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**THE EFFECT OF SOCIODEMOGRAPHIC AND
UNHEALTHY BEHAVIOUR FACTORS ON THE
PHARMACEUTICAL EXPENDITURE SHARE
BY HOUSEHOLDS IN MALAYSIA**

ANG WEI CHERN



UUM
Universiti Utara Malaysia

**MASTER OF ECONOMICS
UNIVERSITI UTARA MALAYSIA
2022**

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FACTORS ON THE PHARMACEUTICAL EXPENDITURE SHARE
BY HOUSEHOLDS IN MALAYSIA**

By

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UUM
Universiti Utara Malaysia

**Thesis Submitted to
School of Economics, Finance and Banking
Universiti Utara Malaysia,
in Fulfillment of the Requirement for the Master of Economics**



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(College of Business)
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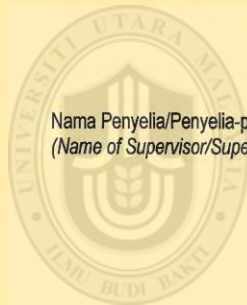
: **Ang Wei Chern**

Tajuk Tesis / Disertasi
(Title of the Thesis / Dissertation)

: **The Effect of Sociodemographic and Unhealthy Behaviour Factors on
The Pharmaceutical Expenditure Share by Households in Malaysia**

Program Pengajian
(Programme of Study)

: **Master of Economics**



Nama Penyelia/Penyelia-penyelia
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ABSTRACT

The third United Nations Sustainable Development Goal (SDG) seeks to improve universal access to medicines. In Malaysia, out-of-pocket expenditure is the highest for private total health expenditure, which includes pharmaceutical products. However, it is unknown how likely and profound the monthly spending is, relative to household income. The objectives of this study are to investigate the sociodemographic and unhealthy behaviour factors associated with pharmaceutical expenditure share (PES) among households in Malaysia generally, among different income groups and different regions by Gross Domestic Product (GDP) per capita. This study used Household Expenditure Survey 2014 microdata analysed mainly by two-part models (probit and ordinary-least square regressions). All households (n=14,838) had a PES of 0.94%, or a mean expenditure of RM 31.53. 43.8% of households purchased pharmaceuticals with a PES of 2.15% or a mean expenditure of RM 71.95. Bivariate analysis shows that age, ethnicity, education and employment status of household heads, residing strata, household income and regions by GDP per capita were significantly associated with PES. Unemployed, female (middle-income states), single household heads (M40 and T20 households) and having a large household increased the likelihood of pharmaceuticals consumption. Increasing age, female (high-income states), increasing education of household heads, and decreasing household income increased PES. Non-Bumiputera households and consuming sugary products increased both the likelihood and allocation on pharmaceuticals. Similarly, those residing in middle-income states were more likely to spend, and spent more of their income than households in low-income states. In contrast, urban households were less likely to spend, but spend more. More public health clinics in urban areas and townships with many retirees in middle-income states while intensifying the existing 'Know your medicine' campaign to large families are among the recommendations suggested from this study.

Keywords: pharmaceutical expenditure, sustainable development, family characteristics, unhealthy behaviours, pharmaceutical product

ABSTRAK

Matlamat Pembangunan Lestari (SDG) Pertubuhan Bangsa-Bangsa Bersatu ketiga adalah untuk meningkatkan akses sejagat kepada ubat-ubatan. Di Malaysia, perbelanjaan luar saku adalah yang tertinggi untuk perbelanjaan kesihatan swasta, yang merangkumi produk farmaseutikal. Namun, adalah tidak diketahui berapa tinggi kebarangkalian dan besarnya perbelanjaan bulanan berbanding dengan pendapatan isi rumah. Objektif kajian ini adalah untuk mengkaji faktor sosiodemografi dan tingkah laku tidak sihat yang berkait dengan bahagian perbelanjaan farmaseutikal (PES) di kalangan isi rumah di Malaysia, amnya, di kalangan kumpulan pendapatan yang berbeza dan wilayah yang berbeza berdasarkan Keluaran Dalam Negara Kasar (KDNK) per kapita. Kajian ini menggunakan data mikro Survei Perbelanjaan Isi Rumah 2014 yang dianalisis dengan model dua bahagian (regresi *probit* dan kaedah kuasa dua terkecil). Semua isi rumah ($n=14,838$) mempunyai PES sebanyak 0.94%, atau perbelanjaan purata RM 31.53. 43.8% isi rumah membeli farmaseutikal dengan PES sebanyak 2.15% atau purata RM 71.95. Analisis bivariat menunjukkan usia, etnik, pendidikan dan status pekerjaan ketua isi rumah, penempatan strata, pendapatan isi rumah, dan wilayah berdasarkan KDNK per kapita berkait signifikan dengan purata PES. Menganggur, wanita (negeri berpendapatan sederhana), ketua isi rumah tunggal (isi rumah M40 dan T20) dan mempunyai isi rumah yang ramai meningkatkan kebarangkalian penggunaan ubat-ubatan. Peningkatan usia, wanita (negeri berpendapatan tinggi), peningkatan pendidikan ketua isi rumah dan pengurangan pendapatan isi rumah meningkatkan PES. Isi rumah bukan Bumiputera dan pengambilan produk bergula meningkatkan kemungkinan dan peruntukan untuk farmaseutikal. Begitu juga, mereka yang tinggal di negeri berpendapatan sederhana lebih cenderung berbelanja, dan berbelanja lebih banyak daripada bahagian pendapatan mereka berbanding isi rumah di negeri berpendapatan rendah. Sebaliknya, isi rumah di bandar kurang cenderung berbelanja, tetapi berbelanja lebih. Penubuhan lebih banyak klinik kesihatan awam di kawasan bandar dan perbandaran yang mempunyai banyak pesara di negeri berpendapatan sederhana, dan mempergiatkan kempen 'Kenali ubat anda' kepada keluarga besar adalah antara cadangan dikemukakan daripada kajian ini.

Kata Kunci: perbelanjaan farmaseutikal, pembangunan lestari, ciri keluarga, tingkah laku tidak sihat, produk farmaseutikal

ACKNOWLEDGEMENTS

I would like to express my utmost gratitude to my supervisor, Associate Professor Dr. Cheah Yong Kang for the strong support, advice and guidance. He has always been a fatherly figure to me throughout the whole journey. I enjoy and truly miss the physical meeting sessions we had until the COVID-19 pandemic hits. Nevertheless, virtual consultations are still beneficial to enhance this research until its completion. Next, a special thanks to the Ministry of Education Malaysia for funding this project via the Fundamental Research Grant Scheme (FRGS, KOD SO 14218).

Besides, I would like to thank Associate Professor Dr. Bakti Hasan Basri, Associate Professor Dr. Shamzaeffa Samsudin and Professor Dr. Jamal Ali for providing me constructive feedback and suggestions during the Proposal Defense session, which further improved my study. I am indebted to my superiors and colleagues in the Ministry of Health Malaysia too, for supporting my further study.

Other than that, I am grateful to my parents, brother and sister-in-law for the motivation to complete this thesis. Last but not least, I would like to express my gratitude to everyone who has contributed to the completion of this thesis.

Thank you very much!



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LIST OF ABBREVIATIONS

COICOP	Classification of Individual Consumption According to Purpose
CHE	Catastrophic health expenditure
DOSM	Department of Statistics Malaysia
GDP	Gross domestic product
HES	Household Expenditure Survey
MOHM	Ministry of Health Malaysia
MNMP	Malaysian National Medicines Policy
RM	Ringgit Malaysia
MMC	Muslim-majority country
NHMS	National Health and Morbidity Survey
NSUM	National Survey on the Use of Medicine
OECD	Organisation for Economic Co-operation and Development
OOPE	Out-of-pocket expense
OTC	Over-the-counter
PES	Pharmaceutical expenditure share
SDG	Sustainable Development Goal
THE	Total healthcare expenditure
TPE	Total pharmaceutical expenditure
UN	United Nations
UNICEF	United Nations Children's Fund
UNSD	United Nations Statistics Division
WHO	World Health Organisation
PSDM	Pharmaceutical Services Division, Ministry of Health Malaysia (currently known as Pharmaceutical Services Programme, Ministry of Health Malaysia)
UHC	Universal health coverage

CHAPTER ONE: INTRODUCTION

1.1. Background and Motivation of the Study

Health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." (World Health Organisation [WHO], 1946). Since the advent of mankind, medicines have become essential to enhance health and wellbeing. Pharmaceutical products consist of both modern and traditional medicines. They are essential for disease prevention and treatment, as well as public health protection (WHO, 2017). The right to health is a fundamental human right, as stated in the United Nations (UN) Universal Declaration of Human Rights, in which access to medicine is a part of it (United Nations [UN], 1948). This is further strengthened by the third UN Sustainable Development Goal (SDG) as a grand vision for 2030 (UN, 2015). SDG's target 3.8 aims to achieve universal health coverage (UHC), including financial risk protection and "access to safe, effective, quality and affordable medicines for all". Financial risk protection safeguards citizens against financial hardship to pay for healthcare services (UN, 2015).

The Malaysian healthcare system supply medicines by a two-tier system: the public universal healthcare sector supported by the government mainly through the Ministry of Health Malaysia (MOHM); and the self-sustaining private sector. At public health facilities, Malaysian patients are charged a minimal user fee of Ringgit Malaysia (RM) 1 and RM 5 for outpatient and specialist clinics, respectively. These include medicines that are dispensed to patients at zero cost, irrespective of their socioeconomic status. However, many patients still prefer to acquire pharmaceuticals out-of-pocket despite the heavily

subsidised access to healthcare for Malaysians in public settings (MOHM, 2019a; WHO, 2013). This could be due to some health service constraints in the public health facilities and the purchase of supplements and herbal medicine that have to be bought by OOPE.

The number of patients in MOHM facilities is rapidly increasing, resulting in a significant increase in ministerial pharmaceutical spending. In 2018, a near 64 million outpatient attendances were registered by MOHM facilities (MOHM, 2019b), meaning a 43.2% increase from the figure in 2010 (MOHM, 2011). The lack of healthcare facilities also implies that patients expect longer waiting times (WHO, 2013). In 2018, Malaysia had 1,001 public health clinics with in-house pharmacies (MOHM, 2019b) to cater for an estimated population of 32.4 million by the Department of Statistics Malaysia (DOSM, 2019), making the public health clinics to population ratio of 1:32 368 which have yet to meet the target of 1:20 000 (WHO, 2013). The upward trend of waiting time is expected to continue in the future.

The medicine policy at the MOHM pharmacy facilities for chronically ill patients is to supply medicines for a period of one month only (Pharmaceutical Services Division Malaysia [PSDM], 2011). This is to ensure the quality of the medicine stored at home, facilitate monitoring of unwanted side effects, ensure medication compliance, avoid medication wastage, and reduce the risk of medical error due to excess medicine stock. However, the policy poses some problems as patients need to be present several times to the pharmacy to get refills of medicines such as congestion and long waiting times at the

pharmacy and time-consuming for the patients involved. Long waiting periods have a negative effect on medication adherence (Manary et al., 2013; Sa'ed et al., 2013).

The non-availability of certain pharmaceuticals in public settings also contributes to acquiring them out-of-pocket (MOHM, 2019a). The latest National Survey on the Use of Medicine (NSUM) by Malaysian consumers (2015) survey shows that 30.3% of our population consumed chronic medications, 31.8% Malaysians were taking vitamins, minerals and supplements, while 16.8% were consuming traditional medicines (PSDM, 2016). The results show that a high prevalence of Malaysians consuming certain types of pharmaceutical products.

From 1997 to 2017, Malaysia's total healthcare expenditure (THE) rose from RM 8.550 billion in 1997 to RM 57.361 billion in 2017, more than 6.7 times the amount in just ten years (MOHM., 2019a). In 2017, total pharmaceutical expenditure (TPE) amounted to RM 4.770 billion or 8% of THE. MOHM constituted the most significant expenditure, RM 24.715 billion or 43% share of THE. This is followed closely by private household out-of-pocket expenditures (OOPE) accounts for RM 21.573 billion (38% of THE), making it the largest portion of private expenditure on healthcare. (MOHM., 2019a).

OOPE on pharmaceuticals covers expenditure on self-medication (Organisation for Economic Co-operation and Development [OECD], 2017). Self-medication is defined as “the use of any pharmaceutical product in any form with or without a prescription to cure, prevent, mitigate or diagnose a disease, abnormal physical state, symptom, abnormal

physiological condition or to restore, modify or correct organic function in humans” (WHO, 2000). On top of that, self-medication is an aspect of self-care. Medications are taken for preventive purposes such as supplements and smoking cessation, and/or curative for self-recognisable conditions and post initial medical diagnosis for chronic or recurring conditions (WHO, 2000). Responsible self-medication with proper symptom identification and medicine selection with the right doses and durations can help individuals and society (Ruiz, 2010). Because of the high cost of private healthcare, self-medication plays an extensive role in healthcare in developing countries (Geissler et al., 2000).

In Malaysia, the reliance on OOPE on healthcare had reduced slightly from 41% (2000) to 33% (2009) and then increased to 38% in 2017 (WHO, 2020). However, OOPE on pharmaceuticals (by function, sales through community pharmacies) raised from RM 0.325 billion in 1997 to RM 2.923 billion in 2019, representing a rising proportion from 10% in 1997 to 14% in 2019 of OOPE on healthcare. It is approximated that 60% of pharmaceuticals used were spent out-of-pocket (MOHM, 2019b). This raised questions on the Malaysians access to medicines, a combination of medicine affordability and medicine availability components as stated in the Malaysian National Medicines Policy (MNMP).

The two fundamental principles reflecting the financial hardships due to OOPE are catastrophic health expenditure (CHE) and impoverishment. CHE happens in the case of the “OOPE of a household is so large in comparison to its available resources that the

households have to sacrifice the consumption of other essential goods and services.” (Saksena et al., 2014). CHE is the official indicator for tracking the financial risk protection of UHC as part of the SDG’s indicator 3.8.2, with a varied threshold of 10 to 25% of total household incomes. Total healthcare OOPE of more than the threshold is regarded as CHE (Wagstaff et al., 2018). The second most commonly cited indicator of financial risk protection is impoverishment. Impoverishment happens when “OOPEs push households below the poverty line, where even the most basic living standards are not guaranteed.” (Saksena et al., 2014). Although impoverishment is not an official SDG indicator, it is used to augment the catastrophic payment indicator by highlighting the poverty consequences of OOPE (Wagstaff et al., 2018).

The 2015 National Health and Morbidity Survey (NHMS) recorded that the population with the poorest quintile of household income (Q1) had higher OOPE relative to other quintiles except for the wealthiest quintile (Q5) (Institute of Public Health Malaysia [IPHM], 2015). Such figures emphasise the importance of constantly maintaining pharmaceuticals' affordability to avoid impoverishment due to high medication expenditure. The medication prices in Malaysia have increased at a far higher rate than in other countries (Hassali et al., 2012). The marking-up of market medicine prices is due to a lack of price monitoring and control rules (Ahmad & Islahudin, 2018). OOPE is determined by the price and quantity of purchased medicines. Tackling the rational use of pharmaceutical products is vital in controlling OOPE (Lu et al., 2014).

In general, lower household income is related to premature mortality risk due to acute and/or chronic diseases (Sommer et al., 2015). Although pharmaceutical expenditure incurred due to acute illness may not be high, some households may consider it catastrophic. CHE, including pharmaceutical expenditure as a percentage of household income (pharmaceutical expenditure share), could put the living standards of households at risk (O'Donnell et al., 2007; MOHM, 2019c). Poor households are more susceptible to unbudgeted healthcare OOPE, leading to impoverishment. The poor already spend a large portion of their income on their needs; therefore, it may discourage them from seeking pharmaceutical care, further increasing the burden of poor health (O'Donnell et al., 2007; Xu et al., 2010).

Pharmaceuticals are unique since the consumer typically does not determine which product to consume. This circumstance contrasts with the standard consumer paradigm framework in economic modelling in which, equipped with complete information, a consumer maximises utility limited by a budget constraint (Ellison et al., 1997).

1.2. Problem Statement

At the macroeconomic level, OOPE is the highest for private THE, in which pharmaceutical expenditure is a part of it (MOHM., 2019a). However, at a microeconomic level, it is unknown how likely the spending occurs and how profound the monthly expenditure is relative to the household income.

High prices and low availability of medicines are vital factors that hinder healthcare accessibility, especially in developing countries (Cameron et al., 2009). In 1995-2006, the growth in pharmaceutical spending per capita in middle-income countries was the highest (Lu et al., 2014). Malaysia is an upper-middle-income country. It remains unclear mainly how Malaysians make consumption decisions and the amount of purchasing pharmaceutical products, regardless of socioeconomic status.

A large portion of the population struggles to achieve socioeconomic and health equities, especially low-income earners in low socioeconomic neighbourhoods (Browne-Yung et al., 2013). The current scenario shows that Malaysia is not only faced with absolute poverty, “but also with relative poverty, pockets of persistent poverty, the conventional rural poverty and urban poverty and rising inequalities” (Nair & Sagarin, 2017). The population's concerns with low wages or the bottom 40% (B40) remain on socioeconomic problems, food and health insecurity (Alam et al., 2016; Jayasooria, 2016).

Inequal health outcomes are frequently related to inequity in the use of healthcare services, including access to medicines (Arcaya et al., 2015). In a nationwide study in Malaysia, it was found that low-income groups have greater healthcare needs, particularly with increased chronic diseases incidence (Thangiah et al., 2014). The dual calamity of high pharmaceutical expenditure and low household income leads to a higher pharmaceutical expenditure share. In another study among low-income groups in Malaysia, low household income was linked with low health-related quality of life (HRQOL) (Puteh et al., 2019). Increased pharmaceutical expenditure is shown to

improve the mortality outcomes, particularly for middle-aged and older people: an analysis of 21 Organisation for Economic Co-operation and Development (OECD) countries by controlling wealth and lifestyle factors, the impact of pharmaceutical use on the remaining life expectancy was positive and statistically significant (as a proxy to health) (Miller & Frech, 2000).

Besides household income, the gross domestic product (GDP) per capita of the states in Malaysia varies widely. Malaysian states are diverse, with GDP per capita ranging from RM 13,668 in Kelantan to RM 121,293 in the Federal Territories of Kuala Lumpur and Putrajaya, the capital city and federal administrative centre of Malaysia as in the State Socioeconomic Report 2018 (DOSM, 2018). Despite this, it is important to disregard the common myth that deprivation in Malaysia is primarily confined to states further away from the capital city of Kuala Lumpur. On the contrary to the official poverty rate of 0% in 2016, a United Nations Children's Fund (UNICEF) survey of low-income apartments in the capital city found that 7% of people live below the national poverty line and 85% in relative poverty (Redmond et al., 2017). Approximately 17% of Kuala Lumpur households survive on less than RM 5,000 per month. However, the average living wage of a family of four in Kuala Lumpur is recommended at RM 6,500 as quoted from the Central Bank of Malaysia (Chong & Khong, 2017). None of this shows that poverty has been eradicated even in the wealthiest state by GDP per capita. Due to the divergence between trends in GDP per capita and household income in various countries, tracking both indicators is recommended for monitoring and evaluating living standards (Nolan et al., 2019).

Malaysians underwent an epidemiological transition in which the pattern of diseases changed from primarily communicable diseases to non-communicable diseases (NCDs), as many are related to the adoption of unhealthy lifestyles. In 2012, the mortality rates for NCDs (563 age-standardised mortality rate per 100,000 population) were about five times the rates for communicable diseases (117 per 100,000 population) (WHO, 2016). Previous research has shown that unhealthy behaviours, especially tobacco and sugary product consumption, lead to increased healthcare utilisation caused by NCDs, hence higher healthcare costs (Dali et al., 2007; Rezayatmand et al., 2017; Scarborough et al., 2011).

There is insufficient literature to elucidate consumer spending on pharmaceutical products. Since Malaysia's sociodemographic profile, lifestyle conditions and healthcare delivery system are unique, quantitative results from outside Malaysia cannot be directly translated into the Malaysian scenario. Although public healthcare is heavily subsidised, OOPE remains the largest portion of private healthcare expenditure. This may be due to the lack of establishing healthcare pre-payment plans (Chua & Cheah, 2012). Malaysia does not mandate citizens to have social health insurance except for private-sector workers which only covers work-related injuries and disabilities by the Social Security Organisation (SOCSO), Ministry of Human Resources. Similarly, private health insurance is available on a voluntary basis, either through an OOPE or employer sponsored. In 2005, 15 percent of the Malaysian population was presumed to be covered in some ways (Central Bank of Malaysia, 2005). In 2015, OOPE of private health

insurance was at 23.7%, while 15% was employer-sponsored, with overlaps between the two (IPHM, 2015).

Sociodemographics and health behaviours have been well-established factors in healthcare utilisation (Andersen & Newman, 1973; Andersen, 1995) and healthcare expenditure (Baltagi & Moscone 2010; Jönsson & Eckerlund 2003; Xu et al., 2011). The association of sociodemographic and unhealthy behaviour factors on household pharmaceutical expenditure share using budget data and within a context compatible with economic theory had been considered by relatively few studies only (Mousnad, Shafie, & Ibrahim, 2014). Investigating pharmaceutical expenditure share will give a clearer picture of the economic conditions and well-being of the households instead of studying pharmaceutical expenditure as an absolute value itself.

1.3. Research Questions

1. How do sociodemographic and unhealthy behaviour factors are associated with the likelihood of consuming pharmaceuticals and the amount spent from household income (pharmaceutical expenditure share) on pharmaceutical products?
2. How do sociodemographic and unhealthy behaviour factors are associated with the likelihood of consuming pharmaceuticals and pharmaceutical expenditure share across different income groups?
3. How do sociodemographic and unhealthy behaviour factors are associated with the likelihood of consuming pharmaceuticals and pharmaceutical expenditure share residing across different regions by GDP per capita?

1.4. Research Objectives

1.4.1 General Objective

To investigate the association of sociodemographic and unhealthy behaviour factors on household pharmaceutical expenditure share in Malaysia.

