bloom and Canning (2000) and Cole and Neumayer (2006), a country's performance is mainly determined by its human and health capital, and poor health is the main factor causing a country to be underdeveloped.

According to the WHO, disease refers to the medical condition that weakens individuals' mental and bodily function. It is well documented that the presence of diseases can seriously affect individuals' health and well-being, which may ultimately cause economic contraction in a country (Peto et al. 1995; Jenkinson, 1995; Burton, 1999; Wahlqvist, 2001). In general, diseases are categorised into two primary categories: one, communicable diseases; and two, non-communicable diseases (NCDs). Communicable diseases are also known as infectious diseases, which are diseases that

can be transmitted from one person to another, such as, HIV/AIDS, malaria, tuberculosis (TB) and dengue. Conversely, NCDs refer to diseases that are non-infectious, such as, high blood pressure, hypercholesterolemia, stroke, cancer and diabetes. Put simply, communicable diseases are caused by the spread of viruses and bacteria, whereas NCDs are determined by individuals' genetic background and lifestyle.

NCDs are regarded as the most common and preventable type of diseases (Beaglehole et al., 2001; Khatib, 2004; Boutayeb, 2006). Researchers have found that unhealthy behaviour and lifestyle, such as, alcohol drinking, smoking, unhealthy diet and physical inactivity are the main factors causing NCDs (Strong et al., 2005; Unwin and Alberti, 2006; Marrero et al., 2012). Parry et al. (2011) pointed out that heavy alcohol drinking can significantly increase individuals' risk of suffering from liver cancer, colon cancer, breast cancer, hypertension, stroke, hepatitis and cirrhosis of the liver. Additionally, Thakur et al. (2011) illustrated that cigarette smokers tend to have a higher risk of suffering from coronary heart disease, stroke, chronic obstructive pulmonary disease and lung cancer than non-smokers. On top of that, Helmrich et al. (1991), LaMonte et al. (2005) and Nicklett et al. (2012) reported that physical inactivity can significantly increase the risk of type 2 diabetes and premature death among the elderly. Moreover, Malik et al. (2010) stated that diet consisting of high sugary foods can increase individuals' risk of becoming obese, which, in turn, can cause various types of NCDs. Therefore, the likelihood of suffering from NCDs can be significantly reduced if individuals live a healthy lifestyle.

NCDs have become a serious health concern in today's society, and it cannot be denied that more and more people are suffering from such diseases as a consequence of

industrialisation and urbanisation. The growing burden of NCDs has become a critical issue and a public health challenge worldwide. The WHO (2011c) noted that the majority (63%) of the mortalities reported in 2008 were associated with NCDs, most notably, cardiovascular diseases (CVDs) and cancers, which accounted for 36 million deaths, of which approximately 80% occurred in the developing countries. NCD related deaths are expected to rise in the near future with a greater increase in the developing countries than in the developed countries. It is predicted that 75% of the total mortalities by the year 2030 will be related to NCDs, which is expected to account for more than 50 million of deaths (Disease Control Division, 2006; Marrero et al., 2012). In fact, this figure is five times more than the communicable diseases related mortalities.

The WHO (2011c) reported that at least 60-80% of the CVD and cancer related mortalities happen in the developing countries. Besides, nearly a quarter (20%) of NCD related deaths in the developing countries occur among the non-elderly adults. In addition, there is evidence suggesting that NCDs are the main barrier to economic growth, and the leading cause of poverty (Marrero et al., 2012). It is estimated that NCDs will cause at least United States dollar (USD) 30 trillion losses in global economic production in the coming decades. In light of the seriousness of NCDs, the rising prevalence of its common modifiable health risk factors, i.e. smoking, alcohol drinking, physical inactivity, and obesity, has become a serious public health concern worldwide (WHO, 2011c).

Each year, smoking causes at least five million deaths worldwide (WHO, 2012b), which translates into about two deaths in every ten second or one in six of total NCDs related deaths (Thakur et al., 2011). By the year 2030, the amount of smoking related deaths will increase to ten million, which will account for more than one in every ten adult

deaths (WHO, 2012b). Smoking causes around 71% of lung cancer, 42% of chronic respiratory disease and 10% of CVDs annually. Globally, more than two-thirds of smokers reside in the developing countries, where smoking related burdens are the heaviest. Moreover, smoking also causes a serious adverse impact on the health of children (WHO, 2012b). Almost 50% of children in the world are breathing smoke-polluted air, and every year, second-hand smoke causes at least 180 thousand of premature deaths among children.

Alcohol drinking is also regarded as one of the serious health issues worldwide, placing it as the third highest risk factor of mortality (WHO, 2011b). Alcohol drinking causes more than 4% of disability adjusted life years (DALY) (Parry et al., 2011), and results in more than 3 million deaths annually, or 3% of all deaths in the world. About 6% and 1% of the male and female mortalities, respectively, are associated with alcohol drinking (WHO, 2011a). Each year, it is found that at least 300,000 individuals aged between 15 and 29 die from consuming alcohol, causing approximately 10% of all deaths in that age group (WHO, 2011b). A large proportion of the alcohol drinking related deaths are attributable to NCDs, such as, cancers, liver cirrhosis and cardiovascular disease, followed by road traffic accidents, violence and suicides. Besides, alcohol drinking also causes numerous social problems in society, most notably violence, child abuse, and poor work performance.

In 2008, approximately 28% of men and 34% of women in the world failed to meet the recommended physical activity guideline. In South East Asia, 15% and 19% of men and women, respectively, were physically inactive in 2008 (WHO, 2012d). In fact, the prevalence of physically inactive adults in developed countries is two times higher than in developing countries. Every second at least one woman in developed countries is

physically inactive (WHO, 2012d). Today, physical inactivity ranks as the fourth highest risk factor of mortality, causing 3 million deaths yearly. Furthermore, it is estimated that around 32.1 million of DALY worldwide are associated with physical inactivity. The WHO (2012d) reported that individuals who are physically inactive are 20-30% more likely to die from NCDs compared to those who are active. Research has also shown that a minimum of 2 hours and 30 minutes of moderately intense physical activity a week can significantly reduce the likelihood of having heart diseases and cancers by about 20-30%. In addition, individuals who participate in physical activity regularly are also found to be less likely to suffer from stroke, hypertension and mental depression.

Obesity is regarded as the fifth highest risk factor of mortality in the world (WHO, 2012c). The prevalence of obesity has increased tremendously since 1980, most notably in the developing countries. Each year, obesity causes more than 2 million deaths and 35 million of DALY worldwide. It is well documented that obesity can significantly increase the risk of cancers, heart diseases, stroke and diabetes. The WHO (2012c) reported that approximately 44% of diabetes, 41% of cancers and 23% of heart diseases are caused by obesity. In 2008, about 200 million men and 300 million women were obese, which was equivalent to approximately 10% of the total world population. Furthermore, almost 50 million of children in the world were obese in 2010. Worse still, the WHO (2012c) predicted that the total prevalence of obesity would increase to 700 million by 2015. In addition, many developing countries are now facing the problem of "double burden" diseases. The situation is that people in developing countries tend to consume low-cost unhealthy foods, which are low in nutrient, but high in calories. Hence, the rising prevalence of obesity and malnutrition in the developing countries is very likely to raise health problems.

1.2 Overview of Malaysia Health Profile

In 2008, the majority of the disease burdens in Malaysia were associated with NCDs, which accounted for more than 65% of total disease burdens (WHO, 2012a), which was equivalent to approximately 2 million of disease burdens in the country. In addition, Yasin et al. (2012) reported that at least 70% of the Malaysians were diagnosed with NCDs, most notably, heart disease and cancer in 2006. In fact, both ischemic heart disease and CVD were the leading factors of DALY in Malaysia, which accounted for 16% of the total DALY (Yasin et al., 2012; WHO, 2012a). Furthermore, the Ministry of Health, Malaysia, reported that heart disease was the main cause of mortality in government hospitals, which accounted for more than 15% of total deaths in 2008 (WHO, 2012a). The WHO (2002) reported that the majority (71%) of mortalities in Malaysia were attributed to NCDs in 2002. In addition, Edwards and Lim (2012) provided evidence to show that the average age of Malaysians being diagnosed with NCDs is getting younger.

Hypertension has become a serious health problem in Malaysia. The Institute for Public Health (2008) pointed out that about twenty thousand of hospital admissions in Malaysia in 1990 were related to hypertension, and this figure had doubled to forty thousand in 2005. Each year, the Malaysian government spends about Ringgit Malaysia (RM) 200 million on treating hypertensive patients. On top of that, it was reported that the prevalence of hypertension and hypercholesterolemia in Malaysia had increased by 1.6 million and 3.5 million, respectively, over the period 2006 to 2011 (Institute for Public Health, 2008; Institute for Public Health, 2011; Edwards and Lim, 2012).

The prevalence of obesity in Malaysia increased from 5.8% in 1996 to 27.2% in 2011, amounting to almost three million obese adults in 2011 (Ismail et al., 2002; Institute for Public Health, 2011; Edwards and Lim, 2012). Meanwhile, the prevalence of diabetes in Malaysia rose from 11.5% in 2006 to 15.2% in 2011 (Institute for Public Health, 2008; Institute for Public Health, 2011). Worst of all, Lee and Loh (2010) reported that Malaysia was ranked as the fourth highest diabetes country in Asia, with a total of eight hundred thousand reported cases in 2007, and this figure is expected to increase to more than one million in the coming decades.

In spite of the alarming evidence, a lot of Malaysians still do not show a healthy lifestyle. In 2011, almost five million Malaysians smoked, while over 40% of Malaysian males were active smokers (WHO, 2012e). Additionally, it was reported that more than 10% of Malaysians consumed alcohol regularly, while almost 40% of Malaysians did not adopt a healthy physical lifestyle in 2011 (Institute for Public Health, 2011). In terms of dietary behaviour, the Institute for Public Health (2011) illustrated that more than 90% of Malaysians did not consume enough of fruits and vegetables, and nearly 20% consumed excessive amounts of sugary beverages in 2011.

1.3 Problem Statement

In light of the alarming evidence of NCDs in Malaysia, there is a need for a set of better and more effective population-based intervention strategies towards promoting a healthy lifestyle in the country. In essence, the factors that affect individuals' health behaviour, such as, alcohol drinking, smoking and participation in physical activity are important. While studies on the factors determining health behaviour has received a great deal of attention in the developed countries, there are little such studies in

Malaysia. Therefore, an in-depth study investigating the factors affecting the health behaviour is much needed.

1.4 Research Questions

Based on the research gaps identified, several research questions related to the health behaviour of adults in Malaysia remain unanswered and unaddressed. Firstly, since health behaviour, such as, alcohol drinking, smoking and participation in physical activity play an important role in preventing diseases, especially NCDs, what are the main factors that affect individuals' health behaviour? Secondly, who tend to engage in healthy and unhealthy behaviour? In particular, who are more or less likely to smoke, drink alcohol and be physically active?

Thirdly, which socio-economic groups of the population should be given particular attention by policy makers in order to overcome the problems of rising prevalence of NCDs? Fourthly, what strategies can be recommended to cure the rising prevalence of NCDs? For example, what policy should the government adopt if the results show that the less-educated and young individuals are more likely to engage in unhealthy behaviour?

1.5 Objectives of Study

In light of the rising prevalence of NCDs and its profound impact on mortality and morbidity, the present study sets out to investigate the factors affecting the health behaviour of adults in Malaysia. The specific objectives are: one, to analyse the factors that affect individuals' probability to consume alcohol; two, to assess the factors that

affect individuals' probability to smoke; and three, to evaluate the factors that affect individuals' probability to participate in physical activity.

1.6 Research Contributions

The present study intends to contribute to the existing literature and society in several ways. Firstly, the focus of the present study is on a rapidly developing upper-middle income country, i.e. Malaysia, where morbidity and mortality are mainly caused by NCDs. Hence, the findings will provide a better understanding of the causes explaining the rising prevalence of NCDs in the country.

Secondly, the present study exploits the latest nationally representative health survey data consisting of a large sample age groups, race, employment status, income and education levels to undertake a robust analysis of the problem. Besides, the large and comprehensive dataset enables a more reliable assessment of the causes of NCD risk factors to assist policy makers in formulating better health policies.

Thirdly, the findings of the present study provide the Ministry of Health Malaysia with the baseline information for reducing the prevalence of NCDs and modifiable health risk factors in the nation. With the findings, policy makers will be better informed about which socio-economic groups of the population should be given special attention.

1.7 Organisation of Study

This thesis is structured as follows. Chapter 1 provides the introduction, which includes the background of study, overview of Malaysia's health profile, problem statement,

research questions, objectives of study and research contributions. Chapter 2 presents the literature review, which consists of theoretical framework, as well as, the findings of the previous empirical studies on the determinants of health behaviour. Chapter 3 analyses the factors that determine individuals' likelihood of drinking alcohol. Chapter 4 assesses the factors that determine individuals' likelihood of smoking. Chapter 5 investigates the factors that affect individuals' propensity to engage in a physically active lifestyle. Chapter 6 presents the summary and conclusions, which includes implications for theory and policy, as well as, limitations of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Theoretical Frameworks

Grossman (1972) claimed that health is a capital good which people need to invest in through consumption of market goods and services. The present study focuses on health behaviour, which is an important determinant of individuals' health status and is closely related to economic theories (Cawley and Ruhm, 2012). The important factors affecting health behaviour include, age, income, education, time preference, advertising, information, and peer. This section reviews the role of economics in health behaviour in detail.

2.1.1 Health Capital Model

From the economics perspective, Grossman (1972, 2000) claimed that health is a capital good that is used to produce output of 'healthy time'. According to Grossman (1972, 2000), health can determine the amount of time that individuals can spend on both market and non-market activities. In actual fact, the level of health capital varies across individuals as it is mainly determined by genetic, lifestyle and environmental factors (Grossman, 1972, 2000). Similar to other types of capital, health can depreciate over time, which means individuals will become weaker as they age, and such depreciation can ultimately lead to death when the health capital falls below the minimum level (Grossman, 1972, 2000), at which, the amount of time that individuals can spend in producing market and non-market goods and services is equal to zero.

In addition, Grossman (1972, 2000) emphasised that the rate of depreciation of health capital mainly depends on individuals' age with the rate of depreciation being higher among older individuals than younger individuals because of the biological process of aging. In other words, older individuals' health tends to deteriorate faster compared to their younger counterparts. In line with the arguments of Becker (1976) who used the household model, to reduce the depreciation of health capital, it is necessary to raise input of resources, such as, time, medical care, shelter, sport equipment and food into health, meaning that individuals need to participate in physical activity, use medical care and consume nutritious foods in order to stay healthy. Grossman (1972) defined this as 'health investment', and concluded that individuals have the capability to determine their length of life (Grossman, 2000).

Grossman (1972, 2000) emphasised that people consume health for two main reasons. First, people have better well-being when they are healthier, thus better health yields greater utility. Second, health increases the amount of time that people can spend on their future market and non-market activities, such as, working, home production and leisure. The first reason is known as 'consumption benefits of health' or 'consumption commodity'. The second reason is known as 'investment benefits of health' or 'investment commodity'.

Cropper (1977) advanced an alternative health capital model, which mainly focuses on how health investments, such as, use of medical care, diet and exercise vary in a life-cycle. According to Cropper (1977), the main purpose of health investment is not to gain more healthy time in the future for money earning activities but to avoid diseases, which are able to yield disutility. The utility that individuals receive when they are sick is equal to the utility gained from consuming nothing. Therefore, illness is considered as

one of the main factors causing serious negative impacts on individuals' quality of life and well-being.

Cropper (1977) argued that the assumption of perfect certainty in health status by Grossman (1972) is unrealistic. In actual fact, individuals do not have perfect information about their own health as there appears to be external factors that can affect health, such as, changes in weather, growth of viruses and bacteria, and environmental pollution. As such, even though individuals invest in their health, individuals are unable to assure that they will not acquire diseases. In other words, the actual probability of acquiring diseases is unknown. Based on these, Cropper (1977) reached the conclusion that individuals will either be in the stage of "sick" or "not sick" throughout their lifetime.

Cawley and Ruhm (2012) applied both Grossman (1972) and Cropper (1977) health models to study individuals' unhealthy behaviour. The study classified unhealthy behaviour, such as, smoking, alcohol drinking and physical inactivity as 'negative health investment', meaning that participation in unhealthy behaviour can depreciate health capital. In addition, Cawley and Ruhm (2012) claimed that individuals' decision to participate in unhealthy behaviour is determined by the marginal costs and marginal benefits of participation. Based on cost-benefit marginal analysis, individuals, being rational, prefer to participate in unhealthy behaviour only when the marginal benefits of participation are greater than the marginal costs, and will tend to optimise the net benefits of participation by equalising the marginal costs and the marginal benefits (Cawley and Ruhm, 2012).

2.1.2 The Role of Age

The causal relationship between health behaviour and age is ambiguous. According to Grossman (1972), owing to the increasing rate of depreciation of heath, older individuals tend to invest in their health more greatly, but at the same time consume less health than younger individuals. This indicates that age is positively associated with health investment but negatively correlated with health consumption. However, Cropper (1977) and Kenkel (2000), who studied the role of age in health in a more in-depth manner, claimed that participation in preventive health behaviour, that is, one of the health investments, such as regular exercise, non-smoking and use of health screening services decreases with age. The reason is that while older individuals face a higher risk of acquiring diseases compared to younger individuals, their pay-off period of health investment is shorter because preventive health behaviour only yields benefits in the future when diseases are successfully prevented.

In addition, Grossman (1972, 2000) suggested that individuals' decision to invest in health depends on the net benefits received from the investment. The situation is that if the benefits received from health investment are higher than the costs, rational individuals will prefer to invest in their health. However, if the benefits received from the investment are lower than the costs, individuals will decide not to invest in their health. At worst, in some circumstances, individuals, especially the elderly who face a large depreciation rate of health capital may choose death if the costs of investment in health are very high and unaffordable. For example, if an elderly cancer patient finds it very expensive and at the same time faces intense suffering to undergo chemotherapy, he or she may prefer to forgo his or her health instead of using the treatment.

2.1.3 The Role of Income

The association between income and health behaviour appears to be inconclusive. On one hand, Grossman (1972) concluded that income is positively correlated with health investment as higher income individuals tend to invest in their health more greatly than lower income individuals. This is because when individuals' income increases, the value of individuals' healthy time increases as well (Grossman, 1972), which put differently means that the time that higher income earners spend on money-earning activities is more valuable compared to the time spent by lower income earners, as income differential is the difference in benefit that individuals can reap when healthy time is converted into money-earning activities. An equivalent way to express this is to say that an increase in the time for money-earning activities is the return of health investment.

However, based on a review of a previous study examining the impacts of income on health behaviour, Cawley and Ruhm (2012) suggested that income is significant and positively associated with individuals' propensity to engage in unhealthy behaviour, that is, negative health investment, if tobacco, alcohol, drugs and junk foods are normal goods, which means the income elasticity of consuming those goods is positive. Conversely, however, the study also claimed that if good health is characterised as a normal good, rational individuals will tend to engage in healthy behaviour when their income increases.

2.1.4 The Role of Education

Education plays an important role in explaining health and health behaviour since it can improve allocative efficiency (i.e. to engage in healthy behaviour) and productive efficiency (i.e. in using health inputs) in producing health (Grossman, 1972; Kenkel, 1991). More specifically, Grossman (1972) emphasised that education is positively associated with health investment as higher educated individuals tend to invest in health capital more than lower educated individuals. This is mainly because higher educated individuals tend to have a higher marginal product of direct inputs to health given that they possess better understanding skills and health knowledge, and consequently are more efficient at using medical care and other effective methods to improve their health, for example, participation in physical activity, avoiding smoking and alcohol drinking, and healthy dieting (Grossman, 1972; Kenkel, 1991; Grossman, 2000). Put simply, well-educated individuals are efficient health producers.

2.1.5 The Role of Time Preference

Time preference refers to individuals' preferences for current consumption over future consumption (Becker and Mulligan, 1997; van der Pol, 2011). It represents individuals' willingness to replace current utility-generating activities with future utility-generating activities. The higher the rate of time preference, the greater the taste for current consumption. This means that individuals with a higher rate of time preference are more present oriented and less patient than those with a lower rate of time preference. Fuchs (1982) and van der Pol (2011) researching the causal relationship between time preference and health investment suggested that individuals with a higher rate of time preference are less likely to engage in healthy behaviour, but are more likely to engage

in unhealthy behaviour. This is simply because healthy behaviour only yields utility or benefit in the future when diseases are successfully prevented, whereas unhealthy behaviour, such as, smoking and alcohol drinking can bring instantaneous pleasure, thus raising individuals' current utility. In conclusion, individuals who are more present oriented or have a higher rate of time preference may tend to face a higher depreciation rate of health.

2.1.6 The Role of Advertising

It is well-documented that advertising can significantly affect consumer preferences (Cawley and Ruhm, 2012). The main purpose of advertising is to lower individuals' search cost by providing detailed information about the use, price and quality of a particular good. In fact, the impact of advertising on consumer purchase decisions is partially determined by the characteristics of the good.

In general, there are three types of goods: one, search good – most of the consumers are certain about the quality of the good; two, experience good – consumers know the quality of the good only when they consume it, and three, credence good – consumers find it hard to determine the quality of the good even after consuming it (Cawley and Ruhm, 2012). Therefore, the different types of goods need different types of advertising to ensure effective outcomes.

The influence of advertising on health behaviour is rather ambiguous and difficult to be determined because unhealthy goods possess these three characteristics (Cawley and Ruhm, 2012). For instance, tobacco and alcohol are 'experience goods' when they have not been consumed, but once they have been consumed, they become 'search goods'.

However, the effect of these goods on health may be uncertain even after they have been consumed. Hence, to some extent, they are also characterised as ‘credence good’.

2.1.7 The Role of Information

The economics literature indicates that information is an important determinant of health behaviour (Kenkel, 1991; Cawley and Ruhm, 2012). From the economics perspective, rational individuals will weigh the costs and benefits of certain health behaviour, and decide to participate only when the benefits exceed the costs. However, individuals are unable to accurately estimate the costs and benefits of participation in health behaviour without sufficient information (Cawley and Ruhm, 2012). A lack of information tends to result in the risks of unhealthy behaviour to be underestimated, thus, leading to excessive participation. Therefore, it can be concluded that a paucity of information on the consequences of unhealthy behaviour may indirectly increase individuals’ risk of acquiring diseases.

2.1.8 The Role of Peer

The influence of the presence of others on individual’s taste and preference for a good is known as ‘peer effect’ (Manski, 2000). Even though peers play an important role in affecting health behaviour, the actual causal relationship between peers and health behaviour appears to be complicated, as it is subject to the types of effect of health affecting goods consumed, as well as the types of social interactions (Cawley and Ruhm, 2012).

According to Leibenstein (1950), an in-depth study based on consumer demand theory, there are two types of effects of goods: one, bandwagon effect; and two, snob effect. Bandwagon effect refers to an increase in individual's preference for a particular good when the consumption of that good in the market increases due to it becoming more common. In other words, the higher the market demand for the good, the more likely that the individual is to consume it. Internet, email and computer software, for instance, are goods that have bandwagon effect. Snob effect, on the other hand, refers to a decrease in individual's preference for a particular good when the consumption of that good in the market increases because it becoming less exclusive. Put simply, consumption of the good decreases with market demand. Sports car, luxury house and branded watch, for example, are the goods that have snob effect.

Drawing on this concept, Cawley and Ruhm (2012) concluded that unhealthy goods have a mix of both bandwagon and snob effects. For instance, teenagers, who are still underage, may prefer to consume tobacco and alcohol because they want to be different from their peers (snob effect). However, at the same time, they still mix with a group of teenagers who are also smokers and alcohol drinkers (bandwagon effect).

Manski (2000) explored the effects of peer on consumer behaviour and pointed out three types of social interactions: one, endogenous interaction – individual's behaviour is influenced by identical group of individuals; two, contextual interaction – individual's behaviour is influenced by different group of individuals; and three, correlated effects – individual's behaviour is influenced by the environment.

Cawley and Ruhm (2012) suggested that these three types of social interactions play an important role in affecting individuals' health behaviour. For instance, teenagers who

have classmates that adopt smoking and alcohol drinking behaviour are more likely to consume tobacco and alcohol compared to their counterparts who do not have such classmates (endogenous interaction). Teenagers who often spend time with their adult friends tend to have a higher likelihood of engaging in smoking and alcohol drinking (contextual interaction). Teenagers are likely to have a higher preference for smoking and alcohol drinking if they belong to an ethnic group where consumption of tobacco and alcohol is embedded in their culture (correlated effects).

