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Determining Factors of Medication Label Awareness: The Case of Malaysia

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Abstract: *Medication labelling and patient knowledge can help reduce risk of misuse of medicine. The present study attempts to investigate the demographic, lifestyle and health determinants of awareness of medication labelling among adults in Malaysia. A nationally representative data is used. Findings show age, income, gender, education, ethnicity, marital status, house locality, employment status, physical activity, smoking, hypercholesterolemia and diabetes are significantly associated with awareness of medication label. In particular, age and unhealthy lifestyle reduce the likelihood of being aware of medication label, whereas education level, being married and employed, and having chronic diseases increase the probability of awareness. The study therefore, recommends intervention measures directed toward promoting awareness of medication label among the individuals who have a low tendency to read medication label or may not need read it properly to ensure desirable outcomes.*

Keywords: health determinants, lifestyle, medication label, demographics
JEL classification: D01, I10, I12

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1. Introduction

Medicine plays an important role in improving health. However, inadequate knowledge can cause misuse of medicine, resulting in various adverse health effects. There are evidences suggesting that awareness of medication label can prevent misuse of medicine and medication errors because the label provides consumers with related information (Wolf et al., 2007). Furthermore, medication label can also promote optimal use of medicine, thus leading to better health outcomes. In light of the importance of medication label, medication labelling is compulsory for all the over-the-counter and non-over-the-counter medicines under the Poison Act, 1952 (Institute for Public Health, 2008). The labels must contain basic information on medicines. Directions, uses, active ingredients and possible side effects, for instance, are required to be listed clearly on medication label. According to the latest Malaysian National Medicines Policy, all generic medicines must have a label stating the generic International Non-

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proprietary Name (INN) of the medicine (Ministry of Health Malaysia, 2013). Additionally, the pharmaceutical industry must ensure that the information on the label is always accurate.

Although information on the label is important, people seldom utilise it. In Malaysia, a study shows that about one in every four diabetic patients are not aware of medication label even though they take medicine frequently (Norhafizah et al., 2012). Cheah et al. (2015) and Cheah and Yip (2017), found that factors contributing to lack of awareness on the importance of reading medication label among Malaysian adults are poor knowledge and health awareness as well as household commitment. Although numerous studies have investigated factors contributing to awareness on reading nutrition label (Nayga, 1996; Nayga et al., 1998; Nayga, 2000; Drichoutis et al., 2005; Jacobs et al., 2011; Graham and Jeffery, 2012), only few studies focused on medication label awareness, especially in Malaysia. In other words, the literature appears to be nearly silent on how demographic, lifestyle and health factors affect awareness of medication label. Norhafizah et al. (2012) were notable in examining the medication label awareness in Malaysia, but they focused only on diabetic patients. Moreover, they did not include lifestyle and health factors in their analysis.

Chua et al. (2009, 2010) found that drug administration errors are quite common in public hospitals in Malaysia, with an error rate between 11% and 12%, which is somewhat similar to the error rate evidenced in developed countries. Salmasi et al. (2015) who reviewed studies on medication error in Southeast Asia, including Malaysia, found that drug administration error rate was between 15% and 89%. The main factors include lack of knowledge, poor awareness, misread medication file, as well as wrongly interpreting medication label (Chua et al., 2009; Salmasi et al., 2015). However, this error can be prevented if patients have medical knowledge by reading the medication label. It can, therefore, be concluded that attention of medication label can prevent the negative consequences of drug administration error.

The research question of this study is: are there demographic, lifestyle and health differences in the awareness of medication label? The objective of the present study is to examine factors affecting medication label awareness among Malaysian adults. In brief, the contributions of the present study are three-fold. First, the present study is among the very few that investigates medication label awareness. Acquiring a better understanding of which groups of individuals are aware or not aware of medication label is important as it can assist government in formulating effective intervention measures. Second, in addition to demographic factors, the present study takes into account of several lifestyle and health factors for analysis. Hence, the relationships between awareness of

medication label and lifestyle, and health factors can be well understood. Third, a nationally representative sample that comprises a large sample size is used. Hence, it will produce important academic findings that can be generalised.

2. Awareness of Medication Label – The Determinants

Because of the lack of study on awareness of medication label, the factors that determine the likelihood of being aware of medication label are derived from previous empirical studies pertaining to nutrition label (Nayga, 1996; Nayga, 2000; Satia et al., 2005; Drichoutis et al., 2005; Petrovici and Ritson, 2006; Misra, 2007; Rasberry et al., 2007; Cheah et al., 2015; Cheah and Yip, 2017). In sum, the determinants are age, income, gender, education, marital status, employment status, lifestyle and health.