1.4.2. Specific Objectives

1. To analyse the association of sociodemographic and unhealthy behaviour factors on the likelihood of consuming pharmaceuticals and share of the amount spent from household income (pharmaceutical expenditure share) on pharmaceutical products.
2. To examine the association of sociodemographic and unhealthy behaviour factors on the likelihood of consuming pharmaceuticals and pharmaceutical expenditure share among different income groups of households.
3. To evaluate the association of sociodemographic and unhealthy behaviour factors on the likelihood of consuming pharmaceuticals and pharmaceutical expenditure share among households residing in different regions.

1.5. Significance of the Study

This research seeks to contribute to the body of knowledge in several ways. There is a lack of study investigating sociodemographic and unhealthy behaviour factors associated with the expenditure share for pharmaceutical products using a large Malaysian nationwide sample, to the best of the author's knowledge. The findings evidenced in other countries are likely to be different from the results evidenced in Malaysia because the socioeconomic status, culture and lifestyle are different. Therefore, it is worthwhile to

compare the findings of this research with those of previous research of other countries. The findings of this research can encourage a comparison of the factors linked with the expenditure share for pharmaceutical products between Malaysia and the results published in the literature for other countries.

This research offers a detailed investigation of the variations of sociodemographic and unhealthy behaviour in expenditure share for pharmaceutical products across income groups and regions in Malaysia. The factors associated with expenditure share for pharmaceutical products among households of different income groups and regions need to be understood, especially given that Malaysians have different income levels and live in vastly different GDP per capita regions.

Data used in this research is a nationally representative sample with a large sample size that enables stratifications by household income and region. Inferences about the general population of Malaysia can be made, and essential academic findings can be generated. The importance of assessing the population income and region that they live in offers valuable inputs to public policymakers as any vulnerable group cannot be overlooked. The study's results can help strategise on reducing the CHE occurrence and impoverishment caused by pharmaceutical expenditure share among Malaysians.

The findings of this research can provide the government with a better understanding of which population classes to be given extra attention. Information on which types of households are more likely or consume more pharmaceutical products relative to their

incomes can be obtained in this research. Each year, despite a substantial part of the national budget is allocated to provide universal free-of-charge medications to the public, patients still prefer to buy their medicines via OOPE. The Ministry of Health Malaysia can better understand which type of households are more likely and fork out more relative to their incomes to consume pharmaceutical products. In that case, it will lead to a more equitable distribution of the public budget to improve access to medicine.

1.6. Scope of the Study

The focus of this study is to examine the underlying reasons that affect the household pharmaceutical expenditure share in Malaysia. This study utilised data from the Household Expenditure Survey (HES) 2014 (DOSM, 2014), to study the association of sociodemographic and unhealthy behaviour factors on household pharmaceutical expenditure in Malaysia.

The dependent variable for this study is the pharmaceutical expenditure share in the past one month at the point of the survey. This division is useful in distinguishing the associations of the factors examined in the model in terms of consumption and amount decisions. The independent variables investigated are ten sociodemographic factors (gender, age, ethnicity, marital status, education, employment status of household head; household size, strata, monthly household income, region) and two unhealthy behaviour factors (tobacco consumption, and sugar-sweetened food and beverages consumption). These are all the sociodemographic and unhealthy behaviour (except alcohol consumption) data available in HES 2014 to ensure all factors are considered.

1.7. Organisation of the Thesis

The thesis is organised as the following: In Chapter 1, the background, issues and the direction of the study are discussed. In Chapter 2, the theoretical and empirical studies related to the determinants of pharmaceutical expenditure are reviewed. In Chapter 3, the research framework and methodology used in conducting the research are described. The findings of this study are discussed in Chapter 4. In Chapter 5, the study's principal findings are summarised, and policy implications and recommendations for further research are proposed.



CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

As emphasised in the previous chapter, household pharmaceutical expenditure share has become a major concern among health economists and policymakers since it may cause CHE and/or impoverishment. Thus, knowledge of household pharmaceutical expenditure factors is vital for policy formulation to improve equitable access to pharmaceutical products.

This chapter reviews the theoretical and empirical studies of pharmaceutical expenditure share. Section 2.2 discusses the theoretical underpinnings of pharmaceutical expenditure, followed by Section 2.3 on the findings of the empirical studies of pharmaceutical expenditure. Finally, this chapter is concluded in Section 2.4.

2.2. Theoretical Review

Research on household expenditure was propagated following the empirical work of Engel (1857, as cited in Anker, 2011), in which he formulated a law that implies a decrease in the food expenditure share as income rises. Accordingly, research into household spending also referred to income as a critical determinant and expanded to other expenditures, such as accommodation, sundries, and healthcare expenditure, including pharmaceutical expenditure.

Whether the proxy of health is utility or self-reported health status, it was only during the 1970s that econometric analyses were used for health research. Grossman (1972) used

econometric to capture factors that determine a population's health stock simultaneously. Grossman set up a theoretical model on the determinants of health. Grossman's health capital model (Grossman, 1972) is notable in the study of health economics. Grossman's model perceives each individual as the sole decision-maker having a dual role as a producer and a consumer of health. Grossman (1972) emphasised that there were two main factors people consumed health. Firstly, when people had improved health status, people had better wellness, thus yielded greater utility, also referred to as “consumption benefits of health”. Equation 2.1 refers to the utility (U) function of the person at a given time t. Utility increases with the health status (H) of the person and other commodities (Z).

$$U_t = f(H_t, Z_t) \dots\dots\dots (2.1)$$

Second, health increases the time people can spend on their future market and non-market activities, referred to as “investment benefits of health”. Health is treated as physical capital, which in the absence of investments can cause depreciation over time. In line with Becker (1965), to reduce the depreciation of health capital, inputs of resources such as time, medical care, housing, sports equipment and food, into health had to be increased, which meant that people had to engage in healthier lifestyle behaviour and use medical care to remain healthy. Hence, Grossman (1972) considered this a “health investment” and stated that individuals could determine their length and quality of life.

To sum these two reasons, health is both a consumption commodity that yields utility from healthy days (consumption goods) and an investment commodity that yields time available for productive activities (capital goods), as in Equation 2.2. Health in the next period (H_{t+1}) depends on current stock of health (H_t), depreciation of health over time (δ_t , as the rate of depreciation) and investments by pharmaceutical expenditure (PE) either as prevention using supplements or as treatments using drugs to improve their health stock.

$$H_{t+1} = H_t - \delta_t H_t + PE_t \dots\dots\dots (2.2)$$

Grossman applies household production theory to health. Health is the non-market good, while healthcare is a market demand derived from the demand for health. Health is produced by combining market goods (particularly healthcare), time and human capital. The demand for healthcare can be considered a demand resulting from the demand for health, according to Grossman (1972)'s approach (Sousa, 2002) with the assumption of healthcare consumption as a pure investment. Standard economic theory suggests that the demand for pharmaceuticals stems from healthcare demand. To meet healthcare demand, agents employ time and inputs by intangibles such as medical care and/or tangibles such as pharmaceutical products (Costa-Font et al., 2007).

In this analysis, factors that may influence pharmaceutical expenditure as a share of household income, known as pharmaceutical expenditure share (PES) were examined. However, the initial Grossman's model is postulated as a function of health (Equation

2.3): ED as education level, Bo as bad health behaviours such as tobacco consumption and excessive sugar consumption.

$$PES_t = f(ED_t, Bo_t) \dots\dots\dots (2.3)$$

Education plays an essential role in explaining health and health behaviour, as it can improve “allocative efficiency” (i.e., engaging in healthy behaviour) and “productive efficiency” (i.e., through the use of health inputs) by health production (Bijwaard & Van Kippersluis, 2016). Education is positively linked with investment in health as higher educated people tend to consume more pharmaceutical products than those less educated. Education can be connected to a higher understanding and consciousness of health, hence promoting the preventive use of pharmaceuticals.

On the other hand, higher-educated individuals appear to have a higher marginal output of direct health inputs. They have a greater understanding capability and knowledge of health and are more efficient in consuming pharmaceutical products to improve their health. To summarise, well-educated people are efficient health producers. Thus, their demand for healthcare services would decrease.

Cawley and Ruhm (2011) classified unhealthy behaviours, for example, tobacco, alcohol and sugary consumption, as “negative health investment” or “health disinvestment”. Unhealthy behaviour factors may lead to individuals being less health-conscious, hence spending less on pharmaceuticals. Andersen’s healthcare utilisation model (Andersen &

Newman, 1973; Andersen, 1995) classified the three dynamics that influence healthcare demand: predisposing, enabling and need factors. Besides sociodemographics, lifestyle factors are vital predisposing factors to healthcare utilisation.

Tobacco use is strongly heritable to the extent that the comparatively large genetic influence on tobacco use compared to other substances, or the modelling and reinforcement of parental smoking behaviour by children, which explains the intergenerational transmission (Chassin et al., 2009). The crowding-out attribution of unhealthy behaviour expenditure on displacing expenditure on other items comes with the presumption that a tobacco-spending household decides on the quantity of tobacco to be purchased before deciding on the quantity of the other goods and services due to its addictive nature (Hussain et al., 2016; Nyakutsikwa et al., 2021). Comparatively, alcohol is less addictive (Nutt et al., 2007; Nyakutsikwa et al., 2021) and is consumed in a lower frequency and prevalence in Muslim-majority countries (MMCs) (WHO, 2019). In MMCs in North Africa and the WHO Eastern Mediterranean Region, the highest percentages of past 12-month abstention ($\geq 80\%$) are reported. Similarly, the WHO Eastern Mediterranean Region and other MMCs in the WHO African Region, such as Niger, have the world's lowest per capita alcohol consumption (less than 2.5 litres) (WHO, 2019).

The crowding-out effect of unhealthy behaviour expenditure (could be tobacco consumption, and sugar-sweetened food and beverage consumption) in replacement of expenditure on other commodities presumes that a household decides on the opportunity

cost, in this case, tobacco and sugar-sweetened food and beverage before the quantity of the other goods and services are determined, and in this case, pharmaceutical expenditure. Husain et al. (2016) analysed the use of smokeless tobacco, indicating potential trade-offs between dietary consumption and tobacco use. In contrast, spending on these unhealthy behaviours leads to various ailments, subsequently increasing pharmaceutical expenditure.

Grossman's model (as a function of health) was good at the time; one of the disadvantages to this model, however, was that the model ignored some of the critical factors. Based on this limitation, Smith and Kington (1997) conducted an empirical study to include all household income (HI) (Equation 2.4).

$$PES_t = f(ED_t, Bo_t, HI_t) \dots\dots\dots (2.4)$$

Any good or service may be graded as inferior, required or luxury by calculating the individual income-elasticity. At the macro level, the health expenditure income elasticity measured for the European countries is not very different from unity. The lower the income level, the higher the income elasticity (Saez & Murillo, 1994). However, the relationship between income and demand is more complex when broken down between various forms of health services. In the case of pharmaceuticals, the ambiguity is more prominent.

Several factors contribute to the complex relationship between income and pharmaceutical demand (Huttin, 1997). For example, income tends to have different

effects on the probability of obtaining medication. The impact of income on pharmaceutical demand also depends on other socioeconomic characteristics. Income is positively associated with spending in health, as individuals with higher incomes are more likely to purchase pharmaceutical products than individuals with lower incomes. This is because as the income of individuals rises, the value of the healthy time of individuals also rises, which in other words means that the time spent by higher-income earners on money-earning activities is more valued relative to the time spent by lower-income earners. Income differential is the benefit that individuals will gain as healthy time is transformed into money-earning activities. An equivalent way to express this is to say that the return on health investment is an increase in the time required for money-earning activities. Besides, income is positively linked with the tendency of people to adhere to good behaviour, if other portions of pharmaceutical products such as supplements are normal goods.

The causal relationship between pharmaceutical expenditure and age (A) is established (Equation 2.5). Owing to the rising rate of health deterioration, older people appear to spend more heavily on their health. This suggests that age is linked positively to the consumption of pharmaceutical products. However, participation in good health behaviour such as the consumption of pharmaceutical products may diminish with age. The explanation is that while older people face a greater risk of disease acquisition relative to younger individuals, their health-investment pay-off time is shorter because preventive health activity only provides benefits in the future when diseases are successfully prevented.

$$PES_t = f(ED_t, Bo_t, HI_t, A_t) \dots\dots\dots (2.5)$$

In summary, the consumption of pharmaceutical products varies across sociodemographic characteristics and unhealthy factors due to few conflicting theories.

2.3. Empirical Determinants of Pharmaceutical Expenditure

Primary research articles were searched exploratively by including those published from 2000 to April 2020 and in the English language available in full text from PubMed and Google Scholar. All relevant studies that describe sociodemographic and unhealthy lifestyle factors on pharmaceutical expenditure share were included as no published study was found on the pharmaceutical expenditure share as the study outcome. Grey literature was excluded. Ten studies met the inclusion criteria. There is no published study on the associations of tobacco and sugar consumption on pharmaceutical expenditure. Previous empirical research on the pharmaceutical expenditure determinants are discussed in detail in this section and summarised in Table 2.1.

2.3.1. Age

Most of the past studies have included age as an independent variable in explaining pharmaceutical expenditure. A study based on the number of pillboxes consumed in 2013 in Turkey obtained from the Turkish office of IMS Health Inc. (Danbury, CT, USA) shows that those aged 65 years old and above had a positive effect on pharmaceutical use in both ordinary least squares (OLS) and all quantile regression models, compared to those less than 65 years old (Alkan & Elmali, 2015).

In another study conducted from December 2012 to January 2013 in four service areas of the urban health centre in Puducherry, India, age range ($p=0.006$, by Chi-square test) was found to be linked with self-medication: increase of age led to an increase in self-medication to a maximum prevalence among 50-59 years old (Selvaraj et al., 2014). There was a positive relationship of the expenditure with age, especially in the elderly groups of 45–65 and 65-85 compared to 25-45 years old through logit and generalised linear model (GLM) with log-link and Poisson distribution in a study based on the Austrian Household Budget Survey 2009/10 (Sanwald & Theurl, 2017). Logically, the expenditure for pharmaceuticals increases with age as health deteriorates, consistent with the three studies presented above. However, plenty of studies proved no significant relationship with age (Chang et al., 2017; Figueiras et al., 2000; Hoai & Dang, 2017; Mayer & Osterle, 2015; Wijesinghe et al., 2012).

2.3.2. Gender

Gender is also a frequent factor being considered in various literature. Female was found to be more susceptible to purchase pharmaceutical products. Female respondents had 1.18 (1.13-1.25) higher (adjusted) odds of utilising pharmaceuticals in a study based on the Spanish National Health Survey of 1993 (Figueiras et al., 2000). Female householders had a highly significant coefficient of 0.264 ($p<0.01$) in the logit model, compared to the male counterpart in the Austrian Household Budget Survey (Sanwald & Theurl, 2017). On the contrary, in Puducherry, India, 17.8% of the male respondents were self-medicating compared to 5.4% of the female (Selvaraj et al., 2014). Gender as a factor did

not vary significantly in other studies (Chang et al., 2017; Hoai & Dang, 2017; Loganathan et al., 2017; Mayer & Osterle, 2015; Wijesinghe et al., 2012).

2.3.3. Ethnicity

There is no published literature on the direct comparison of ethnicity in Malaysia on pharmaceutical expenditure. Only one published study elsewhere on ethnicity as a determinant of pharmaceutical expenditure. The study was based on the 1999 Medicare Current Beneficiary Survey data in the United States (US) analysed using the Oaxaca-Blinder decomposition technique (Gaskin et al., 2006). The decomposition analysis comparing the indigenous whites with blacks (non-Hispanic) suggested that OOPE for whites was 51.8% higher, disparities in sociodemographic characteristics resulted in 23.0% higher spending for whites, despite white people receiving 0.8 fewer prescriptions. Ethnicity accounted for an increase of 28.8% in spending for whites. The study also compared between whites and Hispanics, in which variations in the sociodemographic characteristics increased the spending of the whites by 89.8% and ethnicity contributed to another increase for whites by 10.7%.

2.3.4. Marital Status

Figueiras et al. (2000)'s analysis showed that the ones who are living alone had 1.26 (1.18-1.36) higher odds of therapeutic drugs usage than those with a spouse, based on the Spanish National Health Survey. In contrast, those married had 4.9 higher odds ($p < 0.05$) of self-medicating than those who were non-married in the full logit model based on the

Ho Chi Minh study (Hoai & Dang, 2017). In the Chinese study (Chang et al., 2017), there was no significant relationship between marital status and pharmaceutical expenditure.

2.3.5. Education

There are strong agreements in our empirical review that having a higher education level did lead to higher likelihood (Chang et al., 2017; Figueiras et al., 2000; Mayer & Osterle, 2015; Sanwald & Theurl, 2017) and amount (Sanwald & Theurl, 2017) of pharmaceutical expenditure. There is a slight disagreement in which Hoai and Dang (2017) found that those with high school or vocational education qualifications had 3.6 higher (adjusted, $p < 0.05$) odds of self-medication than those with tertiary education in Ho Chi Minh. There is no significant association between education and pharmaceutical expenditure in other studies (Loganathan et al., 2017; Selvaraj et al., 2014; Wijesinghe et al., 2012).

2.3.6. Employment Status

Most studies (Figueiras et al., 2000; Hoai & Dang, 2017; Loganathan et al., 2017; Mayer & Osterle, 2015) found that employment status does not affect pharmaceutical expenditure.

2.3.7. Household Size

A handful of studies examined the association of household size on pharmaceutical expenditure, with studies (Hoai & Dang, 2017; Loganathan et al., 2017) showing no significant relationship. In a community-based survey on 1,800 adults from Gampaha and Polonnaruwa districts, Sri Lanka conducted by Wijesinghe et al. (2012), urban

households with two or fewer members, were more likely than those with larger households to consume medications (OR: 4.33, 95% CI: 1.10-17.53).

2.3.8. Region and Strata

There was a significant increasing trend of odds ratios in the use of medications along with the increasing number of inhabitants in the municipality of residence (Figueiras et al., 2000). Living in a central location of Ho Chi Minh ($p < 0.01$) reduces the amount of self-medication by 0.248 times using a Poisson model (Hoai & Dang, 2017). Through multiple classification analyses, villagers in India with primary health centres paid an annual adjusted mean of 5,576.50 Indian rupees (INR) compared to those without primary health centres (4,199.15 INR) with a β -value of 0.047 (Loganathan et al., 2017). However, other studies show that the degree of urbanisation (Sanwald & Theurl, 2017) and urban/rural locality (Chang et al., 2017) have no significant association with pharmaceutical expenditure.

Apart from the urban/rural or population density factor, geographical location may affect pharmaceutical consumption, despite within the same country. In a Turkish study, from the 50th and 75th quantile regression models, pharmaceutical consumption was significantly higher in provinces with a coastline (Alkan & Elmali, 2015).

2.3.9. Household Income

Generally, we expect households with higher income to have higher pharmaceutical expenditures, as they can afford to consume them. In a study based on European Health

Interview Survey (EHIS) from March 2006 to February 2007 in Austria, those with >EUR 1,401 had a higher relative-risk ratio of 1.34 (1.11–1.62) compared to those of <EUR 700 to consume non-prescribed medicines (Mayer & Osterle, 2015). This is well supported by other studies: urban residents in Ho Chi Minh City, Vietnam using survey data that the income log had a positive impact on the probability of self-medication, with the coefficient of 0.775 ($p<0.05$, OR=2.17) in the full logit model (Hoai & Dang, 2017); in the Austrian household budget survey, the log of income had a positive effect with the coefficient of 0.188 ($p<0.05$) in the logit model (Sanwald & Theurl, 2017).

However, a study by Chang et al. (2017) based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013, the middle-income group had 1.16 odds (1.02-1.32, $p<0.05$) of consuming pharmaceuticals compared to the group with the lowest income (reference group). The highest-earning group had a ratio of odds ratio (OR) of 0.84 (0.71-0.99, $p<0.05$) compared to the reference group. Hence, this study concluded an inverse-U shape relationship between income and pharmaceutical expenditure, while other studies (Loganathan et al., 2017; Selvaraj et al., 2014; Wijesinghe et al., 2012) show no significant relationship.

2.4. Conclusion

The theoretical and empirical studies of factors influencing pharmaceutical spending were examined in this chapter. Previous studies had illustrated the positions of different socioeconomics and unhealthy behaviours that were found to have mixed outcomes in

determining pharmaceutical spending. It is noteworthy that this research was based on the likelihood of pharmaceutical expenditure and pharmaceutical expenditure share simultaneously as a research gap using nationally representative data, which is further elaborated in Chapter 3.



Table 2.1 *Past Findings on the Determinants of Pharmaceutical Expenditure*

Study ^a	Country	Variable ^b							
		Age	Gender	Marital	Education	Employment	Household size	Region & Strata	Income
Mayer & Österle (2015)	Austria	×	×	-	✓	×	-	-	✓
Alkan & Elmali (2015)	Turkey	✓	-	-	-	-	-	✓	-
Chang et al. (2017)	China	×	×	×	✓	-	-	×	✓
Figueiras et al. (2000)	Spain	×	✓	✓	✓	×	-	✓	-
Wijesinghe et al. (2012)	Sri Lanka	×	×	-	×	-	✓	-	×
Selvaraj et al. (2014)	India	✓	✓	-	×	-	-	-	×
Hoai & Dang (2016)	Vietnam	×	×	✓	✓	×	×	✓	✓
Sanwald & Theurl (2017)	Austria	✓	✓	-	✓	-	-	×	✓
Loganathan et al. (2017)	India	-	×	-	×	×	×	✓	×

Source: Compiled by author

Note:

✓ refers to the variable that is significantly associated with pharmaceutical expenditure

×

- refers to the variable that is not being investigated in the study.

^a There is only a published study by Gaskin et al. (2006) which studies specifically on ethnicity in the United States, in which ethnicity is significantly associated with the amount of pharmaceutical expenditure (not presented in this table).