2.2 Empirical Studies on Determinants

Findings from the past empirical studies on the determinants of health behaviour are reviewed in detail in this section. The first section reviews the studies examining alcohol consumption, followed by tobacco consumption and physical activity. The factors that determine alcohol consumption are summarised in Table 2.1, while tobacco consumption and physical activity are summarised in Table 2.2 and Table 2.3, respectively.

2.2.1 Alcohol Consumption

Agriculture's Nationwide Food Consumption Survey data comprising 6219 respondents was exploited by Nayga and Capps (1994) to analyse the consumption of alcohol products among adult consumers in United States (US). Applying the Heckman two-stage model for analysis, the study found that urban dwellers were more likely to consume alcohol and to consume more than rural dwellers. Males were found to have a higher likelihood of consuming alcohol and consume more alcohol than females. The study suggested that employed individuals were less likely to drink alcohol compared to

the unemployed. Age was found to have a mixed effect on the likelihood of consuming alcohol. More specifically, age was negatively associated with the likelihood of drinking alcohol when individuals were young, but was positively associated when individuals were old. In other words, there was a U-shaped relationship between age and the likelihood of drinking alcohol.

Yen (1994) used a Box-Cox double hurdle model and the 1987-1988 Nationwide Food Consumption Survey consisting of 4273 respondents to analyse the determinants of demand for alcoholic beverage in US. The study found rural households to be less likely to consume alcohol than urban households. Rural households were found to consume less alcoholic beverage compared to urban households. Income was found to have a positive impact on individuals' probability of consuming alcohol, as well as, the amount of alcohol consumed.

Comparing the use of alcohol and drugs among different races of US consumers (Whites, Blacks and Hispanic), Parker et al. (1995) found significant influence of socio-demographic factors on alcohol consumption. Among all the ethnic groups, individuals who had a higher level of income and education tended to consume more alcohol compared to those with a lower level of income and education. Besides, employed individuals were also found to drink more alcohol compared to unemployed individuals. In terms of gender, the study showed that men had a higher probability of drinking alcohol relative to women.

Drawing on a US household survey data, Yen and Jensen (1996) found that age, residential area and income could significantly affect individuals' propensity to consume alcohol. The study used both non-normal and heteroscedastic double-hurdle

models to analyse the likelihood and level of alcohol consumption. Household income was found to be positively associated with individuals' likelihood of consuming alcohol, as well as, the amount consumed. Older household heads were found to have a lower likelihood of consuming alcohol, and the amount consumed compared to younger household heads. Furthermore, the study found that urban households were more likely to consume alcohol, and to spend more money on alcoholic beverages than rural households.

Using the 1990 Survey of Family Expenditures of Canada containing 4377 respondents, Abdel-Ghany and Silver (1998) applied a double-hurdle model for analysis. The study found that economic and demographic factors significantly affected individuals' propensity to consume alcohol. In particular, the study showed that both income and education were positively associated with individuals' likelihood of drinking alcohol, while males had a higher likelihood of drinking alcohol than females. On top of that, the study found that age was negatively correlated with individuals' likelihood of drinking alcohol, which meant that as individuals grew older, their likelihood of drinking alcohol decreased.

Jonas (2000) used a population based survey data of Women's Health Australia study consisting of 14762 respondents to explore alcohol drinking behaviour among young adult women. A multiple logistic regression model was applied to analyse the data statistically. The results of the study showed that socio-demographic factors were significant in affecting individuals' odds of consuming alcohol. More specifically, married and less-educated individuals were less likely to consume alcohol than unmarried and well-educated individuals. Besides, the study found employed individuals to be less likely to consume alcohol relative to the unemployed.

Sharpe et al. (2001) exploited the 1996 Korean Household Panel data and a double-hurdle model to investigate individuals' decision to consume alcohol in Korea. The study observed that age was statistically significant in affecting individuals' likelihood of drinking alcohol, as older individuals were less likely to consume alcohol than younger individuals. Interestingly, the study found that the level of education was positively correlated with individuals' odds of drinking, but negatively correlated with the amount of alcohol consumed. In terms of gender, the study found that males had a higher likelihood of consuming alcohol and consumed more than females.

Manrique and Jensen (2004) explored the alcohol consumption pattern in Spain. The study showed that socioeconomic factors were significantly associated with individuals' drinking behaviour. In particular, using an endogenous switching regression model and a bivariate probit model to analyse the probability of consuming alcoholic beverages among 21155 Spanish households, the study found that both urban and higher income households had a higher probability of consuming alcohol than rural and lower income households. Furthermore, the study found that households headed by males were more likely to consume alcohol than households headed by females.

Zhao and Harris (2004) investigated the consumption pattern of marijuana, alcohol and tobacco in Australia. The study found that socio-demographic factors were the important determinants of alcohol consumption. Using the 1995, 1998 and 2001 Australian National Drug Strategy Household Surveys and a multivariate probit model, the study found that males had a 3.2% higher probability of adopting alcohol drinking habit than females. Furthermore, married individuals were found to have a 1.1% lower probability of consuming alcohol than unmarried individuals. The study also found that age was significantly and negatively correlated with individuals' likelihood of

consuming alcohol. Well-educated individuals have a 4% higher probability of indulging in alcohol drinking than less-educated individuals.

Based on the National Sample Survey (NSS) of India consisting of 471143 respondents, Neufeld et al. (2005) applied a multivariate logistic regression model for analysis. The study found that socio-demographic factors significantly influenced alcohol consumption. In particular, males were about 26 times more likely to consume alcohol than females. Moreover, lower income individuals, especially those living below the poverty line, had a higher likelihood of consuming alcohol relative to higher income individuals. Furthermore, the study found that rural dwellers tended to have higher odds of consuming alcohol compared to urban dwellers. Also, the study found less-educated individuals, especially those without any academic qualifications, to have a higher likelihood of consuming alcohol than well-educated individuals.

Marques-Vidal and Dias (2005) found that education could significantly affect the pattern of alcohol consumption among adults in Portugal. The study deployed two periods of Portuguese National Health Survey data (1995/1996, 1998/1999) to investigate the determinants of alcohol consumption. The statistical analysis was done by using the Mantel-Haenszel model. The results of the study showed that the prevalence of alcohol drinking was higher among higher educated individuals than lower educated individuals.

Le at al. (2009) examined the pattern of alcohol and tobacco consumption among adults in China and Thailand. The study found a significant relationship between socio-demographic factors and alcohol drinking. Drawing on the survey data of South-Western China and Southern Thailand and a multilevel logistic regression model, the

study concluded that age was negatively correlated with individuals' likelihood of consuming alcohol, meaning that older individuals were less likely to indulge in alcohol drinking than younger individuals. Also, gender was found to have a significant impact on alcohol consumption, as females had a lower propensity to consume alcohol compared to males.

In examining the alcohol purchase decisions of households in Malaysia, Tan et al. (2009a) concluded that socio-demographic factors could significantly affect individuals' propensity to purchase alcohol. The study used a Heckman sample selection model to analyse the likelihood and level of alcohol consumption. Income was found to have a positive impact on individuals' probability of consuming alcohol, whereas education was found to be negatively correlated with individuals' probability of consuming alcohol, as well as, the amount of money spent on alcohol products. Nevertheless, the study showed that households with male heads tended to have a higher likelihood of consuming alcohol and expenditure on alcohol products relative to households headed by females.

Using a trivariate Tobit model to investigate the association between socio-demographic factors and demand for vices among different ethnic groups of households (Chinese, Indian, others) in Malaysia, Tan et al. (2009c) found that the level of education was negatively correlated with individuals' probability of consuming alcohol and the amount of alcohol consumed. Household income was found to have a positive impact on individuals' likelihood of consuming alcohol and the amount consumed. Furthermore, the study observed that younger individuals, males and urban dwellers had a lower likelihood of consuming alcohol, and consumed less than older individuals, females and rural dwellers.

Dias et al. (2011) drew on an adult population-based survey in Portugal, which consisted of 2414 observations to examine the influence of social and behavioural factors on alcohol consumption. Using a logistic regression model, the study found that males were more likely to consume alcohol than females. The study also found that older and less-educated individuals tended to have a higher likelihood of consuming alcohol than younger and well-educated individuals.

Yuan and Yen (2012) used a Sample Selection Model (SSM) to analyse the determinants of alcohol consumption in the US. The study found that socio-demographic factors influenced consumer purchase decisions of alcohol. In particular, the study found that age was negatively associated with individuals' probability to consume alcohol, as well as, the amount of alcohol consumed. In addition, men were found to be more likely to consume alcohol and to consume more alcohol than women. Income was observed to have a positive impact on the amount of alcohol consumed. Married individuals were found to be less likely to drink alcohol and to drink less than unmarried individuals.

Redonnet et al. (2012) used the data of TEMPO and GAZEL (the follow-up population based survey data in France) to examine the associated factors of consumption of drugs and substances, such as, tobacco, alcohol and cannabis among young adults. Applying a logistic regression model, the study found that age and gender could significantly affect alcohol consumption, as younger individuals and males had a higher likelihood of consuming alcohol than older individuals and females. Surprisingly, however, the study found education and income factors to be statistically insignificant in affecting individuals' propensity to consume alcohol.

Table 2.1. Past findings on the determinants of alcohol consumption

Study	Year	Country	Variables						
			Age	Gender	Marital	Income	Education	Employment	Residing area
Nayga & Capps	1994	United States	✓	✓		✓		✓	✓
Yen	1994	United States				✓			✓
Parker et al.	1995	United States		✓		✓	✓	✓	
Yen & Jensen	1996	United States	✓			✓			✓
Abdel-Ghany & Silver	1998	Canada	✓	✓		✓	✓		
Jonas	2000	Australia			✓		✓	✓	
Sharpe et al.	2001	Korea	✓	✓			✓		
Manrique & Jensen	2004	Spain		✓		✓			✓
Zhao & Harris	2004	Australia	✓	✓	✓		✓		
Neufeld et al.	2005	India		✓		✓	✓		✓
Marques-Vidal & Dias	2005	Portugal					✓		
Le et al.	2009	Thailand & China	✓	✓					
Tan et al.	2009a	Malaysia		✓		✓	✓		
Tan et al.	2009c	Malaysia	✓	✓		✓	✓		✓
Dias et al.	2011	Portugal	✓	✓			✓		
Yuan & Yen	2012	United States	✓	✓	✓	✓	✓		
Redonnet et al.	2012	France	✓	✓					

Note: ✓ refers to variables that are significantly associated with alcohol consumption.
Source: Compiled by author.

2.2.2 Tobacco Consumption

Hersch (2000) drew on the Current Population Survey (CPS) data consisting of 54425 respondents to explore the socio-demographic determinants of the use of cigarettes among adults in US. Both Probit and Ordinary Least Square (OLS) models were applied to estimate the likelihood, as well as, the amount of cigarette consumed. The study found that higher income individuals were less likely to smoke and to smoke less than lower income individuals. Levels of education were found to have a negative impact on cigarette consumption as higher educated individuals were less likely to smoke and to smoke less than lower educated individuals. Also, the study found that married individuals had a lower likelihood of smoking than unmarried individuals.

Manrique and Jensen (2004) examined the factors associated with tobacco consumption among Spanish adults. The study found that economic and demographic factors played an important role in explaining individuals' probability of smoking. A Spanish household survey consisting of 21155 respondents was used in the study. Specifically, applying a bivariate probit model, the study found that households headed by males were more likely to smoke compared to households headed by females. Also, the study found that higher income households had a higher likelihood of smoking relative to lower income households. Furthermore, households headed by employed individuals had a lower probability of smoking compared to households headed by unemployed individuals.

Based on a primary survey data of Thessaloniki (Greece) comprising 680 respondents, Raptou et al. (2005) found a significant relationship between socio-demographic factors and cigarette consumption. Applying a two-stage model to examine the probability of

consuming tobacco and the amount of tobacco consumed among adults, the study found that women were more likely to consume tobacco, but to consume less compared to men. Income was found to have a significant impact on individuals' likelihood of smoking as higher income individuals were more likely to smoke compared to lower income individuals. Surprisingly, however, income was found to have no impact on the amount of tobacco consumed.

Yen (2005b) applied a Gaussian single-hurdle model to investigate the impact of gender on smoking among adults in US. Using the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) data, the study found that age was negatively associated with smoking, as older individuals were less likely to smoke than younger individuals. The study also found that the level of education had a positive impact on smoking, as higher educated individuals were less likely to smoke compared to lower educated individuals.

Bauer et al. (2007) examined gender differences in the use of tobacco in Germany. The study found that socio-demographic factors played an important role in affecting individuals' decision to smoke. Data used in the study was the German Socio-Economic Panel (SOEP), which was a panel data that contained individuals smoking related information from 1998 to 2004. Applying a Blinder-Oaxaca decomposition model, the study found that unemployed individuals had a lower likelihood of smoking compared to employed individuals. Besides, urban dwellers were found to be more likely to smoke compared to rural dwellers. Also, the study found that higher income individuals were less likely to smoke than lower income individuals.

Alam et al. (2008) explored the socio-demographic determinants of cigarette smoking among adults in Rawalpindi (Pakistan). The study identified that gender, education and residential area significantly affected individuals' decision to smoke. A cross-sectional survey data comprising 2018 respondents was used for analysis. Applying a multivariate logistic regression model to analyse individuals' likelihood of smoking, the study found that males were more likely to smoke compared to females. Lower educated adults were more likely to smoke than higher educated adults. Also, the study found that rural dwellers had a higher likelihood of smoking than urban dwellers.

Aristei and Pieroni (2008) used a double-hurdle model to examine tobacco consumption among adults in Italy. The study found that demographic factors significantly explained individuals' likelihood of consuming tobacco, as well as, the amount of tobacco consumed. The study used the 2002 Italian Household Budget Survey (IHBS) dataset, which was from a cross-sectional survey conducted by the Italian Central Statistics Office (ISTAT). The sample size of the dataset was 27499 observations. The findings of the study illustrated that households with higher educated heads were less likely to smoke and to smoke less than households with lower educated heads. It was surprising to find that households headed by females had a higher likelihood of smoking and smoked more relative to households headed by males. In addition, households with older heads were less likely to smoke and to smoke less compared to households with younger heads.

Using the Social Statistic Survey (SSS) data collected by the Korean National Statistical Office, Cho et al. (2008) found that marital status and education were significantly associated with individuals' decision to smoke. More specifically, deploying a logistic regression model to examine the odds of smoking, the study found that education was

negatively associated with individuals' odds of smoking, meaning that higher educated individuals were less likely to smoke compared to lower educated individuals. Also, the study found that married individuals were less likely to smoke relative to unmarried individuals.

Tan et al. (2009b) claimed that education was an important determinant of tobacco consumption in Malaysia. The study used the Malaysian Household Expenditure Survey 2004/2005 dataset containing 14082 respondents for analysis. Applying the Heckman's sample selection model, the study found households with higher educated heads to be less likely to smoke and to spend less money on tobacco than households with lower educated heads. In addition, the study found that urban households were less likely to purchase tobacco and to spend less than rural households. Furthermore, age significantly affected tobacco consumption, as households with older heads had a lower likelihood of smoking and smoked less than households with younger heads. The study also pointed out that households headed by males were more likely to smoke and to spend more on tobacco than households headed by females.

Bilgic et al. (2010) used the 2003 Turkish Household Expenditure Survey comprising 22208 respondents and a zero-inflated negative binomial model to investigate the determinants of tobacco consumption in Turkey. The study found that married household heads had a lower likelihood of smoking and smoked less compared to unmarried household heads. Besides, the study found that households headed by males were more likely to smoke and to smoke more than households headed by females. Employed household heads had lower odds of smoking than unemployed household heads. Residential area had an ambiguous effect on smoking as urban households with teenagers were less likely to smoke than rural households with teenagers, whereas urban

households without teenagers were more likely to smoke than rural households without teenagers. Furthermore, the study found that age and education were negatively associated with individuals' likelihood of smoking, meaning that older and higher educated household heads were less likely to smoke than younger and lower educated household heads.

Lin (2010) used a probit model and the 2004 Taiwan Panel Study of Family Dynamics comprising 3015 respondents to examine the factors affecting smoking among adults in Taiwan. The results of the study showed that gender was statistically significant in affecting individuals' odds of smoking as males were more likely to smoke than females. Besides, age was found to have a significant impact on individuals' smoking behaviour in Taiwan as older individuals were less likely to smoke than younger individuals. In addition, individuals' likelihood of smoking was found to be negatively correlated with the level of education, which meant higher educated individuals were less likely to smoke compared to lower educated individuals. In terms of marital status, the study found married individuals to have a lower propensity to smoke compared to unmarried individuals.

Based on the Third National Health and Morbidity Survey of Malaysia, Cheah and Naidu (2012) applied a logistic regression model to examine the factors affecting individuals' decision to smoke. The study found that socio-demographic factors were significantly associated with smoking. In particular, the study found that age and income were negatively correlated with individuals' likelihood of smoking, meaning that the higher the individuals' age and income, the less likely that individuals were to smoke. Males were more likely to smoke compared to females, while married individuals were less likely to smoke compared to singles, widows and divorced.

Furthermore, the study found that Chinese, Indians and others had a lower propensity to smoke than Malays. Also, urban dwellers were found to have a lower probability of smoking than rural dwellers. Employed individuals were more likely to smoke than unemployed individuals, while higher educated individuals were less likely to smoke than lower educated individuals.

Tan (2012) used the Malaysian Non-Communicable Disease Surveillance-1 (MyNCDS-1) data to investigate the factors affecting individuals' smoking behaviour in Malaysia. Applying an ordered probit model, the study found that age, income, education, gender, residing area and ethnicity were significantly associated with individuals' likelihood of smoking. In particular, the study found older and higher educated individuals to be less likely to smoke compared to younger and lower educated individuals. The study also found ethnic differences in smoking. Furthermore, low income individuals were more likely to smoke than high income individuals. Rural dwellers and males had a higher likelihood of smoking than urban dwellers and females.

Table 2.2. Past findings on the determinants of tobacco consumption

Study	Year	Country	Variables							
			Age	Gender	Marital	Income	Education	Employment	Residing area	Ethnic
Hersch	2000	United States			✓	✓	✓			
Manrique & Jensen	2004	Spain		✓		✓		✓		
Raptou et al.	2005	Greece		✓		✓				
Yen	2005b	United States	✓				✓			✓
Bauer et al.	2007	Germany				✓		✓	✓	
Alam et al.	2008	Pakistan		✓			✓		✓	
Aristei & Pieroni	2008	Italy	✓	✓			✓			
Cho et al.	2008	Korea			✓		✓			
Tan et al.	2009b	Malaysia	✓	✓			✓		✓	✓
Bilgic et al.	2010	Turkey	✓	✓	✓		✓	✓	✓	
Lin	2010	Taiwan	✓	✓			✓			
Cheah & Naidu	2012	Malaysia	✓	✓	✓	✓	✓	✓	✓	✓
Tan	2012	Malaysia	✓	✓		✓	✓		✓	✓

Note: ✓ refers to variables that are significantly associated with tobacco consumption.
Source: Compiled by author.

2.2.3 Physical Activity

Wu and Porell (2000) utilised the 1992 Health and Retirement Study (HRS) data containing 6433 respondents to investigate the impact of demographic factors on participation in leisure-time physical activity among US adults. The study found that education was statistically significant in affecting individuals' likelihood of participating in physical activity as higher educated individuals were more likely to participate in both light and vigorous physical activity than lower educated individuals. Additionally, the study revealed that males had a higher likelihood of engaging in physical activity relative to females. Moreover, age was found to have a significant impact on participation in physical activities, as younger individuals had a higher propensity to participate in physical activities than older individuals. Furthermore, the study found that there were ethnic differences in participation in physical activities as ethnic Whites and Blacks had higher odds of engaging in physical activities than other ethnic groups. In terms of employment status, the study found that different job characteristics of individuals may be reflected in different preferences for physical activity participation.

Kaplan et al. (2001) used the 1996-1997 Canadian National Population Health Survey consisting of 12611 respondents to examine the demographic and psychosocial factors associated with physical activity participation among the elderly in Canada. Applying a logistic regression model, the study found that older individuals were less likely to participate in physical activity than younger individuals. Also, the study showed that higher educated individuals had a higher likelihood of participating in physical activity than lower educated individuals. Furthermore, the results of the study suggested that

married individuals were less likely to adopt a physically active lifestyle compared to single, widowed and divorced individuals.

Using data from the 1997 health survey of England consisting of 6467 respondents, Farrell and Shields (2002) examined the determinants of physical activity participation in England. The study found that socio-demographic factors could significantly affect individuals' decision to participate in physical activity. In particular, the study applied a random-effects probit model and found that males were more likely to participate in physical activity than females. Older individuals had a lower likelihood of participating in physical activity than younger individuals. Married individuals were less likely to participate in physical activity than unmarried individuals. Besides, the study revealed that ethnic minorities were less likely to participate in physical activity compared to ethnic majorities. Education was found to be statistically significant in affecting individuals' odds of participating in physical activity, as higher educated individuals were more likely to participate in physical activity than lower educated individuals. The study also identified that household income was positively associated with individuals' propensity to engage in physical activity, meaning that higher income earners were more likely to be physically active compared to lower income earners.

Scheerder et al. (2005) explored the social and cultural determinants of participation in leisure-time physical activity among adults in Flanders (Belgium). The study found significant causal relationships between demographic factors and physical activity participation. In particular, using data from the Leuven Growth Study of Flemish Girls and Study on Movement Activities in Flanders (Belgium) and a binary logistic regression model, the study found that age was significantly associated with individuals' propensity to participate in physical activity as older individuals were less likely to

participate in physical activity compared to younger individuals. Also, the study found that females were about 40% less likely to be physically active compared to males. Finally, the study showed that urbanites were more likely to participate in physical activities than rural dwellers.

Downward and Riordan (2007) used the 2002 General Household Survey to investigate the factors affecting participation in physical activity among adults in UK. Applying a Heckman selection model to analyse the likelihood of participating in physical activity and the time spent on it, the study found that age was negatively correlated with individuals' probability of participating in physical activity as older individuals were less likely to engage in physical activity than younger individuals. Besides, the study found that income was negatively associated with the time spent on physical activity, which meant that higher income individuals tended to spend less time on physical activity than lower income individuals.

Downward (2007) investigated the determinants of participation in physical activity among adults in UK. The study found that both demographic and economic factors played an important role in affecting individuals' decision to participate in physical activity. Using data from the 2002 General Household Survey and a logistic regression model, the study found that higher income individuals had a higher likelihood of participating in physical activity than lower income individuals. Gender was statistically significant in affecting participation in physical activity as males were more likely to participate in physical activity than females. In addition, married individuals had a higher likelihood of participating in physical activity than unmarried individuals. Also, the study found that ethnic Whites possessed a higher likelihood of participating in physical activity than other ethnic groups.

Using the German Socio-Economic Panel study (GSOEP) 1984-2006, Lechner (2009) found demographic and lifestyle differences in physical activity participation in Germany. Applying a probit model to examine the factors affecting individuals' likelihood of participating in physical activities, the study found that higher educated individuals were more likely to participate in physical activities compared to lower educated individuals. Besides, the study found that both household income and individual income were positively associated with individuals' likelihood of participating in physical activity.

Using both micro- and macro-level data comprising a total of 3725 respondents, Wicker et al. (2009) found that there were significant relationships between demographic factors and physical activity participation among adults in the city of Stuttgart (Germany). Applying a logistic regression model, the study found that younger individuals had a higher likelihood of participating in physical activity than older individuals. Also, the study showed that higher educated individuals were more likely to participate in physical activity than lower educated individuals. Furthermore, income had a significant positive impact on the likelihood of participating in physical activity as higher income individuals were more likely to engage in physical activity than lower income individuals. Interestingly, the study also found that rural areas equipped with limited amount of sport facilities and fitness centres could reduce individuals' propensity to participate in physical activity.

Downward and Rasciute (2010) used the DCMS Taking Part Survey (TPS) of England comprising 28117 respondents and a tobit model to examine the determinants of demand for physical activity in England. The study found that younger individuals had a higher likelihood of participating in physical activities compared to older individuals.