2.1. Age

Petrovici and Ritson (2006) conducted a population-based study in Romania and found that age is negatively associated with use of nutrition label because of visual impairment among the elderly. Similar findings were noted in Malaysia (Cheah et al., 2015; Cheah & Yip, 2017). The studies claimed that older individuals tend to face more difficulties in reading food label because of poorer vision and consequently are less likely to use label information, even though they are more aware of their health. Based on these findings, the hypothesis of the present study is age is negatively associated with medication label awareness.

2.2. Income

The positive relationship between income and nutrition label awareness was clearly evident in previous studies. Using a nationwide data, Nayga (1996) found that in United States, meal planners from higher income household have a higher likelihood of reading the nutritional content of the product they purchase compared with their lower income counterparts. A University of Minnesota study also found that individuals with higher household income tend to allocate more time reading nutrition facts label than individuals with lower household income. Cheah et al. (2015) and Cheah and Yip (2017) also found that higher income individuals are more likely to read nutrition label than the lower income ones. This could be because individuals who earn higher wages have a greater value of human life than their peers who earn lower wages and thus pay more attention to their health. Income is, therefore, hypothesised to have a positive impact on awareness of medication label.

2.3. Gender

Previous studies consistently found significant gender differences in label awareness. Misra (2007) in a survey of university students found that female students have a higher tendency to read nutrition label than their male counterparts. Rasberry et al. (2007) supported this finding and found female students outnumber their male counterparts in reading nutrition label. Based on a sample of shoppers at a supermarket, Nayga (2000) also found that being female is positively associated with awareness of nutrition label. This is simply because females have better nutrition knowledge than males. Therefore, the present study expects women to have greater awareness of medication label than men.

2.4. Education

Drichoutis et al. (2005) in a survey of shoppers at supermarkets found that well-educated consumers are more likely to read nutrition label than the less educated ones. They claimed that even though well-educated consumers have a higher opportunity cost of time, they have better interpreting skills. Consistent with the findings of Drichoutis et al. (2005), Jacobs et al. (2011) found that level of education is positively associated with nutrition label use because education improves health awareness and understanding skills. Similar findings were noted by Cheah and Yip (2017). Education is, therefore, expected to have a positive effect on awareness of medication label.

2.5. Marital status

The effect of marital status on use of nutrition label information is noteworthy. Graham and Jeffery (2011) conducted a clinical research in a university and found unmarried individuals have a less likelihood of reading nutrition label than their married peers. Likewise, Cheah and Yip (2017) found married individuals are more likely to read nutrition label than unmarried ones because nutrition information is more valuable for the former, especially those with a large family. As such, a positive relationship between being married and awareness of medication label.

2.6. Employment status

Only a few studies looked at the association between employment status and reading nutrition label. Nayga (1996) was among the few researchers who took account of the effect of employment status. In particular, he found that working meal planners have a lower likelihood of reading

nutrition label as employed individuals tend to live a busier lifestyle and consequently have less time on hand to read medication label (Nayga, 1996). The present study hypothesises that being employed has a negative effect on medication label awareness.

2.7. Lifestyle

Unhealthy lifestyle appears to be associated with low usage of nutrition label. As evidenced by Satia et al. (2005), who used a survey data of 658 African Americans, smokers are less likely to read nutrition labels than non-smokers. Cheah et al. (2015) using a nationwide data of Malaysian found that the probability of reading nutrition label tends to be lower among smokers than non-smokers. In view of this evidence, the present study hypothesises that unhealthy lifestyle, such as physical inactivity and smoking is negatively associated with medication label awareness.

2.8. Health

The relationship between health status and awareness of nutrition label was not proven in previous studies. However, the present study expects that diagnosis of chronic diseases, that is, a measure for health condition, may affect medication label awareness. This is because individuals who are suffering from chronic diseases are more aware of their health and consequently are more devoted to make an effort to read the information on the label. Another plausible reason is that individuals with chronic diseases tend to take regular medicine compared with those without chronic diseases. Hence, they may have a higher tendency to use the label. Hence, the present study hypothesises that chronic diseases can increase the likelihood of being aware of medication label.

3. Methods

3.1. Data source

The present study uses data from the Third National Health and Morbidity Survey (NHMS III) (Institute of Public Health, 2008). Analysis of the present study is based on NHMS III and no separate survey is conducted. NHMS III is a nationwide cross-sectional study conducted by the Ministry of Health Malaysia. The survey period is between April 2006 and January 2007. The general objective of NHMS III is to obtain population-based health related information and assist Malaysian public health specialists in reviewing their policies, intervention strategies and allocation of resources. The present study utilises the respondents' sociodemographic, lifestyle and

health profiles collected in NHMS III to develop the dependent and independent variables. Although NHMS III is not the latest survey, it is nationally representative. The survey covers all the urban and rural areas in Malaysia (including the Federal Territory of Kuala Lumpur).