^b There is no published data on tobacco and sugar consumption as determinants of pharmaceutical expenditure.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

The chapter aims to describe the methods used to investigate the pharmaceutical expenditure likelihood and share in Malaysia. The dependent variable is the pharmaceutical expenditure as a share of household income, while the independent variables focus on the sociodemographic and unhealthy behaviour factors that have been highlighted in the literature review: age, gender, ethnicity, marital status, education, employment status, household size, strata, monthly household income, region by GDP per capita; tobacco consumption, and sugar-sweetened food and beverages consumption.

The research framework of this study is discussed in section 3.2 and is followed by Section 3.3, which describes the data. In addition, Section 3.4 addresses the justification of variables and the expected sign for each independent variable. The econometric tests to be conducted are clarified in Section 3.5 and this chapter is concluded in Section 3.6.

3.2. Research Framework

The central question to be answered by most medicine consumption studies is why the population of certain nations, or groups of people within the same country, tends to consume more medicines than others. Awareness of factors driving demand for pharmaceuticals relies heavily on the design of pharmaceutical policies dedicated to improving the reasonable use of drugs and public demand cost-containment strategies.

As in Chapter 2 with the assumption of healthcare consumption as a pure investment of health, sociodemographic variables of education level, household income and age had been established in theories based on Grossman's model while sociodemographic variables of gender, ethnicity, marital status, employment status, household size and strata and of residence had been investigated elsewhere empirically. The ethnicity to be investigated in this study is unique in the Malaysian context. Region by GDP per capita within a country, and in the case of Malaysia, have yet to be investigated.

Unhealthy behaviours are classified as "health disinvestment" in general (Cawley and Ruhm, 2011). Lifestyle factors are also major predisposing factors to healthcare utilisation (Andersen & Newman, 1973; Andersen, 1995). However, unhealthy health behaviours are challenging to be defined and quantified as the scopes are large. Different destructive health behaviours affect pharmaceutical expenditure in different ways, as described in Section 2.2. In this study, we investigated two main bad health behaviours: tobacco consumption and sugar-sweetened food and beverages consumption to examine whether consumption of different unhealthy goods would have different associations on pharmaceutical expenditure.

The health status of the households is not available in the data which is an important variable in healthcare demand model, leading to omitted variable bias. However, health status itself is subjective and difficult to be quantified as has multiple dimensions of self-perceived assessment and clinical indicators (Megari, 2013). Essentially, the data on pharmaceutical expenditure were collected over a short period of one month. It is possible that the disease episode begins before the observation period and/or last longer, which makes association between health status and

pharmaceutical expenditure difficult. Even if health status data is available, other endogeneity issues may arise due to the nature of cross-sectional data. The dispute of causality between health status and healthcare expenditure remains inconclusive (Novignon et al., 2012). Treating both sociodemographic characteristics and health status as explanatory variables may have potential interrelation as well (Mayer & Osterle, 2015).

The paternalistic structure in which household heads make decisions in the interest of all members is assumed. Pharmaceutical expenditure share (PES) was investigated by summing the associations potentially caused by all individual aspects of household heads which are age (A), gender (G), ethnicity (E), marital status (MS), education level (ED), employment status (ES); sociodemographic aspects of households which are household size (HS), strata (S), household income (HI) and region by GDP per capita (R) as unhealthy behaviour factors such as tobacco consumption (TC) and sugar-sweetened food and beverages consumption (SC) (Equation 3.1 and Figure 3.1).

$$PES = f(A, G, E, MS, ED, ES, HS, S, HI, R, TC, SC) \dots (3.1)$$

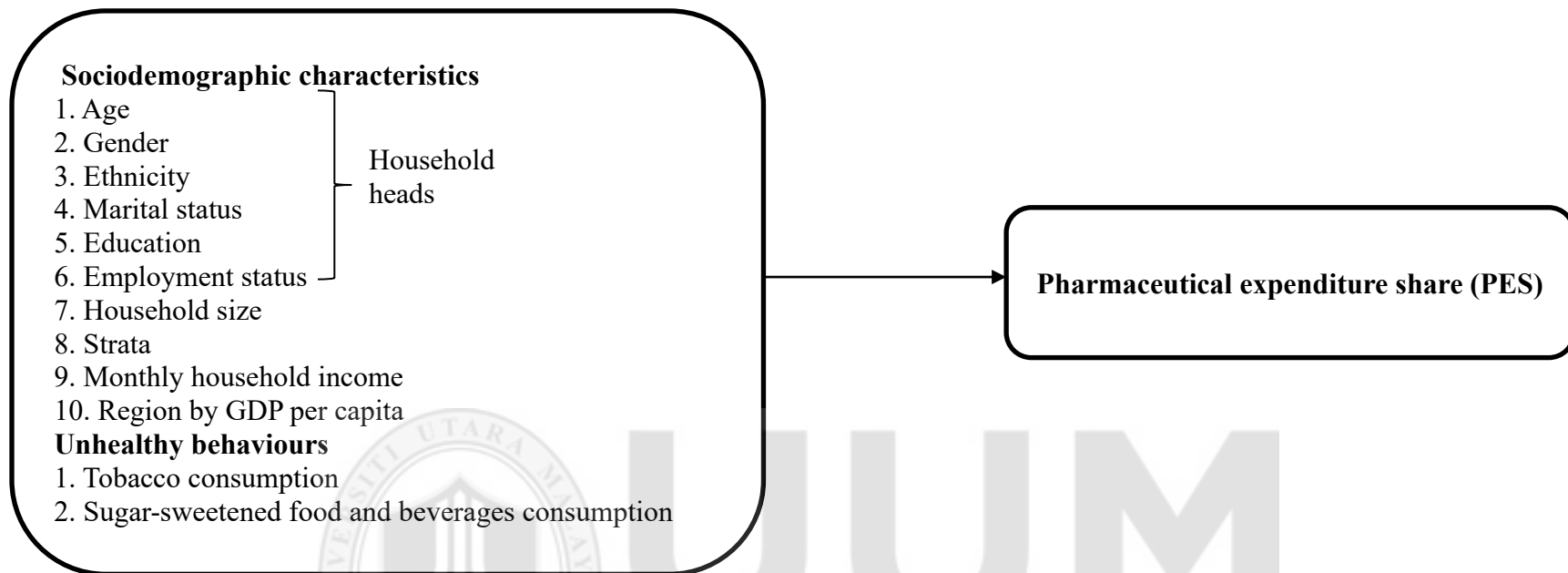


Figure 3.1 *Framework Developed to Analyse Household Pharmaceutical Expenditure Share Determinants*

3.3. Data

Household Expenditure Survey (HES) 2014 (DOSM, 2014) was a nationwide survey carried out by the Department of Statistics Malaysia in 2014. The main objective of HES is to gather information on the degree and pattern of household consumption spending on a variety of goods and services. The sample for HES was designed based on a stratified multi-stage probability sampling to ensure the sample represented all Malaysian households. All states in Malaysia were included in the primary strata. In each state, the secondary strata consist of both urban and rural areas. Enumeration blocks (EBs) were chosen in the first stage of sampling based on the probability calculated based on the population size. EBs are geographical contiguous areas with definable boundaries developed for survey purposes. The second stage involved selecting private living quarters (LQs) from each EB using systematic random selection. This is to ensure that all LQs have an equal chance of being chosen as a sample through a system that generates random number and interval classes. Every EB consisted of 80 to 120 LQs. The survey excluded households in residential establishments, such as hotels, hospitals and prisons, as the survey only covers households living in private LQs.

Before the survey, all interviewers were trained. Household heads of all households in the chosen LQs were surveyed face-to-face. Any household members who could represent the household heads were interviewed if the household heads were not available at the time of the survey. Prior to the interview, each respondent was asked to complete a consent form. Those who refused to consent were not allowed to take part in the survey.

To minimise errors, the skilled and competent workers reviewed the data obtained by the interviewers before it was analysed. The data consist of household characteristics, such as sociodemographics of household heads and household profiles. It also recorded the total monthly expenditure done by the household, which covers the 12 main groups of goods and services. The classification of these main groups was based on the Classification of Individual Consumption According to Purpose (COICOP) (UN, 2000), published by the United Nations Statistics Division (UNSD). The items include food and beverages, clothing and footwear, housing, health, transport. More than 14,838 households were surveyed.

3.4. Dependent Variable

The dependent variable used in this research is the pharmaceutical expenditure share, which is the total monthly household expenditures on pharmaceutical products over the total monthly household income and was expressed in percentages (%).

The expenditure on pharmaceutical products is obtained from the 4-digit item code of 0611 in the HES, which includes controlled medicine (require a doctor's prescription or pharmacist's approval), over-the-counter (OTC), supplements and traditional medicine, which follows the COICOP guidelines without alteration (UN, 2000). This scope of 'pharmaceutical products' is consistent across various intergovernmental organisations (OECD, 2017; UN, 2000; WHO, 2017). In any definition of 'pharmaceutical expenditure', only pharmaceuticals consumed for 'self-medication' purposes are included (WHO, 2000), while pharmaceuticals consumed in and/or obtained from hospitals and clinics as part of diagnosis or examination are excluded (OECD, 2017; UN, 2000). All pharmaceutical products are considered non-durable goods (UN,

2000). Pharmaceutical expenditure share (as a numerical variable) is the percentage of monthly household income allocated for pharmaceutical products.

3.5. Independent Variables

The independent variables consist of ten sociodemographic factors (gender, age, ethnicity, marital status, education, employment status of household head; household size, strata, monthly household income, region) and two unhealthy behaviour factors (tobacco consumption, and sugar-sweetened food and beverages consumption). Certain sociodemographic characteristics of household heads were used because summative effects of all household members for these traits cannot be established easily. Household heads are persons in the household who take essential decisions on behalf of the household members and represent these variables for each household. All independent sociodemographic variables were grouped into categorical variables, while the two unhealthy behaviours were formatted into continuous variables.

All sociodemographic and unhealthy behaviours (except alcohol consumption) available in the HES 2014 were included in this study. There are inconclusive empirical results for each factor and the justification of variables, as explained in Chapter 2. Alcohol consumption is considered a major unhealthy behaviour elsewhere but was excluded from this study. Malaysia is a Muslim majority country (MMC). In Malaysia, 61.3% of the population are Muslims (DOSM, 2011). As Islam is the official religion of Malaysia, the sharia law forbids Muslims from alcohol consumption and being sold to them. According to WHO (2019), Malaysia was classified under “low consumption with a high percentage of past year abstainers” (70.4%).

3.5.1. Age

The first independent variable is the age of the household head, which almost all past studies had included. Pharmaceutical expenditure increased with age, as shown in previous studies due to being in different phases of life (Alkan & Elmali, 2015; Sanwald & Theurl, 2017; Selvaraj et al., 2014), while few studies show no significant relationship (Chang et al., 2017; Figueiras et al., 2000; Hoai & Dang, 2017; Mayer & Osterle, 2015; Wijesinghe et al., 2012). Generally, the assumption is that the age of household heads has a significant association with the amount and likelihood of pharmaceutical expenditure share. In the current study, the age of household heads was separated into ≤ 24 , 25-34, 35-44, 45-64 and ≥ 65 years old, as categorised by the HES 2014.

3.5.2. Gender

There have been conflicting findings on the association of gender in affecting pharmaceutical expenditure. Female was found to be more inclined to consume pharmaceutical products in a few studies (Figueiras et al., 2000; Sanwald & Theurl, 2017), while the male was found to consume more in another study (Selvaraj et al., 2014); and no significant differences between gender and pharmaceutical expenditure in other research (Chang et al., 2017; Hoai & Dang, 2017; Loganathan et al., 2017; Mayer & Osterle, 2015; Wijesinghe et al., 2012). In this study, we hypothesised that the household heads' gender is significantly associated with varying pharmaceutical expenditure share. Gender inclusion in the current model is beneficial because it can represent the disease states, preferences and behaviours of different gender that may affect pharmaceutical expenditure share while controlling other factors. In this study, the gender of household heads was categorised as male and female.

3.5.3. Ethnicity

Ethnicity was included as one of the independent variables in this study for the possibility of cultural differences affecting Malaysian pharmaceutical buying decisions and spending patterns. A study in the US showed that whites, being indigenous, spent more than blacks (non-Hispanic) and Hispanics (Gaskin et al., 2006). A Malaysian study indicates that the ethnicity of household heads is significantly associated with the consumption decision of household healthcare expenditure (Cheah et al., 2021). Hence, it would be interesting to investigate ethnicity in relation to pharmaceutical expenditure share. In the current research, ethnicity was categorised into two groups: *Bumiputera* (Malay and indigenous people) and *non-Bumiputera*, by hypothesising that the ethnicity of household heads influences pharmaceutical expenditure share.

3.5.4. Marital Status

A study by Figueiras et al. (2000) shows that those who were living alone used more pharmaceuticals than households with a partner in the final logistic model, in contrast with one research (Hoai & Dang, 2017) in which married households had higher log odds and frequency of self-medication than those who were single or under other marital status. There was no significant relationship between marital status and pharmaceutical expenditure in another study (Chang et al., 2017). We hypothesised that the marital status of household heads affects pharmaceutical expenditure share. In this research, marital status was comprised of three categories: single, married and widow/divorce.

3.5.5. Education

Past researchers found that education was an essential factor in pharmaceutical consumption and spending patterns. Higher education levels led to higher pharmaceutical expenditure (Chang et al., 2017; Figueiras et al., 2000; Mayer & Osterle, 2015; Sanwald & Theurl, 2017): a study found that those with high school or vocational education had the highest consumptions (Hoai and Dang, 2017) while no significant association in other research (Loganathan et al., 2017; Selvaraj et al., 2014; Wijesinghe et al., 2012). Consistent with the theory and numerous empirical studies, we hypothesised that the education level of household heads has an impact on pharmaceutical expenditure share. In the current study, the education level was collapsed to form four categories: no formal education, primary (<7 years of schooling), secondary (7-11 years) and tertiary (≥ 12 years).

3.5.6. Employment Status

The majority of research (Figueiras et al., 2000; Loganathan et al., 2017; Mayer & Osterle, 2015) (Hoai & Dang, 2017) found that employment status did not affect pharmaceutical expenditure. However, we would like to find out whether this result still holds in the context of Malaysia. We put an early hypothesis that employment of household heads leads to changes in pharmaceutical expenditure share. In this study, employment status was categorised into two groups: employed and unemployed.

3.5.7. Household Size

The household size was also included to explore its association with purchasing probability and the extent of pharmaceutical expenditure share. Smaller households were more likely to consume

medicines in a study by Wijesinghe et al. (2012), while other research (Hoai & Dang, 2017; Loganathan et al., 2017) show no significant relationship. However, in this study, we would like to hypothesis that household size leads to changes in pharmaceutical expenditure share. For this research, the household size was classified into small (less than 5 persons), medium (5-7 persons) and large (8 or more persons), as categorised by Mok et al. (2011) for Malaysians.

3.5.8. Strata

The strata of residence were also included as one of the variables. There was a significant positive trend in the use of medications in urban areas (Figueiras et al., 2000; Loganathan et al., 2017) and a negative trend in another study (Hoai & Dang, 2017), while no significant relationship in another study (Chang et al., 2017). There was rapid urbanisation from 26.8% in 1970 to 71.0% in 2010 to a projected 74% in 2015 (DOSM, 2011). This variable was investigated as urbanisation has various impacts on access to basic amenities, including medicine access, which may affect pharmaceutical expenditure. It was hypothesised that locality is associated with the likelihood and amount of pharmaceutical expenditure share.

For this research, the strata of residence were grouped into urban and rural. The definition of urban employed by DOSM is "Gazetted areas with their adjoining built-up areas, which had a combined population of 10,000 or the special development area that can be identified, which at least had a population of 10,000 with at least 60 % of the population (aged 15 years and above) were involved in non-agricultural activities." Whatever is not urban was considered rural.

3.5.9. Household Income

It was predicted that total monthly household income affects trends of household pharmaceutical expenditure. Most studies (Hoai & Dang, 2017; Mayer & Osterle, 2015; Sanwald & Theurl, 2017) indicate that higher income led to higher expenditure. However, research by Chang et al. (2017) shows an inverse-U shape relationship, while other studies (Loganathan et al., 2017; Selvaraj et al., 2014; Wijesinghe et al., 2012) show no significant relationship.

For the current research, monthly household income was defined as total income received by members of households from four types of sources: paid employment, self-employed, income from property and investment, and current transfer received. Monthly household income was divided into three income groups, namely B40, which had a monthly income of less than RM 4,360, middle 40% (M40) group, which had an income bracket of RM 4,360 – 9,619, and the top 20% (T20) group which had household income equal or more than RM 9,620, as categorised in the report on HIES/BA 2016 (DOSM, 2017)

In general, households with higher disposable incomes tend to consume pharmaceutical products because they are more likely to afford them. Therefore, household income was hypothesised to be associated with the variation of pharmaceutical expenditure share.

3.5.10. Region by GDP per capita

The comparison of regions or states by GDP per capita within the same country has not been employed elsewhere, to the best of our knowledge. The justification of using this variable is to investigate whether living in a region of high or low GDP per capita while adjusting for

household income, affect pharmaceutical expenditure. We hypothesised that those who stay in different GDP per capita regions have different pharmaceutical spending. For the current study, the regions were divided into high-income, middle-income and low-income states, according to the GDP per capita of individual states as in the State Socioeconomic Report 2018 (DOSM, 2018), instead of by geographical regions. From the 15 states (including federal territories) in Malaysia, five states recorded GDP per capita surpassed the 66.7 percentile in GDP per capita among the states ($>RM\ 50,357.70$), namely the Federal Territory of Kuala Lumpur (including Putrajaya), Federal Territory of Labuan, Penang, Sarawak and Selangor, were categorised as high-income states. Five states with GDP per capita lower than 33.3 percentile ($<RM\ 30,244.54$), namely Terengganu, Sabah, Perlis, Kedah and Kelantan, were grouped as low-income states while the remaining five states (GDP per capita of $RM\ 30,244.54 - RM\ 50,367.70$) as middle-income states (Table 3.1).

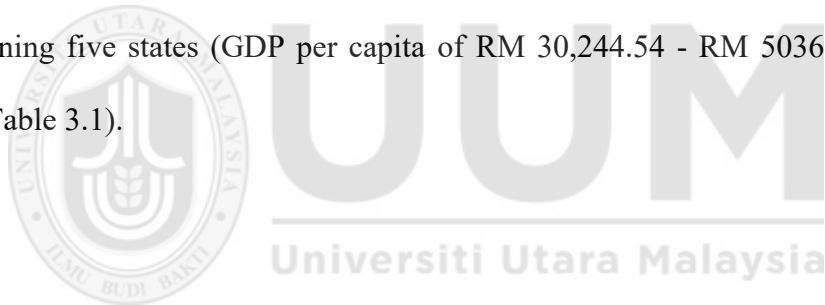


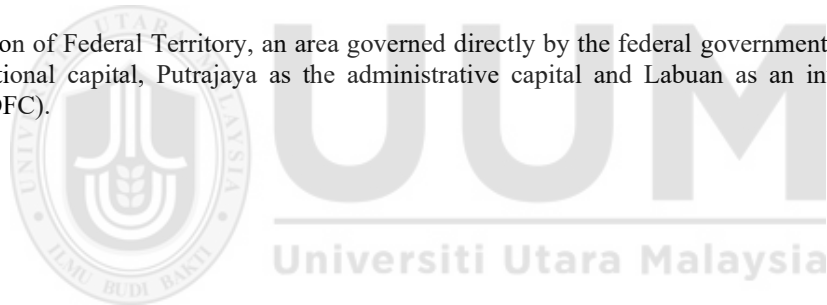
Table 3.1 *Gross Domestic Product (GDP) Per Capita (in Malaysian Ringgit) by Malaysian States in 2018*

State	GDP per capita (RM)	Regional category
FTs Kuala Lumpur and Putrajaya	121,293	High-income states
FT Labuan	74,337	
Penang	52,937	
Sarawak	52,301	
Selangor	51,528	
Melaka	47,960	Middle-income states
Negeri Sembilan	43,047	
Johor	36,394	
Pahang	35,554	
Perak	30,303	
Terengganu	30,216	Low-income states
Sabah	25,861	
Perlis	24,442	
Kedah	21,410	
Kelantan	13,668	

Source: State Socioeconomic Report 2018 (DOSM, 2018).

Note:

FT is an abbreviation of Federal Territory, an area governed directly by the federal government of Malaysia: Kuala Lumpur as the national capital, Putrajaya as the administrative capital and Labuan as an international offshore financial centre (IOFC).



3.5.11. Tobacco Consumption

In 2015, about 5 million Malaysians aged 15 years and above (22.8%) were current smokers (IPHM, 2015). New tobacco consumers may still be healthy and do not need any medicines for lung or gum diseases. Chronic tobacco consumers may need medicines for various lung or gum diseases that they suffer, such as inhalers for chronic obstructive pulmonary disease (COPD). For tobacco consumers who are planning to quit, they could be spending on medicines for smoking cessation, such as nicotine replacement therapy. We hypothesised that a different amount of tobacco consumed causes an additional amount of pharmaceutical expenditure share.

From the HES 2014, the sum of household expenditure in the past one month (from the time of the survey) on cigarettes, cigar/cheroots (included in the 4-digit item code of 0221), and on tobacco, betel leaves, cigarette paper or cigarette leaves (included in the 4-digit item code of 0222) was considered as tobacco expenditure and was expressed as a continuous variable.

3.5.12. Sugar-sweetened Food and Beverage Consumption

The latest Malaysian Adult Nutrition Survey (MANS) 2014 shows that about 55.9% of Malaysian adults consumed sugar-sweetened food and beverage daily as the leading cause of diabetes in Malaysia (IPHM, 2014). Those who have developed diabetes may need to spend on diabetic medicines or other illnesses related to diabetes, such as heart diseases, kidney diseases and bladder problems. There is no empirical study of the association between sugar-sweetened food and beverage consumption and pharmaceutical expenditure, to the best of our knowledge. We hypothesised that different amounts of sugar-sweetened food and beverage consumption have extra pharmaceutical expenditure share.