Also, the study observed that males tended to spend more time on physical activity compared to females. Both education and income factors had positive impacts on individuals' preferences for physical activity. Furthermore, the study concluded that ethnic Whites tended to spend more time on physical activity compared to other ethnicities.

Eberth and Smith (2010) used the 2003 Scottish Health Survey (SHeS) consisting of 4380 respondents to examine individuals' participation decision of physical activity in Scotland. Applying a copula model to analyse individuals' likelihood of participating in physical activity, as well as, the time spent on it, the study found that older individuals were less likely to participate in physical activity and to spend less time on it than younger individuals. The study also showed that gender had a significant impact on participation in physical activity as males had higher odds of participating in physical activity and spend more time on it compared to females. Furthermore, higher income earners had a higher likelihood of engaging in physical activity than lower income earners. Lower educated individuals were less likely to participate in physical activity than higher educated individuals. Also, the study reported that employed individuals had a lower likelihood of engaging in physical activity than unemployed individuals. Married individuals had a lower likelihood of engaging in physical activity and spent less time on it than unmarried individuals.

Cheah (2011) conducted a primary survey in Penang (Malaysia) to investigate individuals' likelihood of participating in physical activity. The study found a significant causal relationship between socio-demographic factors and participation in physical activity. In particular, the study found that age was positively correlated with individuals' propensity to participate in physical activity. Males had a higher likelihood

of engaging in physical activity than females. Compared to ethnic Malays, ethnic Chinese had a higher propensity to participate in physical activity. Furthermore, the study found that married individuals were less likely to participate in physical activity than single individuals. Higher income earners were more likely to participate in physical activity than lower income earners. Also, higher educated individuals had a higher likelihood of participating in physical activity than lower educated individuals. The results of the study also showed that rural dwellers were less likely to participate in physical activity than urbanites.

Using a Cragg model to investigate the economic and demographic determinants of physical activity participation among US adults, Humphreys and Ruseski (2011) found that income, age, marital status, gender and ethnicity significantly affected individuals' likelihood of participating in physical activity. Deploying the 1998-2000 Behavioral Risk Factor Surveillance System (BRFSS) dataset comprising 158964 respondents, the study found that income was positively correlated with individuals' propensity to participate in physical activity, meaning that higher income earners were more likely to participate in physical activity than lower income earners. Besides, the study observed that older individuals were less likely to participate in physical activity than younger individuals. In addition, the study found that married individuals had lower odds of participating in physical activity compared to single individuals. Interestingly, the study found that males were less likely to participate in physical activity but to spend more time on it compared to females. Also, the study found that ethnicity significantly impacted individuals' decision to participate in physical activity, as ethnic Blacks and Hispanics had a higher propensity to participate in physical activities relative to ethnic Whites.

Table 2.3. Past findings on the determinants of physical activity

Study	Year	Country	Variables							
			Age	Gender	Marital	Income	Education	Employment	Residing area	Ethnic
Wu & Porell	2000	United States	✓	✓			✓	✓		✓
Kaplan et al.	2001	Canada	✓		✓		✓			
Farrell & Shields	2002	England	✓	✓	✓	✓	✓			✓
Scheerder et al.	2005	Belgium	✓	✓					✓	
Downward & Riordan	2007	United Kingdom	✓							
Downward	2007	United Kingdom		✓	✓	✓				✓
Lechner	2009	Germany				✓	✓			
Wicker et al.	2009	Germany	✓	✓		✓	✓		✓	
Downward & Rasciute	2010	England	✓	✓	✓	✓	✓			✓
Eberth & Smith	2010	Scotland	✓	✓	✓	✓	✓	✓		
Cheah	2011	Malaysia	✓	✓	✓	✓	✓		✓	✓
Humphreys & Ruseski	2011	United States	✓	✓	✓	✓				✓

Note: ✓ refers to variables that are significantly associated with physical activity participation.
Source: Compiled by author.

CHAPTER 3

ALCOHOL CONSUMPTION

3.1 Introduction

In today's rapidly urbanising society, alcohol consumption has become an overwhelmingly public health issue worldwide (Mohapatra et al., 2010). In 2004, about 2 billion people consumed alcohol, while 76.3 million people were diagnosed with alcohol use disorder (Institute for Public Health, 2008). Each year, approximately 2.5 million mortalities are associated with harmful use of alcohol, and at least 0.3 million people aged between 15 and 29 die from consuming alcohol, which accounts for around 10% of all types of death in that age groups (WHO, 2011b). Globally, the harmful use of alcohol is one of the leading causes of health and social problems. Institute for Public Health (2008) reported that at least 20% of CVD and cancer related deaths are caused by harmful use of alcohol every year. Among the other common consequences of excessive use of alcohol include neuropsychiatric disorder, stroke, hepatitis, cirrhosis of the liver, road traffic accidents, violence, child abuse, suicides, poor work performance and high-risk sexual behaviour (Institute for Public Health, 2008; Baliunas et al., 2010; Parry et al., 2011; WHO, 2011b).

Using the Multi-criteria Decision Analysis (MCDA) framework to analyse the negative effects of 20 types of drugs on people and society, Nutt et al. (2010) found that alcohol (72 points) is far more dangerous than illegal drugs, such as, heroin (55 points), crack cocaine (54 points) and metamphetamine (33 points).[1] In exploring the impact of

[1] 100 refers to the most harmful drug, whereas 0 refers to the least harmful drug.

alcohol drinking on NCDs, Parry et al. (2011) found that an intake of 10-50 grams of alcohol per day can increase the risk of breast cancer, colorectal cancer and oesophagus cancer by about 7%, 20% and 100%, respectively. Additionally, Parry et al. (2011) found that an additional 30-60 grams of alcohol intake per day can increase the risk of dying from liver cirrhosis by almost 3%.

In Malaysia, alcohol abuse has become a serious health concern (Institute for Public Health, 2008). WHO (2004) reported that almost half of the alcohol drinkers in Malaysia are young adults. Sales of alcohol in Malaysia increased from USD 176 million in 2000 to USD 500 million in 2011, placing it the 10th largest alcohol consuming country in the world with estimated 11 litres per capita alcohol consumption (Tan et al., 2009a; Tan, 2011). In addition, alcohol is regarded as one of the leading causes of poverty in Malaysia. There was evidence that a rural worker may spend as much as all of his or her monthly income (approximately USD 80) just on alcohol products, which amounted to about USD 960 in a year (WHO, 2004). Worse still, the Road Safety Council of Malaysia reported that at least three out of every ten road accidents throughout the nation are attributable to alcohol drinking (WHO, 2004; Tan et al., 2009a).

Given the profound impact of alcohol consumption on morbidity and mortality worldwide, there is a growing number of studies examining the factors affecting alcohol consumption in the developed countries (Yen, 1994; Abdel-Ghany and Silver, 1998; Manrique and Jensen, 2004; Yen, 2005a; Saffer and Dave, 2006; Gallet, 2007; Yuan and Yen, 2012). Astonishingly, however, the attention devoted to examining this topic in Malaysia is still lacking, where alcohol consumption is very prevalent. Hence, this

study attempts to narrow this research gap by answering a research question, i.e. what are the factors that affect alcohol consumption among Malaysian adults?

Overall, this study provides three contributions to the literature and society. Firstly, the focus of this study is on Malaysia, where alcohol drinking and NCDs are widespread. Secondly, this study exploits the latest nationally representative health survey data consisting of a large sample size and detailed information on individual's socio-demographic, lifestyle and health profiles for a robust analysis, and thus, seeks to generate important findings. Thirdly, the findings of this study can provide public health administrators with the baseline information on formulating a better nationwide health policy.

3.2 An Economic Analysis of Demand for Alcohol

Individuals tend to behave rationally in order to generate optimal outcomes by maximising the benefits received from consuming market goods and services, while minimising the incurred costs. It is claimed that rational individuals will take account of the costs and benefits of alcohol drinking, and will consume alcohol only when the net benefits received are positive.

The costs and benefits of alcohol drinking comprise both monetary and non-monetary value. Generally, the costs of alcohol drinking are the price of alcohol and its harmful effect on health, whereas the benefits are the pleasure it produces. These costs and benefits are known as personal costs (PC) and personal benefits (PB). It is argued that rational individuals will tend to maximise the total net benefits received from consuming alcohol by equalising their personal marginal costs (PMC) and personal

marginal benefits (PMB) (i.e. PMC = PMB). PMC refers to the additional costs borne by individuals when consuming an additional unit of alcohol, whereas PMB refers to the additional benefits received by individuals when consuming an additional unit of alcohol.

On one hand, since alcohol drinking involves costs of participation, PMC increases with every additional unit of alcohol consumed, i.e. positively associated with alcohol consumption. On the other hand, PMB decreases with every additional unit of alcohol consumed, i.e. negatively correlated with alcohol consumption, because of the law of diminishing returns. Based on cost-benefit marginal analysis, it can be concluded that rational individuals will consume alcohol at the point when PMB is greater than PMC.

There are several reasons to explain the high prevalence of alcohol consumption in today's society. Firstly, the negative effect of alcohol drinking on individuals' health, i.e. the cost of alcohol drinking, only becomes apparent when individuals age, which means that individuals will only realise the costs of alcohol drinking in the future when they face a profound deterioration in their health. This indicates a lag between realisation of the costs of alcohol drinking and participation in alcohol drinking. Therefore, individuals, especially those who are more present oriented are more likely to drink alcohol, and only avoid alcohol drinking when their health is seriously affected.

Secondly, alcohol drinkers often do not realise that alcohol drinking possesses serious negative externalities to the society, such as, car accidents, poor work performance and domestic violence. This shows that alcohol drinking also involves social costs (SC), which are the costs borne by the society as a whole. Since SC is difficult to observe and measure, individuals tend to underestimate the actual costs of alcohol drinking. In other

words, the PMC is lower than the social marginal costs (SMC), thus, leading to overconsumption of alcohol.

3.3 Methodology

The methodology section presents the data used in this study, the selection of variables, and the econometric model, which is applied to examine the factors affecting the likelihood of drinking alcohol.

3.3.1 Data

This study used data from the Third National Health and Morbidity Survey (NHMS III), which was the latest nationally representative cross-sectional population-based survey conducted by the Ministry of Health Malaysia over the period April 2006 to January 2007. The survey covered all the urban and rural areas in the 13 states of Malaysia, as well as, the federal territory of Kuala Lumpur. Following the sampling frame designed by the Department of Statistics Malaysia, a two stage stratified sampling approach proportionate to the size of population in Malaysia was used to collect the data. The first stage sampling unit was based on geographically contiguous areas of the country [Enumeration Blocks (EB)]. The second stage sampling unit was based on the Living Quarters (LQ) in each EB, and all the households and individuals that resided in the selected LQ participated. In particular, each EB consisted of 80-120 LQ with a population of about 600. The EB were based on the population of gazetted and built-up areas [i.e. urban (≥10000 populations) and rural (<10000 populations)].

The inclusion criteria of the survey were: one, all adults aged 18 years old and above; two, all gender; three, all ethnic groups; and four, Malaysian citizens. The target sample size was calculated based on three criteria: one, 95% confidence interval; two, the prevalence and response rate of the Second National Health and Morbidity Survey (NHMS II); and three, the calculated margin of error and design effect. More detailed information about the calculation was described in Institute for Public Health (2008). The calculated target sample size was 34539 respondents, which represented 12923504 Malaysian adults. The targeted household member was classified as 'no response' after three consecutive unsuccessful visits. The overall response rate was about 99.30% (34305 respondents).

The piloted bi-lingual (*Bahasa Malaysia* and English) questionnaires were used by the trained health professionals to interview face-to-face the respondents. During the interview, the respondents were asked to answer several questions about their alcohol drinking behaviour. Besides, the respondents were also asked to self-report their socio-demographic, lifestyle and health profiles. Meanwhile, if the respondents reported that they did not have hypertension or hypercholesterolemia, their blood pressure and blood cholesterol were examined by the health professionals using Omron Digital Automatic Blood Pressure Monitor Model HEM-907 and Accutrend GC – Roche Diagnostic's battery-operated gluco-photometer. The respondents were classified as having hypertension if their systolic blood pressure was ≥140 and diastolic blood pressure was ≥90mmHg, and were classified as having hypercholesterolemia if their blood cholesterol was ≥5.2mmol/L. Besides, if the respondents reported that they were not diabetics, their blood glucose was tested using Accutrend GC – Roche Diagnostic's battery-operated gluco-photometer. If the respondents' blood glucose was ≥6.1mmol/L

(after eight hours of fasting), they were referred to the nearest clinics or hospitals for further examination.

3.3.2 Model Development

Based on the previous empirical studies examining the determinants of alcohol consumption (Yen, 1994; Abdel-Ghany and Silver, 1998; Manrique and Jensen, 2004; Yen, 2005a; Saffer and Dave, 2006; Dias et al., 2011; Redonnet et al., 2012), the following variables were selected, and were hypothesised to have significant impact on individuals' decision to consume alcohol: one, age; two, income; three, gender; four, ethnicity; five, education; six, marital status; seven, residing area; and eight, employment status.

3.3.2.1 Age

The past studies showed an unclear relationship between age and the likelihood of drinking alcohol. Dias et al. (2011) used a Portugal data consisting of 2414 observations to investigate the social and behavioural determinants of alcohol consumption. The study concluded that older individuals were more likely to consume alcohol than younger individuals. More specifically, it found that middle-age males and females had 1.33 times the odds as young-age males and females of consuming alcohol. In contrast, Yen and Jensen (1996) applied a double-hurdle model to examine the factors affecting the probability of consuming alcohol and the amount of alcohol consumed among adults in US. The study found that older household heads were less likely to consume alcohol and to consume less compared to younger household heads. As pointed out by Grossman (1972), Cropper (1977) and Kenkel (2000), individuals' preferences for

negative and positive health investments could be the main contributing factor for this outcome, as individuals of different age may face different rate of depreciation of health capital.[2] Based on the PMB/PMC framework, the PMB is often higher for older individuals than younger individuals. This is because of the 'tolerance effect'. As alcohol drinkers develop tolerance, each additional drink will yield less utility, i.e. PMB falls more rapidly, and thus produces a craving for more alcohol by shifting the PMB curve rightwards. Also, the PMC tends to be lower for older individuals than younger individuals. Two reasons may explain this argument. Firstly, there are costs of withdrawal after establishing the alcohol drinking habit, such as, loss of concentration and irritability. In contrast to other costs, these costs increase with greater reductions in alcohol drinking from the habitual alcohol drinkers. Secondly, older individuals are usually more financially independent and face lower punishment costs from adult supervisors than younger individuals. To capture the causal relationship between age and alcohol drinking, the respondents' age (in years) was included in this study.

3.3.2.2 Income

The past studies showed strong positive correlation between income and alcohol consumption. Exploiting the Nationwide Food Consumption Survey sample of US, Yen (1994) applied a Box-Cox Double Hurdle model and found that males and females with higher income were more likely to consume alcohol than lower income males and females. Based on the National Household Survey on Drug Abuse data comprising 8814 respondents, Parker et al. (1995) found that higher income earners were more likely to consume alcohol compared to lower income earners. In a similar vein, Yen and Jensen

[2] Negative health investment refers to the health behaviour that has adverse impact on health, such as, smoking and drinking, whereas positive health investment refers to the health behaviour that has positive impact on health, such as, physical activity and healthy diet.

(1996) showed that higher income individuals were more likely to consume alcohol and to consume more than lower income individuals. Drawing from the National Health Interview Survey data, Cawley and Ruhm (2012) found that the higher the level of individuals' household income, the more likely that individuals were to indulge in alcohol drinking. However, based on the economic theory, income can raise the incentive for health investment, as wage is the benefit that individuals reap when individuals convert their time into money-earning activities (Grossman, 1972). Since alcohol consumption is considered as a health disinvestment, high income individuals tend to avoid it. This implies that the PMC for alcohol drinking is higher among high income individuals than low income individuals. In an attempt to examine the role of income in alcohol drinking, this study included the respondents' monthly individual income (in RM).

3.3.2.3 Gender

Gender appeared to have a significant influence on individuals' decision to consume alcohol. Using a bivariate probit and an endogenous switching regression model to investigate the use of alcohol and tobacco in Spain, Manrique and Jensen (2004) found that households with male heads were more inclined to consume alcohol than households with female heads. Yuan and Yen (2012) used a sample selection approach to examine the influence of socio-economic factors on alcohol consumption in US. The study found that men were 12.9% more likely to consume alcohol and to consume 13 grams more than women. The findings of Yuan and Yen (2012) were also shared by Redonnet et al. (2012) based on a nationwide sample of France, which showed that males had 2.4 times odds as females of consuming alcohol. Similarly, Cawley and Ruhm (2012) found males to be more likely to adopt alcohol drinking habit than

females. The explanation is that women are more risk averse than men (Croson and Gneezy, 2009). Since alcohol drinking is a risky behaviour, individuals who are more risk-aversion oriented tend to avoid alcohol drinking. Besides, women, especially those in child bearing ages are also more health conscious relative to men. Taken together, these imply that women have a higher PMC for alcohol drinking than men. Since gender could affect individuals' preferences for alcohol consumption, the respondents' gender was included in this study.

3.3.2.4 Ethnicity

In examining the role of ethnicity in alcohol consumption, the previous studies provided evidence of ethnic differences in alcohol consumption in Malaysia. Using a Heckman's sample selection model to examine the determinants of use of alcoholic beverages, such as, whisky, wine and beer among Malaysian households, Tan et al. (2009a) found Indians and other races to be 5-10% less likely to purchase alcohol and to spend RM 4-6 less on alcohol products compared to Chinese. A study investigating the demand for vices (e.g. tobacco, alcohol and gambling), i.e. Tan et al. (2009c), corroborated the findings of Tan et al. (2009a) using the same dataset. Given the wide set of data available to use, the respondents' ethnic backgrounds were included, and were categorised into three groups, i.e. Malay, Chinese and Indian or others.

3.3.2.5 Education

The past empirical studies showed mixed results on the effect of education on alcohol consumption. Using a national health survey data of Portugal consisting of more than 45000 observations, Marques-Vidal and Dias (2005) found that consumption of wine,

beer and whiskey was more prevalent among higher educated individuals than lower educated individuals. The study related this outcome to the fact that alcoholic beverages were more affordable to higher educated individuals, who usually had higher income. Jonas (2000) investigated the association between socio-demographic factors and alcohol consumption in Australia. The study found a similar result that higher educated females were more likely to consume alcohol compared to lower educated females. However, there were also studies found opposite results. For example, Tan et al. (2009a) found households with higher educated heads to be less likely to purchase alcohol products compared to households with lower educated heads. Drawing on several different datasets, Cutler and Lleras-Muney (2010) found that higher educated individuals were more likely to indulge in light alcohol drinking, but were less likely to engage in heavy alcohol drinking compared to lower educated individuals. Cawley and Ruhm (2012) found that higher educated individuals were about 1% less likely to adopt alcohol drinking habit than lower educated individuals. According to the economic theory, education could improve health by improving allocative and productive efficiency of producing health (Grossman, 1972; Kenkel, 1991; Grossman, 2000) and lowering the rate of time preference (Fuchs, 1982; van der Pol, 2011). Owing to alcohol is harmful to health, well-educated individuals have a higher PMC for alcohol drinking than less-educated individuals. Therefore, well-educated individuals are less likely to consume alcohol than less-educated individuals. The respondents' education levels were used in this study, and were divided into three categories, i.e. primary, secondary and tertiary.

3.3.2.6 Marital Status

There was no consensus over the influence of marriage on alcohol consumption. Drawing on the Australian National Drug Strategy Household Surveys, Zhao and Harris (2004) applied a multivariate probit model to explore the factors associated with household purchase decisions of several types of drugs, such as, marijuana, alcohol and tobacco, and found married individuals to be 1.1% less likely to consume alcohol than single individuals. Surprisingly, however, using the 1996 Korean Household Panel data, Sharpe et al. (2001) found that marital status did not possess significant impact on alcohol consumption. The study claimed that alcohol was a highly addictive substance, thus, its consumption was unlikely to be affected by social factors. Since the presence of spouses or extended family commitments may affect individuals' preferences for alcohol consumption, marital status of the respondents was incorporated into this study by three categories, i.e., single, married and widowed or divorced.

3.3.2.7 Residing Area

Several studies found significant rural-urban differences in alcohol consumption. For example, Yen (1994) exploited the Nationwide Food Consumption Survey data of US. The study found that rural households were less likely to consume alcohol and to consume less compared to urban households. Using the Heckman analysis, Nayga and Capps (1994) found a similar relationship that individuals who resided in non-metro areas in US had a lower likelihood of consuming alcohol than those resided in urban and suburban areas. Neufeld et al. (2005) deployed a nationally representative sample of India to examine the relationship between demographic factor and alcohol consumption. The study found an opposite result that rural dwellers were 1.3 times the odds as urban

dwellers of consuming alcohol because of a lack of culture related alcohol prohibitions in the rural community. The rural-urban differences in alcohol consumption could be explained by the advertising and information factors (Kenkel, 1991; Cawley and Ruhm, 2012). Since the availability of advertising and information on alcohol was different in urban and rural areas, the dwellers may have different preferences for and perspectives on alcohol consumption. The respondents' residing area was included in this study. Following the guideline of Department of Statistics Malaysia, the respondents' residing area was divided into two categories, i.e. urban (metropolitan and urban large, or gazetted areas ≥ 10000 populations) and rural (urban small and rural, or gazetted areas < 10000 populations).

3.3.2.8 Employment Status

There was evidence suggesting that employment status was significantly associated with alcohol consumption. On one hand, Parker et al. (1995) explored the factors affecting alcohol and drug consumption in US, and found that employed individuals tended to consume more alcohol than unemployed individuals. As explained by the study, it was due to the influence of social culture on drug use, as alcohol drinking was more acceptable to higher socioeconomic class of individuals than lower socioeconomic class of individuals. On the other hand, Nayga and Capps (1994) made use of the Nationwide Food Consumption Survey (NFCS) of US, and found that employed individuals had a lower likelihood of consuming alcohol than unemployed individuals. This was simply because unemployed individuals tended to have more free time on hand for alcohol consumption. Based on data availability in this study, the respondents' employment status was used, and was grouped into five categories, i.e. civil servant, private sector employee, self-employed, student and unemployed (including housewife and retiree).

3.3.3 Econometric Specification

This study uses 'alcohol drinking status' as the dependent variable with 1 representing 'current alcohol drinker' and 0 otherwise. Current alcohol drinker refers to the respondent who consumed alcohol in the past 30 days prior to the survey or reported to be drinking alcohol at the time of the survey, otherwise the respondent is categorised as a non-alcohol drinker. More detailed information about the classification has been described elsewhere (Institute for Public Health, 2008).

Since the dependent variable is a binary variable, the logit model is used for the statistical analysis, given that it can predict the probability that lies between the unit intervals (Greene, 2007). In exploring the residuals, it is found that the value of Jarque-Bera statistic is 410000, which has a p-value of less than 0.05. Hence, the null hypothesis can be rejected, and this concludes that the residuals are not normally distributed, indicating that the logit model is the appropriate one. In general, the logit model can be written as follows:

$$\log \frac{P}{1-P} = \alpha + \beta_i X_i + \varepsilon \qquad (3.1)$$

where, P is the probability that a respondent is a current alcohol drinker; 1 – P is the probability that a respondent is a non-alcohol drinker; P/(1 – P) is the odds that a respondent is a current alcohol drinker; X are the independent variables which are hypothesised to affect the probability of being a current alcohol drinker; β are coefficients of the independent variables; and ε is the error term.

Statistical tests of proportion are performed to sustain the statistical significance of differences between current alcohol drinkers and non-alcohol drinkers among the respondents. Chi-square and Fisher's exact tests are carried out to assess the causal relationship between diagnosed outcomes (hypertension, hypercholesterolemia and diabetes) and alcohol drinking.[3] Both Likelihood Ratio (LR) and Pearson χ^2 tests are conducted to test the goodness-of-fit of the regression model. Income, age, gender, residing area, education and employment status variables are tested for multicollinearity problems using the correlation coefficient matrix. In addition, variance inflation factor (VIF) test for all the independent variables is also conducted to detect potential multicollinearity problems.[4] The level of significance of all the tests is based on p-value of less than 5% (two-sided). After rejecting the respondents with incomplete information, a total of 30992 are used for analysis. The statistical analysis is performed using Stata statistical software (StataCorp, 2005).