The data collection is based on a two-stage stratified sampling method proportionate to the size of population in Malaysia. This method is designed by the Department of Statistics Malaysia. The first stage sampling unit is based on geographically contiguous areas of the country [Enumeration Blocks (EBs)]. The second stage sampling unit is based on the Living Quarters (LQs) in each EB. In particular, each EB consists of 80-120 LQs with a population of about 600. All the individuals who reside in the selected LQs are surveyed. The piloted bi-lingual (*Bahasa Malaysia* and English) questionnaires are distributed and data is collected through face-to-face interview. The sample size is 34539 respondents but the statistical analysis is limited to respondents who do not have missing information. Hence, only 30992 respondents are used for analysis.

3.2. Techniques of analysis

The dependent variable of the present study is a categorical variable with two outcomes. A value of 1 refers to respondents who are aware of medication label, 0 if otherwise. The categorisation of this dependent variable is arrived based on previous studies pertaining to nutrition label use in Malaysia (Cheah et al., 2015; Cheah and Yip, 2017). In their studies, 1 refers to respondents who read nutrition label information, 0 if otherwise. Three logit models are utilised in the present study to examine the factors affecting awareness of medication label. The first logit model is estimated for overall sample, while the second and third logit models are estimated for males and females respectively. Since there can be gender differences in health, it is worthwhile to examine awareness of medication label across genders (Denton et al., 2004). Mathematically, the dependent variable can be expressed as:

$$p_i = \begin{cases} \Pr(y_i = 1|x_i) & \text{if } y_i = 1 \text{ is observed} \\ 1 - \Pr(y_i = 1|x_i) & \text{if } y_i = 0 \text{ is observed} \end{cases} \quad (1)$$

where p_i is the probability of observing the value of y_i; $\Pr(y_i = 1|x_i)$ is the probability of being aware of medication label conditional on x_i, whereas $1 - \Pr(y_i = 1|x_i)$ is the probability of not being aware of medication label. Hence, the linear probability model (LPM) for the pooled sample estimated using ordinary least square (OLS) can be expressed as:

$$\Pr(y_i = 1|x_i) = \beta_o + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \cdots \quad (2)$$

where x_1 = *age*; x_2 = *income/100*; x_3 = *male*; x_4 = *tertiary*; x_5 = *secondary*; x_6 = *Malay*; x_7 = *Chinese*; x_8 = *married*; x_9 = *widow/divorce*; x_{10} = *urban*; x_{11} = *employed*; x_{12} = *physically active*; x_{13} = *smoker*; x_{14} = *hypertension*; x_{15} = *hypercholesterolemia*; x_{16} = *diabetes*; β_0 is the probability of being aware of medication label when each x is zero; and β_k measures the change of the probability of being aware of medication label when x_k increases by one unit. In addition, the interaction between *tertiary* and *physically active* (x_4x_{12}) is included in order to allow physically active individuals to depend on their education background, i.e. a measure of health knowledge. Since the decision of an individual to be physically active may depend on his/her health knowledge, omitting this interaction may seem inappropriate.

Because of non-linear nature of E($y|x$), maximum likelihood estimation (MLE) is used to estimate the models instead of OLS. To obtain the maximum likelihood estimator, the likelihood function is expressed as:

$$L(\boldsymbol{\beta}) = \prod_{y=1} F(\mathbf{x_i}\boldsymbol{\beta}) \prod_{y=0} [1 - F(\mathbf{x_i}\boldsymbol{\beta})] \quad (3)$$

where $\mathbf{x_i}\boldsymbol{\beta}$ refers to $\beta_0 + \beta_1 x_{i1} + \ldots$. Adding natural log (ln) into equation (3), the log-likelihood function is obtained and can be written as:

$$\ln L(\boldsymbol{\beta}) = \sum_{y=1} F(\mathbf{x_i}\boldsymbol{\beta}) + \sum_{y=0} [1 - F(\mathbf{x_i}\boldsymbol{\beta})] \quad (4)$$

where $F(\cdot)$ lies between zero and one. Assuming $F(\cdot)$ is the logistic distribution function, the present study uses logit model for analysis. The logistic distribution function can be expressed as:

$$F(\mathbf{x_i}\boldsymbol{\beta}) = \exp(z) / [1 + \exp(z)] \quad (5)$$

where z can take on any value from $-\infty$ till ∞. This function ensures that the probability of being aware of medication label lies between zero and one for all the parameters.

3.3. Variable measurements

For the dependent variable, respondents report their medication label awareness when asked 'Do you read the medication label every time you

receive or purchase any type of medicine which you are unfamiliar with?' Two possible answers: 'yes' or 'no'. Those who answer 'yes' are considered as being aware of medication label, whereas those who answer 'no' are considered as not being aware of medication label.

Following Nayga (1996), Nayga (2000), Satia et al. (2005), Drichoutis et al. (2005), Petrovici and Ritson (2006), Misra (2007), Rasberry et al. (2007), Cheah et al. (2015) and Cheah and Yip (2017), the independent variables used in the present study can be divided into three categories – demographic, lifestyle and health. The demographic variables are age, income, gender, education, ethnicity, marital status, house locality and employment status. The lifestyle variables comprise physical activity and smoking. The health variables comprise hypertension, hypercholesterolemia and diabetes. All the independent variables are formatted as categorical variables, except for age and income.