In this study, the monthly household expenditure of sugar-sweetened food and beverages included sugar, jam, honey and confectioneries as stated in the 4-digit item code of 0018, was formatted as a continuous variable.

3.6. Econometric Specification

The description of the pharmaceutical expenditure data collection makes it clear that, for many reasons, there is a lot of zero value in the dependent variable. There are three possible causes of zero consumption: no participation, corner solution and/or infrequent expenditure. The econometric treatment of this information is complicated by this scenario.

Linear probability regression using OLS may be good in providing a clear-cut straightforward regression model but in this case, may give slope estimates that are biased toward zero (omitted-variable bias) due to the limited dependent variable data set.

The sample selection model developed by Heckman (1979) has often been used to deal with data that has a lot of zeros. It is less restrictive compared with tobit as it estimates consumption decisions and amount decisions separately. However, it may not be suitable for the study on the consumption behaviour for several reasons. Firstly, the sample selection model is used to treat data with missing observations. In the consumption data, people choose not to consume because they prefer not to, nor the need to consume. Hence, there is a corner at zero. Since there is no missing observation in the data, the sample selection model is inappropriate even logarithm (log) is added to the dependent variable. Secondly, the sample selection model only works well with an exclusion restriction, which means that the independent variables in the consumption equation

must be greater than those in the amount equation. Otherwise, the inverse Mills ratio (IMR) in the amount equation is highly correlated with the independent variables. As a result, the sample selection issue cannot be well-identified due to the multicollinearity problem. The model for consumption of pharmaceutical products does not have a good exclusion restriction because the variables that affect consumption are likely to affect amount as well. It is challenging to identify which variables should be included in the consumption equation but not in the amount equation. Truncated regression (truncated at zero) may not be suitable as it only identifies the share of expenditure only.

The two-part or hurdle model is popular in examining healthcare demand. The first part is a binary model that emphasises the distinction between pharmaceutical consume(rs) and non-consume(rs). The second part describes how often and how much pharmaceuticals are used if they are used at all. Healthcare utilisation or expenditures data are statistically supported by the break in the estimation procedure due to skewness, excess zeros, and/or heavy right tails. The break in the estimation procedure is motivated from an economic standpoint is to distinguish the two decision-making stages. As a result, the analytical approach used in the first phase is typically based on the Grossman model of healthcare demand (Grossman, 1972; Wagstaff, 1993). Commonly associated with the principal-agent framework, it divides the decision process into two stages: the consumers decide on his or her own on whether to consume preventive or curative pharmaceuticals, and the second step is a collaborative decision of healthcare providers and consumers (Samsudin & Moffatt, 2014).

Unlike tobit, the two-part model allows the values of a decision to consume and the amount of expenditure to be determined by separate mechanisms. The first step of the estimation is to use probit to analyse whether the individuals consume pharmaceutical products (consumption equation). Ordinary least square (OLS) with the condition of having a non-zero pharmaceutical expenditure share is utilised to analyse how much the consumers allocate their household income to spend on pharmaceutical products per month (amount equation). Since the two-part model does not require exclusion restriction for identification purposes, the independent variables included in both consumption and amount equations are identical (Wooldridge, 2010).

Descriptive statistics were computed for all the data. Preliminary one-way analysis of variance (ANOVA) was conducted to investigate the association between sociodemographic variables and mean pharmaceutical expenditure share among all households. ANOVA is a model-independent probabilistic sensitivity analysis tool in determining if an outcome and one or more inputs have a statistical relationship. In contrast to regression analysis, ANOVA does not require any assumptions about the functional structure of relationships between inputs and the numerical outcome. Additionally, categorical inputs and multiple inputs can be addressed (Krishnaiah, 1980). ANOVA was conducted on pharmaceutical expenditure share (numerical data) as the outcome and using all household data as a sensitivity analysis on the amount equation of the subsequent two-part model.

The two-part model was proposed as Equation 3.2 (probit) and Equation 3.3 (OLS), which was derived from Equation 3.1 that consist of sociodemographic aspects of household i which are age (A), gender (G), ethnicity (E), marital status (MS), education level (ED), employment status (ES),

household size (HS), strata (S), household income (HI) and region by GDP per capita (R) with the addition of unhealthy behaviours of household tobacco consumption (TC) and sugar-sweetened food and beverages consumption (SC). The participation or consumption equation was used to examine the likelihood of all households in purchasing pharmaceutical products from the estimation model (Equation 3.2), while the amount equation was used to determine pharmaceutical expenditure share among households who have purchased (Equation 3.3).

$$\text{Likelihood of pharmaceutical expenditure (share), } P(\text{PES}_i=1) = \beta_0 + \beta_1\text{DA}_{25-34i} + \beta_2\text{DA}_{35-44i} + \beta_3\text{DA}_{45-64i} + \beta_4\text{DA}_{65+i} + \beta_5\text{DG}_{Fi} + \beta_6\text{DE}_{Bi} + \beta_7\text{DMS}_{Mi} + \beta_8\text{DMS}_{Wi} + \beta_9\text{DED}_{1i} + \beta_{10}\text{DED}_{2i} + \beta_{11}\text{DED}_{3i} + \beta_{12}\text{DES}_{Ei} + \beta_{13}\text{DHS}_{5-7i} + \beta_{14}\text{DHS}_{8+i} + \beta_{15}\text{DS}_{ui} + \beta_{16}\text{DHI}_{M40i} + \beta_{17}\text{DHI}_{T20i} + \beta_{18}\text{DR}_{MIDGDPi} + \beta_{19}\text{DR}_{HIGHGDPi} + \beta_{20}\text{TC}_i + \beta_{21}\text{SC}_i + u_i \dots (3.2)$$

$$\text{Pharmaceutical expenditure share with purchase, } \text{PES}_i | \text{PES}_i > 0 = \beta_0 + \beta_1\text{DA}_{25-34i} + \beta_2\text{DA}_{35-44i} + \beta_3\text{DA}_{45-64i} + \beta_4\text{DA}_{65+i} + \beta_5\text{DG}_{Fi} + \beta_6\text{DE}_{Bi} + \beta_7\text{DMS}_{Mi} + \beta_8\text{DMS}_{Wi} + \beta_9\text{DED}_{1i} + \beta_{10}\text{DED}_{2i} + \beta_{11}\text{DED}_{3i} + \beta_{12}\text{DES}_{Ei} + \beta_{13}\text{DHS}_{5-7i} + \beta_{14}\text{DHS}_{8+i} + \beta_{15}\text{DS}_{ui} + \beta_{16}\text{DHI}_{M40i} + \beta_{17}\text{DHI}_{T20i} + \beta_{18}\text{DR}_{MIDGDPi} + \beta_{19}\text{DR}_{HIGHGDPi} + \beta_{20}\text{TC}_i + \beta_{21}\text{SC}_i + u_i \dots (3.3)$$

where

PES_i = pharmaceutical expenditure share (%)

DA_{25-34i} = 1, if the age is between 25 to 34 years old; =0, otherwise

DA_{35-44i} = 1, if the age is between 35 to 44 years old; =0, otherwise

DA_{45-64i} = 1, if the age is between 45 to 64 years old; =0, otherwise

DA_{65+i} = 1, if the age is more than or equal to 65; =0, otherwise

DG_{Fi} = 1, for female and =0, for male

DE_{Bi} = 1, for *Bumiputera* and =0, for non-*Bumiputera*

DMS_{Mi} = 1, if marital status is married; =0, otherwise

DMS_{Wi} = 1, if marital status is widow/divorcee; =0, otherwise

DED_{1i} = 1, if primary (<7 years of schooling) education; =0, otherwise

DED_{2i} = 1, if secondary (7-11 years of schooling) education; =0, otherwise

DED_{3i} = 1, if tertiary (≥ 12 years of schooling); =0, otherwise

DES_{Ei} = 1, for employed and =0, for unemployed

DHS_{5-7i} = 1, if the household size is between 5 to 7 persons; =0, otherwise

DHS_{8+i} = 1, if the household size is 8 or more persons; =0, otherwise

DS_{ui} = 1, if the strata is urban area and =0, if the strata is rural

DHI_{M40i} = 1, if the household income is between RM 4,360 to RM 9,619; =0, otherwise

DHI_{T20i} = 1, if the household income is equal or more than RM 9,620; =0, otherwise

$\text{DR}_{MIDGDPi}$ = 1, if the GDP per capita of regions is between RM 30244.54 to RM 50367.70; =0, otherwise

$\text{DR}_{HIGHGDPi}$ = 1, if the GDP per capita of regions is more than RM 50,357.70; =0, otherwise

TC_i = Tobacco consumption (RM)

SC_i = Sugar-sweetened food and beverages consumption (RM)

The model was further stratified by income groups and regions by GDP per capita to compare the factors affecting the expenditure of pharmaceutical products in the three income groups and three regions. Using both indicators, namely GDP per capita and household income, give a comprehensive picture of living standards concerning pharmaceutical expenditure share (Nolan et al., 2019).

Diagnostic checking was performed on the data, including multicollinearity and heteroscedasticity. All independent variables were diagnosed for the potential multicollinearity problem by conducting the variance inflation factor (VIF) tests. Mason et al. (1989) state a VIF of more than 10 as a “reason for concern”. White’s test is a statistical test that specifies a model's variance of errors: if it is constant, the model is homoscedastic (White, 1980). Suppose White’s test is significant ($p < 0.05$), heteroscedasticity is present in the model which robust standard errors are to be computed for both probit (consumption decision) and OLS (amount decision) to obtain unbiased standard errors of coefficients.

All the statistical tests were considered significant p-values at 2-sided levels are below 5%. The statistical analysis is performed using Stata statistical software (StataCorp, 2013).

3.7. Conclusion

In conclusion, by using Grossman’s model, this study aims to investigate the reasons behind the likelihood of pharmaceutical expenditure and pharmaceutical expenditure share. This study used

the Household Expenditure Survey (HES) 2014 data which is nationally representative data. A two-part model (probit and OLS regressions) was the primary econometric test used.



CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Introduction

The major findings on the associations of sociodemographic and unhealthy behaviours on household pharmaceutical expenditure share in Malaysia are presented and discussed in this chapter. Each section from Section 4.2 to 4.4 answers a specific objective, respectively. Section 4.2 answers the first objective on the factors that affect the likelihood of consuming pharmaceuticals and the share of household income spent (pharmaceutical expenditure share) on pharmaceutical products. Section 4.3 examines the factors that affect the likelihood of consuming pharmaceuticals and pharmaceutical expenditure share across different income groups. Section 4.4 evaluates the sociodemographic and unhealthy behaviours that affect the likelihood of consuming pharmaceuticals and pharmaceutical expenditure share across different regions by GDP per capita. Section 4.5 provides discussions of each variable or factor for the results (Section 4.2 to 4.4). Lastly, the chapter is concluded in Section 4.6.

4.2. Overall (pooled) sample

The section analyses the associations of sociodemographic and unhealthy behaviours on pharmaceutical expenditure share in the overall (pooled) sample.

4.2.1. Characteristics of Households

The sociodemographic and unhealthy behaviour characteristics of all respondents (n=14,838) surveyed in the Household Expenditure Survey 2014 are presented descriptively in Table 4.1. The majority of the household heads were in the range of 45-64 years old (45.2%), male (84.8%),

Bumiputera (68.2%), married (79.1%), secondary school leavers (56.7%) and employed (92.5 %). The mean age of household heads was 46 years old.

Most households consisted of a small household size of less than 5 (57.7%), residing in the urban areas (69.1%) had B40 monthly income (51.3%), and in high-income states of the Federal Territories, Penang, Sarawak or Selangor (40.0%). The average monthly household income was RM 4234.24, with a household of 4 respectively. By adding all households together (including those who did not spend), the households spent an average (mean) of RM 61.10 on tobacco and RM 22.43 on sugar-sweetened food and beverage monthly.

Characteristics of households with (n=6,501) and without (n=8,337) pharmaceutical expenditure (PE) are also presented in Table 4.1. Descriptively, there was no vast characteristic difference between the three household groups except on PE. All households group spent RM 31.53 per month on pharmaceuticals. However, if only households with non-zero PE (n=6,501) were considered, mean PE was raised slightly more than double, to RM 71.95 a month.

Table 4.1 *Sociodemographics and Unhealthy Behaviour Characteristics of Households With, Without Pharmaceutical Expenditure (PE) and All Households*

Characteristics	n (%) / Mean ± SD of Households		
	With PE (n=6,501)	Without PE (n=8,337)	All (n=14,838)
Age (years old)	47.01±13.26	46.04±12.79	46.46 ±13.01
< 25	143 (2.2)	201 (2.4)	344 (2.3)
25-34	1181 (18.2)	1521 (18.2)	2702 (18.2)
35-44	1542 (23.7)	2175 (26.1)	3717 (25.1)
45-64	2974 (45.7)	3730 (44.7)	6704 (45.2)
> 64	661 (10.2)	710 (8.5)	1371 (9.2)
Gender			
Male	5509 (84.7)	7071 (84.8)	12580 (84.8)
Female	992 (15.3)	1266 (15.2)	2258 (15.2)
Ethnicity			
Bumiputera	4320 (66.5)	5796 (69.5)	10116 (68.2)
Non-Bumiputera	2181 (33.5)	2541 (30.5)	4722 (31.8)
Marital status			
Single	790 (12.2)	1003 (12.0)	1793 (12.1)
Married	5157 (79.3)	6578 (78.9)	11735 (79.1)
Widow/Divorced	554 (8.5)	756 (9.1)	1310 (8.8)
Education			
No formal education	276 (4.2)	380 (4.6)	656 (4.4)
Primary school	1140 (17.5)	1469 (17.6)	2609 (17.6)
Secondary school	3640 (56.0)	4772 (57.2)	8412 (56.7)
Tertiary	1445 (22.2)	1716 (20.6)	3161 (21.3)
Employment			
Employed	5959 (91.7)	7768 (93.2)	13727 (92.5)
Unemployed	542 (8.3)	569 (6.8)	1111 (7.5)
Household size	4.36 2.105	4.29 1.982	4.32±2.04
Small (≤ 4)	3767 (57.9)	4793 (57.5)	8560 (57.7)
Medium (5-7)	2237 (34.4)	3040 (36.5)	5277 (35.6)
Large (≥ 8)	497 (7.6)	504 (6.0)	1001 (6.7)
Strata			
Urban	4483 (69.0)	5763 (69.1)	10246 (69.1)
Rural	2018 (31.0)	2574 (30.9)	4592 (30.9)
Household income			
(RM/month)	5972.35±629.12	5982.45±611.63	4234.24±610.77
B40 (≤ 4,359)	3384 (52.1)	4231 (50.7)	7615 (51.3)
M40 (4,360 – 9,619)	2132 (32.8)	2832 (34.0)	4964 (33.5)
T20 (≥9,620)	985 (15.2)	1274 (15.3)	2259 (15.2)
Region by GDP per capita (state)			
Low-income	1906 (29.3)	2786 (33.4)	4692 (31.6)
Middle-income	1996 (30.7)	2211 (26.5)	4207 (28.4)
High-income	2599 (40.0)	3340 (40.1)	5939 (40.0)

Table 4.1 (Continued)

Characteristics	n (%) / Mean \pm SD of Households		
	With PE (n=6,501)	Without PE (n=8,337)	All (n=14,838)
Tobacco (RM)	61.64 \pm 112.68	60.66 \pm 114.42	61.10 \pm 113.65
Sugar-sweetened food and beverage (RM)	24.97 \pm 27.24	20.46 \pm 25.54	22.43 \pm 26.39
Pharmaceuticals (RM)	71.95 \pm 128.24	-	31.53 \pm 92.09

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)



4.2.2. Association between Characteristics and Mean Pharmaceutical Expenditure Share

All households had a mean expenditure of RM 31.53 on pharmaceuticals. In this study, pharmaceutical expenditure share (PES) is presented as the percentage of income allocated for pharmaceutical expenditure. The mean PES among all households was 0.94%. One-way ANOVA was performed to determine the sociodemographic characteristics and mean PES. The results are presented in Table 4.2.

Six factors were highly significant ($p < 0.001$) in affecting PES: age, ethnicity and education of household heads, residing strata, household income and regions by GDP per capita. Increasing age of household heads increased PES: those more than 64 years old had the highest pharmaceutical expenditure share at 1.26%. Non-Bumiputera household heads spent more, which on average 1.23% of household income spent on pharmaceutical products, while Bumiputera only spent 0.93%. Household heads with tertiary education (1.42%), residing in urban (1.08%), in the income bracket of B40 (1.43%) and living in middle-income states (1.26%, which are Melaka, Negeri Sembilan, Johor, Pahang, Perak) had the highest PES. Besides the six highly significant factors, the employment status of household heads also affected significantly on PES: those unemployed spent 1.19 % of their income, while households with employed household heads forked out 0.92 % on pharmaceuticals.

Table 4.2 Mean Pharmaceutical Expenditure Share (PES) among All Households (n=14,838)

Variable	Mean PES, % (SD)	p-value
Age (years old)		<0.001
<25	0.50 (1.71)	
25-34	0.86 (2.82)	
35-44	0.92 (3.93)	
45-64	0.95 (3.31)	
>64	1.26 (4.03)	
Gender		0.274
Male	0.93 (3.40)	
Female	1.01 (3.64)	
Ethnicity		<0.001
Bumiputera	0.81 (2.98)	
Non-Bumiputera	1.23 (4.25)	
Marital status		0.575
Single	0.96 (3.21)	
Married	0.95 (3.49)	
Widow/Divorced	0.84 (3.27)	
Education		<0.001
No formal education	0.50 (2.43)	
Primary school	0.72 (2.55)	
Secondary school	0.87 (3.44)	
Tertiary	1.42 (4.15)	
Employment		0.013
Employed	0.92 (3.41)	
Unemployed	1.19 (3.84)	
Household size		0.400
Small (≤ 4)	0.96 (3.42)	
Medium (5-7)	0.93 (3.56)	
Large (≥ 8)	0.81 (2.95)	
Strata		<0.001
Urban	1.08 (3.83)	
Rural	0.64 (2.34)	
Household income (RM/month)		<0.001
B40 ($\leq 4,359$)	1.43 (4.58)	
M40 (4,360 – 9,619)	0.53 (1.47)	
T20 ($\geq 9,620$)	0.22 (0.75)	
Region by GDP per capita (state)		<0.001
Low-income	0.62 (2.60)	
Middle-income	1.26 (3.95)	
High-income	0.98 (3.61)	

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

4.2.3. Factors Affecting Consumption and Amount Decisions

The variance inflation factor (VIF) results for all independent variables are tabulated in Table 4.3. All variables had VIF values of less than 5, except dummy variables related to education (4.23-6.76) and age group (5.54-12.70). Only one dummy variable of 45-64 years old had a VIF of more than 10. However, since the age range used was exactly as in the official report of DOSM (2014), the one dummy variable was not dropped from the model as other issues might arise, such as specification error or bias.



Table 4.3 *Variance Inflation Factor (VIF) Values of Variables*

Characteristics	VIF
Age (years old)	
<25	-
25-34	7.58
35-44	9.75
45-64	12.70
>64	5.54
Gender	
Male	-
Female	1.47
Ethnicity	
Bumiputera	1.15
Non-Bumiputera	-
Marital status	
Single	-
Married	2.11
Widow/Divorced	2.04
Education	
No formal education	-
Primary school	4.23
Secondary school	6.76
Tertiary	5.36
Employment	
Employed	1.34
Unemployed	-
Household size	
Small (≤ 4)	-
Medium (5-7)	1.17
Large (≥ 8)	1.11
Strata	
Urban	1.22
Rural	-
Household income (RM/month)	
B40 ($\leq 4,359$)	-
M40 (4,360 – 9,619)	1.10
T20 ($\geq 9,620$)	1.10
Region by GDP per capita (state)	
Low-income	-
Middle-income	1.44
High-income	1.49
Tobacco/100	1.05
Sugar-sweetened food and beverage/100	1.05

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

The value of White's test was highly significant ($p < 0.001$) for the model (Table 4.4), which means that heteroscedasticity was present in the model. For the two-part model, robust standard errors were computed. Marginal effects of consumption decisions were computed purely based on probit regression using dichotomous consumption decision data. All households ($n=14,838$) were included for analysis in the consumption equation to calculate the likelihood of consumption. Only households ($n=6,501$) who consumed pharmaceutical products were used for estimates in the amount equation, with a mean PES of 2.15%.

The log pseudolikelihood (consumption decisions) and the F-statistic (amount decisions) of the two-part model were both highly significant, indicating that all independent variables were cumulatively significant in describing consumption and amount decisions of the percentages of pharmaceutical expenditure share.

Age of household heads was strongly and positively associated with percentage spent starting from the age of more than 35 years old but no significant association on the likelihood. Those aged 35-44, 45-64 and more than 64 spent 0.769%, 0.956% and 1.821% more from their household income than those under 25 years old to purchase medicine.

The ethnicity of household heads played a substantial role in determining the likelihood and amount of percentage spent on pharmaceuticals. Bumiputera was 3.4% less likely and spent 0.537% less of their household income to buy pharmaceutical products than non-Bumiputera. The education level of household heads did not significantly affect the consumption decision but significantly affected the amount spent on pharmaceutical products over household income.

Secondary school leavers spent 0.818%, and those with tertiary education qualifications spent 1.833% more from their household income than household heads without formal education.

Employment was only associated with the probability of consumption with a p-value less than 0.01. Household heads who were employed were 4.7% less likely to purchase pharmaceutical products. Large households (members of more than 7) had a 6% higher likelihood of spending on pharmaceutical products than small households.

The living strata of households affected both likelihood and expenditure share on pharmaceutical products. Households were 2.2% less likely to buy pharmaceuticals in urban areas but spent 0.548% more from their income than their rural counterparts. Household income was highly significant in influencing the percentages spent on pharmaceuticals. Households with M40 income spent nearly 2% less compared to B40 as a base group, and those of T20 spent 2.715% less. Staying in different states of different GDP per capita in Malaysia also affected significantly both probability and amount of consumption relative to household income. Those residing in middle-income states (Melaka, Negeri Sembilan, Johor, Pahang, Perak) were 6.7% more likely and allocated 0.742% more from household income, while those in high-income states (Federal Territories of Kuala Lumpur, Putrajaya and Labuan, Penang, Sarawak, Selangor) had a 2.7% higher probability of consuming medicine compared to household residing in low-income states (Terengganu, Sabah, Perlis, Kedah, Kelantan) as the reference group.