3.4 Results

The results section presents the characteristics of the survey respondents of this study, the relationship between diagnosed outcomes and alcohol drinking, as well as, the factors that affect the odds of alcohol drinking.

3.4.1 Characteristics of the Survey Respondents

The characteristics of the survey respondents are shown in Table 3.1. Out of the total 30992 respondents, 1282 (4.14%) are current alcohol drinkers, whereas 29710 (95.86%)

[3] The respondents who reported to have hypertension, hypercholesterolemia or diabetes, or are diagnosed with hypertension, hypercholesterolemia or diabetes during the survey are categorised as 'being diagnosed with hypertension, hypercholesterolemia or diabetes'.
[4] Age and income are formatted as categorical variables when VIF test is performed (see Appendix B).

are non-alcohol drinkers. The average age of the total respondents is about 42 years old, while the average age of the current alcohol drinkers is about 37 years old (p = 0.000), which is slightly younger than the non-alcohol drinkers (42 years old) (p = 0.000). The average monthly individual income of the overall respondents is around RM 1963.05, whereas the average monthly individual income of the current alcohol drinkers is approximately RM 3421.86 (p = 0.000), which is far higher than the average monthly individual income of the non-alcohol drinkers (RM 1900.10) (p = 0.000).

Approximately 44.39% of the respondents are males, and 55.61% are females. 6.89% (p = 0.000) of males are current alcohol drinkers, compared to only 1.94% (p = 0.000) of females, thus indicating that alcohol drinking is more common among males than females. Overall, the ethnic breakdown in the sample comprises 56.51% Malays, 21.56% Chinese and 21.93% Indian or others. Only a very small proportion (0.43%) (p = 0.000) of Malays drink alcohol, whilst around 11.73% (p = 0.000) of Chinese and 6.23% (p = 0.000) of Indian or others are current alcohol drinkers. Hence, it can be concluded that alcohol drinking is least prevalent among Malay, whereas is most prevalent among Chinese.

The majority (51.69%) of the respondents have secondary education, followed by those with primary (37.99%) and tertiary education (10.32%). Almost one tenth (9.53%) (p = 0.000) of the tertiary educated respondents drink alcohol, compared to only 4.76% (p = 0.000) and 1.82% (p = 0.000) of the secondary and primary educated respondents, respectively. This shows that alcohol drinking is most prevalent among the tertiary educated respondents, while is least prevalent among the primary educated respondents. The total sample comprises 71.32%, 7.83% and 20.85% of the married, widowed or divorced and single respondents, respectively. The sample shows that alcohol drinking

is more common among the single (6.44%) (p = 0.000) respondents than the married (3.80%) (p = 0.000) and widowed or divorced (1.11%) (p = 0.000) respondents.

Table 3.1: Descriptive analysis of independent variables when alcohol drinking is used as the dependent variable

Variables	Current alcohol drinker (n_1 = 1282)		Non-alcohol drinker (n_2 = 29710)		Total sample (n = 30992)
	Mean/%*	p-value	Mean/%*	p-value	Mean/%*
Age	36.97 [12.73]	0.000	42.33 [15.77]	0.000	42.11 [15.69]
Income	3421.86 [3705.40]	0.000	1900.10 [2602.63]	0.000	1963.05 [2674.48]
Gender					
Male	6.89	0.000	93.11	0.000	44.39
Female	1.94	0.000	98.06	0.000	55.61
Ethnicity					
Malay	0.43	0.000	99.57	0.000	56.51
Chinese	11.73	0.000	88.27	0.000	21.56
Indian/others	6.23	0.000	93.77	0.000	21.93
Education					
Tertiary	9.53	0.000	90.47	0.000	10.32
Secondary	4.76	0.000	95.24	0.000	51.69
Primary	1.82	0.000	98.18	0.000	37.99
Marital status					
Married	3.80	0.000	96.20	0.000	71.32
Widowed/divorced	1.11	0.000	98.89	0.000	7.83
Single	6.44	0.000	93.56	0.000	20.85
Residing area					
Urban	5.53	0.000	94.47	0.000	59.42
Rural	2.09	0.000	97.91	0.000	40.58
Employment status					
Civil servant	3.02	0.001	96.98	0.001	9.93
Private sector	6.52	0.000	93.48	0.000	28.82
Self-employed	5.30	0.000	94.70	0.000	19.59
Student	8.11	0.000	91.89	0.000	3.18
Unemployed	1.72	0.000	98.28	0.000	38.48

Note: *For age and income variables, the value refers to mean [standard deviation], whereas for the other variables, the value refers to percentage.
Source: Compiled from NHMS III.

About 59.42% of the total respondents reside in urban areas, while 40.58% reside in rural areas. Approximately 5.53% (p = 0.000) of urban dwellers drink alcohol, compared to only 2.09% (p = 0.000) of rural dwellers, which indicates that alcohol drinking is more widespread in urban areas than in rural areas. Of the total sample, the majority (38.48%) are the unemployed, followed by private sector employees (28.82%), the self-employed (19.59%), civil servants (9.93%) and students (3.18%). The sample demonstrates that alcohol drinking is most prevalent among students (8.11%) (p = 0.000), whereas is least prevalent among the unemployed (1.72%) (p = 0.000).

3.4.2 Association between Diagnosed Outcomes and Alcohol Drinking

Analysing the relationship between hypertension and alcohol drinking, the Chi-square with one degree of freedom is 49.962, which has a p-value of less than 0.05, and the p-value of Fisher's exact test is also less than 0.05, thus, showing a significant causal relationship between hypertension and alcohol drinking (Table 3.2).

Table 3.2: The association between hypertension and alcohol drinking

	Hypertension	Non- hypertension	Total
Current alcohol drinker	376	906	1282
Non-alcohol drinker	11632	18078	29710
Total	12008	18984	30992

Note: Chi-square with one degree of freedom = 49.962; p-value = 0.000. P-value for Fisher's exact test = 0.000.
Source: Compiled from NHMS III.

Assessing the relationship between hypercholesterolemia and alcohol drinking, the Chi-square with one degree of freedom is 46.850, which has a p-value of less than 0.05, and the p-value of Fisher's exact test is also less than 0.05, thus, indicating a significant causal relationship between hypercholesterolemia and alcohol drinking (Table 3.3).

Table 3.3: The association between hypercholesterolemia and alcohol drinking

	Hypercholesterolemia	Non-hypercholesterolemia	Total
Current alcohol drinker	203	1079	1282
Non-alcohol drinker	7175	22535	29710
Total	7378	23614	30992

Note: Chi-square with one degree of freedom = 46.850; p-value = 0.000. P-value for Fisher's exact test = 0.000.
Source: Compiled from NHMS III.

Examining the relationship between diabetes and alcohol drinking, the Chi-square with one degree of freedom is 12.189, which has a p-value of less than 0.05, and the p-value of Fisher's exact test is also less than 0.05, thus, demonstrating a significant causal relationship between diabetes and alcohol drinking (Table 3.4).

Table 3.4: The association between diabetes and alcohol drinking

	Diabetes	Non-diabetes	Total
Current alcohol drinker	113	1169	1282
Non-alcohol drinker	3577	26133	29710
Total	3690	27302	30992

Note: Chi-square with one degree of freedom = 12.189; p-value = 0.000. P-value for Fisher's exact test = 0.000.
Source: Compiled from NHMS III.

3.4.3 Factors Affecting the Odds of Alcohol Drinking

Table 3.5 shows the results of the logit analysis of alcohol drinking. The value of Likelihood Ratio (LR) χ^2 with 14 degrees of freedom is 2810.000, which has a p-value of less than 0.05. Thus, the null hypothesis can be rejected, which indicates that the current regression model fits the data well. Besides, the value of Pearson χ^2 with 25587 degrees of freedom is 20439.570, which has a p-value of more than 0.05. Therefore, the null hypothesis cannot be rejected, which further indicates that the current regression model is robust. The calculated correlation coefficients between income, age, gender, residing area, education and employment status variables imply that multicollinearity is

not a serious issue in the current regression model (see Appendix A). Furthermore, the VIF values of all the independent variables are less than five, thus further concluding that there is no multicollinearity problem in the current regression model (Studenmund, 2006) (see Appendix B).

The results of this study show that an additional year of age reduces the odds of drinking alcohol by 0.018 times (OR: 0.982; 95% CI: 0.976, 0.988). However, an increase of RM 100 in monthly individual income increases the odds of drinking alcohol by 0.003 times (OR: 1.003; 95% CI: 1.002, 1.005). With regard to gender, males have 3.630 times the odds as females of drinking alcohol (OR: 3.630; 95% CI: 3.146, 4.188). Malays are found to have 0.054 times the odds as Indian or others of drinking alcohol (OR: 0.054; 95% CI: 0.042, 0.070), whereas Chinese have 1.844 times the odds as Indian or others of drinking alcohol (OR: 1.844; 95% CI: 1.605, 2.120).

The results demonstrate that tertiary educated individuals have 4.047 times the odds as primary educated individuals of drinking alcohol (OR: 4.047; 95% CI: 3.261, 5.021), whilst, secondary educated individuals have 2.475 times the odds as primary educated individuals of drinking alcohol (OR: 2.475; 95% CI: 2.081, 2.943). It is found that urban dwellers have 1.271 times the odds as rural dwellers of drinking alcohol (OR: 1.271; 95% CI: 1.087, 1.487). In terms of employment status, the results show that civil servants (OR: 1.333; 95% CI: 1.014; 1.753), private sector employees (OR: 1.447; 95% CI: 1.201, 1.743), the self-employed (OR: 1.535; 95% CI: 1.257, 1.875) and students (OR: 1.414; 95% CI: 1.024, 1.953) have 1.333, 1.447, 1.535 and 1.414 times the odds, respectively, as the unemployed of drinking alcohol.

Table 3.5: Results of the logit analysis of alcohol drinking

Variables	Estimated coefficient	Standard error	Odds ratio	95% CI	P-value
Age	-0.018	0.003	0.982	0.976, 0.988	0.000
Income[#]	0.003	0.001	1.003	1.002, 1.005	0.000
Gender					
Male	1.289	0.073	3.630	3.146, 4.188	0.000
Female*	–	–	1.000	–	–
Ethnicity					
Malay	-2.912	0.128	0.054	0.042, 0.070	0.000
Chinese	0.612	0.071	1.844	1.605, 2.120	0.000
Indian/others*	–	–	1.000	–	–
Education					
Tertiary	1.398	0.110	4.047	3.261, 5.021	0.000
Secondary	0.906	0.088	2.475	2.081, 2.943	0.000
Primary*	–	–	1.000	–	–
Marital status					
Married	0.046	0.085	1.047	0.886, 1.237	0.589
Widowed/divorced	-0.140	0.224	0.869	0.560, 1.349	0.532
Single*	–	–	1.000	–	–
Residing area					
Urban	0.240	0.080	1.271	1.087, 1.487	0.003
Rural*	–	–	1.000	–	–
Employment status					
Civil servant	0.288	0.140	1.333	1.014, 1.753	0.040
Private sector	0.369	0.095	1.447	1.201, 1.743	0.000
Self-employed	0.429	0.102	1.535	1.257, 1.875	0.000
Student	0.346	0.165	1.414	1.024, 1.953	0.035
Unemployed*	–	–	1.000	–	–
Constant	-3.964	0.169	–	–	0.000
LR χ^2 (14)	2810.000				
p-value	0.000				
Pearson χ^2 (25587)	20439.570				
p-value	1.000				
Observations	30992				

Note: CI refers to confidence interval and LR refers to likelihood ratio. [#]income divided by 100. *refers to reference/base category (coded as 0).
Source: Compiled from NHMS III.

3.5 Discussion

The results of this study show that age, income, gender, ethnicity, education, residing area and employment status are statistically significant in determining individuals' likelihood of consuming alcohol. More specifically, young individuals, high income earners, males, Chinese, the well-educated, urban dwellers, civil servants, private sector employees, the self-employed and students are more likely to consume alcohol than others.

3.5.1 Age

The results of this study lend support to the findings of Yen and Jensen (1996) that age is negatively associated with individuals' propensity to consume alcohol, meaning that older individuals are less likely to adopt alcohol drinking habit than younger individuals. This is because older individuals tend to face a higher rate of depreciation of health capital, and consequently are more devoted to invest in their health by living a healthy lifestyle (Grossman, 1972). Furthermore, as a consequence of depreciating health capital, older individuals tend to be more aware of their own health and the risks of unhealthy lifestyles compared to younger individuals, who tend to take health for granted. However, the arguments of Cropper (1977) and Kenkel (2000) that age reduces individuals' preferences for health investments are not supported by the finding of this study. Hence, it can be concluded that while age reduces the pay-off period of health investment, older individuals may still prefer to invest in their health.[5] The policy implications of this finding include the need to launch awareness creation programmes directed at youngsters to help reduce the prevalence of alcohol consumption. Since the

[5] Health investment in this study refers to efforts to prevent or discourage alcohol drinking.

introduction of health and pictorial warning labels on tobacco products is effective in reducing tobacco consumption throughout the nation (Fathelrahman et al., 2010), public health authorities should consider applying the same strategy on alcohol products, especially beer, wine and liquor. In addition, efforts to utilise social media which have strong influences on youngsters, such as, Facebook, Twitter and Yahoo to advertise the facts about the harmful effects of alcohol drinking, as well as, to increase the minimum age to purchase and consume alcohol to at least 21 years of age are worthy of consideration.

3.5.2 Income

Consistent with the findings of Yen (1994), Parker et al. (1995) and Yen and Jensen (1996), income is significantly and positively associated with the likelihood of consuming alcohol as higher income individuals are more likely to consume alcohol compared to lower income individuals, thus suggesting that alcohol is a normal good only for individuals who addicted to it. However, this result does not support the argument of Grossman (1972) that income raises the incentive for health investment. In terms of policy implementation, the government should take note that alcohol is an addictive good as its price elasticity of demand is less elastic (Cook and Moore, 2000; Cawley and Ruhm, 2012). For instance, Wagenaar et al. (2009) systematically reviewed 112 studies on the association between price of alcohol and alcohol consumption. The study found that the mean price elasticity of demand for beer, wine and liquor is only -0.46, -0.69 and -0.80, respectively, which is also supported by Gallet (2007) based on a meta-analysis of studies examining the demand for alcohol. Therefore, in order to effectively reduce alcohol consumption, the government should use other direct intervention measures rather than increasing the tax.

3.5.3 Gender

Interestingly, this study finds significant gender differences in alcohol consumption as males are more likely to drink alcohol than females, which is consistent with the findings of the previous studies on developed countries (Manrique and Jensen, 2004; Yuan and Yen, 2012; Redonnet et al., 2012). Croson and Gneezy (2009) reviewed the economic studies on gender differences in risk and social preferences. The study found that women were more risk averse than men. Since alcohol drinking is a risky health behaviour, individuals who are more risk-aversion oriented (i.e. women) tend to avoid alcohol drinking. Nevertheless, Croson and Gneezy (2009) claimed that women were also more sensitive to social cues, i.e. the verbal and non-verbal communications which affected individual's social interaction. Since alcohol drinking by women is less socially accepted than by men, especially in the developing countries like Malaysia, women are likely to have a lower preference for alcohol drinking than men. Considering this finding, the Ministry of Health of Malaysia should pay considerable attention to reducing alcohol consumption among males by introducing more nationwide anti-alcohol programmes. In particular, these programmes should include advertising the information about how alcohol drinking can impair men's health, such as, erectile dysfunction and low sperm count (Lee et al., 2010; Joo et al., 2012). Since information plays an important role in influencing individuals' health behaviour (Kenkel, 1991; Cawley and Ruhm, 2012), policies focusing on providing more alcohol drinking information for the public can produce desirable outcomes.

3.5.4 Ethnicity

In line with the findings of Tan et al. (2009a,c), ethnicity plays a notable role in affecting individuals' alcohol drinking behaviour. Comparing among the ethnic groups, Malays have the lowest likelihood of consuming alcohol, whereas Chinese have the highest likelihood. Perhaps, this is attributable to the cultural and religious differences between the ethnic groups. In Malaysia, Malays (Muslims) are strictly prohibited from consuming alcohol because of their Islamic religious background. Quite the opposite, the Chinese culture allows people to incorporate alcohol into their lifestyle. In fact, alcohol is considered as an important good in most of the Chinese traditional festivals and celebrations, such as, New Year festival and wedding ceremonies (Cochrane et al., 2003). Moreover, alcohol is also often used by the Chinese, especially the businessman as a method to maintain a good social relationship with people (Cochrane et al., 2003). An important implication of this finding is that government strategies should pay particular attention to reducing alcohol consumption among Chinese. For instance, the government can utilise various channels of mass media, such as, newspapers, television programmes and radio channels, as well as, health professionals and religious spokespersons from Chinese ethnic background to discourage people from drinking alcohol by highlighting its harmful effects on health and well-being.

3.5.5 Education

The finding of this study conforms to the popular belief that education plays an important role in influencing individuals' health behaviour (Grossman, 1972; Kenkel, 1991; Grossman, 2000). Specifically, it shows that well-educated individuals are significantly more likely to consume alcohol than less-educated individuals, which

corroborates the findings of Jonas (2000), Marques-Vidal and Dias (2005) and Cutler and Lleras-Muney (2010) that education increases individuals' propensity to consume alcohol. According to the economic theories, education can improve health in two ways. Firstly, education increases allocative and productive efficiency of producing health (Grossman, 1972; Kenkel, 1991). Secondly, high levels of education are associated with low rates of time preference, resulting in a high preference for healthy behaviour (Fuchs, 1982; van der Pol, 2011). Since light alcohol drinking may improve health (Agarwal, 2002), higher educated individuals have a higher likelihood of consuming alcohol than lower educated individuals, as they are efficient health producers and also have a lower rate of time preference. However, the finding of this study needs to be explored more rigorously in the future studies as it will be useful to gather data on the amount and type (e.g. beer, wine and liquor) of alcohol consumed than simply incidence of alcohol drinking, because light drinkers may be highly educated, while heavy drinkers may be less-educated. With regard to policy implication, health education related programmes (e.g. campaigns, seminars and workshops) and reading materials (e.g. books, newspapers and magazines) should be directed at the less-educated segments of the population to increase knowledge about the benefits of light alcohol drinking, as they can potentially help reduce the harmful use of alcohol. While the main objective of these programmes is to improve knowledge of alcohol among the less-educated, individuals should not be highly encouraged to use alcohol as a way to improve their health as it may lead to misuse and overconsumption.

3.5.6 Marital Status

Surprisingly, however, this study finds marital status to have no significant correlation with alcohol consumption, thus, suggesting that household commitments do not cause

notable impact on individuals' propensity to consume alcohol. This is likely attributable to the fact that alcohol is an addictive substance, whereby its consumption is unlikely to be impacted by the presence of spouse and children. However, such explanation may have to be further confirmed by the future studies that include 'presence of children' and 'household commitments' as explanatory variables.

3.5.7 Residing Area

Interestingly, this study finds spatial differences in alcohol consumption as urban dwellers are more likely to consume alcohol than rural dwellers, which is consistent with the findings of Yen (1994) and Nayga and Capps (1994) based on US data. This may be a consequence of the urban lifestyle (parties, the need to maintain social status and the linking of drinking to high-class living). Based on the finding of this study, a strategy targeted at reducing the prevalence of alcohol consumption among urban dwellers may be worthwhile. The Ministry of Health Malaysia should make a concerted effort to ban alcohol related advertisements throughout the nation with a focus on the urban areas. Television, newspaper, magazine, poster and cinema, for instance, should be strictly prohibited from including any types of alcohol advertisements. Although such a tough measure has been given consideration by the government, no action has been taken thus far. Since the alcohol companies have been spending a lot of money on advertising in Malaysia (approximately RM 100 million) (Mahpar, 2010), a total ban on advertising will result in a significant reduction in the prevalence of alcohol consumption.

3.5.8 Employment Status

In terms of employment status, employed individuals and students are found to be significantly more likely to consume alcohol than the unemployed, which matches with the finding of Parker et al. (1995) that unemployed individuals have a lower likelihood of consuming alcohol. A plausible reason to explain why students are more likely to drink alcohol is that students often stay away from their parents during the semesters, and consequently are attracted to seek instantaneous pleasures, such as, alcohol drinking and other unhealthy behaviour (Karam et al., 2007). With regard to the employed, the explanation is that since alcohol drinking is a common activity at social functions of the employees, those employed individuals, being influenced by their working peers, are more likely to adopt drinking habit compared to the unemployed (Huerta and Borgonovi, 2010). The main implication of this finding is that intervention strategies directed primarily at employed individuals and students can be very effective. The government should take more serious efforts to conduct workplace health promotion programmes to discourage drinking among employed individuals. Meanwhile, to reduce alcohol consumption among students, the Ministry of Education Malaysia should consider introducing more health related subjects and courses in universities and colleges to educate students about the disadvantages of alcohol drinking.

3.6 Summary

Using the latest nationally representative sample and rigorous statistical methods, this study reaches the conclusion that alcohol drinking is significantly related to serious health problems (hypertension, hypercholesterolemia and diabetes), and economic and socio-demographic factors play a major role in influencing individual's alcohol drinking

behaviour. Hence, the public policy makers should take account of the factors affecting alcohol drinking when formulating population-based intervention measures. However, two inherent limitations are noted due to the limited availability of data. Firstly, several important variables that can affect drinking, such as, presence of children in a family, type of alcohol consumed and alcohol price could not be included in this study. Secondly, this study could not take account of the amount of alcohol consumed by the respondents.

CHAPTER 4

TOBACCO CONSUMPTION

4.1 Introduction

As a consequence of industrialisation and urbanisation, smoking has become a serious health issue worldwide. Studies have found that smoking can increase the risk of stroke and chronic obstructive pulmonary disease by 40-50% (Thakur et al., 2011). Smokers are about three times more likely to suffer from coronary heart disease and lung cancer than non-smokers (Thakur et al., 2011). Each year, smoking-induced diseases are responsible for five million of mortality (WHO, 2012b). Worse still, at least twelve people die in every one minute, and one out of six NCD related deaths are attributable to smoking (Thakur et al., 2011).

The increase in prevalence of smoking is a profound public health challenge in both developed and developing countries. WHO (2012b) estimated that smoking-induced mortality would reach ten million by 2030. Smoking is responsible for 71% of lung cancer, 42% of chronic respiratory disease and 10% of cardiovascular disease yearly (WHO, 2012b). In fact, the burden attributable to smoking is more serious in developing countries than in developed countries with an estimated 70-80% of smokers and smoking related deaths are in the developing countries (WHO, 2011d; WHO, 2012b; Lim et al., 2013). Smoking also causes serious negative impacts on children health (WHO, 2012b). About half of the children worldwide live in the smoke-polluted environment, and around two hundred thousand pass away annually due to second hand smoke (WHO, 2012b).

Studies show that almost one-fourth of mortality in Malaysia are associated with smoking, which accounts for about 10 thousand of deaths yearly (Lim et al., 2009; Tan et al., 2009b; Tan, 2012). WHO (2012e) reported that almost five million of adults in Malaysia were cigarette smokers in 2011 (WHO, 2012e). In terms of public health burden, smoking was responsible for 15% of total government hospital admissions in 2006 (Institute for Public Health, 2008). Worse still, approximately RM 1 billion are allocated by the government for treatments for smoking-induced diseases annually (Tan, 2012).

The vital role of smoking in determining mortality and morbidity results in a growing number of studies exploring the factors affecting smoking in developed countries (Chaloupka and Warner, 2000; Saffer and Chaloupka, 2000; Gallet and List, 2003; Manrique and Jensen, 2004; Yen, 2005a,b; Bauer et al., 2007; Aristei and Pieroni, 2008; Cawley and Ruhm, 2012). However, the current literature is still nearly silent on what are the factors that can explain smoking in Malaysia. The objective of this study is to narrow this research gap.

The contributions of this study to the literature and society are threefold. Firstly, the focus of this study is on a developing country, i.e. Malaysia, where the issue of smoking has been received considerable attention by the government. Secondly, the latest nationally representative health survey data comprising a large sample size and detailed information on individual's socio-demographic, lifestyle and health profiles is exploited for a robust analysis, thus, important findings can be generated. Thirdly, a better understanding of the factors affecting smoking can assist the public policy makers in formulating more effective population-based intervention strategies.

4.2 An Economic Analysis of Demand for Tobacco

Individuals tend to behave rationally in order to generate optimal outcomes by maximising the benefits received from consuming market goods and services, while minimising the incurred costs. In fact, rational individuals will consider the costs and benefits of smoking, and will smoke only when the net benefits received are positive.