Age is obtained based on respondents' date of birth. Respondents are requested to self-report their monthly individual income [in Ringgit Malaysia (RM)]. As pointed out by Cawley et al. (2016), while self-report income may have the problem of reporting error, it can still be used in the research. The survey asks about respondents' education level: 'What is your highest education level?' Following previous studies pertaining to nutrition label use (Cheah et al., 2015; Cheah and Yip, 2017) and medical care usage (Cheah, 2016) in Malaysia, respondents are categorised as having primary (≤6 years of schooling), secondary (7-11 years) and tertiary (≥12 years) level education. The purpose is to identify whether less-educated individuals, i.e. those with primary education, have a lower tendency to be aware of medication label than well-educated individuals defined as those with tertiary or secondary education, because of poorer health awareness and understanding skills. In addition, respondents are asked to report their ethnicity: Malay, Chinese and Indian/Others. Malays are the majority in Malaysia. It is expected that there could be cultural and religious differences in medication label awareness. Since the cultures and religions of these three ethnic groups are very different, they are grouped separately. Owing to limited sample size for both Indian and Others, these two ethnic groups are combined together to form a single category.

Information on the marital status and employment status of respondents is obtained by asking: 'What is your marital status?' 'What is your current employment status?' Respondents' answers for marital status are categorised into three categories: married, widow/divorced and single. Singles may display different level of awareness of medication label from married and widow/divorced individuals because of the absence of spouses or extended family commitments. Hence, for comparison purposes, these three categories of marital status are developed. For employment status, the answers are grouped into two categories: employed and unemployed. The

unemployed category includes student, housewife and retiree. Those who earn wages are in the employed category Employed individuals tend to face greater time constraints than unemployed individuals because they need to work, thus their likelihood of reading medication label information may be lower.

Respondents' house locality is categorised into urban and rural. Urban refers to a gazetted area that has 10000 or more populations, whereas rural refers to a gazetted area that has less than 10000 populations. House locality is developed in light of the possibility that availability of health information may vary across regions due to urbanisation level differences. In terms of lifestyle, the survey asks respondents about their physical activity and smoking behaviours. Respondents who spend 150 minutes or more in moderate physical activities or 60 minutes or more in vigorous physical activities are considered as physically active. The intensity of physical activities is measured based on metabolic equivalents (METs) (Meltzer and Jena, 2010). Respondents who smoke at least one day in the past 30 days preceding the survey are considered as smokers. Since healthy and unhealthy behaviours can be associated with medication label awareness as they can measure health concern, the physical activity and smoking variables are developed. Being physically active and non-smoking are considered as healthy behaviours.

In addition, respondents are requested to answer the questions about their health conditions. To determine whether respondents have hypertension, respondents are asked 'In the last 12 months, have you ever been told by a medical practitioner that you have hypertension?' Similar questions are used for hypercholesterolemia and diabetes. The possible answers for these questions are 'yes' or 'no'. Following the study by Cheah (2018), the present study uses this information to come up with three health variables with binary outcomes: hypertension, hypercholesterolemia and diabetes. This will facilitate a comparison of medication label awareness between individuals with chronic diseases and those without. It is anticipated that individuals with chronic diseases are more likely to be aware of medication label than their counterparts without chronic diseases because they take their medicines regularly and are also more concerned about their health.

3.4. Profile of respondents

Table 1 presents summary statistics for all the independent variables. The average age is approximately 42 years old. The average monthly individual income is RM 1963.05. Nearly half (44.39%) of respondents are males. Majority of respondents have secondary education (51.59%), followed by those who have primary (38.09%) and tertiary education (10.32%). In

terms of ethnicity, the sample consists of 56.51% Malay, 21.56% Chinese and 21.93% Indian/Others. Most of the respondents are married (71.32%), followed by single (20.85%) and widowed/divorced (7.83%). Slightly more than half of respondents are urban dwellers (59.42%) and employed (58.34%). Of the total sample, the majority (56.53%) are physically active and nearly one-fourth (22.76%) are smokers. Considering the health condition, only the minority have hypertension (38.75%), hypercholesterolemia (23.81%) and diabetes (11.91%).