Consuming sugar-sweetened food and beverage increased both the likelihood and amount spent on pharmaceuticals. Each increase of RM 100 consumption in sugar-sweetened food and

beverage led to a 16.1% higher likelihood and a 0.890% higher out of household income to purchase pharmaceutical expenditure.



Table 4.4 Estimation Results of Variables in the Two-part Model with Robust Standard Error for Pharmaceutical Expenditure Share

Variable	Consumption		Amount
	Coefficients	Marginal effects	Coefficients
Constant	-0.191 (0.104)	-	0.888** (0.391)
Age (years old)			
<25	-	-	-
25-34	0.039 (0.074)	0.015 (0.029)	0.385 (0.247)
35-44	-0.026 (0.075)	-0.010 (0.030)	0.769*** (0.273)
45-64	0.056 (0.075)	0.022 (0.029)	0.956*** (0.252)
>64	0.147 (0.085)	0.058 (0.033)	1.821*** (0.336)
Gender			
Male	-	-	-
Female	0.019 (0.035)	0.008 (0.014)	0.393 (0.207)
Ethnicity			
Bumiputera	-0.085*** (0.024)	-0.034*** (0.009)	-0.537*** (0.149)
Non-Bumiputera	-	-	-
Marital status			
Single	-	-	-
Married	-0.017 (0.038)	-0.006 (0.015)	-0.094 (0.201)
Widow/Divorced	-0.079 (0.053)	-0.031 (0.021)	-0.360 (0.294)
Education			
No formal education	-	-	-
Primary school	0.034 (0.056)	0.013 (0.022)	0.299 (0.246)
Secondary school	0.066 (0.054)	0.026 (0.022)	0.818*** (0.243)
Tertiary	0.110 (0.059)	0.043* (0.023)	1.833*** (0.287)
Employment			
Employed	-0.119*** (0.046)	-0.047*** (0.018)	-0.059 (0.244)
Unemployed	-	-	-
Household size			
Small (≤ 4)	-	-	-
Medium (5-7)	-0.025 (0.024)	-0.010 (0.009)	0.104 (0.141)
Large (≥ 8)	0.153*** (0.044)	0.060*** (0.017)	-0.298 (0.203)
Strata			
Urban	-0.057** (0.025)	-0.022** (0.010)	0.548*** (0.122)
Rural	-	-	-
Household income			
B40	-	-	-
M40	-0.038 (0.023)	-0.015* (0.009)	-1.999*** (0.117)
T20	-0.016 (0.030)	-0.006 (0.012)	-2.715*** (0.118)
Region by GDP per capita (state)			
Low-income	-	-	-
Middle-income	0.171*** (0.028)	0.067*** (0.011)	0.742*** (0.146)
High-income	0.069*** (0.026)	0.027*** (0.010)	0.178 (0.135)

Table 4.4 (Continued)

Variable	Consumption		Amount
	Coefficients	Marginal effects	Coefficients
Tobacco/100 ^a	-0.002 (0.009)	-0.001 (0.004)	0.136 (0.085)
Sugar-sweetened food and beverage/100 ^a	0.408*** (0.085)	0.161*** (0.034)	0.890*** (0.271)
Log pseudolikelihood	-10059.343***		
F-statistics			32.420***
White's test	257.73		
p-value	<0.001		
Max. VIF	12.70		
Observations	14,838		6,501

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

Note:

Robust standard error in parenthesis

^a Tobacco consumption; sugar-sweetened food and beverage consumption divided by 100

***, ** Significant at $p < 0.01$ and $p < 0.05$ respectively



4.3. Stratification by Household Income

Since household income was highly significant in both the association ($p < 0.001$) and in amount decisions ($p < 0.01$) with high coefficients, household income was used to further stratified the samples to gather more meaningful comparisons.

4.3.1. Characteristics of Households

Recapitulate from Table 4.1, the breakdown of monthly household income for B40 (\leq RM 4,359), M40 (RM 4,360 – 9,619) and T20 (\geq RM 9,620) are 51.3%, 33.5% and 15.2%. Table 4.5 illustrates the stratification of variables into the three household income groups. The pooled sample and the various household income groups shared similar characteristics: the majority of the household heads were in the range of 45-64 years old, male, Bumiputera, married, secondary school leavers and employed. Most households had a small household size of less than 5, inhabiting the urban areas and in high-income states of the Federal Territories, Penang, Sarawak or Selangor. Regardless of household income, approximately an average of RM 60 was spent monthly on tobacco, RM 22 on sugar-sweetened food and beverage and RM 31 on pharmaceuticals.

Table 4.5 *Sociodemographic and Unhealthy Behaviour Characteristics of All Households Stratified by Household Incomes (n=14,838)*

Characteristics	n (%) / Mean ± SD		
	B40	M40	T20
Age (years old)	46.47±12.95	46.55±13.17	46.25±12.83
<25	168 (2.2)	126 (2.5)	50 (2.2)
25-34	1382 (18.1)	904 (18.2)	416 (18.4)
35-44	1927 (25.3)	1217 (24.5)	573 (25.4)
45-64	3436 (45.1)	2239 (45.1)	1029 (45.6)
>64	702 (9.2)	478 (9.6)	191 (8.5)
Gender			
Male	6485 (85.2)	4157 (83.7)	1938 (85.8)
Female	1130 (14.8)	807 (16.3)	321 (14.2)
Ethnicity			
Bumiputera	5234 (68.7)	3377 (68.0)	1505 (66.6)
Non-Bumiputera	2381 (31.3)	1587 (32.0)	754 (33.4)
Marital status			
Single	895 (11.8)	614 (12.4)	284 (12.6)
Married	6080 (79.8)	3868 (77.9)	1787 (79.1)
Widow/Divorced	640 (8.4)	482 (9.7)	188 (8.3)
Education			
No formal education	332 (4.4)	225 (4.5)	99 (4.4)
Primary school	1330 (17.5)	888 (17.9)	391 (17.3)
Secondary school	4347 (57.1)	2771 (55.8)	1294 (57.3)
Tertiary	1606 (21.1)	1080 (21.8)	475 (21.0)
Employment			
Employed	7043 (92.5)	4583 (92.3)	2101 (93.0)
Unemployed	572 (7.5)	381 (7.7)	158 (7.0)
Household size	4.33±2.02	4.30±2.06	4.33±2.04
Small (≤4)	4362 (57.3)	2891 (58.2)	1307 (57.9)
Medium (5-7)	2723 (35.8)	1748 (35.2)	806 (35.7)
Large (≥8)	530 (7.0)	325 (6.5)	146 (6.5)
Strata			
Urban	5209 (68.4)	3475 (70.0)	1562 (69.1)
Rural	2406 (31.6)	1489 (30.0)	697 (30.9)
Region by GDP per capita (state)			
Low-income	2280 (29.9)	1625 (32.7)	787 (34.8)
Middle-income	2228 (29.3)	1373 (27.7)	606 (26.8)
High-income	3107 (40.8)	1966 (39.6)	866 (38.3)
Tobacco (RM)	61.48±115.35	60.85±111.33	60.30±113.01
Sugar-sweetened food and beverage (RM)	22.10±22.54	23.00±31.07	22.27±27.21
Pharmaceuticals (RM)	31.10±91.14	32.78±91.00	30.21±97.50
Observations	7,615	4,964	2,259

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

4.3.2. Association between Characteristics and Mean Pharmaceutical Expenditure Share

Households of B40, M40 and T20 had a mean PES of 1.42%, 0.53% and 0.21%, respectively. Similarly in this stratification, one-way ANOVA was performed to determine the sociodemographic characteristics that affected the mean PES of all households across different household income groups (Table 4.6).

Across all three incomes groups, four factors, namely ethnicity and education level of household heads, residing location in terms of strata and regions of different GDP per capita, were highly significant in affecting PES, which were the same attributes in the overall sample.

For the B40 income group, non-Bumiputera household heads spent a mean of 1.87% of household income to purchase pharmaceuticals compared to Bumiputera, who only spent 1.23%. Household heads with a tertiary qualification (2.11%), residing in urban areas (1.65%) and middle-income states of Melaka, Negeri Sembilan, Johor, Pahang and Perak (1.87%) spent significantly higher than their counterparts. Age and employment status of household heads were the additional factors for B40 income groups, on top of the four factors. Similarly, increasing age increased PES in which those aged 65 years old and above spend 1.88% of income and those unemployed spent 1.84%.

Among the M40 income group, those over 64 years old spent the largest portion of household income at 0.75%. Non-Bumiputera household heads (0.71%), of tertiary education qualification (0.87%), living in urban (0.60%), middle-income states (0.67%) spent significantly larger portions of their income on pharmaceuticals. In addition to the common four factors, the age of

the household heads was also significantly associated with PES.

Households in the T20 income only shared the four significant factors. Non-Bumiputera household heads (0.33%), with tertiary education (0.35%), residing in urban areas (0.25%) and middle-income states (0.34%), had the highest pharmaceutical expenditure share compared to their counterparts within the T20 income bracket.



Table 4.6 Mean Pharmaceutical Expenditure Share (PES) among All Households by Household Income (n=14,838)

Characteristics	Mean PES, % (SD)					
	B40	p-value	M40	p-value	T20	p-value
Age (years old)		0.025		<0.001		0.237
<25	0.85 (2.36)		0.21 (0.48)		0.08 (0.20)	
25-34	1.26 (3.69)		0.55 (1.48)		0.17 (0.46)	
35-44	1.44 (5.29)		0.42 (1.27)		0.23 (0.71)	
45-64	1.42 (4.39)		0.56 (1.50)		0.23 (0.76)	
>64	1.88 (5.30)		0.75 (1.91)		0.29 (1.23)	
Gender		0.280		0.590		0.474
Male	1.40 (4.53)		0.53 (1.45)		0.21 (0.75)	
Female	1.56 (4.88)		0.56 (1.58)		0.25 (0.75)	
Ethnicity		<0.001		<0.001		<0.001
Bumiputera	1.23 (3.95)		0.45 (1.32)		0.16 (0.53)	
Non-Bumiputera	1.87 (5.71)		0.71 (1.74)		0.33 (1.05)	
Marital status		0.885		0.160		0.935
Single	1.44 (4.31)		0.59 (1.52)		0.21 (0.53)	
Married	1.43 (4.63)		0.53 (1.50)		0.22 (0.76)	
Widow/Divorced	1.34 (4.49)		0.43 (1.21)		0.24 (0.93)	
Education		<0.001		<0.001		<0.001
No formal education	0.74 (3.25)		0.31 (1.20)		0.09 (0.27)	
Primary school	1.10 (3.40)		0.40 (1.13)		0.14 (0.45)	
Secondary school	1.33 (4.60)		0.46 (1.34)		0.20 (0.64)	
Tertiary	2.11 (5.47)		0.87 (1.97)		0.35 (1.16)	
Employment		0.025		0.242		0.894
Employed	1.39 (4.54)		0.52 (1.46)		0.22 (0.75)	
Unemployed	1.84 (5.07)		0.62 (1.66)		0.21 (0.72)	
Household size		0.473		0.053		0.425
Small (≤ 4)	1.44 (4.55)		0.58 (1.53)		0.23 (0.86)	
Medium (5-7)	1.45 (4.77)		0.47 (1.33)		0.19 (0.55)	
Large (≥ 8)	1.19 (3.79)		0.46 (1.65)		0.22 (0.59)	
Strata		<0.001		<0.001		0.010
Urban	1.65 (5.12)		0.60 (1.59)		0.25 (0.84)	
Rural	0.95 (3.07)		0.38 (1.12)		0.16 (0.48)	
Region by GDP per capita (state)		<0.001		<0.001		<0.001
Low-income	0.96 (3.54)		0.37 (1.20)		0.12 (0.40)	
Middle-income	1.87 (5.18)		0.67 (1.63)		0.34 (0.89)	
High-income	1.45 (4.76)		0.57 (1.55)		0.22 (0.87)	
Observations	7,615		4,964		2,259	

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

4.3.3. Factors Affecting Consumption and Amount Decisions

The VIF results for all independent variables are tabulated in Table 4.7. Similar to the overall sample (Table 4.4), almost all variables have VIF values of less than 5. No dummy variable was dropped with the same reasoning as explained in Section 4.2.3.



Table 4.7 Variance Inflation Factor (VIF) Values of Variables by Household Income.

Characteristics	VIF		
	B40	M40	T20
Age (years old)			
<25	-	-	-
25-34	7.88	7.08	7.95
35-44	10.2	9.10	10.10
45-64	13.20	11.99	13.07
>64	5.70	5.49	5.25
Gender			
Male	-	-	-
Female	1.44	1.53	1.47
Ethnicity			
Bumiputera	1.15	1.15	1.14
Non-Bumiputera	-	-	-
Marital status			
Single	-	-	-
Married	2.07	2.24	1.99
Widow/Divorced	2.01	2.14	1.94
Education			
No formal education	-	-	-
Primary school	4.27	4.18	4.27
Secondary school	6.83	6.62	6.92
Tertiary	5.39	5.29	5.49
Employment			
Employed	1.33	1.38	1.33
Unemployed	-	-	-
Household size			
Small (≤ 4)	-	-	-
Medium (5-7)	1.18	1.17	1.18
Large (≥ 8)	1.12	1.10	1.10
Strata			
Urban	1.22	1.22	1.22
Rural	-	-	-
Region by GDP per capita (state)			
Low-income	-	-	-
Middle-income	1.49	1.43	1.36
High-income	1.52	1.49	1.43
Tobacco/100	1.06	1.06	1.04
Sugar-sweetened food and beverage/100	1.06	1.04	1.08

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

White's test results for both M40 and T20 models were $p < 0.001$ (Table 4.8). Robust standard errors were computed to adjust for the heteroscedasticity of the data, including for the B40 stratification. The log pseudolikelihood and F-statistics of the two-part models were both highly significant for all subgroups analysis.

The age group of the household heads was a significant determinant on the amount decision of pharmaceutical expenditure share for B40 (35 years old onwards) and M40 (all age categories) family income. In the B40 group, households led by those aged 35-44, 45-65 and 65 and above have a 1.272%, 1.346% and 2.533% higher purchase respectively relative to their income, than those led by less than 25 years old. For the M40 income bracket, all age categories affected the percentages of expenditure share. Household heads aged 25-34 (0.625%), 35-44 (0.519%), 45-64 (0.909%) and >64 (1.552%) had a higher expenditure out of their income than those aged below 25 years old.

Ethnicity significantly affected the consumption decision for B40 and T20, and amount decisions across all income groups. Bumiputera household heads were less likely to spend and spend less on their income than non-Bumiputera of the same income category. For the B40 group, Bumiputera was 3.6% less likely and spent 0.736% less. Bumiputera of M40 income spent 0.404% lesser, while those with T20 income had 7.9% less probability and 0.222% lesser than their counterparts.

The likelihood to spend was also affected by the marital status of household heads but only for those of widow or divorcee status compared to those who are single. Separated household heads

with M40 and T20 income had a 7.0% and 10.4% lower probability of purchasing medicines respectively, than those who were single with the same income groups.

The education level of household heads influenced those with secondary school and tertiary qualification, with higher percentages of spending across all income status than those without formal education. Secondary school leavers spent 1.178% more income to buy medicines for the B40 group, 0.463% for M40 and 0.301% for T20. Those with tertiary education utilised 2.560% more of their income among the B40 group, 1.207% among M40 and 0.627% among T20, compared to household heads without formal education qualification of the same groups.

Household size only affected the likelihood of medicine purchase for families with large households within the B40 and T20 groups. Families with eight members or more were 5.8% more likely to buy medicine within the B40 group and 12.0% higher likelihood within the T20 group, as compared to families with four members or less.

Location in terms of strata and the states where households were living also influenced pharmaceutical expenditure share. Urban households forked out 0.885% (B40) and 0.215% (M40) more than rural households. Staying in middle-income states enormously contributed to both probability and the percentages spent from income than those living in low-income states. Middle-income states' households were more likely (5.5%) and spent more (1.149%) within the B40 category, more likely (8.9%) to spent and spent more (0.316%) within the M40 category and 6.7% higher probability and used 0.316% more of their income within T20 group than those

residing in low-income states. Staying in high-income states only affected the B40 group, in which they were 3.1% more likely to buy medications than those living in low-income states.

Tobacco consumption only affected percentages expenditure share among the B40 group. Each increase of RM 100 tobacco spending led to a 0.214% higher consumption from household income to purchase pharmaceutical expenditure. On the other hand, sugar-sweetened food and beverage consumption was a vital unhealthy behaviour in both consumption and amount decisions of pharmaceutical expenditure share for B40 and M40 groups and only consumption decisions for T20 group. Every RM 100 increment in sugary product purchase caused 24.4% higher likelihood and 1.475% more purchase for B40 households, 10.7% more tendency and 0.706% more for M40, and 15.5% more probability of purchase for T20 households.

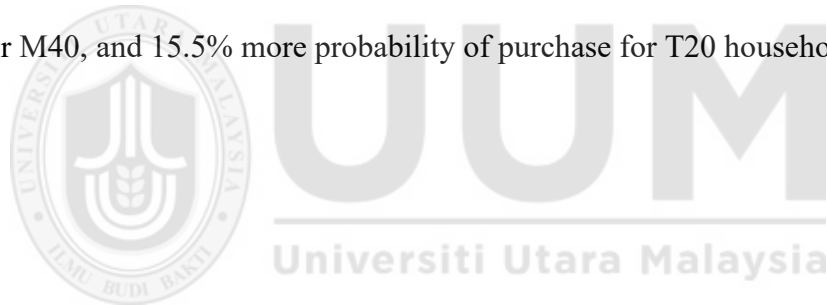


Table 4.8 *Estimation Results of Variables in the Two-part Model with Robust Standard Errors for Pharmaceutical Expenditure Share by Household Income*

Variable	B40			M40			T20		
	Consumption		Amount	Consumption		Amount	Consumption		Amount
	Coef.	ME	Coef.	Coef.	ME	Coef.	Coef.	ME	Coef.
Constant	-0.299** (0.146)		-0.063 (0.725)	-0.182 (0.175)		-0.462 (0.344)	0.046 (0.273)		-0.360 (0.255)
Age (years old)									
<25	-	-	-	-	-	-	-	-	-
25-34	0.057 (0.106)	0.022 (0.042)	0.511 (0.481)	0.095 (0.124)	0.037 (0.049)	0.625*** (0.155)	-0.147 (0.195)	-0.058 (0.076)	-0.053 (0.096)
35-44	-0.067 (0.107)	-0.026 (0.042)	1.272** (0.532)	0.019 (0.126)	0.007 (0.050)	0.519*** (0.176)	0.000 (0.197)	0.000 (0.076)	0.044 (0.094)
45-64	0.033 (0.106)	0.013 (0.042)	1.346*** (0.489)	0.124 (0.125)	0.049 (0.049)	0.909*** (0.171)	-0.017 (0.196)	-0.007 (0.076)	0.144 (0.091)
>64	0.118 (0.120)	0.047 (0.047)	2.533*** (0.633)	0.221 (0.143)	0.087 (0.056)	1.552*** (0.263)	0.070 (0.222)	0.028 (0.086)	0.404 (0.265)
Gender									
Male	-	-	-	-	-	-	-	-	-
Female	0.018 (0.049)	0.007 (0.019)	0.607 (0.383)	-0.034 (0.060)	-0.013 (0.024)	0.141 (0.170)	0.147 (0.092)	0.058 (0.037)	0.119 (0.113)
Ethnicity									
Bumiputera	-0.091*** (0.034)	-0.036*** (0.013)	-0.736*** (0.282)	-0.031 (0.041)	-0.012 (0.016)	-0.404*** (0.108)	-0.200*** (0.060)	-0.079*** (0.024)	-0.222*** (0.079)
Non-Bumiputera	-	-	-	-	-	-	-	-	-
Marital status									
Single	-	-	-	-	-	-	-	-	-
Married	0.063 (0.052)	0.025 (0.021)	-0.139 (0.393)	-0.100 (0.065)	-0.039 (0.025)	-0.098 (0.161)	-0.113 (0.093)	-0.045 (0.036)	0.145 (0.091)
Widow/Divorced	0.042 (0.074)	0.017 (0.029)	-0.571 (0.561)	-0.179** (0.089)	-0.070** (0.035)	-0.229 (0.214)	-0.263** (0.135)	-0.104** (0.053)	0.156 (0.194)

Table 4.8 (Continued)

Variable	B40			M40			T20		
	Consumption		Amount Coef.	Consumption		Amount Coef.	Consumption		Amount Coef.
	Coef.	ME		Coef.	ME		Coef.	ME	
Education									
No formal education	-	-	-	-	-	-	-	-	-
Primary school	0.037 (0.079)	0.015 (0.031)	0.444 (0.448)	-0.013 (0.096)	-0.005 (0.038)	0.127 (0.198)	0.138 (0.146)	0.054 (0.058)	0.092 (0.100)
Secondary school	0.073 (0.077)	0.029 (0.030)	1.178** (0.441)	0.009 (0.093)	0.004 (0.037)	0.463** (0.196)	0.164 (0.142)	0.065 (0.056)	0.301** (0.118)
Tertiary	0.106 (0.083)	0.042 (0.033)	2.560*** (0.530)	0.083 (0.100)	0.033 (0.039)	1.207*** (0.219)	0.169 (0.154)	0.067 (0.061)	0.627*** (0.193)
Employment									
Employed	-0.111 (0.063)	-0.044 (0.025)	-0.391 (0.439)	-0.103 (0.079)	-0.041 (0.031)	0.266 (0.209)	-0.233 (0.121)	-0.092 (0.047)	0.294 (0.189)
Unemployed	-	-	-	-	-	-	-	-	-
Household size									
Small (≤ 4)	-	-	-	-	-	-	-	-	-
Medium (5-7)	-0.020 (0.033)	-0.008 (0.013)	0.250 (0.261)	-0.059 (0.041)	-0.023 (0.016)	-0.081 (0.095)	0.026 (0.060)	0.010 (0.024)	-0.095 (0.069)
Large (≥ 8)	0.146** (0.060)	0.058** (0.024)	-0.429 (0.365)	0.079 (0.076)	0.031 (0.030)	-0.091 (0.201)	0.305*** (0.114)	0.120*** (0.045)	-0.112 (0.104)
Strata									
Urban	-0.056 (0.034)	-0.022 (0.014)	0.885*** (0.226)	-0.050 (0.043)	-0.020 (0.017)	0.215** (0.087)	-0.089 (0.064)	-0.035 (0.025)	0.028 (0.057)
Rural	-	-	-	-	-	-	-	-	-

Table 4.8 (Continued)

Variable	B40			M40			T20		
	Consumption		Amount Coef.	Consumption		Amount Coef.	Consumption		Amount Coef.
	Coef.	ME		Coef.	ME		Coef.	ME	
Region by GDP per capita (state)									
Low-income	-	-	-	-	-	-	-	-	-
Middle-income	0.139*** (0.039)	0.055*** (0.015)	1.149*** (0.272)	0.226*** (0.048)	0.089*** (0.019)	0.316*** (0.114)	0.169** (0.070)	0.067** (0.028)	0.316*** (0.077)
High-income	0.080** (0.037)	0.031** (0.014)	0.278 (0.249)	0.076 (0.045)	0.0297 (0.018)	0.092 (0.104)	0.032 (0.066)	0.013 (0.026)	0.114 (0.071)
Tobacco/100^a	0.003 (0.013)	0.001 (0.005)	0.214** (0.150)	-0.009 (0.017)	-0.003 (0.007)	0.007 (0.045)	-0.009 (0.024)	-0.003 (0.010)	0.045 (0.064)
Sugary food & beverage/100^a	0.618*** (0.079)	0.244*** (0.027)	1.475** (0.607)	0.273** (0.057)	0.107*** (0.022)	0.706*** (0.210)	0.393*** (0.105)	0.155*** (0.041)	0.069 (0.132)
Log pseudolikelihood	-5161.086***			-3353.995***			-1519.329***		
F-statistics	9.100***			10.060***			3.380***		
White's test	161.61			378.64			374.45		
p-value	0.834			<0.001			<0.001		
Max. VIF	13.20			11.99			13.07		
Observations	7,615		3,384	4,964		2,132	2,259		985

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

Note:

Coef.: Coefficients

ME: Marginal effects

Robust standard error in parenthesis

^a Tobacco consumption; sugar-sweetened food and beverage consumption divided by 100

***, ** Significant at p<0.01 and p<0.05 respectively

4.4. Stratification by Region (GDP per capita)

Region by GDP per capita was highly significant in both the association ($p < 0.001$) and as an attribute for both consumption ($p < 0.01$) and amount ($p < 0.01$) equations, hence it is used in the stratification to facilitate comparisons between these regions.