The costs of smoking, including both monetary and non-monetary value, are the price of tobacco and its negative impact on health, whereas the benefits are the pleasures it produces. These costs and benefits are known as personal costs (PC) and personal benefits (PB). Thus, rational individuals will tend to maximise the total net benefits received from smoking by equalising their personal marginal costs (PMC) and personal marginal benefits (PMB) (i.e. PMC = PMB). PMC refers to the additional costs borne by individuals when consuming an additional unit of tobacco. PMB, on the other hand, refers to the additional benefits received by individuals when consuming an additional unit of tobacco.

Since smoking involves costs of participation, PMC increases with every additional unit of tobacco consumed, i.e. positively correlated with tobacco consumption. Conversely, however, owing to the law of diminishing returns, PMB decreases with every additional unit of tobacco consumed, i.e. negatively correlated with tobacco consumption. Based on cost-benefit marginal analysis, it can be concluded that rational individuals will smoke only when their PMB is greater than their PMC.

There are several reasons to explain the high prevalence of smoking in the present society. Firstly, the adverse effects of smoking on health only become apparent when a

serious deterioration in health occurs, meaning that individuals will only realise the costs of smoking in the future when they age. This shows a lag between realisation of the costs of smoking and participation in smoking. Hence, individuals, especially those who are more present oriented are more likely to smoke, and only avoid smoking when their health and well-being are seriously affected.

Secondly, smokers often do not realise that smoking can cause serious negative externalities to the society, such as, second-hand smoke and environmental pollution. This means that smoking also involves social costs (SC), which are the costs borne by the society as a whole. Since SC is difficult to measure and observe, individuals tend to underestimate the actual costs of smoking, which means that the PMC of smoking is lower than the social marginal costs (SMC). This will, in turn, result in overconsumption of tobacco.

4.3 Methodology

The methodology section presents the data used in this study, the selection of variables, and the econometric model, which is applied to examine the factors affecting the likelihood of smoking.

4.3.1 Data

This study used data from the Third National Health and Morbidity Survey (NHMS III), which was the latest nationally representative cross-sectional population-based survey conducted by the Ministry of Health Malaysia over the period April 2006 to January 2007. The survey covered all the urban and rural areas in the 13 states of Malaysia,

including the federal territory of Kuala Lumpur. Following the sampling frame designed by the Department of Statistics Malaysia, a two stage stratified sampling approach proportionate to the size of population in Malaysia was applied for data collection. The first stage sampling unit was based on geographically contiguous areas of the country [Enumeration Blocks (EB)]. The second stage sampling unit was based on the Living Quarters (LQ) in each EB, and all the households and individuals that resided in the selected LQ participated. In particular, each EB consisted of 80-120 LQ with a population of about 600. The EB were based on the population of gazetted and built-up areas [i.e. urban (≥10000 populations) and rural (<10000 populations)].

The inclusion criteria of the survey were: one, all adults aged 18 years old and above; two, all gender; three, all ethnic groups; and four, Malaysian citizens. The target sample size was calculated based on three criteria: one, 95% confidence interval; two, the prevalence and response rate of the Second National Health and Morbidity Survey (NHMS II); and three, the calculated margin of error and design effect. More detailed information about the calculation was described in Institute for Public Health (2008). The calculated target sample size was 34539 respondents, which represented 12923504 Malaysian adults. The targeted household member was classified as 'no response' after three consecutive unsuccessful visits. The overall response rate was about 99.30% (34305 respondents).

The piloted bi-lingual (*Bahasa Malaysia* and English) questionnaires were used by the trained health professionals to interview face-to-face the respondents. During the interview, the respondents were asked to answer several questions about their smoking behaviour. Besides, the respondents were also asked to self-report their socio-demographic, lifestyle and health profiles. Meanwhile, if the respondents reported that

they did not have hypertension or hypercholesterolemia, their blood pressure and blood cholesterol were examined by the health professionals using Omron Digital Automatic Blood Pressure Monitor Model HEM-907 and Accutrend GC – Roche Diagnostic's battery-operated gluco-photometer. The respondents were classified as having hypertension if their systolic blood pressure was ≥140 and diastolic blood pressure was ≥90mmHg, and were classified as having hypercholesterolemia if their blood cholesterol was ≥5.2mmol/L. Besides, if the respondents reported that they were not diabetics, their blood glucose was tested using Accutrend GC – Roche Diagnostic's battery-operated gluco-photometer. If the respondents' blood glucose was ≥6.1mmol/L (after eight hours of fasting), they were referred to the nearest clinics or hospitals for further examination.

4.3.2 Model Development

The selection of the independent variables was based on the previous empirical studies examining the factors affecting smoking (Yen, 2005a,b; Raptou et al., 2005; Alam et al., 2008; Aristei and Pieroni, 2008; Cho et al., 2008; Bilgic et al., 2010; Lin, 2010). In particular, the variables that were selected, and were hypothesised to affect individuals' decision to smoke were: one, age; two, income; three, gender; four, ethnicity; five, education; six, marital status; seven, residing area; and eight, employment status.

4.3.2.1 Age

The previous studies found that age was significant in affecting smoking. Using data from the Continuing Survey of Food Intakes, Yen (2005b) applied a double-hurdle model for analysis. The study found age to be negatively correlated with individuals'

probability of smoking, meaning that older individuals were less likely to smoke than younger individuals. Aristei and Pieroni (2008) exploited data from the Italian Household Budget Survey for analysis. The study found that age reduced the likelihood and frequency of smoking among adults. According to the economic theories, individuals of different age may face different rate of depreciation of health capital, and consequently had different preferences for health investment, such as, participation in healthy behaviour and use of medical care (Grossman, 1972; Cropper, 1977; Kenkel, 2000). Since smoking was an unhealthy behaviour, i.e. a negative health investment, the likelihood of smoking was likely to vary across age groups. According to the PMB/PMC framework, the PMB is greater among older individuals relative to younger individuals because of the 'tolerance effect'. As smokers develop tolerance, each additional tobacco yields less benefit, i.e. PMB falls more rapidly, thus the smokers will crave for more tobacco by shifting the PMB curve rightwards. Besides, the PMC is also lower for older individuals than younger individuals. The fact of the matter is that there are costs of withdrawal after establishing the smoking habit, such as, loss of concentration and irritability. As opposed to other costs, these costs reduce with greater increases in smoking among the habitual smokers. Another explanation is that younger individuals are usually less financially independent and face higher punishment costs from adult supervisors than older individuals. Hence, to examine the causal relationship between age and smoking, the respondents' age (in years) was included.

4.3.2.2 Income

The findings of the previous studies showed that the causal relationship between income and smoking was mixed. Raptou et al. (2005) made use of a data of Greece consisting of 680 respondents to examine the determinants of smoking. The study found that income

increased individuals' probability of smoking, as individuals with higher monthly income to be more likely to smoke than individuals with lower monthly income. A review of studies on cigarette demand by Gallet and List (2003) found that the mean income elasticity of smoking was about 0.42, thus, indicating that cigarette consumption rose with income. Conversely, however, Bauer et al. (2007) used the German Socio-Economic Panel data and a Blinder-Oaxaca decomposition model for analysis. The study found that income was negatively associated with individuals' likelihood of smoking. In particular, the study observed males with a monthly income above 2000 Euros to be less likely to smoke compared to males with a monthly income below 2000 Euros. Similarly, drawing on the National Health Interview Survey sample, Cawley and Ruhm (2012) found that smoking was less prevalent among high income individuals than low income individuals. According to the economic theory, income increases the incentive for health investment, as wage is the return that individuals receive when individuals convert their time into working activities (Grossman, 1972). Since smoking is a health disinvestment, high income individuals are likely to avoid it. This suggests that high income individuals have a higher PMC for smoking than low income individuals. In this study, the respondents' monthly individual income (in RM) was included.

4.3.2.3 Gender

Bilgic et al. (2010) used the 2003 Turkish Household Expenditure Survey to investigate the factors affecting smoking among adults. The study found that gender was significant in determining smoking, as households with male heads were more likely to smoke than households with female heads. Lin (2010) deployed a nationwide panel data of Taiwan comprising 3015 observations for analysis. The study shared a similar finding that

males were more likely to smoke than females. Likewise, Cawley and Ruhm (2012) studied the differences in health behaviour across population subgroups, and found that males had a higher likelihood of smoking compared to females. A plausible reason was that smoking by females was less socially accepted than by males. Besides, women are also more risk averse than men (Croson and Gneezy, 2009). Since smoking is a risky behaviour, individuals who are more risk-aversion oriented tend to avoid smoking. Also, women in child bearing ages tend to be more health conscious relative to men. Taken together, these imply that women have a higher PMC for smoking than men. In this study, gender of the respondents was included.

4.3.2.4 Ethnicity

There was evidence suggesting that ethnicity was significantly associated with smoking. For instance, Yen (2005b) observed different races of individuals in US (i.e. Black and Hispanic) to have different preferences for smoking. Tan et al. (2009b) used data from the Malaysian Household Survey and a Heckman's sample selection model for analysis. The study found significant ethnic (Malay, Chinese and Indian or others) differences in households purchase decisions of tobacco products. Drawing on the Malaysia Non-Communicable Disease Surveillance-1 (MyNCDS-1) dataset, Tan (2012) found that ethnicity played an important role in affecting individuals' decision to consume tobacco. To examine the impact of ethnicity on smoking, the respondents' ethnic backgrounds were included, and were divided into three categories, i.e. Malay, Chinese and Indian or others.

4.3.2.5 Education

The previous studies found that years of education were negatively correlated with individuals' likelihood of smoking as higher educated individuals were less likely to smoke than lower educated individuals (Yen, 2005b; Aristei and Pieroni, 2008; Bilgic et al., 2010; Lin, 2010). These findings were also evidenced by Cutler and Lleras-Muney (2010) and Cawley and Ruhm (2012) examining the influence of education on unhealthy behaviour. Using instrumental variables for education, such as, availability of colleges in a country and college attendance during a war period to investigate the causal relationship between education and smoking, Currie and Moretti (2003), de Walque, (2007) and Grimard and Parent (2007) found a similar outcome that levels of education could significantly reduce individuals' probability of smoking. The explanation was that education could lower the rate of time preference (Fuchs, 1982; van der Pol, 2011) and enhance allocative and productive efficiency of producing health by improving individuals' health knowledge (Grossman, 1972; Kenkel, 1991; Grossman, 2000). Since smoking causes serious negative impact on health, well-educated individuals tend to avoid it. This implies that well-educated individuals have a higher PMC for smoking than less-educated individuals. In this study, the respondents' education levels were included, and were grouped into three categories, i.e. primary, secondary and tertiary.

4.3.2.6 Marital Status

Exploring the association between marital status and smoking in Korea, Cho et al. (2008) found that smoking was less prevalent among married individuals than unmarried individuals. The study claimed that married individuals had the advantages of receiving

social and psychological supports from their spouses, and thus, were less likely to engage in unhealthy behaviour. Hersch (2000) used data from the US Current Population Survey to explore the factors affecting smoking. The study showed that married individuals were less likely to smoke relative to unmarried individuals. In essence, household commitments and time constraint may also explain these findings, given that household activity could pose as a barrier to participation in leisure activity, which included smoking, alcohol drinking and physical activity (Cawley, 2004). In this study, the respondents' marital status was included, and was segmented into three categories, i.e. married, widowed or divorced and single.

4.3.2.7 Residing Area

The causal relationship between residing area and smoking was inconclusive. Using the cross-sectional household survey of Pakistan, Alam et al. (2008) found significant rural-urban differences in smoking as rural dwellers were about 1.5 times more likely to smoke than urban dwellers, which was also supported by Lim et al. (2013) based on a Malaysian dataset. On the contrary, Bauer et al. (2007) found that urbanites had a higher likelihood of smoking than rural dwellers. In fact, smoking related advertising and information may be the contributing factor for these findings (Kenkel, 1991; Cawley and Ruhm, 2012). It was claimed that the availability of advertising and information about smoking varied across dwelling areas, thus, different areas of dwellers may possess different preferences for and perspectives on smoking (Alam et al., 2008; Lim et al., 2013). Hence, the respondents' residing area was included in this study. Following the classification of Department of Statistics Malaysia, the respondents' residing area was classified into two categories, i.e. urban (metropolitan and urban large

or gazetted areas ≥ 10000 populations) and rural (urban small and rural or gazetted areas < 10000 populations).

4.3.2.8 Employment Status

The impact of employment status on smoking was ambiguous. On one hand, using data from the Spanish household survey to investigate the factors influencing smoking and alcohol drinking, Manrique and Jensen (2004) found employed household heads to be less probable to smoke compared to unemployed household heads. On the other hand, Bauer et al. (2007) exploited a German data for analysis, and found that full time workers were more likely to smoke than the unemployed. Given the availability of data, the respondents' employment status was included, and was divided into five categories, i.e. civil servant, private sector employee, self-employed, student and unemployed (including housewife and retiree).

4.3.3 Econometric Specification

This study uses 'smoking status' as the dependent variable with 1 representing 'current smoker' and 0 otherwise. Current smoker refers to the respondent who smoked at least one day in the past 30 days prior to the survey or reported to be smoking at the time of the survey, otherwise the respondent is categorised as non-smoker. More detailed information about the measurement has been described elsewhere (Institute for Public Health, 2008).

Since the dependent variable is a binary variable, the logit model is used for the statistical analysis, given that it can predict the probability that lies between the unit

intervals (Greene, 2007). In exploring the residuals, it is found that the value of Jarque-Bera statistic is 543.30, which has a p-value of less than 0.05. Hence, the null hypothesis can be rejected, and this concludes that the residuals are not normally distributed, indicating that the logit model is the appropriate one. In general, the logit model can be written as follow:

$$\log \frac{P}{1-P} = \alpha + \beta_i X_i + \varepsilon \tag{4.1}$$

where, P is the probability that a respondent is a current smoker; 1 – P is the probability that a respondent is a non-smoker; P/(1 – P) is the odds that a respondent is a current smoker; X are the independent variables which are hypothesised to affect the probability of being a current smoker; β are coefficients of the independent variables; and ε is the error term.

Statistical tests of proportion are performed to sustain the statistical significance of differences between smokers and non-smokers among the respondents. Chi-square and Fisher's exact tests are carried out to assess the causal relationship between diagnosed outcomes (hypertension, hypercholesterolemia and diabetes) and smoking.[6] Both Likelihood Ratio (LR) and Pearson χ^2 tests are conducted to test the goodness-of-fit of the regression model. Income, age, gender, residing area, education and employment status variables are tested for multicollinearity problems using the correlation coefficient matrix. Besides, variance inflation factor (VIF) test for all the independent variables is also conducted to detect potential multicollinearity problems. The level of significance of all the tests is based on p-value of less than 5% (two-sided). After

[6] The respondents who reported to have hypertension, hypercholesterolemia or diabetes, or are diagnosed with hypertension, hypercholesterolemia or diabetes during the survey are categorised as 'being diagnosed with hypertension, hypercholesterolemia or diabetes'.

rejecting the respondents with incomplete information, a total of 30992 are used for analysis. The statistical analysis is performed using Stata statistical software (StataCorp, 2005).

4.4 Results

The results section presents the characteristics of the survey respondents of this study, the causal relationship between diagnosed outcomes and smoking, as well as, the factors that affect the odds of smoking.

4.4.1 Characteristics of the Survey Respondents

The characteristics of the survey respondents of this study are illustrated in Table 4.1. The sample consists of 30992 respondents, of which 7054 (22.76%) are current smokers and 23938 (77.24%) are non-smokers. The average age of the total respondents is around 42.11 years old. The average age of the respondents who currently smoke (40.23 years old) ($p = 0.000$) is younger than the respondents who do not smoke (42.66 years old) ($p = 0.000$). The average monthly individual income of the overall respondents is about RM 1963.05. The average monthly individual income of current smokers (RM 1720.43) ($p = 0.000$) is lower than non-smokers (RM 2034.55) ($p = 0.000$).

In terms of gender, 44.39% of the total respondents are males and 55.61% are females. Approximately 48.97% ($p = 0.000$) of males are current smokers, compared to only 1.84% ($p = 0.000$) of females, thus, suggesting that smoking is more prevalent among males than females. Overall, the ethnic breakdown comprises 56.51% Malays, 21.56% Chinese and 21.93% Indian or others. Among all the ethnic groups, smoking is most

prevalent among Malays (25.43%) (p = 0.000), whereas is least prevalent among Chinese (17.31%) (p = 0.000).

Table 4.1: Descriptive analysis of independent variables when smoking is used as the dependent variable

Variables	Current smoker (n_1 = 7054)		Non-smoker (n_2 = 23938)		Total sample (n = 30992)
	Mean/%*	p-value	Mean/%*	p-value	Mean/%*
Age	40.23 [15.21]	0.000	42.66 [15.79]	0.000	42.11 [15.69]
Income	1720.43 [1938.54]	0.000	2034.55 [2851.48]	0.000	1963.05 [2674.48]
Gender					
Male	48.97	0.000	51.03	0.000	44.39
Female	1.84	0.000	98.16	0.000	55.61
Ethnicity					
Malay	25.43	0.000	74.57	0.000	56.51
Chinese	17.31	0.000	82.69	0.000	21.56
Indian/others	21.24	0.001	78.76	0.001	21.93
Education					
Tertiary	14.82	0.000	85.18	0.000	10.32
Secondary	24.91	0.000	75.09	0.000	51.69
Primary	22.00	0.012	78.00	0.012	37.99
Marital status					
Married	22.34	0.006	77.66	0.006	71.32
Widowed/divorced	9.98	0.000	90.02	0.000	7.83
Single	28.99	0.000	71.01	0.000	20.85
Residing area					
Urban	19.97	0.000	80.03	0.000	59.42
Rural	26.85	0.000	73.15	0.000	40.58
Employment status					
Civil servant	24.07	0.069	75.93	0.069	9.93
Private sector	31.86	0.000	68.14	0.000	28.82
Self-employed	37.87	0.000	62.13	0.000	19.59
Student	10.24	0.000	89.76	0.000	3.18
Unemployed	8.96	0.000	91.04	0.000	38.48

Note: *For age and income variables, the value refers to mean [standard deviation], whereas for the other variables, the value refers to percentage.
Source: Compiled from NHMS III.

A large proportion (51.69%) of the respondents have secondary education, followed by those with primary (37.99%) and tertiary education (10.32%). Smoking is most common among the secondary educated respondents (24.91%) (p = 0.000), whilst is least common among the tertiary educated respondents (14.82%) (p = 0.000). Of the total sample, the majority (71.32%) are married, followed by single (20.85%) and widowed or divorced (7.85%). Only a small proportion (9.98%) (p = 0.000) of the widowed or divorced respondents smoke, whereas more than one-fifth of the single (28.99%) (p = 0.000) and married (22.34%) (p = 0.006) respondents are current smokers, which implies that smoking is most prevalent among single individuals, whereas is least prevalent among widowed or divorced individuals.

Approximately 59.42% of the respondents are urban dwellers and 40.58% are rural dwellers. More than one-fourth (26.85%) (p = 0.000) of rural dwellers currently smoke, compared to only 19.97% (p = 0.000) of urban dwellers, which indicates that smoking is more widespread in rural areas than in urban areas. The total sample consists of 38.48% of the unemployed, followed by 28.82% of private sector employees, 19.59% of the self-employed, 9.93% of civil servants and 3.18% of students. Smoking is most common among the self-employed (37.87%) (p = 0.000), whereas is least common among the unemployed (8.96%) (p = 0.000).

4.4.2 Association between Diagnosed Outcomes and Smoking

Examining the relationship between hypertension and smoking, the Chi-square with one degree of freedom is 130.065, which has a p-value of less than 0.05, and the p-value for Fisher's exact test is also less than 0.05, thus, indicating a significant causal relationship between hypertension and smoking (Table 4.2).

Table 4.2: The association between hypertension and smoking

	Hypertension	Non- hypertension	Total
Smoker	2323	4731	7054
Non-smoker	9685	14253	23938
Total	12008	18984	30992

Note: Chi-square with one degree of freedom = 130.065; p-value = 0.000. P-value for Fisher's exact test = 0.000.
Source: Compiled from NHMS III.

Exploring the relationship between hypercholesterolemia and smoking, the Chi-square with one degree of freedom is 63.385, which has a p-value of less than 0.05, and the p-value for Fisher's exact test is also less than 0.05, thus, showing a significant causal relationship between hypercholesterolemia and smoking (Table 4.3).

Table 4.3: The association between hypercholesterolemia and smoking

	Hypercholesterolemia	Non-hypercholesterolemia	Total
Smoker	1429	5625	7054
Non-smoker	5949	17989	23938
Total	7378	23614	30992

Note: Chi-square with one degree of freedom = 63.385; p-value = 0.000. P-value for Fisher's exact test = 0.000.
Source: Compiled from NHMS III.

Analysing the relationship between diabetes and smoking, the Chi-square with one degree of freedom is 60.454, which has a p-value of less than 0.05, and the p-value for Fisher's exact test is also less than 0.05, thus, suggesting a significant causal relationship between diabetes and smoking (Table 4.4).

Table 4.4: The association between diabetes and smoking

	Diabetes	Non-diabetes	Total
Smoker	654	6400	7054
Non-smoker	3036	20902	23938
Total	3690	27302	30992

Note: Chi-square with one degree of freedom = 60.454; p-value = 0.000. P-value for Fisher's exact test = 0.000.
Source: Compiled from NHMS III.

4.4.3 Factors Affecting the Odds of Smoking

Table 4.5 shows the results of the logit analysis of smoking. The value of Likelihood Ratio (LR) χ^2 with 14 degrees of freedom is 12410.060, which has a p-value of less than 5%. Hence, the null hypothesis can be rejected, which indicates that the current regression model fits the data well. The calculated correlation coefficients between income, age, gender, residing area, education and employment status variables suggest that there is no serious multicollinearity problem in the current regression model (see Appendix A). Additionally, the VIF values of all the independent variables are less than five, and this suggests that multicollinearity is not an issue in the current regression model (Studenmund, 2006) (see Appendix B).

The results of this study demonstrate that an additional year of age reduces the odds of smoking by 0.025 times (OR: 0.975; 95% CI: 0.972, 0.978), while an increase of RM 100 in monthly individual income reduces the odds of smoking by 0.006 times (OR: 0.994; 95% CI: 0.992, 0.996). With regard to gender, males have 55.172 times the odds as females of smoking (OR: 55.172; 95% CI: 48.690, 62.517).

Comparing among the ethnic groups, Malays have 1.460 times the odds as Indian or others of smoking (OR: 1.460; 95% CI: 1.340, 1.590), whereas Chinese have 0.790 times the odds as Indian or others of smoking (OR: 0.790; 95% CI: 0.709, 0.881). The results of this study show that tertiary educated individuals have 0.363 times the odds as primary educated individuals of smoking (OR: 0.363; 95% CI: 0.315, 0.420), while secondary educated individuals have 0.743 times the odds as primary educated individuals of smoking (OR: 0.743; 95% CI: 0.682, 0.811).

Table 4.5: Results of the logit analysis of smoking

Variables	Estimated coefficient	Standard error	Odds ratio	95% CI	P-value
Age	-0.025	0.002	0.975	0.972, 0.978	0.000
Income[#]	-0.006	0.001	0.994	0.992, 0.996	0.000
Gender					
Male	4.010	0.064	55.172	48.690, 62.517	0.000
Female*	–	–	1.000	–	–
Ethnicity					
Malay	0.378	0.044	1.460	1.340, 1.590	0.000
Chinese	-0.235	0.055	0.790	0.709, 0.881	0.000
Indian/others*	–	–	1.000	–	–
Education					
Tertiary	-1.012	0.073	0.363	0.315, 0.420	0.000
Secondary	-0.297	0.044	0.743	0.682, 0.811	0.000
Primary*	–	–	1.000	–	–
Marital status					
Married	-0.009	0.053	0.991	0.894, 1.099	0.867
Widowed/divorced	0.619	0.109	1.858	1.500, 2.300	0.000
Single*	–	–	1.000	–	–
Residing area					
Urban	-0.177	0.038	0.838	0.778, 0.902	0.000
Rural*	–	–	1.000	–	–
Employment status					
Civil servant	0.098	0.069	1.103	0.964, 1.262	0.154
Private sector	0.405	0.054	1.500	1.350, 1.666	0.000
Self-employed	0.549	0.053	1.731	1.560, 1.921	0.000
Student	-1.146	0.130	0.318	0.247, 0.410	0.000
Unemployed*	–	–	1.000	–	–
Constant	-2.975	0.102	–	–	0.000
LR χ^2 (14)	12410.060				
p-value	0.000				
Pearson χ^2 (25587)	30290.100				
p-value	0.000				
Observations	30992				

Note: CI refers to confidence interval and LR refers to likelihood ratio. [#]income divided by 100. *refers to reference/base category (coded as 0).
Source: Compiled from NHMS III.