Table 1. Summary statistics of independent variables

Variables	**Mean / Percent**	**Std. dev. / Frequency**
Continuous		
Age	42.10	15.69
Income	1963.05	2674.48
Categorical		
Male	44.39	13756
Female	55.61	17236
Tertiary	10.32	3199
Secondary	51.59	16020
Primary	38.09	11773
Malay	56.51	17515
Chinese	21.56	6683
Indian/Others	21.93	6794
Married	71.32	22105
Widow/divorce	7.83	2426
Single	20.85	6461
Urban	59.42	18415
Rural	40.58	12577
Employed	58.34	28081

Table 1: (Continued)

Variables	Mean / Percent	Std. dev. / Frequency
Unemployed	41.66	12911
Physically active	56.53	17519
Physically inactive	43.47	13473
Smoker	22.76	7054
Non-smoker	77.24	23938
Hypertension	38.75	12008
No hypertension	61.25	18984
Hypercholesterolemia	23.81	7378
No hypercholesterolemia	76.19	23614
Diabetes	11.91	3690
No diabetes	88.09	27302
Observation	30992	

Source: NHMS III
Note: For continuous variables, the values refer to mean and standard deviation. For categorical variables, the values refer to percentage and frequency.

Table 2 shows demographic, lifestyle and health profiles by their awareness of medication label among the respondents. Pearson χ^2 is used to test the proportion of people with medication label awareness and without. Of the total respondents, 24988 are aware of medication label. A total of 82.66% of males are aware of medication label, compared with 79% females, indicating that medication label awareness is more prevalent among males than females. In terms of education, 94.59% and 92.35% of respondents with tertiary and secondary level education respectively are aware of medication label. However, only 60.89% of individuals with primary level education are aware of medication label. Malays (84.22%) account for the largest number of respondents in terms of their level of label awareness compared with Indian/Others (77.22%) and Chinese (74.67%).

Table 2. Proportion of respondents with demographic, lifestyle and health profiles by medication label awareness

Variables	Medication label awareness				*p*-value*
	Yes		No		
	Percent	Frequency	Percent	Frequency	
Male	82.66	11371	17.34	2385	<0.001
Female	79.00	13617	21.00	3619	
Tertiary	94.59	3026	5.41	173	
Secondary	92.35	14794	7.65	1226	<0.001
Primary	60.89	7168	39.11	4605	
Malay	84.22	14752	15.78	2763	
Chinese	74.67	4990	25.33	1693	<0.001
Indian/Others	77.22	5246	22.78	1548	
Married	81.85	18093	18.15	4012	
Widow/divorce	52.31	1269	47.69	1157	<0.001
Single	87.08	5626	12.92	835	
Urban	83.54	15384	16.46	3031	<0.001
Rural	76.36	9604	23.64	2973	
Employed	85.33	15429	14.67	2652	<0.001
Unemployed	74.04	9559	25.96	3352	
Physically active	83.69	14661	16.31	2858	<0.001
Physically inactive	76.65	10327	23.35	3146	
Smoker	80.98	5712	19.02	1342	0.400
Non-smoker	80.52	19276	19.48	4662	
Hypertension	73.26	8797	26.74	3211	<0.001
No hypertension	85.29	16191	14.71	2793	

Table 2: (Continued)

Variables	Medication label awareness				*p*-value*
	Yes		No		
	Percent	Frequency	Percent	Frequency	
Hypercholesterolemia	77.47	5716	22.53	1662	
No hypercholesterolemia	81.61	19272	18.39	4342	<0.001
Diabetes	75.01	2768	24.99	922	
No diabetes	81.39	22220	18.61	5082	<0.001
Observations	24988		6004		

Source: NHMS III
Note: * *p*-value for χ^2. The *p*-value is based on a test of equality between the proportion of people with medication label awareness and those without.

Respondents in the widow/divorce category (52.31%) are the least label-aware while urban dwellers, 83.54%, are aware of medication label, compared with those residing in rural areas (76.36%). Medication label awareness is better among employed individuals (85.33%) than unemployed ones (74.04%). A total of 83.69% of physically active individuals are aware of medication label, whereas only 76.65% of physically inactive individuals are aware. Between 81.39% and 85.29% of individuals who do not have chronic diseases are aware of medication label, compared to between 73.26% and 77.41% of individuals who have chronic diseases. These outcomes indicate that awareness of medication label is better among individuals who have good health conditions than individuals who have poor health conditions.

4. Results

Table 3 presents the factors affecting awareness of medication label among all respondents. The marginal effect of each independent variable is estimated in order to identify the changes of probability of being aware of medication label. The result of likelihood ratio concludes that all the independent variables are jointly significant in explaining awareness of medication label. Considering the robustness of the model, about 83.20% of outcomes are correctly predicted by the model.

