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Relationships between health data, BMI, basic medical skills: some insights from a 2016 Vietnamese medical survey

Quan-Hoang Vuong

Does owning a medicine cabinet or having practical first-aid knowledge and skills at home have any effects on people's attitude towards periodic health examinations (GHEs)? In this study, we analyzed a dataset consisting of 2,068 observations to point out differences in periodic health examinations-taking tendencies between those with and without a family medicine cabinet; as well as between those who know and do not know how to use basic medical equipment. In addition, the factors of age, gender, job and marital status were also documented in relation to body mass index (BMI): the BMI of a Vietnamese person is average by conventional standards (the mean BMI = 20.848, SD = 2.67, CI = 20.73-20.96), and is directly proportional to age (β_{age}=0.019, P < 0.01). Female (β_{male} =1.846, P <0.001), married people (β_{other}=−0.965, P = 0.001) and homemakers tend to have a higher BMI ($\beta_{otherJobs}$<0, P = 0.05).

Keywords: Periodic general health examinations, Medicine Cabinet, Medical Tools, BMI.

JEL Classifications: I18

CEB Working Paper N° 17/001
January 2017

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Abstract

Does owning a medicine cabinet or having practical first-aid knowledge and skills at home have any effects on people's attitude towards periodic health examinations (GHEs)? In this study, we analyzed a dataset consisting of 2,068 observations to point out differences in periodic health examinations-taking tendencies between those with and without a family medicine cabinet; as well as between those who know and do not know how to use basic medical equipment. In addition, the factors of age, gender, job and marital status were also documented in relation to body mass index (BMI): the BMI of a Vietnamese person is average by conventional standards (the mean BMI = 20.848, SD = 2.67, CI = 20.73-20.96), and is directly proportional to age (β_{age}=0.019, P < 0.01). Female (β_{male} =1.846, P < 0.001), married people (β_{other}=-0.965, P = 0.001) and homemakers tend to have a higher BMI ($\beta_{otherJobs}$< 0, P = 0.05).

Keywords: Periodic general health examinations, Medicine Cabinet, Medical Tools, BMI.

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Introduction

People tend to use self-medication to avoid medical costs *(1)*. In Vietnam, 70% of those unable to afford insurance would fall into extreme destitution if they get seriously ill *(2)*. Therefore, almost every family has a medicine cabinet, which is seen as a sort of "medical center" for treatments of minor injuries or common sickness *(3)*. The downside is that this use of drugs is usually without prescription or advice from health professionals, and habits such as keeping expired medicines may cause many side effects. Many people thus still choose health examination services upon recognizing signs of illness *(4-6)*. This is particularly prominent in the USA, where each year millions of people do health check-ups even without signs of disease *(7)*. The reliability of advice from doctors, as perceived by patients, also affects patients' choice of healthcare providers *(8)*. Health check-ups were carried out with the aim of helping people improve their health *(9)*. Some previous studies have also shown that people with knowledge in medicine or working in the sector will take GHE more frequently *(10)*. For instance, to improve people's understanding of health care, the Japanese Health Department asked the city to issue a health handbook, providing information in health examinations, health education and health counseling *(11)*. But in China, this matter has never gained sufficient attention, which leads to scarce knowledge on health among the people: only 6.48% of the population is fully aware of their existing health care services *(12)*.

In conversations with medical professionals on issues related to health, most people care about weight and diet, especially women and higher income people *(13)*. Some studies show that women have a higher risk of obesity than men *(14-16)*, and older women risk having a higher BMI *(17-19)*. Remarkably, among men, the higher BMI they have, the more susceptible they are to having fatal illnesses such as heart disease, while obese women are more susceptible to bone illnesses *(20)*. Waaler said that "females seem to tolerate variations in overweight better than males". On the other hand, lower BMI increases the risk of Osteogenesis *(21)*. It is also worth noting that there are differences in BMI among the groups *(22, 23)*. Moreover BMI, along with age and sex, are factors that affect body

fat percentage *(24)*. In the United States, the average BMI is 25 kg/m^2 both for men and women, and obesity tends to be more often observed in adults *(23)*. In general, white people have higher BMI than Asians but lower proportion of fat *(25)*, whereas regional traditions, custom and habits can be a contributor element to BMI – for example, in Nigeria, children are given less food than adults in the family *(26)*. BMI is also closely related to education and physical activities: the higher the educational level, the lower the BMI *(27)*. A study on BMI in Japan showed that, contrary to popular belief, people who worked as policemen and firefighters have higher BMI and are likely to become obese due to unhealthy lifestyle *(28)*.