4.4.1. Characteristics of Households

Reiterate from Table 4.1, the breakdown of households staying in low-income states (Terengganu, Sabah, Perlis, Kedah, Kelantan), middle-income states (Melaka, Negeri Sembilan, Johor, Pahang, Perak) and high-income states (Federal Territories, Penang, Sarawak, Selangor) was 31.6%, 28.4% and 40.0% respectively.

Table 4.9 describes the stratification of variables into the GDP per capita of the states. Similar characteristics were shared by the overall sample and across the different regions: the majority of the household heads were 45-64 years old, male, Bumiputera, married, secondary school leavers and employed. Most households had a B40 monthly income, a small household size of less than five and residing in urban areas. In general, the household spent an average of RM 61.10 on tobacco (Table 4.1). However, there was a discrepancy in tobacco spending across different regions: an average of RM 46.50 spent by households in low-income, RM 85.30 in middle-income and RM 55.50 in high-income states. Regardless of regions, an average of RM 20 was spent on sugar-sweetened food and beverage monthly. However, households spent an average of RM 20.76 in low-, RM 41.71 in the middle- and RM 32.81 in high-income states.

Table 4.9 Sociodemographic and Unhealthy Behaviour Characteristics of All Households Stratified by Region by GDP Per Capita, by States (n=14,838)

Characteristics	n (%) / Mean ± SD		
	Low-income	Middle-income	High-income
Age (year old)	47.14±13.00	47.88±13.14	44.93±12.75
<25	121 (2.6)	78 (1.9)	145 (2.4)
25-34	764 (16.3)	662 (15.7)	1276 (21.5)
35-44	1109 (23.6)	990 (23.5)	1618 (27.2)
45-64	2245 (47.8)	2002 (47.6)	2457 (41.4)
>64	453 (9.7)	475 (11.3)	443 (7.5)
Gender			
Male	3924 (83.6)	3600 (85.6)	5056 (85.1)
Female	768 (16.4)	607 (14.4)	883 (14.9)
Ethnicity			
Bumiputera	3883 (82.8)	2660 (63.2)	3573 (60.2)
Non-Bumiputera	809 (17.2)	1547 (36.8)	2366 (39.8)
Marital status			
Single	464 (9.9)	465 (11.1)	864 (14.5)
Married	3767 (80.3)	3347 (79.6)	4621 (77.8)
Widow/Divorced	461 (9.8)	395 (9.4)	454 (7.6)
Education			
No formal education	275 (5.9)	110 (2.6)	271 (4.6)
Primary school	1012 (21.6)	809 (19.2)	788 (13.3)
Secondary school	2702 (57.6)	2530 (60.1)	3180 (53.5)
Tertiary	703 (15.0)	758 (18.0)	1700 (28.6)
Employment			
Employed	4356 (92.8)	3837 (91.2)	5534 (93.2)
Unemployed	336 (7.2)	370 (8.8)	405 (6.8)
Household size	4.62±2.23	4.16±1.92	4.20±1.93
Small (≤4)	2427 (51.7)	2529 (60.1)	3604 (60.7)
Medium (5-7)	1811 (38.6)	1467 (34.9)	1999 (33.7)
Large (≥8)	454 (9.7)	211 (5.0)	336 (5.7)
Strata			
Urban	2619 (55.8)	2902 (69.0)	4725 (79.6)
Rural	2073 (44.2)	1305 (31.0)	1214 (20.4)
Household income			
B40	2280 (48.6)	2228 (53.0)	3107 (52.3)
M40	1625 (34.6)	1373 (32.6)	1966 (33.1)
T20	787 (16.8)	606 (14.4)	866 (14.6)
Tobacco (RM)	46.5± 94.7	85.3±142.4	55.5±101.1
Sugar-sweetened food and beverage (RM)	22.5±21.5	20.7±22.5	23.6±31.6
Pharmaceuticals (RM)	20.76±68.40	41.71±101.42	32.81±100.19
Observations	4,692	4,207	5,939

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

4.4.2. Association between Characteristics and Mean Pharmaceutical Expenditure Share

Households living in low-, middle- and high-income states had a mean PES of 0.62%, 1.26% and 0.98%, respectively. One-way ANOVA was performed to determine the sociodemographic characteristics that affected the mean PES among all households stratified by their residence in different regions by GDP per capita (Table 4.10).

The age of household heads was significantly associated with the mean expenditure share on pharmaceuticals for those living in middle-income states. Those over 64 years old spent the highest at 1.84% out of their household income. Ethnicity was also a significant factor affecting the mean amount of pharmaceutical expenditure share. Non-Bumiputera household heads consumed more in high-income states (1.32%). The education level of household heads was a major contributing factor in the two regions (both with $p < 0.001$). Those with tertiary education spent the highest at 1.13% in low-income states and 1.49% in high-income states. Apart from attributes of household heads, living strata and household income also significantly affected expenditure share on pharmaceuticals across all regions at $p < 0.001$. Urban residents consistently spent more than their rural counterparts, with 0.76% out of their income in low-income, 1.33% in middle-income and 1.11% in high-income states. B40 households consumed the most at 0.96% in low-, 1.87% in the middle-, and 1.45% in high-income states compared to households of other income categories.

Table 4.10 Mean Pharmaceutical Expenditure Share (PES) among All Households by Region by GDP Per Capita, by States (n=14,838)

Characteristics	Mean PES, % (SD)					
	Low-income	p-value	Middle-income	p-value	High-income	p-value
Age (years old)		0.366		0.005		0.120
<25	0.18 (0.65)		0.66 (1.81)		0.69 (2.17)	
25-34	0.56 (2.56)		1.23 (3.30)		0.84 (2.66)	
35-44	0.65 (3.11)		1.05 (3.92)		1.02 (4.40)	
45-64	0.65 (2.53)		1.25 (4.00)		0.98 (3.29)	
>64	0.59 (1.82)		1.84 (4.77)		1.33 (4.67)	
Gender		0.059		0.409		0.147
Male	0.59 (2.35)		1.28 (4.04)		0.95 (3.57)	
Female	0.78 (3.62)		1.13 (3.37)		1.14 (3.82)	
Ethnicity		0.056		0.291		<0.001
Bumiputera	0.58 (2.38)		1.21 (3.78)		0.75 (2.86)	
Non-Bumiputera	0.77 (3.43)		1.34 (4.23)		1.32 (4.50)	
Marital status		0.989		0.327		0.989
Single	0.63 (3.01)		1.25 (3.37)		0.98 (3.22)	
Married	0.62 (2.42)		1.29 (4.15)		0.98 (3.68)	
Widow/Divorced	0.63 (3.42)		0.98 (2.67)		0.96 (3.59)	
Education		<0.001		0.090		<0.001
No formal education	0.34 (1.08)		0.83 (2.36)		0.51 (3.29)	
Primary school	0.38 (1.77)		1.15 (3.03)		0.72 (2.79)	
Secondary school	0.60 (2.58)		1.22 (4.28)		0.81 (3.30)	
Tertiary	1.13 (3.77)		1.56 (3.86)		1.49 (4.41)	
Employment		0.100		0.205		0.228
Employed	0.60 (2.55)		1.23 (3.92)		1.19 (3.89)	
Unemployed	0.84 (3.19)		1.51 (4.28)		0.96 (3.59)	
Household size		0.843		0.995		0.754
Small (≤ 4)	0.64 (2.49)		1.26 (3.85)		0.98 (3.61)	
Medium (5-7)	0.60 (2.66)		1.26 (4.16)		1.01 (3.77)	
Large (≥ 8)	0.59 (2.90)		1.23 (3.63)		0.85 (2.47)	
Strata		<0.001		0.093		<0.001
Urban	0.76 (3.12)		1.33 (4.28)		1.11 (3.87)	
Rural	0.44 (1.70)		1.10 (3.09)		0.49 (2.28)	
Household income		<0.001		<0.001		<0.001
B40	0.96 (3.54)		1.87 (5.18)		1.45 (4.76)	
M40	0.37 (1.20)		0.67 (1.63)		0.57 (1.55)	
T20	0.12 (0.40)		0.34 (0.89)		0.22 (0.87)	
Observations	4,692		4,207		5,939	

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

4.4.3. Factors Affecting Consumption and Amount Decisions

The VIF results for all independent variables are as tabulated in Table 4.11. Similarly, almost all variables had VIF values of less than 5, except the age group and education level of household heads.



Table 4.11 *Variance Inflation Factor (VIF) Values of Variables by GDP Region (state)*

Characteristics	VIF		
	Low-income	Middle-income	High-income
Age (years old)			
<25	-	-	-
25-34	6.52	8.39	8.01
35-44	8.80	11.58	9.64
45-64	11.85	15.86	11.81
>64	5.25	7.68	4.69
Gender			
Male	-	-	-
Female	1.53	1.54	1.40
Ethnicity			
Bumiputera	1.08	1.11	1.16
Non-Bumiputera	-	-	-
Marital status			
Single	-	-	-
Married	2.40	2.23	1.90
Widow/Divorced	2.44	2.25	1.72
Education			
No formal education	-	-	-
Primary school	3.76	6.95	3.56
Secondary school	5.17	10.60	6.99
Tertiary	3.48	7.36	6.47
Employment			
Employed	1.24	1.37	1.44
Unemployed	-	-	-
Household size			
Small (≤ 4)	-	-	-
Medium (5-7)	1.23	1.18	1.14
Large (≥ 8)	1.16	1.08	1.09
Strata			
Urban	1.10	1.15	1.28
Rural	-	-	-
Household income			
B40	-	-	-
M40	1.12	1.09	1.10
T20	1.12	1.09	1.10
Tobacco/100	1.03	1.07	1.04
Sugar-sweetened food and beverage/100	1.07	1.05	1.04

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

The value of the White's test was highly significant ($p < 0.001$) for the low-income states stratification (Table 4.12), hence robust standard errors were computed for the three models. The log pseudolikelihood and F-statistics of the two-part models were both highly significant for all subgroups analysis.

Age groups of household heads influenced strongly but only on the percentages of expenditure share of those who spent pharmaceuticals for families staying in low- and middle-income states. Within low-income states, those aged 35-44 years old spent 0.985% more, those 45-64 spent 1.142% more, and those aged over 64 spent 1.276% more of their income than families led by young household age less than 25 years old. A similar pattern occurred in middle-income states as well, in which household heads of 25-34, 45-64 and above 64 years old forked out 0.995%, 1.498% and 2.841% more from their income. Only the elderly (over 64) spent 1.530% more than their young counterpart within high-income states.

Gender played significant roles ($p < 0.05$) only in a few aspects for middle-income (consumption decisions) and high-income (amount decisions) states. Households led by a female were 6.0% more likely to purchase pharmaceuticals in middle-income states and spent 0.659% more in high-income states than those led by a male. Ethnicity was highly significant in contributing to both the probability and amount of pharmaceutical purchasing but only in high-income states: Bumiputera households were 8.5% less likely and spent 0.645% less from income than non-Bumiputera.

Percentages of pharmaceutical expenditure share were strongly affected by education across all regions. In low-income states, household heads with a secondary school qualification spent 0.705% more than those without formal education. Those equipped with higher education spent 1.725% more in low-, 1.545% more in the middle- and 1.853% more in high-income states than household heads with no formal education background.

The employment of household heads only affected the likelihood of pharmaceutical spending among residents in low- and high-income states. Employed household heads had a 7.8% less tendency in buying pharmaceuticals in low- and 8.0% less likely in high-income states than household heads without employment.

The number of family members only influenced the likelihood of purchase in high-income states: households with many members (8 or more) had a 12.1% higher chance to purchase than households with four or fewer members. Strata within the states in Malaysia also affected the amount spent for low- and high-income states. Families staying in urban areas had a 0.571% higher purchase from income within low-income states and 0.725% more within high-income states than families in rural areas within the same GDP per capita region.

Household income played a very vital role across all Malaysian GDP per capita regions on the amount spent on pharmaceuticals from income. M40 households spent 1.404% less in low-, 2.538% less in the middle- and 1.999% less in high-income states compared to B40 households in the same regions. Households of T20 income forked out even lesser across all regions: 2.089% less in low-, 3.258% in the middle- and 2.714% in high-income states than B40 group.

Sugar-sweetened food and beverage consumption influenced the likelihood of purchase in all regions but only affected the purchase amount relative to income in low-income states. Each increase of RM 100 in sugary food and drinks caused a 19.8 % higher likelihood to purchase medicine in low-income states, 30.3% more chance in the middle- and 11.3% more in high-income states. The same unit increase in sugary products also led to a 1.448% increase in the amount spent on pharmaceuticals from income for those staying in low-income states.



Table 4.12 *Estimation Results of Variables in the Two-part Models with Robust Standard Errors for Pharmaceutical Expenditure Share, by Region by GDP Per Capita (State)*

Variable	Low-income			Middle-income			High-income		
	Consumption		Amount	Consumption		Amount	Consumption		Amount
	Coef.	ME	Coef.	Coef.	ME	Coef.	Coef.	ME	Coef.
Constant	-0.151 (0.173)		0.686 (0.474)	-0.539** (0.217)		1.831 (0.839)	0.148 (0.165)		0.939 (0.972)
Age (years old)									
<25	-	-	-	-	-	-	-	-	-
25-34	-0.018 (0.129)	-0.007 (0.050)	0.631 (0.379)	0.173 (0.155)	0.069 (0.062)	0.995** (0.505)	0.004 (0.113)	0.001 (0.045)	-0.068 (0.419)
35-44	-0.074 (0.130)	-0.029 (0.051)	0.985*** (0.360)	0.127 (0.156)	0.051 (0.062)	0.898 (0.562)	-0.091 (0.114)	-0.036 (0.045)	0.677 (0.480)
45-64	-0.035 (0.129)	-0.013 (0.050)	1.142*** (0.381)	0.203 (0.155)	0.081 (0.062)	1.498*** (0.525)	0.005 (0.114)	0.002 (0.045)	0.557 (0.435)
>64	0.030 (0.145)	0.012 (0.056)	1.276*** (0.432)	0.330 (0.171)	0.131 (0.068)	2.841*** (0.686)	0.089 (0.135)	0.035 (0.053)	1.530** (0.611)
Gender									
Male	-	-	-	-	-	-	-	-	-
Female	-0.061 (0.062)	-0.024 (0.024)	0.682 (0.357)	0.149** (0.069)	0.060** (0.027)	-0.190 (0.370)	0.006 (0.055)	0.002 (0.022)	0.659** (0.340)
Ethnicity									
Bumiputera	0.033 (0.051)	0.013 (0.020)	-0.560 (0.306)	0.008 (0.043)	0.003 (0.017)	-0.324 (0.249)	-0.216*** (0.036)	-0.085*** (0.014)	-0.645*** (0.244)
Non-Bumiputera	-	-	-	-	-	-	-	-	-

Table 4.12 (Continued)

Variable	Low-income			Middle-income			High-income		
	Consumption		Amount Coef.	Consumption		Amount Coef.	Consumption		Amount Coef.
	Coef.	ME		Coef.	ME		Coef.	ME	
Marital status									
Single	-	-	-	-	-	-	-	-	-
Married	0.067 (0.073)	0.026 (0.028)	-0.111 (0.443)	-0.075 (0.072)	-0.030 (0.029)	-0.470 (0.370)	-0.021 (0.054)	-0.008 (0.021)	0.110 (0.292)
Widow/Divorced	0.010 (0.098)	0.004 (0.038)	-0.329 (0.635)	-0.152 (0.100)	-0.060 (0.040)	-0.834 (0.494)	-0.084 (0.081)	-0.033 (0.032)	-0.074 (0.465)
Education									
No formal education	-	-	-	-	-	-	-	-	-
Primary school	-0.106 (0.087)	-0.041 (0.034)	0.309 (0.222)	0.220 (0.131)	0.087 (0.052)	0.314 (0.523)	0.024 (0.091)	0.009 (0.036)	0.194 (0.508)
Secondary school	0.016 (0.085)	0.006 (0.033)	0.705*** (0.233)	0.126 (0.130)	0.050 (0.052)	1.032 (0.556)	0.044 (0.087)	0.017 (0.034)	0.561 (0.496)
Tertiary	0.089 (0.097)	0.034 (0.038)	1.725*** (0.362)	0.200 (0.138)	0.080 (0.055)	1.545** (0.605)	0.051 (0.093)	0.020 (0.036)	1.853*** (0.562)
Employment									
Employed	-0.200** (0.080)	-0.078** (0.031)	-0.234 (0.423)	0.076 (0.081)	0.030 (0.032)	-0.239 (0.456)	-0.204*** (0.078)	-0.080*** (0.031)	0.283 (0.393)
Unemployed	-	-	-	-	-	-	-	-	-
Household size									
Small (≤ 4)	-	-	-	-	-	-	-	-	-
Medium (5-7)	-0.062 (0.043)	-0.024 (0.017)	-0.142 (0.215)	-0.081 (0.044)	-0.032 (0.018)	0.185 (0.259)	0.025 (0.037)	0.010 (0.015)	0.227 (0.245)
Large (≥ 8)	0.112 (0.067)	0.044 (0.026)	-0.430 (0.339)	-0.036 (0.093)	-0.014 (0.037)	-0.138 (0.493)	0.307*** (0.074)	0.121*** (0.029)	-0.214 (0.289)

Table 4.12 (Continued)

Variable	Low-income			Middle-income			High-income		
	Consumption		Amount Coef.	Consumption		Amount Coef.	Consumption		Amount Coef.
	Coef.	ME		Coef.	ME		Coef.	ME	
Strata									
Urban	-0.052 (0.039)	-0.020 (0.015)	0.571*** (0.166)	-0.043 (0.045)	-0.017 (0.018)	0.382 (0.233)	-0.051 (0.046)	-0.020 (0.018)	0.725*** (0.248)
Rural	-	-	-	-	-	-	-	-	-
Household income									
B40	-	-	-	-	-	-	-	-	-
M40	-0.060 (0.041)	-0.023 (0.016)	-1.404*** (0.180)	0.021 (0.043)	0.008 (0.017)	-2.538*** (0.229)	-0.068 (0.037)	-0.027 (0.014)	-1.999*** (0.193)
T20	-0.008 (0.053)	-0.003 (0.020)	-2.089*** (0.177)	0.029 (0.058)	0.012 (0.023)	-3.258*** (0.222)	-0.054 (0.049)	-0.021 (0.019)	-2.741*** (0.198)
Tobacco/100^a	0.021 (0.020)	0.008 (0.008)	0.050 (0.091)	0.001 (0.014)	0.000 (0.006)	0.152 (0.148)	-0.026 (0.016)	-0.010 (0.007)	0.153 (0.141)
Sugary food & beverage/100^a	0.510*** (0.094)	0.198*** (0.037)	1.448** (0.707)	0.760*** (0.111)	0.303*** (0.041)	0.884** (0.394)	0.287*** (0.099)	0.113*** (0.020)	0.582 (0.364)
Log pseudolikelihood	-3133.106***			-2867.488***			-4013.466***		
F-statistics			9.980***			9.850***			12.340***
White's test	330.31			138.86			167.03		
p-value	<0.001			0.988			0.730		
Max. VIF	11.85			15.86			11.81		
Observations	4,692		1,906	4,207		1,996	5,939		2,599

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

Note:

Coef.: Coefficient

ME: Marginal effect

Robust standard error in parenthesis

^a Tobacco consumption; sugar-sweetened food and beverage consumption divided by 100

***, ** Significant at p<0.01 and p<0.05 respectively

4.5. Discussion

The Minister of Health Malaysia admitted that despite the 2017 Global Monitoring Report on Tracking Universal Health Coverage showed that Malaysia scored 70% in the UHC service coverage index, its out-of-pocket expenditure (OOPE) stood at 38% in 2018, in which the WHO recommends that the OOPE should be at around 20% (MOHM, 2019c; O'Donnell et al., 2007). From this study, the mean PES of all households was 0.94%, while of households who spent on pharmaceutical products (n=6,501) was 2.15% in 2014. Assuming similar percentages around that time point, the results in this study indicate that OOPE due to pharmaceuticals was not the major contributor to the overall medical OOPE. This section is divided into subsections of individual independent variables and is discussed in detail.