Table 3. Factors affecting awareness of medication label: pooled sample

Variables	Estimates	Marginal effects
Constant	0.944***	–
	(0.080)	–
Age	-0.033***	-0.004***
	(0.002)	(0.001)
Income/100[#]	0.004***	0.001***
	(0.001)	(0.001)
Male	0.218***	0.026***
	(0.044)	(0.005)
Tertiary	1.766***	0.130***
	(0.089)	(0.004)
Secondary	1.502***	0.187***
	(0.042)	(0.005)
Malay	0.444***	0.054***
	(0.041)	(0.005)
Chinese	-0.140***	-0.017***
	(0.048)	(0.006)
Married	0.834***	0.113***
	(0.053)	(0.008)
Widow/divorce	0.342***	0.037***
	(0.076)	(0.007)
Urban	0.229***	0.028***
	(0.036)	(0.004)
Employed	0.125***	0.015***
	(0.038)	(0.005)
Physically active	0.249***	0.030***
	(0.033)	(0.004)
Smoker	-0.297***	-0.038***
	(0.048)	(0.006)
Hypertension	0.001	-0.001
	(0.037)	(0.004)
Hypercholesterolemia	0.088**	0.010**
	(0.038)	(0.004)
Diabetes	0.123***	0.014***
	(0.048)	(0.005)

Table 3: (Continued)

Variables	Estimates	Marginal effects
Tertiary × Physically active	-0.053	-0.006
	(0.161)	(0.020)
Likelihood ratio		6090.600***
Correct prediction (%)		83.20
Observations		30992

Source: NHMS III

Note: # income divided by 100. Standard errors in parentheses. *** indicate significance at 1% level, ** at 5% level and * at 10% level.

Age has a negative effect on medication label awareness as an additional year of age reduces the probability of being aware of medication label by 0.4%. This implies that older individuals are less likely to be aware of medication label than younger ones. An increase of RM100 in monthly individual income raises the probability of being aware of medication label by only 0.1%, suggesting that budget constraint plays a role in label usage and awareness. Although the effects of age and income are small, they are highly significant.

There are gender differences in awareness of medication label. Specifically, males are 2.6% more likely to be aware of medication label than females. The positive relationship between education and the medication label awareness is consistent with the expectation of this study. Those with tertiary and secondary level education are 13% and 18.7% more likely to be aware of medication label, respectively relative to their primary-educated counterparts. Thus, it is clear that education promotes medication label awareness. The results on ethnicity are interesting. Compared with Indian/Others, the likelihood of being aware of medication label is higher if individuals are Malays (5.4%), whereas it is lower if individuals are Chinese (-1.7%).

The effect of marital status on medication label awareness is positive. It is greater if individuals are married (11.3%) and smaller if individuals are widowed/divorce (3.7%). These findings suggest that household commitment can alter an individual's propensity to be aware of medication label. In terms of house locality, urbanites are 2.8% more likely to be aware of medication label than rural dwellers. Employment status variable also has a positive effect on awareness of medication label. In particular, employed individuals are 1.5% more likely to be aware of medication label than their unemployed counterparts. Taken together, these findings imply that residing in urban areas and being employed can increase the probability of being aware of medication label.

The marginal effects of lifestyle and health variables are highly significant. Living a healthy lifestyle appears to be positively associated with medication label awareness. Individuals who are physically active are 3% more likely to be aware of medication label than their peers who are physically inactive. Smokers are 3.8% less likely to be aware of medication label than non-smokers. As expected, individuals who have hypercholesterolemia have a higher likelihood (1%) of being aware of medication label than their counterparts who are without hypercholesterolemia. Similar pattern exists for those with diabetes. Individuals who have diabetes are 1.4% more likely to be aware of medication label than non-diabetics.

Table 4 shows factors related to medication label awareness among males and females. The likelihood ratios for both models are highly significant, concluding that all the independent variables are jointly significant in affecting awareness of medication label. In terms of goodness of fit, the proportions of correct prediction for both models are large [83.10% (males); 83.80% (females)].

Table 4: Factors affecting awareness of medication label: gender

Variables	**Males**		**Females**	
	Estimates	**Marginal effects**	**Estimates**	**Marginal effects**
Constant	0.945***	–	1.180***	–
	(0.135)	–	(0.115)	–
Age	-0.020***	-0.002***	-0.046***	-0.005***
	(0.002)	(0.001)	(0.002)	(0.001)
Income/100[#]	0.005***	0.001***	0.004***	0.001***
	(0.001)	(0.001)	(0.001)	(0.001)
Tertiary	1.546***	0.121***	1.960***	0.133***
	(0.119)	(0.006)	(0.135)	(0.005)
Secondary	1.269***	0.160***	1.705***	0.205***
	(0.059)	(0.008)	(0.060)	(0.007)
Malay	0.250***	0.030***	0.597***	0.072***
	(0.062)	(0.008)	(0.055)	(0.007)
Chinese	-0.432***	-0.056***	0.112*	0.013*
	(0.072)	(0.010)	(0.066)	(0.007)
Married	0.593***	0.078***	0.925***	0.124***
	(0.078)	(0.011)	(0.078)	(0.012)

Table 4: (Continued)