By applying regression analysis, this study will put forth the empirical relationships between the fact of owning a medical cabinet and some medical equipment along with having the skills to use them, and a tendency to frequently take periodic GHEs. At the same time, we also evaluate the average BMI in Vietnam and factors influencing it.

Results

Statistical descriptions

The dataset provided some personal information of the participants, whether or not they own medicine cabinets and have the skills to use basic medical tools, and the amount of time since the participant's most recent periodic GHE.

<< Figure 1 | about here>>

During the survey, 1 out of 6 people invited to interview denied to respond. Among those who agreed to participate in the interviews, 64.08% were female and 57.35% were married. Based on the figures in Fig.1, it can be seen that the proportion of people having stable jobs account for a high percentage (53.30%), while only 1.79% were already retired. The average age of the respondents was 29.17 (SD =

10.09, 95%CI = 28.74-29.60). More than half of those who responded were under 30 (63.15%), and a majority had BMI from 18.5 to <23 (60.06%), which is a normal figure for Asian people according to WTO (29). With the average BMI = 20.848 (SD = 2.67, 95%CI = 20.73-20.96), it can be said that Vietnamese people tend to have a relatively stable BMI. On the other hand, the percentage of overweight people (BMI >=23) is also quite high (20.21%).

Regarding the time since the participant's most recent periodic GHE, approximately 2/3 reported the exact time, of which 51.21% told that they last attended a periodic GHE nearly 12 months ago. This proves that people are gradually becoming more familiar with GHEs and attending annual check-ups for their own sake. In addition, 73.01% of respondents own a medical cabinet in their homes and 66.78% know how to use common medical equipment.

Time since most recent periodic GHE

The BCL model is employed to examine the relationships between the length of time since the respondent's most recent health check and their basic medical skills. The response variable is "RecPerExam" (the time since the respondent's most recent periodic GHE at the time of the survey), divided into 4 categories: less than 12 months ("less12") since the last GHE, between 12 and 24 months ("b1224"), more than 24 months ("g24"), and the time is forgotten ("unknown"). Two independent variables include: having a medicine cabinet with some basic medicine ("MedCabinet"); and being able to use some common medical tools ("Tooluseskills"). These two predictors have two categories, "yes" and "no". The estimation results are described in Table 1.

<< Table 1 | about here>>

With p-value < 0.05, 7 out of 9 coefficients are statistically significant. Therefore, it can be stated that the relationships between these above variable are confirmed.

From the results in Table 1, regression equations are formed as follows:

$$\ln(\pi_{b1224}/\pi_{less12}) = -0.812 - 0.575 \times \text{yesMedCabinet} - 0.547 \times \text{yesTooluseskills} \quad \text{(Eq.1)}$$

$$\ln(\pi_{g24}/\pi_{less12}) = -0.949 - 0.413 \times \text{yesMedCabinet} - 0.126 \times \text{yesTooluseskills} \quad \text{(Eq.2)}$$

$$\ln(\pi_{unknown}/\pi_{less12}) = -0.021 - 0.691 \times \text{yesMedCabinet} - 0.298 \times \text{yesTooluseskills} \quad \text{(Eq.3)}$$

From the 3 above equations, the probability of a person who owns a medicine cabinet and being able to use common medical equipment having attended a periodic GHE since more than 24 months ago is calculated as follows:

$$\pi_{g24} = e^{-0.949-0.413-0.126} / (1 + e^{-0.812-0.575-0.547} + e^{-0.949-0.413-0.126} + e^{-0.021-0.691-0.298}) = 0.130 \quad \text{(Eq.4)}$$

In the same manner, other conditional probabilities of "RecPerExam" against "MedCabinet" and "Tooluseskills" are computed and displayed in Table 2.