Widowed or divorced individuals have 1.858 times the odds as single individuals of smoking (OR: 1.858; 95% CI: 1.500, 2.300). Urban dwellers have 0.838 times the odds as rural dwellers of smoking (OR: 0.838; 95% CI: 0.778, 0.902). In terms of employment status, private sector employees (OR: 1.500; 95% CI: 1.350, 1.666), the self-employed (OR: 1.731; 95% CI: 1.560, 1.921) and students (OR: 0.318; 95% CI: 0.247, 0.410) have 1.500, 1.731 and 0.318 times the odds, respectively, as the unemployed of smoking.

4.5 Discussion

This study finds that age, income, gender, ethnicity, education, marital status, residing area and employment status are statistically significant in affecting individuals' likelihood of smoking. In particular, young individuals, low income earners, males, Malays, the less-educated, widowed or divorced individuals, rural dwellers, private sector employees and the self-employed are more likely to smoke compared to others.

4.5.1 Age

Age is found to be negatively correlated with individuals' likelihood of smoking, meaning that older individuals are less likely to smoke than younger individuals. This finding was also evidenced by Yen (2005b) and Aristei and Pieroni (2008), which found older individuals to have a lower probability of smoking than younger individuals. The explanation for this finding is that the rate of depreciation of health capital increases with individual's age because of the biological process of aging (Grossman, 1972). Hence, older individuals, being weaker, are more devoted to seek health investment by making efforts to avoid smoking than younger individuals. Nevertheless, as a result of

depreciating health capital, older individuals are also more aware of their own health condition, as well as, the negative consequences of unhealthy behaviour. Ironically, however, the finding of this study contradicts those of Cropper (1977) and Kenkel (2000) that age reduces individuals' preferences for health investment. Hence, it can be concluded that even though older individuals reap a shorter pay-off period of health investment than younger individuals, they have a higher propensity to invest in their health. The policy implication of this finding is that government intervention strategies should be directed at the youngsters to reduce the prevalence of smoking. In particular, these strategies should include the need to increase the minimum age to purchase and consume tobacco to at least 21 years of age. Although the legal age to purchase tobacco in Malaysia has been set at 18, it seems to be too low in the present society, especially given the increase in prevalence of smoking among youngsters. Additionally, detailed information about the disadvantages of smoking should reach out to the youngsters through the social media that has strong influences on that age group, such as, Facebook, Twitter and Yahoo.

4.5.2 Income

Consistent with the findings of Bauer et al. (2007) and Cawley and Ruhm (2012), income is negatively associated with the likelihood of smoking as lower income individuals are more likely to smoke than higher income individuals. This finding indicates that income is a factor that drives individuals to invest in their health, i.e. to avoid smoking, as wage is the return of health investment (Grossman, 1972; 2000). In other words, wage is the benefit that individuals receive when they convert their time into money-earning activities. Therefore, higher income individuals tend to reap a higher return from health investment, and consequently are less likely to smoke

(Grossman, 1972; 2000). The finding of this study implies that the recent action taken by the Ministry of Health Malaysia to ban all the promotions for cigarette, while allowing only the large size of cigarette pack to be sold in the market is promising (Lee, 2012). Although the main purpose of this intervention is to make the cigarette become unaffordable to consumers, they should be undertaken carefully, due to they may possibly lead to illegal sales of cigarette in the black market.

4.5.3 Gender

The finding of this study shows that gender plays a significant role in affecting smoking, as males have a higher likelihood of smoking than females, which lends support to those of Bilgic et al. (2010) and Lin (2010). Also, the finding of Cawley and Ruhm (2012) that males are less likely than females to engage in healthy behaviour is supported by this study. The differences in risk and social preferences across gender pointed out by Croson and Gneezy (2009) can be the plausible explanation for this finding. In particular, females are usually more risk averse and socially sensitive than males (Croson and Gneezy, 2009). Since smoking is a risky health behaviour, women tend to avoid smoking. Furthermore, smoking by females is less acceptable to the society than smoking by males, especially in the developing countries like Malaysia, thus females, who are more sensitive to social cues, are less likely to smoke than males. In light of the finding of this study, anti-smoking programmes should be targeted primarily at males if the goal of reducing the prevalence of smoking is to be achieved. It is well-worth considering the strategy suggested by Tan (2012) that the public health authorities should design nationwide health awareness campaigns with a specific focus on addressing the harmful effects of smoking on men's health, such as, prostate cancer, erectile dysfunction and low sperm count.

4.5.4 Ethnicity

This study finds a causal relationship between ethnicity and smoking, which supports the findings of Tan et al. (2009b) and Tan (2012) that ethnicity plays an important role in determining smoking. Comparing among the ethnic groups, Malays have the highest likelihood of smoking, whereas Chinese have the lowest. This is likely attributable to the culture and socioeconomic differences across ethnic groups (Lim et al., 2013). It appears, therefore, that the government should pay special attention to the influence of ethnicity on smoking when formulating population-based intervention measures. Two anti-smoking strategies are suggested based on the finding of this study. Firstly, health specialists, such as, medical doctors, pharmacists and nurses from Malay ethnic background should be invited to play the role as spokespersons in the designed nationwide anti-smoking programmes, such as, "Tak Nak" (Say No) to highlight the risk of smoking. Secondly, Malay language-based mass media, such as, television, radio, billboard and newspaper should be used as a channel to advertise the harmful effects of smoking on health and well-being, as well as, the increase in prevalence of smoking-induced diseases in the country.

4.5.5 Education

Levels of education are found to be significantly and negatively correlated with individuals' likelihood of smoking. This finding is consistent with those of Yen (2005b), Aristei and Pieroni (2008), Bilgic et al. (2010) and Lin (2010) that higher educated individuals are less likely to smoke than lower educated individuals. Furthermore, the findings of Currie and Moretti (2003), de Walque (2007), Grimard and Parent (2007), Cutler and Lleras-Muney (2010) and Cawley and Ruhm (2012) are also echoed by this

study. The explanation for this finding is that education improves the production of health by enhancing allocative and productive efficiency, meaning that education makes individuals more efficient at producing health by improving individuals' health knowledge (Grossman, 1972; Kenkel, 1991; Grossman, 2000). Since smoking causes adverse impacts on health, i.e. a negative health investment, well-educated individuals, who are efficient health producers, may tend to avoid it. Another plausible rationale is that high level of education is associated with a low rate of time preference (Fuchs, 1982; van der Pol, 2011). Individuals' with a lower rate of time preference tend to be more patient and future oriented, and consequently have a lower likelihood of indulging in unhealthy behaviour, i.e. smoking, than individuals' with a higher rate of time preference (Fuchs, 1982; van der Pol, 2011). The conclusion drawn from this finding is that education plays a very important role in reducing the prevalence of smoking. Therefore, the government should devote its attention to promoting health education throughout the nation. Specifically, the government should consider introducing more health related subjects and courses to the primary and secondary schools. This is to ensure individuals to acquire better knowledge on health and smoking since young because individuals are less likely to quit smoking once they start smoking at an earlier age (Zawahir et al., 2013). In addition, the government should also take an initiative to provide more health related reading materials, such as, magazines and books for the public, and these reading materials should be written in an easily understandable format to encourage reading from the less-educated.

4.5.6 Marital Status

In terms of marital status, widowed or divorced individuals are found to be significantly more likely to smoke compared to single individuals. A likely contributing factor for

this finding is that widowed or divorced individuals tend to suffer from emotional distress caused by marital disruptions (Kiecolt-Glaser et al., 1987), and consequently are more likely to use smoking as a way to relax and release their anxiety, whereas such situation is unlikely to occur among married individuals, who often receive social and psychological supports from their spouses (Hersch, 2000; Cho et al., 2008; Lim et al., 2013). However, the expectation that smoking is constrained by household activity is not supported by this study. Perhaps, this is because smoking is not a time-consuming activity like physical activity, thus, its participation is not highly subject to time constraint. Considering the finding of this study that divorce and widowhood can lead to smoking, government should set up professional bodies to provide counselling services and social supports for divorced and widowed individuals.

4.5.7 Residing Area

Conforming to the arguments of Alam et al. (2008) based on Pakistan data and Lim et al. (2013) using Malaysian data that residing area is significantly associated with smoking as rural dwellers are more likely to smoke than urban dwellers. This may be because of the lack of health related information in rural areas (Alam et al., 2008; Lim et al., 2013). As pointed out by the previous studies, smokers who lack health knowledge tend to underestimate the costs of smoking (Schoenbaum, 1997), and to be over-optimistic about their own health status (Smith et al., 2001; Khwaja et al., 2007), thus, resulting in overconsumption of tobacco. Based on the finding of this study that health information plays an important role in determining smoking, especially in rural areas, the public health authorities should put more efforts into increasing health awareness among rural dwellers. In addition to the introduction of pictorial and text warning labels on tobacco products, the Ministry of Health Malaysia should organise more anti-smoking related

seminars, workshops and campaigns in the rural areas to educate the dwellers about the negative impacts of smoking on health and well-being.

4.5.8 Employment Status

In corroboration with the findings of Bauer et al. (2007), employment status is found to have significant impact on smoking. Compared to the unemployed, private sector employees and the self-employed are more likely to smoke, whereas students are less likely to smoke. Two reasons may explain this finding. Firstly, employed individuals tend to suffer from job pressure, and consequently have an intention to smoke, which can yield instantaneous pleasures and relieve stress (Childs and de Wit, 2010). Secondly, students tend to face more constraints in smoking compared to the unemployed, as smoking is strictly prohibited in universities and colleges. In terms of policy implication, intervention strategies directed at employed individuals can potentially help reduce the smoking prevalence. Given the effectiveness of workplace health promotion programmes organised in Kuala Lumpur (Malaysia) (Moy et al., 2006; 2008), the extension of such programmes to the whole nation seems worthy of consideration. Nonetheless, while prohibition of smoking in public areas and workplaces has been implemented, the authorities should further strengthen the rules and regulations in an effort to reduce smoking among the employed.

4.6 Summary

Using the latest nationally representative data and rigorous statistical methods, this study finds that smoking is significantly associated with serious health problems (hypertension, hypercholesterolemia and diabetes), and economic and socio-

demographic factors are significant in determining smoking among adults in Malaysia. Therefore, the government should take account of the factors that can influence smoking when formulating nationwide policies. However, owing to the limited availability of data, two limitations are noted. Firstly, two important variables that can affect smoking cannot be included in this study. Among them are presence of children in a household and household size. Secondly, this study cannot examine the amount of tobacco that the respondents consume per day.

CHAPTER 5

PHYSICAL ACTIVITY

5.1 Introduction

Physical activity plays an important role in determining morbidity and mortality worldwide. Physical inactivity is responsible for 3 million of deaths and 32 million of disability-adjusted life year (DALY) annually, placing it as the fourth highest health risk factor in the world (WHO, 2012d). NCDs, such as, diabetes, cancer and CVDs are more prevalent among physically inactive adults than physically active adults (Panagiotakos et al., 2007; Humphreys and Ruseski, 2011). There is evidence to suggest that 150 minutes of participation in moderately intense physical activity per week can significantly reduce the risk of NCDs by about 30% (WHO, 2012d). More specifically, Nicklett et al. (2012) found that physically active women had a 50% lower probability of dying prematurely compared to physically inactive women. In addition, Helmrich et al. (1991) and LaMonte et al. (2005) found that frequent participation in physical activity could reduce up to 45% of risk of diabetes.

Given today's busy and hectic lifestyle, people seldom spend enough of time on physical activity. As reported by WHO (2012d), more than a quarter of males and females in the world failed to meet the recommended physical activity guideline in 2008. In Malaysia, approximately 36% of adults were physically inactive in 2011, of which a large proportion were females and the elderly (Institute for Public Health, 2011). Drawing on data from the Malaysian Adults Nutrition Survey (MANS), Poh et al. (2010)

found that only 31% and 14% of Malaysian adults had ever-exercised and adequate exercise, respectively.

The important role of physical activity in health causes the issue concerning the factors affecting participation in physical activity to receive a great deal of attention in literature (Farrell and Shields, 2002; Downward, 2007; Humphreys and Ruseski, 2007; Downward and Rasciute, 2010; Eberth and Smith, 2010; Humphreys and Ruseski, 2011). In Malaysia, although there is a growing number of studies examining the factors affecting participation in physical activity (Dan et al., 2007; Aniza and Fairuz, 2009; Cheah, 2011; Kee et al., 2011; Siti Affira et al., 2011), the studies do not use a nationally representative data for analysis, thus, have not contributed much to the literature. The main objective of this study is to fill this research gap.

This study attempts to contribute to the literature and society in several ways. Firstly, the focus of this study is on Malaysia, where physically inactive adults and NCDs are prevalent. Secondly, the latest nationally representative sample comprising a large sample size and detailed information on individual's socio-demographic, lifestyle and health profiles is exploited for a robust analysis, thus, important findings can be generated. Thirdly, the findings of this study can provide the public policy makers with a useful guideline for developing a better population-based intervention strategy directed at increasing the prevalence of physical activity.

5.2 An Economic Analysis of Demand for Physical Activity

This study uses SLOTH model developed by John Cawley to explain participation in physical activity (Cawley, 2004). It is an economic framework that describes how

individuals allocate their time for their daily activities in order to maximise the utility received. In general, the SLOTH model can be expressed as:

$$U(S, L, O, T, H) \tag{5.1}$$

where, U is utility; S is the time spent on sleeping; L is the time spent on leisure activity; O is the time spent on occupation; T is the time spent on transportation; and H is the time spent on home activity. The amount of utility received from participating in these activities varies across individuals as different individuals may have different tastes and preferences.

Since there are only 24 hours per day, the sum of the time spent on SLOTH equals to 24. Hence, the time constraint based on SLOTH model can be written as:

$$S + L + O + T + H = 24 \tag{5.2}$$

When individuals can spend their time efficiently, they will gain equal marginal net utility for an hour spent on each type of activity, meaning that individuals' utility will be maximised regardless of which daily activity that they engage in, as long as, their time is used efficiently. For example, if the marginal net utility of spending an hour on working activity is higher than physical activity, i.e. leisure activity, rational individuals will increase their time spent on working activity until the marginal net utility for an hour spent on working activity and physical activity becomes equal. However, if the marginal net utility of spending an hour on physical activity rises dramatically (holding the marginal net utility of spending an hour on working activity constant), rational

individuals will reallocate their time and prefer to increase their time spent on physical activity.

As pointed out by Cawley (2004), individuals' consumption utility is subject to their budget constraint. Owing to the limited resources, individuals need to choose between health related goods and non-health related goods. However, the amount of utility received from consuming these goods varies across individuals as different individuals may have different tastes and preferences. Assuming that individuals are not allowed to borrow money, the money that individuals can spend on health and non-health related goods equals to their income. In general, the budget constraint can be expressed as:

$$Y.P_Y + X.P_X = W.O \tag{5.3}$$

where, Y is the amount of non-health related goods purchased; P_Y is the price of non-health related goods; X is the amount of health related goods purchased; P_X is the price of health related goods; W is hourly wage; and O is the time spent on occupation.

When individuals can spend their money efficiently, they will gain equal marginal net utility for a dollar spent on each type of goods. For instance, if the marginal net utility of spending a dollar on non-health related goods is higher than sporting goods, i.e. health related goods, individuals will increase their money spent on non-health related goods until the marginal net utility for a dollar spent on non-health related goods and sporting goods becomes equal. However, if the marginal net utility of spending a dollar on sporting goods rises tremendously (holding the marginal net utility of spending a dollar on non-health related goods constant), individuals will reallocate their money and prefer to increase their money spent on sporting goods.

Cawley (2004) concluded that health is one of the things that can yield utilities and benefits to people, which means that people do value other things beside than health. Therefore, rational people may sometimes choose to forgo their health for other things that they value more. For this reason, some people, especially those who value their present outcomes more greatly than their future, i.e. exhibit a high rate of time preference, are less likely to engage in physical activity because physical activity will only yield health benefits in the future when diseases are successfully prevented. In other words, the lag between participation in physical activity and positive health outcomes reduces individuals' propensity to engage in a physically active lifestyle.

5.3 Methodology

The methodology section presents the data used in this study, the selection of variables, and the econometric model, which is applied to examine the factors affecting the likelihood of being physically active.

5.3.1 Data

This study used data from the Third National Health and Morbidity Survey (NHMS III), which was the latest nationally representative cross-sectional population-based survey conducted by the Ministry of Health Malaysia over the period April 2006 to January 2007. The survey covered all the urban and rural areas in the 13 states of Malaysia, as well as, the federal territory of Kuala Lumpur. Following the sampling frame designed by the Department of Statistics Malaysia, a two stage stratified sampling approach proportionate to the size of population in Malaysia was used to collect the data. The first stage sampling unit was based on geographically contiguous areas of the country

[Enumeration Blocks (EB)]. The second stage sampling unit was based on the Living Quarters (LQ) in each EB, and all the households and individuals that resided in the selected LQ participated. In particular, each EB consisted of 80-120 LQ with a population of about 600. The EB were based on the population of gazetted and built-up areas [i.e. urban (≥10000 populations) and rural (<10000 populations)].

The inclusion criteria of the survey were: one, all adults aged 18 years old and above; two, all gender; three, all ethnic groups; and four, Malaysian citizens. The target sample size was calculated based on three criteria: one, 95% confidence interval; two, the prevalence and response rate of the Second National Health and Morbidity Survey (NHMS II); and three, the calculated margin of error and design effect. More detailed information about the calculation was described in Institute for Public Health (2008). The calculated target sample size was 34539 respondents, which represented 12923504 Malaysian adults. The targeted household member was classified as 'no response' after three consecutive unsuccessful visits. The overall response rate was about 98.20% (33933 respondents).

The piloted bi-lingual (*Bahasa Malaysia* and English) questionnaires were used by the trained health professionals to interview face-to-face the respondents. During the interview, questions regarding work, travel and leisure related physical activity were addressed. Besides, the respondents were also asked to self-report their socio-demographic, lifestyle and health profiles. Meanwhile, if the respondents reported that they did not have hypertension or hypercholesterolemia, their blood pressure and blood cholesterol were examined by the health professionals using Omron Digital Automatic Blood Pressure Monitor Model HEM-907 and Accutrend GC – Roche Diagnostic's battery-operated gluco-photometer. The respondents were classified as having

hypertension if their systolic blood pressure was ≥140 and diastolic blood pressure was ≥90mmHg, and were classified as having hypercholesterolemia if their blood cholesterol was ≥5.2mmol/L. Besides, if the respondents reported that they were not diabetics, their blood glucose was tested using Accutrend GC – Roche Diagnostic's battery-operated gluco-photometer. If the respondents' blood glucose was ≥6.1mmol/L (after eight hours of fasting), they were referred to the nearest clinics or hospitals for further examination.

5.3.2 Model Development

The following variables were selected, and were hypothesised to affect individuals' decision to participate in physical activity: one, age; two, income; three, gender; four, ethnicity; five, education; six, marital status; seven, residing area; and eight, employment status. The selection of these independent variables was based on the previous empirical studies examining the factors affecting participation in physical activity (Kaplan et al., 2001; Farrell and Shields, 2002; Downward, 2007; Downward and Riordan, 2007; Lechner, 2009; Humphreys and Ruseski, 2009; Eberth and Smith, 2010; Humphreys and Ruseski, 2011).

5.3.2.1 Age

The previous studies found causal relationship between age and participation in physical activity. Drawing on data from the 2002 General Household Survey, Downward and Riordan (2007) applied a Heckman model to investigate the determinants of participation in physical activity. The study found that age reduced individuals' likelihood of participating in physical activity, meaning that older individuals were less

likely to be physically active than younger individuals. Kaplan et al. (2001) made use of the Canadian National Population Health Survey consisting of 12611 respondents for analysis. The study also found age to be negatively associated with individuals' likelihood of participating in physical activity. Since physical activity was a health investment, individuals of different age may exhibit difference preferences for it as rate of depreciation of health capital varied across age (Grossman, 1972; Cropper, 1977; Kenkel, 2000). To examine the impact of age on participation in physical activity, the respondents' age (in years) was included.

5.3.2.2 Income

Income appeared to have significant impact on participation in physical activity. Farrell and Shields (2002) examined the influence of economic factors on physical activity participation in England. The study found that income was positively correlated with individuals' probability of engaging in a physically active lifestyle as lower income households were 11.6% less likely to participate in physical activity than higher income households. Using the Behavioral Risk Factor Surveillance System (BRFSS) dataset of US, Humphreys and Ruseski (2011) applied an economic model to explore the factors affecting participation in physical activity. The finding of the study showed that higher income individuals were more likely to participate in physical activity than lower income individuals. Furthermore, using the National Health Interview Survey (NHIS), Cawley and Ruhm (2012) found that physical activity was more prevalent among higher income individuals than lower income individuals. The relationship between income and physical activity could be explained by the substitution and income effect (Humphreys and Ruseski, 2006; 2011). To explore the impact of income on

participation in physical activity, the respondents' monthly individual income (in RM) was included.

5.3.2.3 Gender

There was evidence suggesting that gender could influence individuals' decision to participate in physical activity. Using data from the 2002 General Household Survey of UK, Downward (2007) found that the likelihood of participating in physical activity varied across gender as males were more likely to participate in physical activity relative to females. Scheerder et al. (2005) exploited three Belgium large-scale cross-sectional surveys for analysis. The study found that adult females had a 20% lower likelihood of participating in physical activity than adult males. Wicker et al. (2009) used a survey conducted in the city of Stuttgart to examine the impact of sport facilities on individuals' decision to participate in sport activity. The study found males to possess higher odds of being physically active compared to females. In addition, Humphreys and Ruseski (2006) drew on the Behavioral Risk Factor Surveillance System (BRFSS) dataset to investigate the participation in physical activity among adults in US. The study found that females were about 2% less likely to participate in physical activity than males. Interestingly, Cawley and Ruhm (2012) found that while females were less likely to indulge in unhealthy behaviour, such as, smoking and alcohol drinking than males, they were more likely to be physically inactive. The effect of gender on physical activity could be explained by the fact that individuals of different gender may face different levels of time constraint in physical activity participation (Humphreys and Ruseski, 2006; Ruseski et al., 2011). Therefore, the respondents' gender was included.

5.3.2.4 Ethnicity

The previous studies found significant influence of ethnicity on participation in physical activity in western countries. For example, Farrell and Shields (2002), Humphreys and Ruseski (2006), Downward and Rasciute (2010) and Humphreys and Ruseski (2011) found that ethnic White and Black possessed different likelihood of participating in physical activity because of the cultural differences and unequal privileges in accessing sport facilities. In Malaysia, Cheah (2011) conducted a cross-sectional population-based survey in Penang (Malaysia). The study found that adults of different races had different odds of participating in leisure-time physical activity. To assess the causal relationship between ethnicity and physical activity, the respondents' ethnic backgrounds were included, and were divided into three categories, i.e. Malay, Chinese and Indian or others.

5.3.2.5 Education

The association between education and physical activity was found to be significant. Wu and Porell (2000) used data from the 1992 Health and Retirement Study containing 6433 respondents to examine the factors affecting participation in physical activity among adults in US. The study found higher educated individuals to be more aware of the benefits of physical activity, and thus, were more likely to participate in physical activity than lower educated individuals. Lechner (2009) made use of data from the German Socio-Economic Panel study (GSOEP) 1984–2006. The study found that levels of education had positive impact on individuals' probability of participating in physical activity. In addition, Cawley and Ruhm (2012) suggested that tertiary educated individuals were 22.3% less likely to be physically inactive than non-tertiary educated

individuals. Using the National Health Interview Survey, Kenkel (1991) found that the higher the levels of individuals' education, the more likely that individuals were to engage in healthy behaviour. Cutler and Lleras-Muney (2010) used two countries of dataset to investigate the effect of education on health behaviour, and found a similar outcome that education increased individuals' likelihood of living a healthy lifestyle. The explanation for these findings was that education could improve individuals' health knowledge, thus, so did the allocative and productive efficiency of producing health (Grossman, 1972; Kenkel, 1991; Grossman, 2000). Also, well-educated individuals tended to have a low rate of time preference, i.e. exhibited more patient and future oriented characteristic, and consequently were more likely to live a healthy lifestyle compared to less-educated individuals (Fuchs, 1982; van der Pol, 2011). In this study, the respondents' education levels were included, and were divided into three categories, i.e. primary, secondary and tertiary.