4.5.1. Age

In the preliminary analysis using one-way ANOVA, the age of household heads was significantly associated with mean pharmaceutical expenditure share for all households, among M40 households and those staying in middle-income states, with an increasing trend with age. These are consistent with the amount decision of the two-part models on the overall, stratified samples of M40 and middle-income states (only applicable for household heads more than 64 years old). The amount decision was highly significant for all household heads' age ranges more than 35 years old among B40 households, in which they spent more than those less than 25 years old. For the low-income group, the amount decision was strongly associated with the age of 35 years old and above with an increasing trend. This is supported by the theory that there is a rising rate of health

deterioration as the age increases (Emeh, 2020), which translates into more portions of an income were needed to be spent on their health.

This is similar to a past study in which household heads aged 65 and above had a higher pharmaceutical usage than those under 65, by ordinary least squares (OLS) regression and all quantile regression models (Alkan & Elmali, 2015). In a study based on the Austrian Household Budget Survey 2009/10, there was a positive relationship between expenditure and age, particularly in the elderly groups of 45–65 and 65–85 years old compared to 25–45 years old, using logit and GLM with log link and Poisson distribution (Sanwald & Theurl, 2017). This proposition was confirmed by using the logit model, which gave the probability estimates and GLM for flexible generalisation of OLS regression that consented for the reaction variable to have other than the normal distribution such as Poisson distribution (Lu et al., 2018). In a study among Malaysian elderly outpatients, 52% was on polypharmacy, meaning consuming five or more medications (Ang et al., 2021).

Being old itself may not be the sole cause of higher consumption share because other limiting factors still exist, such as having a lower disposable income (from retirement funds or pension schemes) during their non-productive years. Despite the free public healthcare for the old, they may also not have good access, which increases spending on additional pharmaceutical products should they fall sick. If they are healthy, other preceding factors will dominate, such as having good healthy behaviours and health maintenance attitudes such as regularly attending check-ups (Cheah & Meltzer, 2020).

PES on the age spectrum hypothesises that amount consumption is likely a reactive (being sick causes higher PES) decision among consumers.

4.5.2. Gender

Gender is an essential characteristic of every individual and has been examined as the demographic factor in many studies. This research had highlighted gender as one of the factors affecting pharmaceutical expenditure. The bivariate analysis shows no significance in total samples and subgroup analysis. However, in the two-part models, households led by a female were more likely to purchase pharmaceuticals in middle-income states and spent more in high-income states than those led by a male. Pharmaceuticals bought can be for self-use or the use of their family members. Women were found to use healthcare more frequently because they were more likely to suffer from chronic diseases (Redondo-Sendino et al., 2006)

According to the findings, this association could be related to women's higher responsibilities as leaders in a family and more substantial involvement in healthcare matters (Hart et al., 2019). In addition, this is also partly due to the socially constructed roles of men and women (Smith, 2016), such as the behaviour towards healthcare matters. This is due to cultural elements where women are more health-conscious, hence more likely to take care of health (Ek, 2015). Besides, females have a better knowledge of pharmaceutical products since they see doctors and pharmacists more frequently, leading to more purchases (Figueiras et al., 2000). Thus, it causes more spending on pharmaceutical products as well as spending on maintaining the health status.

Similarly, in a study on the Spanish National Health Survey 1993, female respondents had 1.18 higher (adjusted) chances of using pharmaceuticals (Figueiras et al., 2000). In the Austrian Household Budget Survey, female householders had a highly significant coefficient of 0.264 ($p < 0.01$) in the logit model, relative to their male counterparts (Sanwald & Theurl, 2017).

4.5.3. Ethnicity

The present study shows a highly significant relationship between ethnicity and pharmaceutical expenditure. Ethnicity was significantly associated with mean pharmaceutical expenditure share in the pooled, all income groups and residence of high-income states where non-Bumiputera consumed more out of their income.

The results are in concordance with amount decisions. Besides Bumiputera consumed less among the groups, they were less likely to purchase as well for the overall, B40, T20 and in high-income states. This disparity may be due to differences between cultures and religions that shape pharmaceutical consumption behaviours (McQuaid & Landier, 2018). Bumiputera may use natural forms of traditional and complementary medicine (TCM), which was not captured in this study. A study by Kew et al. (2015) shows that Bumiputera had a slight preference for TCM than non-Bumiputera, especially in the natural forms and herbal mixture.

There is no direct comparison study of ethnicity study on pharmaceutical expenditure in Malaysia. However, extensive Malaysian ethnic studies on preventive medical care (Cheah & Tang, 2017; Cheah, 2018; Cheah & Meltzer, 2020), such as medical check-ups and diagnostic tests, could be related in which ethnicity has a significant impact on the likelihood of seeking preventive medical care. In a study by Cheah & Meltzer (2020), it was found that non-Bumiputera were more likely, to have medical check-ups when they were 70–79 years old than Bumiputera. In a closer resemblance study on household healthcare expenditure in Malaysia, Bumiputera household heads were less likely to spend on healthcare, consistent with our study findings on pharmaceuticals (Cheah et al., 2021).

4.5.4. Marital Status

The marital status of household heads shows no significant association and no effect on the amount decisions on the overall and in any subgroups. This means household heads spent on pharmaceuticals regardless of their marital status. The result from this study is consistent with the previous study, where there was no significant relationship between pharmaceutical expenditure and marital status (Chang et al., 2017).

The sole significant finding from the current research on marital status was that single household heads with M40 and T20 income had a higher probability of purchasing pharmaceutical products than separated household heads from the same income groups. Parents tend to stay with single household heads, hence may have a higher chance of purchasing pharmaceuticals. Divorced/widowed household heads may have lesser

responsibility towards other family members (Thomas et al., 2017), hence lesser probability of purchasing pharmaceuticals.

However, this was contrary to the Spanish National Health Survey (Figueiras et al., 2000) that people who lived alone had 1.26 higher chances of using therapeutic drugs than those with a partner (Figueiras et al., 2000). This contradiction with the current findings could be due to the differences in the social structures of these communities. William (2003) indicated that social structure impacts the dimension of health beliefs and psychological factors, either positively or negatively. In general, marriage is associated with good health (William, 2003; Simon, 2002). Unmarried people have less access to resources, especially on disposable income than married people, which may affect utilisation (Pandey et al., 2019). Different dependency factors such as healthcare benefits and health insurance also may affect the pharmaceutical expenditure among residents with different marital statuses (Siddiqi et al., 2009; Atnafu et al., 2018). Literature on health and mortality by marital status has constantly acknowledged that single individuals generally report inferior health and have a higher mortality hazard than their married counterparts, with men being mainly affected in this respect (Read & Gorman, 2011).

4.5.5. Education

Education is one of the main concepts being scrutinised in the economic literature involving purchase amount and intention. Education attainment of household heads was highly significant in the association with pharmaceutical expenditure share for total

samples that consume pharmaceuticals, all income groups and residency in low- and high-income states with the general trend of increment of education level from no formal education to tertiary with increasing mean PES. This is supported by the significance of the amount decisions on the overall sample, all income groups and in low-income states, but for secondary education onwards and tertiary education only for high-income states.

All results show that higher education led to a higher expenditure share. A study shows that higher education levels led to a higher amount of pharmaceutical expenditure (Sanwald & Theurl, 2017). This is supported by the theory that education is positively linked with investment in health (Bijwaard & Van Kippersluis, 2016), in this case through “productive efficiency” (i.e., through the use of health inputs). The theory that higher-educated individuals appear to have a higher marginal output of direct health inputs as efficient health producers, was not demonstrated here (Bijwaard & Van Kippersluis, 2016).

Education did not affect the likelihood of pharmaceutical purchase. The findings could be the new evidence on the association of education on buying intention of pharmaceutical products. Empirically, this finding of non-significance in likelihood is in contrast with multiple studies that having a higher education degree led to higher pharmaceutical spending (Chang et al., 2017; Figueiras et al., 2000; Mayer & Osterle, 2015; Sanwald & Theurl, 2017). In our study, the more an individual was educated, the higher the amount to purchase the pharmaceutical products, without affecting his/her discretion.

4.5.6. Employment Status

The employment status of household heads was significantly associated in the pooled samples and B40 group. However, it only affects the likelihood of purchase in pooled samples while no association in both amount and consumption decisions among the B40 group. The employment status among residents in the pooled sample, low and high-income states, affected the probability of pharmaceutical expenditure, where employed household heads were less likely to spend on pharmaceutical products than those unemployed. A study by Olasehinde & Olaniyan (2017) in Nigeria discovered that households with unemployed household heads spent more on healthcare than those employed due to the opportunity cost of time for accessing healthcare for the unemployed is lower. The results in this study are not supported by the outcomes of most studies (Figueiras et al., 2000; Hoai & Dang, 2017; Loganathan et al., 2017; Mayer & Osterle, 2015) concluded that job status has no bearing on pharmaceutical spending.

The findings contradict the normal perception that employed households with a consistent income are more inclined to spend on pharmaceutical products as preventive care. Nevertheless, this research has shown that unemployed households heads had a higher probability of spending on pharmaceutical products. It can be predicted that unemployment with no permanent income may lead them to buy medicines more frequently while sharing a similar proportion of purchase with those who are employed. In Malaysia, employed household heads may have health insurance covered by their employers by visiting panel clinics (Zin et al., 2020), reducing the tendency to purchase medicine.

4.5.7. Household Size

There was no significant association between household size and pharmaceutical expenditure share, which shared the same results as the amount decisions in the two-part model. A few studies had looked at the impact of household size on pharmaceutical spending, with results showing no substantial relationship (Hoai & Dang, 2017; Loganathan et al., 2017).

Although there was no significant relationship between household size and pharmaceutical expenditure share, the study discovered that in the overall sample of those who purchase medicine, as well as among B40, T20, and residents of high-income states, only those with a large household size of eight members or more had a significantly higher likelihood of medicine consumption.

Having more family members means more tendencies of pharmaceutical consumption but has no effects on the overall amount. A postulation that can be made is health status of family members is independent of household size. Hence, the amount remained the same although households with more than eight members might buy them more frequently due to the higher number of members itself, and/or cater for the needs of more members. Large households cannot afford to spend a lump sum of income on pharmaceuticals at any one time. However, it is inconsistent with the community-based study by Wijesinghe et al. (2012)'s of 1800 adults in the Gampaha and Polonnaruwa districts of Sri Lanka that found urban households with two or fewer members were more likely to consume drugs than those with larger households.

4.5.8. Strata

There was a strong association between strata and mean pharmaceutical expenditure share for all consumers and throughout all income and regional subgroups (except middle-income states) in which urban households consistently spent higher than their rural counterparts. This translates into the significance and similar trends of amount decisions for the total, B40, M40, low- and high-income states. This can be due to urban areas having more types of pharmaceuticals, hence leading to more purchases out of their income. Pharmaceuticals in urban areas may cost more due to the higher cost of living. Based on the Malaysian Medicine Price Monitoring Survey (MPMS) 2011-2015, urban areas had a higher retail price than rural (Ahmad et al., 2019). This may be due to market segmentation. Vendors may charge based on the willingness-to-pay of customers by segmenting demand. As a result, some consumers may be subjected to higher prices than they are willing to pay in some cases (Russo & McPake, 2010). Other research, however, found that the urban/rural locality (Chang et al., 2017) and the degree of urbanisation (Sanwald & Theurl, 2017) had no significant effect on pharmaceutical expenditure. There is a contradiction with the current findings that households from urban areas tend to spend more on pharmaceutical products than those from rural areas.

In addition, for consumption decisions, only the overall sample show significance but in the opposite trend. Urban households were less likely to purchase pharmaceuticals than their rural counterparts. This is in line with a Vietnamese study suggesting that living in central Ho Chi Minh reduced the frequency of self-medication by 0.248 times, utilising a Poisson model ($p < 0.01$) (Hoai & Dang, 2017).

4.5.9. Household Income

Household income was highly associated with mean pharmaceutical expenditure share for all consumers and regional subgroups in which T20 spent the least, followed by M40 and B40. These results were the same for the amount decisions. Household income did not significantly affect the likelihood in any groups. This means income did not affect the decision to consume but affected the amount in relation to income.

This is not supported by the standard theory of increment of health investment for those with higher incomes (Huttin, 1997; Acharya et al., 2019). Instead, the results are in congruent with the notion that poorer groups may have more ailments, hence fork out more of their income for pharmaceuticals. They may not pay so much attention to their healthcare, including routine medical check-up, good diet and/or regular exercise. In addition, poorer groups may need to spend more of their income on pharmaceuticals due to poor health status. Following an increasing body of research, those from the poorest socioeconomic groups were the ones who suffered the most from illnesses (Barnett et al., 2012; Lasser et al., 2006; Orpana et al., 2007) which led to high pharmaceutical spending. They have intrinsically lower incomes, hence spending a higher fraction for the same items. More affluent households may consume more luxury goods, hence spending lesser of their income on pharmaceuticals. Besides, wealthier households have a better standard of living, e.g. better hygiene in living conditions, sewage, food and water supply, and thus less hazard of being ill. As a result, they spend a minor portion of their income on buying medicines. Households with higher income have greater access and more options

to acquire healthcare. Besides, poor households often find themselves in more stressful situations, which can be detrimental to their health and well-being (Lenhart, 2019).

4.5.10. Region by GDP per capita

Similar to household income, regions' GDP per capita grouping was significantly associated with all consumers and household income subgroups. Based on bivariate analysis, middle-income states' residents spent the most, followed by high- and low-income states. Residents in middle-income states spent a significantly higher amount out of income and were more likely than those of low-income states. In contrast, those in high-income states show no significance in terms of amount decisions.

Middle-income states may be overlooked on the accessibility of public healthcare which residents may resort to purchasing pharmaceuticals. Households in high-income states had a higher likelihood of purchasing pharmaceutical products in the overall and B40 samples.

In this study, GDP per capita was highly associated with the pharmaceutical expenditure share, where the residents of different regions had different pharmaceutical expenditure shares. There is no comparative study of regional subgroups by GDP per capita within a country in the literature.

4.5.11. Tobacco Consumption

Tobacco consumption was categorised as unhealthy lifestyle behaviour where the perception of undergoing an unhealthy lifestyle leads to more expenditure on pharmaceuticals. However, this research provided insight from different perspectives. This research shows that tobacco consumption did not significantly affect the likelihood and amount spent out of income on pharmaceuticals in any subgroups.

There may be trade-offs between the consumption of pharmaceuticals and tobacco. However, from a logical standpoint, it is still regarded as an unhealthy behaviour resulting in high pharmaceutical costs. The perception of tobacco consumption causing high pharmaceutical expenditure is not supported by the results of this research.

4.5.12. Sugar-sweetened Food and Beverage Consumption

An increase in sugary products consumption increased the likelihood of purchases in all main and subgroup analyses and increased the amount spent out of income among B40, M40 and low-income states' subgroups. The results of sugary product consumption are not supported by Cawley and Ruhm (2011)'s theory of "negative health investment" or "health disinvestment" nor supported by the crowding-out effect of unhealthy behaviours expenditure in replacement of other expenditure which a household decides on the opportunity cost of unhealthy lifestyles before pharmaceutical expenditure is determined. In this study, spending on sugary products led to various ailments, specifically diabetes, hence an increase in pharmaceutical expenditure share, in which smokers had to purchase pharmaceuticals to treat the ailments caused by smoking.

In contrast with the findings of tobacco consumption as another unhealthy lifestyle, sugar-sweetened food and beverage consumption factors had an impact on the pharmaceutical expenditure share. Lifestyle behaviours are attitudes and choice of practices, including dietary, tobacco and sugary consumption, and even the dependent of our study: pharmaceutical consumption itself. The overall lifestyle of a consumer influences the purchasing of pharmaceutical products. For example, when a consumer leads a healthy lifestyle and is still healthy, it could be no spending on pharmaceutical products with no or little spending on preventive pharmaceutical products (Jarbøl et al., 2017).

4.6. Conclusion

This chapter has explored the analysis and the determinant factors of both the likelihood and amount of pharmaceutical expenditure share of Malaysian households, focusing on the household incomes and regions by GDP per capita in which the households reside. Nationally representative microdata was used, namely the Malaysian Household Expenditure Survey 2014 (DOSM, 2014). All households spent an average of RM 31.53 on pharmaceuticals monthly, with a PES of 0.94%. Out of 14,838 households, 6,501 (43.8%) had purchased pharmaceuticals with a mean expenditure of RM 71.95, with an expenditure share of 2.15%. Household income and regions by GDP per capita were the two factors significantly associated with PES in overall and all subgroups. The equations for the final models are in Appendix 1.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1. Introduction

This chapter summarises empirical findings and offers some policy recommendations for reducing the country's high household debt levels. Finally, this chapter addresses the study's limitations and offers suggestions for future research in the domain of pharmaceutical expenditure.

5.2. Summary of Findings

A total of 14,838 households were sampled. Ten sociodemographic factors (gender, age, ethnicity, marital status, education, employment status of household head; household size, strata, monthly household income, region) and two lifestyle factors (tobacco consumption, and sugar-sweetened food and beverages consumption) were examined as the independent variables. The associations between sociodemographic characteristics and mean pharmaceutical expenditure share among households were investigated using a preliminary one-way ANOVA, followed by a two-part model (probit and OLS). Subsequently, the model is further stratified by income groups and regions by GDP per capita.

All households (n=14,838) had a mean expenditure of RM 31.53 on pharmaceuticals, with a PES of 0.94%. Bivariate analysis shows age, ethnicity, education and employment status of household heads, residing strata, household income and regions by GDP per capita were significantly associated with pharmaceutical expenditure share (PES). All households were included in the consumption equation; 6,501 households (43.8%) who

consumed pharmaceutical products were analysed in the amount equation with a mean expenditure of RM 71.95, at a PES of 2.15%. Being unemployed and having a large family increased the likelihood of consuming medications. PES raised as household heads get older, were higher educated, living in high-income states, and decreasing household income. Being a non-Bumiputera and consuming sugary items increased the likelihood and allocation of income to medications, whereas urban families were less likely to but spend more on pharmaceuticals. Compared to households in low-income states, those who lived in middle-income states were more likely to spend more of their household income. Table 5.1 summarises the significant variables in the two-part model for the overall sample on PES.



Table 5.1 Significant Variables in the Two-part Model for Pharmaceutical Expenditure Share in Overall Sample

Significant Variable	Coefficient	
	Consumption	Amount
↑ Age (cf. <25)	-	↑0.769-1.821
Ethnicity Bumiputera	-0.085	-0.537
↑ Education (cf. no formal education)	-	↑0.818-1.833
Employment Employed	-0.119	-
Household size Large (≥8) (cf. ≤4)	0.153	-
Strata Urban	-0.057	0.548
↑ Household income (cf. B40)	-	↑-(1.999-2.715)
↑ GDP per capita by region (cf. low-income states)	↓0.171-0.069	0.742 (middle-income)
Sugary product/100	0.408	0.890

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

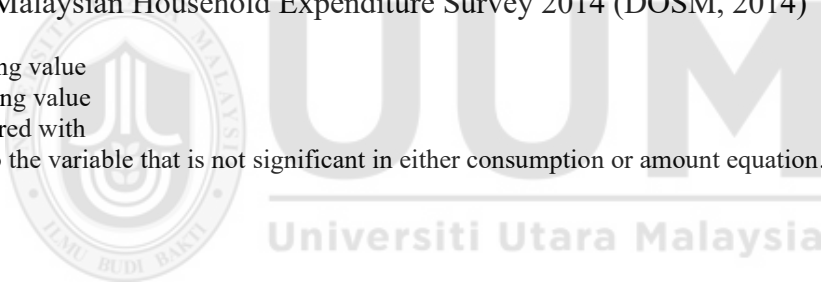
Note:

↑: increasing value

↓: decreasing value

cf.: compared with

- refers to the variable that is not significant in either consumption or amount equation.



To answer the second specific objective, households with a monthly income of RM 4,359 or less were classified as B40, RM 4,360 – 9,619 as M40 and 9,620 and more as T20: with a breakdown of 7,615 (51.3%) households, 4,964 (33.5%) and 2,259 (15.2%) respectively. One-way ANOVA shows that ethnicity and education level of household heads, residing strata and regions by GDP per capita were significantly associated with PES across all household income groups. Large household size among B40 and T20 households, residing in high-income states among B40 households and increasing sugary food and beverage consumption among T20 households increased the likelihood of pharmaceutical consumption. In contrast, separated household heads among M40 and T20 households reduced the likelihood. Household heads of age more than 35 among B40, increasing age among M40, increasing education post-primary level across all income groups, staying in urban areas among B40 and M40 increased PES, while Bumiputera household heads among B40 reduced PES. Residing in middle-income states across all household income and increasing consumption in sugary products increased both probability and amount on PES. On the contrary, Bumiputera household heads among B40 and T20 households were less likely and spent less on pharmaceuticals. Table 5.2 summarises the significant variables for the households stratified by household income on PES.