<< Table 2 | about here>>

Factors affecting BMI

BMI was observed in order to obtain insights on Vietnamese people's average health and body figure. The linear regression model is employed with BMI as the dependent variable. Explanatory variables include:

- Age ("Age");
- Biological gender ("Sex"), including: male and female;
- Marital status ("MaritalStt"), consisting of: "married" – having been already married, and "other" – unmarried or other marital statuses;

- Job status ("Job"), classified into 6 categories: pupils or students ("student"), stable jobs ("stable"), unstable jobs ("unstable"), being retired ("retired"), homemakers ("homemaker"), and other statuses ("other").

The estimation results are displayed in Table 3.

<< Table 3 | about here>>

From Table 3, the regression equation of (Eq.5) is established to determine the relationship between variables:

$$BMI = 20.521 + 0.019 \times Age + 1.846 \times Male - 0.965 \times otherMaritalStt - 0.806 \times studentJob - 0.199 \times stableJob - 1.269 \times \textit{unstableJob} - 0.687 \times retiredJob - 0.789 \times otherJob \quad \text{(Eq.5)}$$

From (Eq.5), the BMI of a man aged 29, being married and having a stable job would be computed as follows:

$$BMI = 20.521 + 0.019 \times 29 + 1.846 \times 1 - 0.199 \times 1 = 22.719 \quad \text{(Eq.6)}$$

Discussion

Observing the regression coefficients in (Eq.1), (Eq.2) and (Eq.3), it can be seen that in all three equations, the coefficients of "MedCabinet" are larger than "Tooluseskills" (in absolute value). This implies that having a medicine cabinet will have a stronger influence on the respondent's participation in annual physical check-ups. This is because a household that keeps medicine ready in a cabinet is likely that of a family with someone susceptible of illness or is suffering from certain diseases,

meaning that they need medicine to be available at all time. In other words, due to the risk (or threat) of disease being higher, they care more about their health and tend to update themselves on their own health status. Meanwhile, with the popularity of first-aid education programs, putting to use basic medical equipment such as thermometer or gauze bandage has become more conventional. However, they also may not practice it with their family and themselves.

On the other hand, the probabilities calculated in Table 2 show that both factors of having medicine cabinets and having skills to use medical equipment encourage people to participate in periodic GHEs. This is further illustrated in the following Fig.2:

<< Figure 2 | about here>>

In Fig.2 (left) and (right), the probability lines of "less12" have a downwards trend while the "g12/unknown" slope upwards when moving from "yes. Tooluseskills" to "no. Tooluseskills". In addition, the "less12" line climbs from over 0.5 to nearly 0.58 in Fig.2 (left) and from over 0.35 to nearly 0.53 in Fig.2 (right), showing the increased propensity of attending periodic GHEs in both situations – having a medicine cabinet and having practicable skills of basic medical tools. To conclude, owning some basic medical equipment and skills might indicates the individual's proneness illness, but more importantly it shows one's medical care knowledge, which increases their probability to visit doctors or practitioners for some health checks.

When it comes to body mass index, it can be seen in (Eq.5) that the coefficient of "age" is positive (β_1= 0.019). This means that the average BMI tend to increase when age increases, each increase of 1 unit in age will boost BMI by 0.019 units. In other words, if all other variables remain constant, a normal person will add 1 unit of BMI after 52.63 years on average. Moreover, $\beta_2 = 1.846 > 0$ reveals

that mean BMI among men is higher than women. The same remark has been made in several other Asian countries, such as Taiwan, Philippines and Korea *(21)*.

<< Figure 3 | about here>>

Unsurprisingly, in the group of participants with BMI < 23, there are more women than men, whereas in groups with higher BMI, the majority is male (Fig.3). Furthermore, $\beta_3 = -0.965 < 0$ indicates that those who are unmarried or having other marital status will have a lower BMI than married people. Depending on the exact situation, there are a few possible explanations for this. First, married life usually urges people to be aware of the need to eat proper meals, particularly in Asia. Moreover, being cared by their spouse, people tend to gain weight. On the other hand, older people are less likely to exercise and might gain weight as a result. To add to it, in Vietnam, the mindset of men being the "strong" genus and women the "pretty" remained widespread, thus making the idea of a man with the same height as a woman but has a more robust physique and greater weight is neither rare nor confusing.