5.3.2.6 Marital Status

Applying a micro-economic theory to examine the determinants of participation in physical activity among adults in England, Downward and Rasciute (2010) found that married adults were less likely to participate in physical activity than unmarried adults. Eberth and Smith (2010) used data from the 2003 Scottish Health Survey to examine the participation and time spent in physical activity. The study found that single women were more likely to participate in physical activity and to spend more time in physical activity than non-single women. Humphreys and Ruseski (2009) examined the influence of economic factors on participation in physical activity. The study found that married individuals tended to spend less time in physical activity than unmarried individuals. As pointed out by the previous studies, household commitments could be the explanation

for these findings (Downward and Rasciute, 2010; Eberth and Smith, 2010; Ruseski et al., 2011). In this study, the respondents' marital status was used, and was categorised into three categories, i.e. single, married and widowed or divorced.

5.3.2.7 Residing Area

There were findings to suggest that residing area was significantly associated with individuals' likelihood of participating in physical activity. As pointed out by Wicker et al. (2009), a paucity of sport facilities may pose as a barrier to participation in physical activity. In particular, the study found that undersupply of fitness centre, recreational parks and sports fields in Stuttgart (Germany) was the main factor causing physical inactivity among the dwellers. Also, Scheerder et al. (2005) claimed that individuals who resided in the areas of Flanders (Belgium), where consisted of sufficient sport facilities, were more likely to be physically active than individuals who resided in the areas where consisted of insufficient sport facilities. Interestingly, however, Ruseski et al. (2011) found that individuals who needed to travel a longer distance to physical activity settings, i.e. those faced higher costs of using sport facilities, were more likely to participate in physical activity than individuals who travelled a shorter distance because they tended to make a greater commitment to participate in physical activity. In this study, the respondents' residing area was included, and was grouped into two categories based on the guideline of Department of Statistics Malaysia, i.e. urban (metropolitan and urban large or gazetted areas $\geq$ 10000 populations) and rural (urban small and rural or gazetted areas < 10000 populations).

5.3.2.8 Employment Status

Using a copula model for analysis, Eberth and Smith (2010) found that employment status could significantly affect individuals' likelihood of participating in physical activity as retirees were more likely to participate in physical activity than the employed. This was simply because of the influence of time constraints as retirees tended to have more free time on hands for physical activity than the employed. In addition, Wu and Porell (2000) claimed that the likelihood of participating in physical activity could vary across individuals' job characteristics. In particular, the study emphasised that different job of workers may face different level of stress associated with job, which could, in turn, influence the workers' propensity to participate in physical activity. Given the wide set of data available to use, the respondents' employment status was included, and was grouped into five categories, i.e. civil servant, private sector employee, self-employed, student and unemployed (including housewife and retiree).

5.3.3 Econometric Specification

This study uses 'physical activity' as the dependent variable with 1 representing 'physically active' and 0 otherwise. In general, physical activity is defined as "any bodily movement produced by the skeletal muscles which results in energy consumption" (Caspersen et al., 1985). Following the guideline of Ministry of Health Malaysia, the respondent who spends at least 150 or 60 minutes per week in moderate or vigorous work, travel and leisure related physical activity is categorised as 'physically active', otherwise the respondent is categorised as 'physically inactive'. The details about this measurement have been described elsewhere (Institute for Public Health, 2008).

Since the dependent variable is a binary variable, the logit model is applied for the statistical analysis, given that it can predict the probability that lies between the unit intervals (Greene, 2007). In exploring the residuals, it is found that the value of Jarque-Bera statistic is 4171, which has a p-value of less than 0.05. Hence, the null hypothesis can be rejected, and this concludes that the residuals are not normally distributed, indicating that the logit model is the appropriate one. In general, the logit model can be written as follow:

$$\log \frac{P}{1-P} = \alpha + \beta_i X_i + \varepsilon \qquad (5.4)$$

where, P is the probability that a respondent is physically active; 1 – P is the probability that a respondent is physically inactive; P/(1 – P) is the odds that a respondent is physically active; X are the independent variables which are hypothesised to affect the probability of being physically active; β are coefficients for the independent variables; and ε is the error term.

Statistical tests of proportion are performed to sustain the statistical significance of differences between physically active individuals and physically inactive individuals among the respondents. Chi-square and Fisher's exact tests are carried out to assess the causal relationship between diagnosed outcomes (hypertension, hypercholesterolemia and diabetes) and physical activity.[7] Both Likelihood Ratio (LR) and Pearson χ^2 tests are conducted to test the goodness-of-fit of the regression model. Correlation coefficients between income, age, gender, residing area, education and employment status variables are estimated in order to diagnose the potential multicollinearity

[7] The respondents who reported to have hypertension, hypercholesterolemia or diabetes, or are diagnosed with hypertension, hypercholesterolemia or diabetes during the survey are categorised as 'being diagnosed with hypertension, hypercholesterolemia or diabetes'.

problems. Furthermore, variance inflation factor (VIF) test for all the independent variables is also conducted to detect the multicollinearity problems. The significant level of all the tests is based on p-value of less than 5% (two-sided). After rejecting the respondents with incomplete information, a total of 30992 are used for analysis. The statistical analysis is performed using Stata statistical software (StataCorp, 2005).

5.4 Results

The results section presents the characteristics of the survey respondents of this study, the relationship between diagnosed outcomes and physical activity, as well as, the factors that affect the odds of being physically active.

5.4.1 Characteristics of the Survey Respondents

The characteristics of the survey respondents are illustrated in Table 5.1. Of the total 30992 respondents, 17519 (56.52%) are physically active individuals, whereas 13473 (43.47%) are physically inactive individuals. The average age of the total respondents is about 42.10 years old. The average age of the physically inactive respondents (43.93 years old) ($p = 0.000$) is older than the average age of the physically active respondents (40.70 years old) ($p = 0.000$). The average monthly individual income of the total respondents is approximately RM 1963.05. The average monthly individual income of the physically active respondents (RM 1922.46) ($p = 0.002$) is lower than the average monthly individual income of the physically inactive respondents (RM 2015.84) ($p = 0.002$).

Table 5.1: Descriptive analysis of independent variables when physical activity is used as the dependent variable

Variables	Physically active (n_1 = 17519)		Physically inactive (n_2 = 13473)		Total sample (n = 30992)
	Mean/%*	p-value	Mean/%*	p-value	Mean/%*
Age	40.70 [14.58]	0.000	43.93 [16.85]	0.000	42.10 [15.69]
Income	1922.46 [2424.00]	0.002	2015.84 [2968.00]	0.002	1963.05 [2674.48]
Gender					
Male	64.87	0.000	35.13	0.000	44.39
Female	49.87	0.000	50.13	0.000	55.61
Ethnicity					
Malay	57.97	0.000	42.03	0.000	56.51
Chinese	53.18	0.000	46.82	0.000	21.56
Indian/others	56.09	0.414	43.91	0.414	21.93
Education					
Tertiary	55.77	0.360	44.23	0.360	10.32
Secondary	59.48	0.000	40.52	0.000	51.69
Primary	52.72	0.000	47.28	0.000	37.99
Marital status					
Married	56.67	0.438	43.33	0.438	71.32
Widowed/divorced	42.54	0.000	57.46	0.000	7.83
Single	61.31	0.000	38.69	0.000	20.85
Residing area					
Urban	54.51	0.000	45.49	0.000	59.42
Rural	59.48	0.000	40.52	0.000	40.58
Employment status					
Civil servant	65.35	0.000	34.65	0.000	9.93
Private sector	62.01	0.000	37.99	0.000	28.82
Self-employed	66.08	0.000	33.92	0.000	19.59
Student	56.19	0.826	43.81	0.826	3.18
Unemployed	45.31	0.000	54.69	0.000	38.48

Note: *For age and income variables, the value refers to mean [standard deviation], whereas for the other variables, the value refers to percentage.
Source: Compiled from NHMS III.

The total sample comprises 44.39% males and 55.61% females. About 64.87% (p = 0.000) of males are physically active, compared to only 49.87% (p = 0.000) of females, thus, indicating that physical activity is more prevalent among males than females.

Overall, the ethnic breakdown consists of 56.51% Malays, 21.56% Chinese and 21.93% Indian or others. The prevalence of being physically active is higher among Malays (57.97%) ($p = 0.000$) than Chinese (53.18%) ($p = 0.000$).

A large proportion of the respondents have secondary education (51.69%), followed by the respondents with primary (37.99%) and tertiary education (10.32%). About 59.48% ($p = 0.000$) of the secondary educated respondents are physically active, compared to only 52.72% ($p = 0.000$) of the primary educated respondents, thus, showing that physical activity is more common among secondary educated individuals than primary educated individuals. In terms of marital status, around 71.32%, 20.85% and 7.83% of the respondents are married, single and widowed or divorced, respectively. Physical activity is more prevalent among the single respondents (61.31%) ($p = 0.000$) than the widowed or divorced respondents (42.54%) ($p = 0.000$).

About 59.42% and 40.58% of the total respondents reside in urban and rural areas, respectively. The proportion of rural dwellers (59.48%) ($p = 0.000$) being physically active is higher than urban dwellers (54.51%) ($p = 0.000$). A large proportion of the respondents are unemployed (38.48%), followed by private sector employees (28.82%), the self-employed (19.59%), civil servants (9.93%) and students (3.18%). Among the respondents of different employment status, physical activity is most widespread among the self-employed respondents (66.08%) ($p = 0.000$), whereas is least common among the unemployed respondents (45.31%) ($p = 0.000$).

5.4.2 Association between Diagnosed Outcomes and Physical Activity

Exploring the relationship between hypertension and physical activity, the Chi-square with one degree of freedom is 37.925, which has a p-value of less than 0.05, and the p-value for Fisher's exact test is also less than 0.05, thus, indicating a significant causal relationship between hypertension and physical activity (Table 5.2).

Table 5.2: The association between hypertension and physical activity

	Hypertension	Non- hypertension	Total
Physically active	6526	10993	17519
Physically inactive	5482	7991	13473
Total	12008	18984	30992

Note: Chi-square with one degree of freedom = 37.925; p-value = 0.000. P-value for Fisher's exact test = 0.000.
Source: Compiled from NHMS III.

Examining the relationship between hypercholesterolemia and physical activity, the Chi-square with one degree of freedom is 0.867, which has a p-value of more than 0.05, and the p-value for Fisher's exact test is also more than 0.05, thus, suggesting that there is no causal relationship between hypercholesterolemia and physical activity (Table 5.3).

Table 5.3: The association between hypercholesterolemia and physical activity

	Hypercholesterolemia	Non-hypercholesterolemia	Total
Physically active	4136	13383	17519
Physically inactive	3242	10231	13473
Total	7378	23614	30992

Note: Chi-square with one degree of freedom = 0.867; p-value = 0.352. P-value for Fisher's exact test = 0.353.
Source: Compiled from NHMS III.

Analysing the relationship between diabetes and physical activity, the Chi-square with one degree of freedom is 30.412, which has a p-value of less than 0.05, and the p-value

for Fisher's exact test is also less than 0.05, thus, showing a significant causal relationship between diabetes and physical activity (Table 5.4).

Table 5.4: The association between diabetes and physical activity

	Diabetes	Non-diabetes	Total
Physically active	1930	15589	17519
Physically inactive	1760	11713	13473
Total	3690	27302	30992

Note: Chi-square with one degree of freedom = 30.412; p-value = 0.000. P-value for Fisher's exact test = 0.000.
Source: Compiled from NHMS III.

5.4.3 Factors Affecting the Odds of Being Physically Active

The results of the logit analysis of being physically active are presented in Table 5.5. The value of LR χ^2 with 14 degrees of freedom is 1621.670, which has a p-value of less than 0.05. Hence, the null hypothesis can be rejected, which indicates that the current regression model fits the data well. Furthermore, the value of Pearson χ^2 with 25587 degrees of freedom is 25663.210, which has a p-value of more than 0.05. Therefore, the null hypothesis cannot be rejected, and this concludes that the current regression model is robust. The calculated correlation coefficients between income, age, gender, residing area, education and employment status variables imply that there is no serious multicollinearity problem in the current regression model (see Appendix A). Also, the VIF values of all the independent variables are less than five, which further concludes that multicollinearity does not exist in the current regression model (Studenmund, 2006) (see Appendix B).

Table 5.5: Results of the logit analysis of being physically active

Variables	Estimated coefficient	Standard error	Odds ratio	95% CI	P-value
Age	-0.011	0.001	0.989	0.987, 0.991	0.000
Income[#]	-0.002	0.001	0.998	0.997, 0.999	0.000
Gender					
Male	0.418	0.027	1.519	1.442, 1.600	0.000
Female*	–	–	1.000	–	–
Ethnicity					
Malay	0.061	0.030	1.062	1.002, 1.127	0.043
Chinese	-0.011	0.037	0.989	0.920, 1.064	0.773
Indian/others*	–	–	1.000	–	–
Education					
Tertiary	-0.218	0.049	0.804	0.730, 0.886	0.000
Secondary	0.002	0.031	1.002	0.943, 1.064	0.958
Primary*	–	–	1.000	–	–
Marital status					
Married	0.045	0.036	1.046	0.974, 1.123	0.218
Widowed/divorced	-0.136	0.061	0.873	0.775, 0.984	0.027
Single*	–	–	1.000	–	–
Residing area					
Urban	-0.168	0.026	0.845	0.803, 0.889	0.000
Rural*	–	–	1.000	–	–
Employment status					
Civil servant	0.651	0.046	1.918	1.751, 2.101	0.000
Private sector	0.441	0.033	1.554	1.456, 1.658	0.000
Self-employed	0.621	0.035	1.861	1.736, 1.994	0.000
Student	0.141	0.074	1.152	0.996, 1.333	0.057
Unemployed*	–	–	1.000	–	–
Constant	0.341	0.061	–	–	0.000
LR χ^2 (14)	1621.670				
p-value	0.000				
Pearson χ^2 (25587)	25663.210				
p-value	0.3671				
Observations	30992				

Note: CI refers to confidence interval and LR refers to likelihood ratio. [#]income divided by 100. *refers to reference/base category (coded as 0).
Source: Compiled from NHMS III.

The results of this study demonstrates that an additional year of age reduces individuals' odds of being physically active by 0.011 times (OR: 0.989; 95% CI: 0.987, 0.991), while an increase of RM 100 in monthly individual income decreases individuals' odds of being physically active by 0.002 times (OR: 0.998; 95% CI: 0.997, 0.999). With regard to gender, males are found to have 1.519 times the odds as females of being physically active (OR: 1.519; 95% CI: 1.442, 1.600).

Malays have 1.062 times the odds as Indian or others of being physically active (OR: 1.062; 95% CI: 1.002, 1.127). Tertiary educated individuals have 0.804 times the odds as primary educated individuals of being physically active (OR: 0.804; 95% CI: 0.730, 0.886). In terms of marital status, widowed or divorced individuals are found to have 0.873 times the odds as single individuals of being physically active (OR: 0.873; 95% CI: 0.775, 0.984).

Urban dwellers have 0.845 times the odds as rural dwellers of being physically active (OR: 0.845; 95% CI: 0.803, 0.889). With regard to employment status, civil servants (OR: 1.918; 95% CI: 1.751, 2.101), private sector employees (OR: 1.554; 95% CI: 1.456, 1.658) and the self-employed (OR: 1.861; 95% CI: 1.736, 1.994) have 1.918, 1.554 and 1.861 times the odds, respectively, as the unemployed of being physically active.

5.5 Discussion

This study finds age, income, gender, ethnicity, education, marital status, residing area and employment status to be statistically significant in affecting individuals' likelihood of participating in physical activity. More specifically, old individuals, high income

earners, females, Indian or others, the well-educated, widowed or divorced individuals, urban dwellers and the unemployed are less likely to participate in physical activity than others.

5.5.1 Age

Consistent with the arguments of Kaplan et al. (2001) using the Canadian National Population Health Survey, and Downward and Riordan (2007) using the 2002 General Household Survey of UK, age is found to be significantly and negatively correlated with individuals' likelihood of participating in physical activity, which means that older individuals are less likely to be physically active than younger individuals. However, this finding does not support the conclusion drawn by Grossman (1972) that age is positively associated with the probability of investing in health. There are two reasons to explain how age reduces the likelihood of participating in physical activity. Firstly, although older individuals face a higher rate of depreciation of health capital, their pay-off period of health investment, i.e., the benefit received from participating in physical activity, is shorter compared to younger individuals as health investment only generates benefits in the future when diseases are successfully prevented (Cropper, 1977; Kenkel, 2000). Secondly, aging poses as a barrier to participation in physical activity, meaning that older individuals tend to face greater difficulty in participating in physical activity than younger individuals. An important implication of this finding is that the government intervention strategies should be directed primarily at the elderly to promote participation in physical activity. In efforts to increase the prevalence of physical activity among this group of individuals, the government should consider building more elderly-oriented sport facilities, as well as, organising more low- and moderate-intensity sport activities in the recreational parks.

5.5.2 Income

Surprisingly, income is found to be negatively associated with individuals' likelihood of being physically active, meaning that higher the levels of individuals' income, the less likely that individuals are to participate in physical activity. This finding contradicts those of Farrell and Shields (2002), Humphreys and Ruseski (2011) and Cawley and Ruhm (2012) that income increases individuals' probability of participating in physical activity. The substitution and income effects may be the contributing factors for this finding (Humphreys and Ruseski, 2006; 2011). On one hand, as income increases, so does the opportunity cost of non-working time. Hence, higher income individuals, who have higher wages per hour, may tend to find working activity more attractive than physical activity, and consequently are more likely to substitute working activity for physical activity. This is known as substitution effect. On the other hand, assuming that physical activity is a normal good, i.e. consumption rises with income, higher income individuals tend to participate in physical activity more frequently than lower income individuals. This is known as income effect. Since the finding of this study shows income to be negatively correlated with participation in physical activity, it can be concluded that substitution effect dominates in this study. Based on the finding of this study, an intervention strategy focusing on promoting physical activity among the rich can ensure effective outcomes. In particular, the Ministry of Health Malaysia should introduce more nationwide health awareness programmes with a specific focus on delivering detailed information about the importance and benefits of physical activity, as well as, how to stay physically active without spending a long time on exercise to the rich.

5.5.3 Gender

Gender is found to be significant in affecting participation in physical activity as males are more likely to participate in physical activity than females, which is consistent with the findings of Scheerder et al. (2005), Humphreys and Ruseski (2006), Downward (2007), Wicker et al. (2009) and Cawley and Ruhm (2012). A plausible reason for this finding is that females possess the natural family care taker characteristic, thus, they tend to face tighter time constraints in participation in physical activity than males as they often need to spend more time on household activity, such as, caring for relatives and children (Humphreys and Ruseski, 2006; Ruseski et al., 2011). Since individuals' propensity to participate in physical activity is subject to their time spent on other activities (Cawley, 2004), the extra time that females allocate for household activity poses as a restriction to participation in physical activity. In terms of policy implication, females should be given particular attention by the public health authorities if the goal of increasing the prevalence of physical activity is to be achieved. As an intervention measure towards promoting physical activity among females, a successful policy should make the home-based workout television programmes educating females about how to stay physically active without joining health club or going to recreational park more available to the public.

5.5.4 Ethnicity

The results of this study show that ethnicity plays a significant role in determining individuals' likelihood of participating in physical activity, which lend support to that of Cheah (2011) based on a primary survey of Penang (Malaysia). It is found that Malays are more likely to participate in physical activity than Indian and others, thus,

concluding that cultural, religious and socioeconomic backgrounds may influence individuals' preferences for physical activity. The policy implication of this finding is that the government should urgently develop an intervention strategy focusing on increasing the awareness of being physically active among Indian and others. Specifically, this strategy should include the need to use health and fitness specialists, such as, physicians, nurses and national sport coaches from Indian and others ethnic backgrounds to highlight the importance of physical activity in the nationwide health awareness campaigns. Nevertheless, using Indian and English language-based mass media, such as, newspapers, magazines, television programmes and radio channels to advertise the benefits of physical activity is also worthy of consideration.

5.5.5 Education

Astonishingly, higher educated individuals are found to be less likely to participate in physical activity than lower educated individuals, which contradicts the findings of Wu and Porell (2000), Lechner (2009), Cutler and Lleras-Muney (2010) and Cawley and Ruhm (2012) that levels of education increase individuals' likelihood of participating in physical activity. Although well-educated individuals have good allocative and productive efficiency of producing health (Grossman, 1972; Kenkel, 1991; Grossman, 2000) and a low rate of time preference (Fuchs, 1982; van der Pol, 2011), they tend to engage in low physically demanding jobs (white-collar jobs). Conversely, however, while less-educated individuals are inefficient at producing health and also have a high rate of time preference, they tend to work in high physically demanding jobs (blue-collar jobs). Therefore, higher educated individuals are generally less physically active relative to lower educated individuals. Furthermore, the finding of this study can also be explained by the 'generalization theory' pointed out by Wu and Porell (2000). The

explanation is that individuals who work in physically demanding jobs, i.e. less-educated individuals, are more likely to participate in physical activity during their leisure time compared to individuals who work in less physically demanding jobs, i.e. well-educated individuals. The finding of this study implies that the public health policy directed primarily at well-educated individuals to promote participation in physical activity can potentially help reduce the prevalence of physical inactivity. It is suggested that the workplace health promotion programmes should focus on increasing the levels of physical activity among individuals who hold the managerial and administrative positions by providing them education about how to stay physically active during working hours, such as, use of staircase and walking meeting.

5.5.6 Marital Status

The significant causal relationship between marital status and participation in physical activity suggests that family commitment plays an important role in influencing individuals' likelihood of participating in physical activity. This study finds that widowed and divorced individuals are less likely to engage in a physically active lifestyle than single individuals, which supports the findings of Downward and Rasciute (2010) and Eberth and Smith (2010). The fact of the matter is that widowed and divorced individuals tend to have less time on hand for physical activity because they carry more family responsibilities than single individuals. An additional hour spent on family can decrease individuals' likelihood of participating in physical activity, meaning that family responsibility reduces individuals' propensity to be physically active (Ruseski et al., 2011). Surprisingly, however, this study finds no differences in participation in physical activity between married and single individuals. Perhaps, this is because married individuals have spouses to share their family responsibilities. Two

intervention strategies are suggested based on the finding of this study. Firstly, since divorce can cause physical inactivity, successful policy should discourage people from divorcing. This can include using professional body to provide counselling services and social supports for individuals who face marital disruptions. Secondly, the government should put serious efforts into reducing the household commitments borne by widowed and divorced individuals. Child care centres and nursery schools, for instance, should be made more available in the residential areas. This is to ensure widowed and divorced individuals to have more time on hand for physical activity.

5.5.7 Residing Area

Contrary to the finding of Scheerder et al. (2005), this study finds that urbanites have a lower probability of participating in physical activity than rural dwellers. There are two reasons to explain this finding. Firstly, urban dwellers tend to live a busy and hectic lifestyle, and consequently, face more barriers to participation in physical activity than rural dwellers. Secondly, rural dwellers tend to face higher costs of participating in physical activity due to the lack of sports facilities in rural areas, thus, they are more committed to participating in physical activity than urban dwellers (Ruseski et al., 2011). It appears that the finding of this study does not support that of Wicker et al. (2009) that undersupply of sport facilities can result in physical inactivity. In view of the finding of this study, the public health authorities should concentrate their efforts on promoting physical activity among urban dwellers. It seems worthwhile to advocate using urban-based health promotion programmes, such as, seminars, conferences and workshops to educate urban dwellers about the importance of physical activity, as well as, how to incorporate physical activity into their busy lifestyle.