Variables	Males		Females	
	Estimates	**Marginal effects**	**Estimates**	**Marginal effects**
Widow/divorce	-0.023	-0.003	0.643***	0.063***
	(0.145)	(0.018)	(0.100)	(0.008)
Urban	0.167***	0.020***	0.291***	0.035***
	(0.054)	(0.007)	(0.048)	(0.006)
Employed	0.136**	0.017**	0.087*	0.010*
	(0.062)	(0.008)	(0.050)	(0.006)
Physically active	0.193***	0.024***	0.310***	0.036***
	(0.051)	(0.006)	(0.045)	(0.005)
Smoker	-0.176***	-0.021***	-0.674***	-0.099***
	(0.051)	(0.006)	(0.140)	(0.025)
Hypertension	0.011	0.001	0.054	0.006
	(0.053)	(0.006)	(0.051)	(0.006)
Hypercholesterolemia	0.065	0.008	0.148***	0.017***
	(0.060)	(0.007)	(0.050)	(0.006)
Diabetes	0.132*	0.015*	0.147**	0.016**
	(0.075)	(0.008)	(0.063)	(0.007)
Tertiary × Physically active	0.105	0.012	-0.122	-0.015
	(0.216)	(0.024)	(0.246)	(0.031)
Likelihood ratio	1624.180***		4636.080***	
Correct prediction (%)	83.10		83.80	
Observations	13756		17236	

Source: NHMS III

Note: # income divided by 100. Standard errors in parentheses. *** indicate significance at the 1% level, ** at the 5% level and * at the 10% level.

The effects of age and income on medication label awareness are similar for both genders. For males, an additional year (in terms of age) reduces the probability of being aware of medication label by 0.2%, whereas an increase of RM100 in income increases the probability by 0.1%. For females, age reduces the probability by 0.5% while income increases the probability by 0.4%. The positive relationship between education and medication label awareness is seen in both male and female

samples. Compared with primary-educated individuals, tertiary-educated individuals are 12.1% (males) and 13.3% (females) more likely to be aware of medication label, and secondary-educated individuals are 16% (males) and 20.5% (females) more likely to be aware of medication label The implication of these findings is that education can improve medication label awareness among males and females.

In terms of ethnicity, Malay males and females are 3% and 7.2% more likely to be aware of medication label respectively, compared with Indians/Others. However, the results are different with ethnic Chinese. On one hand, Chinese males are 5.6% less likely to be aware of medication label than their Indian/Others counterparts but on the other hand, Chinese females are 1.3% more likely to be aware of medication label than their Indian/Others peers. The findings on marital status are noteworthy. Both married (12.4%) and widowed/divorce women (6.3%) are more likely to be aware of medication label than their single counterparts while married males (7.8%) have a higher likelihood of being aware of medication label than their single counterparts.

Considering the effect of house locality, urban males and females are 2% and 3.5% more likely to be aware of medication label, respectively, relative to their rural counterparts. Residing in urban areas seems to be positively associated with medication label awareness. Working male and female are 1.7% and 1% more likely to be aware of medication label respectively. This indicates that being employed can lead to greater awareness of reading medication label.

Lifestyle factors appear to have significant impacts on medication label awareness for both genders. Among males, physically active individuals are 2.4% more likely to be aware of medication label than their inactive counterparts while smokers are 2.1% less likely to be aware of medication label than non-smokers. Similarly, among females, being physically active increases the likelihood of being aware of medication label (3.6%) and smoking reduces their likelihood of being aware of medication label (-9.9%). It can, therefore, be concluded that there is a positive relationship between healthy lifestyle and medication label awareness.

Health condition plays an important role in determining awareness of medication label among males and females. In particular, men with diabetes are 1.5% more likely to be aware of medication label than non-diabetics. Women who have hypercholesterolemia (1.7%) and diabetes (1.6%) have a higher likelihood of being aware of medication label compared with their counterparts without these diseases.

In line with the hypothesis, age is found to have a negative impact on awareness of medication label. This is because older individuals tend to have visual problem and consequently may face more difficulties in reading

the label compared with their younger counterparts (Petrovici and Ritson, 2006).

The findings on income support the hypothesis, and those of Nayga (1996), Cheah et al. (2015) and Cheah and Yip (2017) that the frequency of reading label information increases with income. A likely reason is that higher income individuals face greater opportunity costs of not working than lower income individuals (Grossman, 1972). Hence, they are more aware of their health. However, because wage is not included in the analysis, it is impossible for the present study to test the substitution and income effects of medication label.

Surprisingly, the effect of gender on medication label awareness found in the present study contradicts those of previous ones (Nayga, 2000; Misra, 2007; Rasberry et al., 2007). Time constraint factor can be the explanation for this finding. Women often work in the jobs which offer less time flexibility than men (Humphreys & Ruseski, 2011). Furthermore, the majority of housework is done by women. As a result, women are likely to have less time on hand for reading medication label information.