Table 5.2 Significant Variables in the Two-part Model for Pharmaceutical Expenditure Share, by Household Income

Significant Variable	Coefficient					
	B40		M40		T20	
	Consumption	Amount	Consumption	Amount	Consumption	Amount
↑ Age (cf. <25)	-	↑1.272- 2.533	-	↑0.625- 1.552	-	-
Ethnic						
Bumiputera	-0.091	-0.736	-	-0.404	-0.200	-0.222
Marital status						
Widow/Divorced (cf. single)	-	-	-0.179	-	-0.263	-
↑ Education (cf. no formal education)	-	↑1.178- 2.560	-	↑0.463- 1.207	-	↑0.301- 0.627
Household size						
Large (≥8) (cf. ≤4)	0.146	-	-	-	0.305	-
Strata						
Urban	-	0.885	-	0.215	-	-
Region by GDP per capita	↓0.139-0.080 as ↑GDP per capita					
Middle-income states (cf. low-income states)		1.149	0.226	0.316	0.169	0.316
Sugary product/100	0.618	1.475	0.273	0.706	0.393	-

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

Note:

↑: increasing value

↓: decreasing value

cf.: compared with

- refers to the variable that is not significant in either consumption or amount equation.

Stratification by residence in regions by GDP per capita aims to answer the third specific objective. The low-income states were Terengganu, Sabah, Perlis, Kedah and Kelantan; Melaka, Negeri Sembilan, Johor, Pahang and Perak were middle-income states; Federal Territory of Kuala Lumpur (including Putrajaya), Federal Territory of Labuan, Penang, Sarawak and Selangor, were high-income states. Collectively, 4,692 (31.6%) respondents stayed in low-income states, 4,207 (28.4%) in middle-income states and 5,939 (40.0%) in high-income states. The age of household heads in middle-income states; ethnicity in high-income states; education level and residing strata in low- and high-income states; household income in all regions, were significantly associated with PES. Having female household heads in middle-income states and increasing consumption of sugary products in the middle- and high-income states increased the probability of purchasing pharmaceuticals. In contrast, Bumiputera household heads led to a decrease in the probability. Increasing the age of household heads in low- and middle-income states, aged 65 or more in high-income states; female household heads in high-income states; having higher education and staying in urban areas, in low and high-income states increased PES. Increasing household income further reduced PES. Increasing consumption of sugary products in low-income states increased both the likelihood and amount of income spent on pharmaceuticals, while Bumiputera household heads in high-income states were less likely and spent less from their income on pharmaceuticals. Table 5.3 summarises the significant variables for the households stratified by region by GDP per capita on PES.

Table 5.3 Significant Variables in the Two-part Model for Pharmaceutical Expenditure Share, by Region by GDP Per Capita (State)

Significant Variable	Coefficient					
	Low-income		Middle-income		High-income	
	Consumption	Amount	Consumption	Amount	Consumption	Amount
↑ Age (cf. <25)	-	↑0.985-1.276	-	↑0.995-2.841	-	1.530 (>65)
Gender	-	-	0.149	-	-	0.659
Female						
Ethnic	-	-	-	-	-0.216	-0.645
Bumiputera						
↑ Education (cf. no formal education)	-	↑0.705-1.725	-	1.545 (tertiary)	-	1.853 (tertiary)
Employment						
Employed	-0.200	-	-	-	-0.204	-
Household size						
Large (≥8) (cf. ≤4)	-	-	-	-	0.307	-
Strata						
Urban	-	0.571	-	-	-	0.725
↑ Household income (cf. B40)	-	↑-(1.404-2.089)	-	↑-(2.538-3.258)	-	↑-(1.999-2.741)
Sugary product/100	0.510	1.448	0.760	0.884	0.287	-

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

Note:

↑: increasing value

↓: decreasing value

cf.: compared with

- refers to the variable that is not significant in either consumption or amount equation.

To sum up, the two characteristics that were significantly associated with PES in pooled and all subgroups were household income (decreasing income spent more but no association on likelihood) and regions by GDP per capita (residents of middle-income states spent most likely and more, followed by high-income states on likelihood, compared to low-income states). Ethnicity and education level were significant in all subgroups except in middle-income states where non-Bumiputera spent more and purchased more while the general increment of education level increased expenditure share but not likelihood. Female-led households were more likely to purchase pharmaceuticals in middle-income states and spent more in high-income states. Households led by those employed were less likely to spend on pharmaceuticals in pooled samples, low- and high-income states. On residing strata, urbanites spent more but had reduced likelihood in pooled samples, B40, M40, low- and high-income states. An increase in sugary products consumption increased the likelihood of purchases in all main and subgroup analyses, and increased the amount spent out of income among B40, M40 and low-income states' households. Marital status, household size and tobacco consumption show no significant impact on pharmaceutical expenditure share in any subgroup analysis. Table 5.4 summarises the significant variables for the three research objectives.

Table 5.4 Summary of Significant Variables in the Two-part Model for Pharmaceutical Expenditure Share in Overall Sample and by Household Income and Region by GDP Per Capita (State)

Significant Variable	Coefficient	
	Consumption	Amount
↑ Age (cf. <25)	-	↑+ve
Gender		
Female	+ve (middle-income states)	+ve (high-income states)
Ethnicity		-ve
Bumiputera	-ve	
Marital status		
Widow/Divorced (cf. single)	-ve (M40 and T20)	
↑ Education (cf. no formal education)	-	↑+ve
Employment		
Employed	-ve	-
Household size		
Large (≥8) (cf. ≤4)	+ve	-
Strata		
Urban	-ve	+ve
↑ Household income (cf. B40)	-	↑-ve
Region by GDP per capita		
Middle-income states (cf. low-income states)	+ve	+ve
Sugary product/100	+ve	+ve

Source: Malaysian Household Expenditure Survey 2014 (DOSM, 2014)

Note:

↑: increasing value

↓: decreasing value

+ve: positive value

-ve: negative value

cf.: compared with

- refers to the variable that is not significant in either consumption or amount equation.

5.3. Implication of the Study

Government health spending can help to substitute, hence reducing household out-of-pocket expenditure (OOPE) on pharmaceuticals. However, if government spending on health continues to rise without a reduction in other public spending, the government will be forced to raise taxes, which will harm the economic performance of a nation (Chernew & Newhouse, 2011). As a result, public spending on pharmaceuticals must be carefully planned to improve public health and well-being, while avoiding excessive spending on them. This planning requires a thorough understanding of the factors that influence household pharmaceutical spending.

Pharmaceutical expenditure share increased as household heads get older without affecting much on likelihood. Older people have a higher risk of diseases, hence a higher pharmaceutical expenditure share. In this study, higher health maintenance marginal costs did not act as a barrier to the pharmaceutical expenditure share among the elderly. The elderly are willing to fork out more of their incomes on medicines despite the Ministry of Health Malaysia providing free outpatient treatments and medicines for Malaysian geriatrics (the same cut-off age as the United Nations). Malaysia will become a fully ageing nation by 2030, according to United Nations projections, when 15% of the population is classed as elderly citizens (Hairi et al., 2010; Abd Mutalib et al., 2020).

Suppose accessibility of these incentives from the government is an issue, more public health clinics can be set up in townships with high proportions of retirees to ease accessibility to free medicine. Although this initiative may increase the government

spending due to the increased healthcare consumption among the elderly, it may improve societal welfare that no one is left behind and as an appreciation for the elderly who had built the nation. The association between the age of household heads and mean pharmaceutical expenditure share can assist pharmaceutical companies in manufacturing more age-specific products.

Having a lower household income in the pooled sample, urban areas and all regional subgroups increased PES, in which T20 spent the least, followed by M40 and B40. These results were the same for the amount decisions. Household income did not significantly affect the likelihood in any groups. A better living environment for the poor such as better sewage, food and water supply, is beneficial as a preventive public health measure to reduce the amount spent out of their income.

In terms of the locality of residence, residents in middle-income states spent significantly higher amounts out of income and were more likely to purchase pharmaceuticals compared with low-income states. Those in high-income states, on the other hand, demonstrate no significance in terms of amount decisions. Despite spending more of their income, urban households were less likely to purchase pharmaceuticals. This raises the alarm on the prices of pharmaceuticals, especially in urban areas.

The current pharmaceutical market in Malaysia is under free market forces. Government intervention can be suggested for more public provision and price control, such as setting up a price ceiling for each medicine sold in the private sector. The regulation of the pharmaceutical supply chain may help to reduce the disparity in pharmaceutical products

prices between urban and rural areas in Malaysia. Urban and rural regions must have rules in place that take into consideration the rise in overhead costs, distribution costs, and profit margins. It has been suggested that limiting markups on wholesale and retail prices can help to keep pharmaceutical costs down, as reported in Jordan, Kenya, Kuwait, and Lebanon (WHO, 2015).

These interventions are necessary to alleviate B40 and M40 groups financially in Malaysia, generally regardless of residing states, and to focus on urban areas and middle-income states such as Melaka, Negeri Sembilan, Johor, Pahang and Perak. Urban areas may have better access to public health clinics in terms of distance but may not be enough to cater to the population density.

The existing pharmacy value-added services provided by the public healthcare to ease the collection of follow-up medicines such as medicines by post and drive-through pharmacy can be promoted among residents in urban and middle-income states. Stakeholders from the pharmaceutical industries can study deeper and further on the region by GDP per capita to improve their performance in terms of products and services by targeting the right audience for their products.

Besides strata, the participation decision and amount decision of pharmaceutical expenditure share differed on those with more than eight family members. While not affecting consumption amount, they were more likely to purchase in the overall sample, B40, T20 and high-income states. The adjusted household income for large household

sizes may be far less. There is a possibility of rationing and sharing of medicines among these households to save money. Public health policymakers can look into a need-based approach for large family members. Allocation of public resources can be concentrated on households with large members, especially those with B40 and in states such as all Federal Territories, Penang, Sarawak and Selangor. The existing ‘Know your medicine’ campaigns by the Pharmaceutical Services Programme, Ministry of Health Malaysia, can be intensified to promote safe and rationale self-medication behaviours.

Sugary product consumption increased the likelihood in all groups and increased the amount spent out of income among B40, M40 and low-income states. Policy to impose a tax on sugar-sweetened food and beverages can be effective and worthy of consideration. Imposition of sugar tax can reduce sugary consumption, hence pharmaceutical expenditure share. Preventive population-based public health measures such as campaigns to discourage, subsequently replace sugary product consumption with healthier options are proposed. Those who are aware of the importance of consuming a minimal number of sugary products may not have good knowledge of the types of products that may contain hidden sugar. Social and mass media should periodically disseminate infographics on the sugar content of common, new and trending sugary products.

5.4. Study Limitations

This research is not without its limitations. It was conducted based on the HES 2014 data. HES 2016 was the latest published HES. The full dataset for the latest HES in 2016

cannot be obtained and is acknowledged as part of the limitation of the study. However, using HES 2014 can still be advantageous compared to HES 2016 as it was combined with two other surveys. Household Income/Basic Amenities Survey (HIS/BA). They were conducted simultaneously as the Household Income, Expenditure and Basic Amenities Survey (HIES/BA) 2016.

Combining questionnaires and conducting them in one go can be cost-saving for our nation. However, respondents are more likely to break off in the middle of the interview session, non-response item rises, and most significantly, answers at the middle and end of the interview sessions may be of poorer quality as the motivation and energy level of respondents reduce, commonly known as survey fatigue (Burchell & Marsh, 1992; Porter et al., 2004). Hence, the data of HES 2014 were analysed in this study.

The income elasticity of pharmaceutical demand in Malaysia cannot be determined precisely in this study as our dependent variable was already adjusted to income. It is inconclusive that pharmaceuticals in Malaysia are necessary or luxury goods.

Another limitation is that the health status of the households is not available in the HES to be analysed, acknowledging that the health status of the individuals is an essential variable in the healthcare demand model.

Existing data available could not be further broken down. For example, the employment status of household heads is only available as employed and unemployed. Different types

of employment status are linked with the different methods of healthcare payment, access to healthcare, insurance coverage and social safety net, which are then linked to different OOPE of pharmaceuticals.

5.5. Recommendation for Future Research

Future research could utilise panel data for comparative research to look at changes in households over time. Despite the inherent data limitations of the latest HIES/BA 2016, it could be analysed with the current data of HES 2014 using time-series analysis. If a series of data in the previous years are available, detailed analysis on variables, especially age could be investigated to see if the factors change over time.

Ethnic differences in pharmaceutical use warrant further investigations, which may be explored and captured through a qualitative study. The differences in both likelihood and amount between Bumiputera and non-Bumiputera can be explored through the purposes of the purchase and preferences, especially on their respective traditional and complementary medicine (TCM). It is imperative that they are using both conventional medicine and TCM safely, especially natural forms and herbal mixtures of TCM.

An independent study on pharmaceutical expenditure can be conducted with the addition of types of pharmaceuticals consumed, health utility and health outcomes of the households so that associations between cost-utility analysis (CUA) and cost-effectiveness analysis (CEA) can be determined to enhance the practice of evidence-based medicine (EBM). We can understand pharmaceutical consumption in greater detail

to formulate more targeted and effective health policies. Accessibility to the heavily subsidised medicines by the government, such as distance to the nearest public health clinics and the population density, can be investigated as well.



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APPENDICES

Appendix 1. The Equations in the Final Models

Based on the model developed (Equation 3.2), there are three dummy variables and one continuous variable that did not significantly affect consumption and amount decisions of pharmaceutical expenditure share regardless of any types of stratification, namely:

DMS_{Mi} =1, if marital status is married; =0, otherwise

DED_{li} =1, if primary (<7 years of schooling) education; =0, otherwise

DHS_{5-7i} =1, if the household size is between 5 to 7 persons; =0, otherwise

TC_i = Tobacco consumption (RM)



The factors for the overall (pooled) sample can be summarised in Equations A1 and A2:

$$\text{Likelihood of pharmaceutical expenditure (share), } P(\text{PES}_i=1) = - 0.085 \text{ DE}_{\text{Bi}} - 0.119 \text{ DES}_{\text{Ei}} + 0.153 \text{ DHS}_{8+i} - 0.057 \text{ DS}_{\text{ui}} + 0.171 \text{ DHI}_{\text{M40i}} + 0.069 \text{ DHI}_{\text{T20i}} + 0.408 (\text{SC}_i/100) + u_i \dots \text{ (A1)}$$

where

- PES_i = pharmaceutical expenditure share (%)
- DE_{Bi} =1, for *Bumiputera* and =0, for non-*Bumiputera*
- DES_{Ei} =1, for employed and =0, for unemployed
- DHS_{8+i} =1, if the household size is 8 or more persons; =0, otherwise
- DS_{ui} =1, if the strata is urban area and =0, if the strata is rural
- DHI_{M40i} =1, if the household income is between RM 4,360 to RM 9.619; =0, otherwise
- DHI_{T20i} =1, if the household income is equal or more than RM 9,620; =0, otherwise
- SC_i = Sugar-sweetened food and beverages consumption (RM)

$$\text{Pharmaceutical expenditure share with purchase, } \text{PES}_i|\text{PES}>0 = 0.888 + 0.769 \text{ DA}_{35-44i} + 0.956 \text{ DA}_{45-64i} + 1.821 \text{ DA}_{65+i} - 0.537 \text{ DE}_{\text{Bi}} + 0.818 \text{ DED}_{2i} + 1.833 \text{ DED}_{3i} + 0.548 \text{ DS}_{\text{ui}} - 1.999 \text{ DHI}_{\text{M40i}} - 2.715 \text{ DHI}_{\text{T20i}} + 0.742 \text{ DR}_{\text{MIDGDPi}} + 0.890 (\text{SC}_i/100) + u_i \dots \text{ (A2)}$$

where

- DA_{35-44i} =1, if the age is between 35 to 44 years old; =0, otherwise
- DA_{45-64i} =1, if the age is between 45 to 64 years old; =0, otherwise
- DA_{65+i} =1, if the age is more than or equal to 65; =0, otherwise
- DED_{2i} =1, if secondary (7-11 years of schooling) education; =0, otherwise
- DED_{3i} =1, if tertiary (≥ 12 years of schooling); =0, otherwise
- $\text{DR}_{\text{MIDGDPi}}$ =1, if the GDP per capita of regions is between RM30244.54 to RM50367.70; =0, otherwise

The factors affecting pharmaceutical expenditure shares stratified by household income are summarised in Equations A3-A4 (B40), A5-A6 (M40) and A7-A8 (T20):

$$\text{Likelihood of pharmaceutical expenditure (share) within B40 group, } P(\text{PES}_{\text{B40}}=1) = -0.091 \text{ DEB}_i + 0.146 \text{ DHS}_{8+i} + 0.139 \text{ DR}_{\text{MIDGDP}_i} + 0.080 \text{ DR}_{\text{HIGHGDP}_i} + 0.618 (\text{SC}_i/100) + u_i \dots \text{ (A3)}$$

$$\text{Pharmaceutical expenditure share with purchase within B40 group, } \text{PES}_{\text{B40}}|\text{PES}>0 = 2.533 \text{ DA}_{65+i} - 0.736 \text{ DEB}_i + 1.178 \text{ DED}_{2i} + 2.560 \text{ DED}_{3i} + 0.885 \text{ DS}_{ui} + 1.149 \text{ DR}_{\text{MIDGDP}_i} + 1.475 (\text{SC}_i/100) + u_i \dots \text{ (A4)}$$

where
 $\text{DR}_{\text{HIGHGDP}_i} = 1$, if the GDP per capita of regions is more than RM 50,357.70; $=0$, otherwise

$$\text{Likelihood of pharmaceutical expenditure (share) within M40 group, } P(\text{PES}_{\text{M40}}=1) = -0.179 \text{ DMS}_{W_i} + 0.226 \text{ DR}_{\text{MIDGDP}_i} + 0.273 (\text{SC}_i/100) + u_i \dots \text{ (A5)}$$

where
 $\text{DMS}_{W_i} = 1$, if marital status is widow/divorce; $=0$, otherwise

$$\text{Pharmaceutical expenditure share with purchase within M40 group, } \text{PES}_{\text{M40}}|\text{PES}>0 = 0.625 \text{ DA}_{25-34i} + 0.519 \text{ DA}_{35-44i} + 0.909 \text{ DA}_{45-64i} + 1.552 \text{ DA}_{65+i} + -0.404 \text{ DEB}_i + 0.463 \text{ DED}_{2i} + 1.207 \text{ DED}_{3i} + 0.215 \text{ DS}_{ui} + 0.316 \text{ DR}_{\text{MIDGDP}_i} + 0.706 (\text{SC}_i/100) + u_i \dots \text{ (A6)}$$

where
 $\text{DA}_{25-34i} = 1$, if the age is between 25 to 34 years old; $=0$, otherwise

$$\text{Likelihood of pharmaceutical expenditure (share) within T20 group, } P(\text{PES}_{\text{T20}}=1) = -0.200 \text{ DEB}_i - 0.263 \text{ DMS}_{W_i} + 0.305 \text{ DHS}_{8+i} + 0.169 \text{ DR}_{\text{MIDGDP}_i} + 0.393 (\text{SC}_i/100) + u_i \dots \text{ (A7)}$$

$$\text{Pharmaceutical expenditure share with purchase within T20 group, } \text{PES}_{\text{T20}}|\text{PES}>0 = -0.222 \text{ DEB}_i + 0.301 \text{ DED}_{2i} + 0.627 \text{ DED}_{3i} + 0.316 \text{ DR}_{\text{MIDGDP}_i} + u_i \dots \text{ (A8)}$$

The factors affecting pharmaceutical expenditure shares stratified by region (by GDP per capita) in Malaysia are summarised as in Equations A9-A10 (low-income states), A11-A12 (middle-income states) and A13-A14 (high-income states):

Likelihood of pharmaceutical expenditure (share) for low-income states, $P(\text{PES}_{\text{LOWGDP}}=1) = -0.200 \text{ DES}_{\text{Ei}} + 0.510 (\text{SC}_i/100) + u_i \dots$ (A9)

Pharmaceutical expenditure share with purchase for low-income states, $\text{PES}_{\text{LOWGDP}}|\text{PES}>0 = 0.985 \text{ DA}_{35-44i} + 1.142 \text{ DA}_{45-64i} + 1.276 \text{ DA}_{65+i} + 0.705 \text{ DED}_{2i} + 1.725 \text{ DED}_{3i} + 0.571 \text{ DS}_{\text{ui}} - 1.404 \text{ DHI}_{\text{M40i}} - 2.089 \text{ DHI}_{\text{T20i}} + 1.448 (\text{SC}_i/100) + u_i \dots$ (A10)

Likelihood of pharmaceutical expenditure (share) for middle-income states, $P(\text{PES}_{\text{MIDGDP}}=1) = -0.539 + 0.149 \text{ DG}_{\text{Fi}} + 0.760 (\text{SC}_i/100) + u_i \dots$ (A11)

where

$\text{DG}_{\text{Fi}}=1$, for female and $=0$, for male

Pharmaceutical expenditure share with purchase for middle-income states, $\text{PES}_{\text{MIDGDP}}|\text{PES}>0 = 2.841 \text{ DA}_{65+i} - 2.538 \text{ DHI}_{\text{M40i}} - 3.258 \text{ DHI}_{\text{T20i}} + u_i \dots$ (A12)

Likelihood of pharmaceutical expenditure (share) for high-income states, $P(\text{PES}_{\text{HIGHGDP}}=1) = -0.216 \text{ DE}_{\text{Bi}} - 0.204 \text{ DES}_{\text{Ei}} + 0.307 \text{ DHS}_{8+i} + 0.287 (\text{SC}_i/100) + u_i \dots$ (A13)

Pharmaceutical expenditure share with purchase for high-income states, $\text{PES}_{\text{HIGHGDP}}|\text{PES}>0 = 0.659 \text{ DG}_{\text{Fi}} - 0.645 \text{ DE}_{\text{Bi}} + 1.853 \text{ DED}_{3i} + 0.725 \text{ DS}_{\text{ui}} - 1.999 \text{ DHI}_{\text{M40i}} - 2.741 \text{ DHI}_{\text{T20i}} + u_i \dots$ (A14)