5.5.8 Employment Status

This study finds significant causal relationship between employment status and participation in physical activity as unemployed individuals are less likely to participate in physical activity than employed individuals (civil servants, private sector employees and the self-employed). Several factors contribute to this outcome. Firstly, since the type of physical activity examined in this study includes work related physical activity, it seems reasonable to find employed individuals to be more physically active than unemployed individuals. Secondly, based on the generalization theory, there is a positive correlation between work and participation in leisure-time physical activity, meaning that the greater the efforts that individuals put into works, the more likely that individuals are to participate in physical activity (Wu and Porell, 2000). In terms of policy implication, an intervention measure towards promoting physical activity among the unemployed can potentially help increase the prevalence of physical activity. As a suggestion, the government should devote their attention to building more public sport facilities and recreational parks around the residential areas to encourage the unemployed to engage in physical activity.

5.6 Summary

Considering the important role of physical activity in improving health, this study makes an effort to investigate the factors that affect individuals' likelihood of participating in physical activity. Using the latest nationally representative survey and rigorous statistical methods, this study finds that physical inactivity is significantly associated with serious health problems (hypertension and diabetes), and economic and socio-demographic factors can influence participation in physical activity among adults

in Malaysia. However, owing to the limited availability of data, this study excludes a few potentially important variables that may influence participation in physical activity, such as, presence of children in a family and the distance from workplace or home to physical activity settings. Also, this study could not segregate physical activity into work, travel and leisure categories for a more detailed individual analysis.

CHAPTER 6

CONCLUSIONS AND IMPLICATIONS

6.1 Synthesis of Findings

As a consequence of rapid urbanisation and industrialisation, NCDs and modifiable health risk factors, such as, cancer, diabetes, obesity, hypertension, hypercholesterolemia and CVDs are becoming more prevalent in today's society, and it cannot be denied that more and more people are suffering from such diseases and risk factors. In spite of this alarming evidence, a lot of people still engage in unhealthy behaviour, such as, alcohol drinking, smoking and physical inactivity. The paucity of studies examining the health behaviour in Malaysia, where NCDs and modifiable health risk factors are very prevalent, motivates this study to undertake an in-depth investigation of the factors that affect the likelihood of drinking alcohol, smoking and participating in physical activity among adults in Malaysia.

Data from the Third National Health and Morbidity Survey (NHMS III), which is the most recent nationally representative cross-sectional population-based sample consisting of 30992 respondents and detailed information on individual's socio-demographic, lifestyle and health profiles, is exploited for a robust analysis. Statistical tests of proportion are performed to sustain the statistical significance of differences between alcohol drinkers and non-alcohol drinkers, smokers and non-smokers, as well as, physically active individuals and physically inactive individuals among the respondents. Chi-square and Fisher's exact tests are carried out to assess the causal relationship between diagnosed outcomes (hypertension, hypercholesterolemia and

diabetes) and health behaviour (alcohol drinking, smoking and physical activity). Logit models are applied to examine the factors that influence individuals' likelihood of drinking alcohol, smoking and participating in physical activity. Two goodness-of-fit tests, i.e. Likelihood Ratio (LR) and Pearson χ^2, are conducted to assess the robustness of the regression models. Nevertheless, correlation coefficient matrix is used to diagnose the potential multicollinearity problem in the regression models.

The results of this study show that alcohol drinking is significantly associated with serious health problems (hypertension, hypercholesterolemia and diabetes). Age, income, gender, ethnicity, education, residing area and employment status are found to be statistically significant in determining individuals' likelihood of drinking alcohol. More specifically, young individuals, high income earners, males, Chinese, the well-educated, urban dwellers, civil servants, private sector employees, the self-employed and students are more likely to drink alcohol than others.

In terms of smoking, this study finds that smoking is significantly associated with serious health problems (hypertension, hypercholesterolemia and diabetes). The results of the logit analysis show that age, income, gender, ethnicity, education, marital status, residing area and employment status are statistically significant in affecting individuals' likelihood of smoking. In particular, young individuals, low income earners, males, Malays, the less-educated, widowed or divorced individuals, rural dwellers, private sector employees and the self-employed are more likely to smoke than others.

This study finds that physical inactivity is significantly associated with serious health problems (hypertension and diabetes). Age, income, gender, ethnicity, education, marital status, residing area and employment status are found to be statistically

significant in affecting individuals' likelihood of participating in physical activity. More specifically, older individuals, high income earners, females, Indian or others, the well-educated, widowed or divorced individuals, urban dwellers and the unemployed are less likely to participate in physical activity than others.

6.2 Implications for Theory

The relationship between age and health behaviour appears to be mixed. On one hand, age is negatively associated with individuals' probability of drinking alcohol and smoking, which strongly supports the demand for health theory developed by Grossman (1972). According to Grossman (1972), older individuals tend to face a higher rate of depreciation of health capital because of the biological process of aging, and consequently will have a higher preference for health investment, i.e. avoid alcohol drinking and smoking, than younger individuals. On the other hand, consistent with the conclusion drawn by Cropper (1977) and Kenkel (2000), age is found to be negatively correlated with individuals' likelihood of investing in heath, i.e. participate in physical activity. As emphasised by Cropper (1977) and Kenkel (2000), the pay-off period of health investment is shorter among older individuals than younger individuals because health behaviour only generates benefits in the future when diseases are successfully prevented. As such, older individuals may tend to find health investment unattractive, and thus, have a lower preference for it than younger individuals. Taken together, it can be concluded that the arguments of Grossman (1972), Cropper (1977) and Kenkel (2000) are supported by the findings of this study.

Income is negatively associated with individuals' likelihood of smoking, whereas is positively associated with individuals' likelihood of drinking alcohol and participating

in physical activity. The negative relationship between income and smoking lends support to the arguments of Grossman (1972) that income raises individuals' preferences for health investment. According to Grossman (1972), when individuals' income increases, so does the value of individuals' healthy time, which, in turn, causing higher income individuals to be more likely to invest in their health than lower income individuals. Ironically, however, the conclusion drawn by Grossman (1972) is not supported by the findings on alcohol drinking and participation in physical activity. In fact, the negative relationship between income and participation in physical activity suggests that higher income individuals are more likely to substitute working activity for physical activity than lower income individuals, which is known as substitution effect (Humphreys and Ruseski, 2006; 2011).

The association between education and health behaviours is inconclusive. Higher educated individuals are less likely to smoke, but are more likely to drink and be physically inactive than lower educated individuals. The negative causal relationship between smoking and levels of education lends support to the arguments of Grossman (1972) and Kenkel (1991) that education can enhance allocative and productive efficiency of producing health by improving individuals' health knowledge. Furthermore, since well-educated individuals are associated with a low rate of time preference, the findings of this study also support the fact that individuals with a low rate of time preference are likely to invest in health (Fuchs, 1982; van der Pol, 2011). However, these conclusions are not strongly complied by the findings on alcohol drinking and participation in physical activity.

Rural dwellers are found to be more likely to smoke than urban dwellers, thus, suggesting that information plays an important role in determining health behaviour

(Kenkel, 1991; Cawley and Ruhm, 2012). Since rural areas lack health information, rural dwellers may tend to underestimate the actual costs of smoking (including explicit and implicit), and consequently have a higher likelihood of smoking than urban dwellers (Schoenbaum, 1997; Alam et al., 2008; Lim et al., 2013).

6.3 Implications for Policy

Based on the findings of this study, numerous population-based intervention measures pertaining to promoting healthy lifestyle among adults in Malaysia are suggested. First, the government intervention strategies directed primarily at youngsters to reduce alcohol and tobacco consumption can be very effective, especially given the current findings that age is negatively associated with individuals' likelihood of drinking alcohol and smoking. These strategies include the need to increase the legal age of consuming alcohol and tobacco, as well as, use the social media which have strong influences on youngsters, such as, Facebook, Twitter and Yahoo to advertise the disadvantages of alcohol drinking and smoking. Meanwhile, since age reduces individuals' likelihood of participating in physical activity, the public health administrators should make an effort to promote physically active lifestyle among the elderly, such as, building elderly-oriented sport facilities and organising low- or moderate-intensity sport activities in the recreational parks.

Second, a tough intervention measure aimed primarily at promoting physical activity among high income individuals may seem worthwhile given that income can reduce individuals' likelihood of participating in physical activity. The government should devote its attention to providing high income people with more information about the

benefits of physical activity, as well as, how to stay physically active without spending a lot of time on exercise.

Third, the government should specifically focus on reducing alcohol and tobacco consumption among males given the findings that males have a higher likelihood of drinking alcohol and smoking than females. In particular, the government should introduce more nationwide health awareness campaigns with particular attention on publicising the harmful effects of alcohol drinking and smoking on men's health, such as, prostate cancer, erectile dysfunction and low sperm count. Conversely, as a measure towards increasing the prevalence of physical activity, an effective public health policy should be primarily targeted at females, as females are less likely to be physically active than males. Home-based workout television programmes educating females about how to stay physically active without joining health club or going to recreational park, for instance, should be made more available to the public.

Fourth, considering the ethnic differences in health behaviour, the public health specialists should pay special attention to reducing the prevalence of alcohol consumption among Chinese, tobacco consumption among Malays and physical inactivity among Indian and others. It is suggested that the government should fully utilise various types of multi-lingual based mass media, such as, newspapers, magazines, television programmes and radio channels, as well as, health professionals, such as, medical doctors, pharmacists and nurses from the specific ethnic backgrounds to discourage people from drinking alcohol, smoking and being physically inactive by highlighting the negative effects of unhealthy behaviour on health and well-being.

Fifth, owing to the fact that education plays an important role in determining alcohol drinking and smoking, health education programmes directed at less-educated individuals to increase health knowledge can potentially help reduce the harmful use of alcohol and tobacco. Specifically, these programmes should include the need to introduce more nationwide health related courses, seminars and workshops, as well as, provide more health related reading materials, such as, newspaper, magazines and books for the public. In addition, the government should also focus on promoting participation in physical activity among well-educated individuals by providing them detailed information on how to stay physically active during working hours. This is in view of the current findings that well-educated individuals are less likely to be physically active than less-educated individuals.

Sixth, since the findings of this study show that widowed and divorced individuals have a higher likelihood of smoking and being physically inactive compared to single individuals, a successful intervention strategy should concentrate on improving the well-being among widowed and divorced individuals. Therefore, it seems worthwhile to advocate setting up professional bodies to provide counselling services and social supports for this group of individuals.

Seventh, the findings of this study show that urban dwellers are more likely to drink alcohol and be physically inactive than rural dwellers, thus, the public health authorities are suggested to put more serious efforts into improving the urban dwellers' lifestyle. A tough measure focusing on banning all the alcohol advertisements in the urban areas, as well as, utilising health promotion programmes to educate urban dwellers about how to incorporate physical activity into their busy lifestyle can ensure effective outcomes. Meanwhile, the public health authorities should also make a concerted effort to increase

the awareness of the risk of smoking among rural dwellers, as this study finds that rural dwellers are more likely to smoke compared to urban dwellers. Hence, the strategy that includes organising anti-smoking related programmes in rural areas is worthy of consideration.

Last, based on the findings of this study, policies focusing on reducing the prevalence of alcohol and tobacco consumption should be specifically targeted at employed individuals. It is suggested that the government should conduct workplace health promotion programmes to provide health education for employed individuals. Besides, an intervention measure paying particular attention to promoting physical activity among unemployed individuals also seems worthy of consideration, as the current findings show unemployed individuals to be less likely to be physically active than employed individuals. An effective government strategy to increase physical activity levels of this group of individuals is to build more public sport facilities and recreational parks around the residential areas.

6.4 Limitations of Study

Owing to the limited availability of data, this study possesses several inherent limitations. Firstly, numerous important variables which are claimed by the previous studies that could potentially affect individuals' health behaviour could not be included. Among them are presence of children in a family, household size, household income, body mass index and distance from workplace or home to physical activity settings. Secondly, detailed respondents' alcohol drinking and smoking profiles, such as, compulsive drinkers or smokers, light drinkers or smokers and heavy drinkers or smokers could not be included for examination. Third, this study could not segregate

physical activity into work, travel and leisure categories for a more detailed individual analysis.

6.5 Suggestion for Future Research

Future studies should seek data, preferably several panel data that can surmount the mentioned shortcomings when examining the factors affecting health behaviour in Malaysia. One of the extensions of the study is to take account of different types of physical activity, alcohol drinking and smoking status for a more robust analysis. Furthermore, the study can also be extended to explore how alcohol drinking, smoking and participation in physical activity act like an input to determine the production of health.

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Appendix A: Correlation coefficients between income, age, gender, residing area, education and employment status variables

Variables	Income	Age	Male	Urban	Primary	Second	Tertiary
Income	-	-0.066 (0.000)	0.017 (0.003)	0.211 (0.000)	-0.202 (0.000)	0.028 (0.000)	0.277 (0.000)
Age	-0.066 (0.000)	-	0.011 (0.053)	-0.066 (0.000)	0.539 (0.000)	-0.420 (0.000)	-0.169 (0.000)
Male	0.017 (0.003)	0.011 (0.053)	-	0.024 (0.000)	-0.060 (0.000)	0.043 (0.000)	0.025 (0.000)
Urban	0.211 (0.000)	-0.066 (0.000)	0.024 (0.000)	-	-0.190 (0.000)	0.092 (0.000)	0.153 (0.000)
Civil servant	0.083 (0.000)	-0.067 (0.000)	0.064 (0.000)	0.023 (0.000)	-0.201 (0.000)	0.056 (0.000)	0.230 (0.000)
Private sector	0.097 (0.000)	-0.281 (0.000)	0.180 (0.000)	0.137 (0.000)	-0.185 (0.000)	0.126 (0.000)	0.089 (0.000)
Self-employed	-0.022 (0.000)	0.094 (0.000)	0.220 (0.000)	-0.149 (0.000)	0.119 (0.000)	-0.064 (0.000)	-0.085 (0.000)
Student	0.007 (0.201)	-0.255 (0.000)	-0.013 (0.024)	0.056 (0.000)	0.141 (0.000)	0.091 (0.000)	0.075 (0.000)
Unemployed	-0.121 (0.000)	0.222 (0.000)	-0.382 (0.000)	-0.020 (0.000)	0.196 (0.000)	-0.097 (0.000)	-0.153 (0.000)

Note: P-value in parentheses. The estimated correlation coefficients for all the variables are less than 0.8, thus, indicating that there are no serious multicollinearity problems in the regression models (Studenmund, 2006).
Source: Compiled from NHMS III.

Appendix B: VIF test for all the independent variables

Variables	VIF	1/VIF
Age		
18-30 years*	-	-
31-40 years	1.81	0.55
41-50 years	2.04	0.49
≥51 years	2.85	0.35
Income		
RM 0-999*	-	-
RM 1000-2999	1.37	0.73
RM 3000-5999	1.42	0.70
≥RM 6000	1.26	0.79
Gender		
Male	1.26	0.80
Female*	-	-
Ethnicity		
Malay	1.59	0.63
Chinese	1.71	0.58
Indian/others*	-	-
Education		
Tertiary	1.70	0.59
Secondary	1.72	0.58
Primary*	-	-
Marital status		
Married	2.15	0.47
Widowed/divorced	1.87	0.53
Single*	-	-
Residing area		
Urban	1.21	0.82
Rural*	-	-
Employment status		
Civil servant	1.40	0.71
Private sector	1.66	0.60
Self-employed	1.44	0.70
Student	1.26	0.79
Unemployed*	-	-

Note: *refers to reference category (coded as 0). VIF refers to variance inflation factor. A VIF value of more than five indicates a multicollinearity problem.
Source: Compiled from NHMS III.

Appendix C: Stata output – The logit analysis of alcohol drinking

```
Logistic regression                                     Number of obs   =      30992
                                                        LR chi2(14)     =    2810.00
                                                        Prob > chi2     =     0.0000
Log likelihood = -3933.6763                             Pseudo R2       =     0.2632

------------------------------------------------------------------------------
current_dr~k |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0184172   .0031454    -5.86   0.000    -.0245821   -.0122522
   income100 |   .0034313   .0007414     4.63   0.000     .0019781    .0048845
        male |   1.289156   .0729727    17.67   0.000     1.146132     1.43218
       malay |  -2.911902   .1275697   -22.83   0.000    -3.161934    -2.66187
     chinese |   .6121344   .0710574     8.61   0.000     .4728644    .7514044
    tertiary |   1.397896   .1100871    12.70   0.000     1.182129    1.613663
   secondary |   .9061259   .0883745    10.25   0.000     .7329149    1.079337
     married |   .0460092   .0850595     0.54   0.589    -.1207044    .2127228
      widdiv |  -.1401194   .2243492    -0.62   0.532    -.5798358    .2995971
       urban |   .2398697   .0799881     3.00   0.003      .083096    .3966435
       civil |   .2875574    .139815     2.06   0.040     .0135249    .5615898
     private |   .3693593   .0949763     3.89   0.000     .1832092    .5555094
        self |   .4286237   .1019736     4.20   0.000      .228759    .6284884
     student |   .3464815   .1646374     2.10   0.035      .023798    .6691649
       _cons |  -3.963798    .168865   -23.47   0.000    -4.294767   -3.632829
------------------------------------------------------------------------------
```

```
Logistic regression                                     Number of obs   =      30992
                                                        LR chi2(14)     =    2810.00
                                                        Prob > chi2     =     0.0000
Log likelihood = -3933.6763                             Pseudo R2       =     0.2632

------------------------------------------------------------------------------
current_dr~k | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .9817514    .003088    -5.86   0.000     .9757176    .9878225
   income100 |   1.003437    .000744     4.63   0.000      1.00198    1.004896
        male |   3.629721   .2648705    17.67   0.000     3.146001    4.187818
       malay |   .0543722   .0069362   -22.83   0.000     .0423438    .0698176
     chinese |   1.844364   .1310557     8.61   0.000     1.604584    2.119975
    tertiary |   4.046677   .4454871    12.70   0.000     3.261311     5.02117
   secondary |   2.474717   .2187019    10.25   0.000     2.081138    2.942727
     married |   1.047084   .0890645     0.54   0.589     .8862959    1.237042
      widdiv |   .8692545   .1950166    -0.62   0.532     .5599903    1.349315
       urban |   1.271084   .1016715     3.00   0.003     1.086646    1.486826
       civil |   1.333167   .1863968     2.06   0.040     1.013617    1.753458
     private |   1.446807   .1374124     3.89   0.000     1.201066    1.742828
        self |   1.535143   .1565441     4.20   0.000     1.257039    1.874774
     student |   1.414083    .232811     2.10   0.035     1.024083    1.952606
------------------------------------------------------------------------------
```

Appendix D: Stata output – The logit analysis of smoking

```
Logistic regression                                     Number of obs   =      30992
                                                        LR chi2(14)     =   12410.06
                                                        Prob > chi2     =     0.0000
Log likelihood = -10418.113                             Pseudo R2       =     0.3733

------------------------------------------------------------------------------
current_sm~e |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0252026   .0016983   -14.84   0.000    -.0285313   -.0218739
   income100 |  -.0057077   .0009432    -6.05   0.000    -.0075562   -.0038591
        male |   4.010449   .0637677    62.89   0.000     3.885466    4.135431
       malay |   .3783725   .0435679     8.68   0.000     .2929809     .463764
     chinese |  -.2354899   .0552355    -4.26   0.000    -.3437494   -.1272304
    tertiary |  -1.012232   .0733551   -13.80   0.000    -1.156005   -.8684584
   secondary |  -.2966315   .0441767    -6.71   0.000    -.3832162   -.2100468
     married |  -.0087847   .0526022    -0.17   0.867    -.1118831    .0943138
      widdiv |   .6193274   .1090053     5.68   0.000      .405681    .8329739
       urban |  -.1768764   .0378527    -4.67   0.000    -.2510664   -.1026865
       civil |   .0981398   .0688472     1.43   0.154    -.0367983    .2330778
     private |   .4053464   .0535595     7.57   0.000     .3003717    .5103211
        self |   .5487643   .0532085    10.31   0.000     .4444776     .653051
     student |  -1.146062   .1295139    -8.85   0.000    -1.399905   -.8922198
       _cons |  -2.974559    .101768   -29.23   0.000    -3.174021   -2.775097
------------------------------------------------------------------------------


Logistic regression                                     Number of obs   =      30992
                                                        LR chi2(14)     =   12410.06
                                                        Prob > chi2     =     0.0000
Log likelihood = -10418.113                             Pseudo R2       =     0.3733

------------------------------------------------------------------------------
current_sm~e | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .9751123   .0016561   -14.84   0.000     .9718718    .9783636
   income100 |   .9943086   .0009378    -6.05   0.000     .9924722    .9961483
        male |   55.17162   3.518169    62.89   0.000     48.68964    62.51654
       malay |   1.459907   .0636051     8.68   0.000     1.340417    1.590048
     chinese |   .7901836   .0436462    -4.26   0.000     .7091066    .8805308
    tertiary |    .363407   .0266578   -13.80   0.000      .314741    .4195979
   secondary |   .7433179   .0328373    -6.71   0.000     .6816655    .8105463
     married |   .9912538   .0521422    -0.17   0.867     .8941488    1.098905
      widdiv |   1.857678   .2024968     5.68   0.000     1.500324    2.300149
       urban |   .8378833   .0317162    -4.67   0.000     .7779707    .9024099
       civil |   1.103117   .0759465     1.43   0.154     .9638706     1.26248
     private |   1.499822   .0803297     7.57   0.000     1.350361    1.665826
        self |   1.731113   .0921099    10.31   0.000     1.559675    1.921394
     student |    .317886   .0411707    -8.85   0.000     .2466204    .4097452
------------------------------------------------------------------------------
```

Appendix E: Stata output – The logit analysis of being physically active

```
Logistic regression                                     Number of obs   =      30992
                                                        LR chi2(14)     =    1621.67
                                                        Prob > chi2     =     0.0000
Log likelihood = -20406.323                             Pseudo R2       =     0.0382

------------------------------------------------------------------------------
    physical |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0110409   .0011119    -9.93   0.000    -.0132202   -.0088616
   income100 |  -.0018083   .0005067    -3.57   0.000    -.0028014   -.0008151
        male |   .4181362   .0265822    15.73   0.000     .3660361    .4702364
       malay |   .0605987   .0299134     2.03   0.043     .0019695    .1192279
     chinese |  -.0106915   .0371081    -0.29   0.773     -.083422     .062039
    tertiary |  -.2179675   .0494217    -4.41   0.000    -.3148323   -.1211027
   secondary |   .0016164   .0308631     0.05   0.958    -.0588741     .062107
     married |   .0446512   .0362754     1.23   0.218    -.0264472    .1157496
      widdiv |  -.1355562   .0610977    -2.22   0.027    -.2553056   -.0158068
       urban |  -.1684197     .02616    -6.44   0.000    -.2196923    -.117147
       civil |   .6513206   .0464443    14.02   0.000     .5602914    .7423498
     private |   .4405116    .033089    13.31   0.000     .3756583    .5053649
        self |   .6208907   .0353546    17.56   0.000     .5515969    .6901845
     student |   .1414903   .0744559     1.90   0.057    -.0044407    .2874212
       _cons |   .3409402   .0607816     5.61   0.000     .2218104      .46007
------------------------------------------------------------------------------
```

```
Logistic regression                                     Number of obs   =      30992
                                                        LR chi2(14)     =    1621.67
                                                        Prob > chi2     =     0.0000
Log likelihood = -20406.323                             Pseudo R2       =     0.0382

------------------------------------------------------------------------------
    physical | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .9890199   .0010997    -9.93   0.000     .9868668    .9911776
   income100 |   .9981933   .0005058    -3.57   0.000     .9972025    .9991852
        male |   1.519128   .0403818    15.73   0.000     1.442007    1.600372
       malay |   1.062472   .0317822     2.03   0.043     1.001971    1.126627
     chinese |   .9893654   .0367135    -0.29   0.773     .9199628    1.064004
    tertiary |   .8041516   .0397426    -4.41   0.000     .7299113     .885943
   secondary |   1.001618    .030913     0.05   0.958     .9428254    1.064076
     married |   1.045663   .0379318     1.23   0.218     .9738995    1.122715
      widdiv |   .8732301   .0533524    -2.22   0.027     .7746797    .9843174
       urban |   .8449991   .0221052    -6.44   0.000     .8027657    .8894544
       civil |   1.918072   .0890835    14.02   0.000     1.751183    2.100866
     private |   1.553502   .0514039    13.31   0.000      1.45595     1.65759
        self |   1.860584   .0657803    17.56   0.000     1.736023    1.994083
     student |   1.151989   .0857724     1.90   0.057     .9955692    1.332986
------------------------------------------------------------------------------
```