As expected, there appears to be a positive relationship between education and medication label awareness. Similar findings are shown by Drichoutis et al. (2005), Jacobs et al. (2011) and Cheah and Yip (2017). First, well-educated individuals are efficient health producers because they have good health knowledge (Kenkel, 1991). Second, rate of time preference reduces with level of education (van der Pol, 2011). The present study also points to cultural and religious differences in medication label awareness. Malays seem to have a higher likelihood of being aware of medication label than Indians/Others, which is consistent with the findings of Cheah et al. (2015). However, the results appear to be mixed among ethnic Chinese. On one hand, Chinese males are more aware of medication label than their Indian/Others counterparts but on the other, Chinese females are less aware. The reasons are unclear and therefore it is recommended future research focus on understanding the relationship between ethnicity and medication label awareness.

The findings of the present study support those of Graham and Jeffery (2012) and Cheah and Yip (2017), namely being married increases the propensity to read labels. In addition, the present study found widowed/divorced individuals are more likely to be aware of medication label than their unmarried counterparts. It can, thus, be concluded that household commitment raises an individual's likelihood of being aware of medication label. Since married and widowed/divorced individuals tend to have a larger family size and carry more responsibilities to take care of their family health, they are more likely to make an effort to acquire medical information.

Cheah et al. (2015) are among few researchers that have factored locality whereby they found that residing in urban areas is positively associated with nutrition label use, which is supported by the findings of the present study. Since health information and medical facilities are more accessible and readily available in urban areas than in rural areas, urbanites are more aware of the importance of medication label.

Surprisingly, the findings on employment status do not support the hypothesis and the findings of Nayga (1996). Although employed individuals have less time on hand for reading medication label information than their unemployed counterparts, they often have better health awareness. This is because they participate in workplace health promotion programmes. Although it may seem appropriate to relate health awareness to employment status, it would be even better to include health awareness as a separate variable for analysis.

The positive relationship between living a healthy lifestyle and awareness of medication label found in the present study is supported by its hypothesis. Similar findings are reported by Satia et al. (2005) and Cheah et al. (2015). The reason for this outcome is that individuals who are physically active and do not smoke are usually more concerned about their health and risk-averse than their counterparts who do not engage in healthy behaviours. Therefore, they are more likely to make an effort to read medication label information. However, health knowledge may not explain medication label awareness among physically active individuals because the interaction between physical activity and education does not have significant effect on the likelihood of being aware of medication label.

The findings on health status are noteworthy. They appear to be consistent with the hypothesis that having poor health condition increases the propensity to be aware of medication label. This is due to the fact that individuals who suffer from illnesses tend to be concerned about their own health and are diligent in taking their take medicines on time.

5. Policy Implications

Findings of the present study have important implications for policy. First, intervention measures directed toward increasing awareness of medication label among the elderly may appear promising. In particular, policy makers should make a concerted effort to teach the elderly how to interpret and read medication label information properly. Second, women should be one of the targets of public health administrators. Intervention programmes directed towards encouraging women, particularly those who are unlikely to be aware of medication label, such as the elderly, the less-educated and rural dwellers to be aware of medication label are worthwhile. Third, health promotion campaigns aimed at providing less-educated individuals with

more health information may help to improve medication label awareness. Government should consider introducing more health-related subjects in primary and secondary schools, so that people would have good health knowledge since schooling years. Fourth, rural dwellers and the unemployed should be given special attention. Policy interventions improving the level of medication label awareness among these groups of individuals can yield desirable outcomes. Finally, policies should be targeted at individuals who do not practice a healthy lifestyle. These include physically inactive individuals and smokers. Health awareness programmes that can alter their lifestyle may ensure effective outcomes.

6. Conclusion

Awareness of medication label is vital in preventing harmful effects of misuse of medicine. The present study achieved its objective by highlighting factors affecting awareness of medication label, such as demography, lifestyle and health Although the results of the present study are not estimated based on the latest data, they throw new light on how demographic, lifestyle and health factors affect medication label awareness. Age, income, gender, education, ethnicity, marital status, house locality, employment status, physical activity, smoking, hypercholesterolemia and diabetes are significantly associated with the likelihood of reading medication label. The results from stratified samples by gender are similar to those from the pooled sample.

Although the present study has significant contributions for policy and literature, it has some limitations. First, the logit models used may have endogeneity problems. There could be a reverse causation in the relationship between health condition and medication label awareness. To deal with this problem, an instrumental variable must be used. However, to find an appropriate instrumental variable is difficult, especially given the limited availability of data. Second, all the information obtained from the data is self-reported. Hence, there may be reporting error. Third, data used in the present study is not from the latest survey. Nevertheless, it is nationally representative and has a large sample size. Thereby, the estimated results can provide inferential information. Finally, the study only provides information on whether or not respondents are aware of medication label. Future studies may want to use a panel data to examine the changes in the factors affecting medication label awareness. The studies can also extend the analysis by looking at how medication label awareness can act as an input to health production.

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