With respect to job status, all of the coefficients of $\beta_4, \beta_5, \beta_6, \beta_7, \beta_8$ in (Eq.5) are negative, showing that on the same conditions of age, sex and marital status, homemakers are more likely to have higher BMI compared to others. This may be due to their lower level of dynamism and social interaction; coupled with more stress, it might cause an increasing appetite and finally lead to a larger figure. A recommended solution for homemakers (usually women) is to join gym clubs, where they can lose weight, tone their body, refine their health and even reduce stress through making social relationships.

Limitations: Despite having already resolved the given research questions and presenting some noteworthy remarks, the dataset used in the study still shows certain limitations. First, its participants were limited to those who came from within Hanoi and its vicinities; this means that the results are not

necessarily an illustration of the situation in the whole of Vietnam. Moreover, the estimation results are not yet perfect since not all coefficients are statistically significant, and the influential differences between the independent variables on the response are not quite substantial (Table 2). In addition, the adjusted R^2 in Table 3 merely attained 21.42%, showing that the extent of explanation by the explanatory variables on the dependent in (Eq.5) is relatively low.

Materials and Methods

Experimental Design

The research is based on a dataset about the tendencies among citizens of Hanoi and its surrounding areas concerning personal health in general and periodic GHE in particular. The dataset was collected by Vuong&Associates research team during September 2016. The survey was performed under the license of V&A/07/2016 (September 12, 2016), following which a statement of research ethics is provided at the end of this article. Finally, a total of 2,068 valid questionnaires were gathered, with 12-15 minutes taken for each interview. The survey was conducted on random participants with no discriminatory standards.

In this paper, we focus on gaining insights on two main issues: (1) the correlations and the influential propensities between having common medical skills and the likelihood of attending periodic GHE in the close future; and (2) analyzing the factors affecting BMI in order to attain more in-depth understanding of the Vietnamese population's current average body figure and health.

Statistical Analysis

To answer the question (1), we use BCL model as specified in *(30).* Raw data is entered in MS Excel before being converted into CSV. Data treatment and categorical structuring for multi-way contingency data tables is processed in R 3.3.1. Despite log-linear specification being a possible choice, the application of logistic regression proves to be more efficient because: a) the model is comprised of a

predetermined number of variables, thus showing each variable's significance more clearly; and, b) explanations for estimated coefficients in empirical calculations can be acquired directly. Both response and predictor variables in this model are categorical variables. The multinomial logistic regression model is used to predict the likelihood of a category of dependent variable *Y* in various conditions of independent variable *x*.

The general equation of the baseline-categorical logit model is:

$$\ln(\pi_j(\mathbf{x})/\ \pi_J(\mathbf{x})) = \alpha_j + \boldsymbol{\beta}_j^{'}\mathbf{x}, \quad j=1,\ldots, J-1. \qquad \text{(Eq.7)}$$

in which *x* is the independent variable; and $\pi_j(\mathbf{x})=P(Y=j|\mathbf{x})$ its probability. Thus $\pi_j=P(Y_{ij}=1)$ with *Y* being the dependent variable.

The estimated coefficients in multivariable logistic model are used to calculate the empirical probabilities *(31-33)*. The statistical significance of predictor variables in the model are determined based on z-value and P-value; with $P < 0.05$ being the conventional level of statistical significance required for a positive result *(31)*.

In the logit model in consideration, the probability of an event is computed as:

$$\pi_j(\mathbf{x}) = \exp(\alpha_j + \boldsymbol{\beta}_j^{'}\mathbf{x})/(1+{}^{J-1}\textstyle\sum_{(h-1)}\exp(\alpha_j + \boldsymbol{\beta}_j^{'}\mathbf{x})) \qquad \text{(Eq.8)}$$

With $\sum_j \pi_j(\mathbf{x})=1$; $\alpha_J=0$ and $\beta_J=0$; in which *n* is the number of observations in the sample, *j* the categorical values of an observation *i*, and *h* a row in basic matrix X_i. Estimated probabilities can be used to predict the possibilities of the person's most recent GHE (since less than a year, over a year, or not recalled) under certain conditions such as whether or not the person has a medicine cabinet or possesses skills to use common medical equipment.

To deal with the question (2), the method employed is multi-variable linear OLS regression with the general model described as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k \qquad \text{(Eq.9)}$$

In which the condition is that all k independent variables must have the same sample sizes. Y is a continuous variable, while the independent variables of X_i can be concrete/categorical or continuous. The data, after being treated in R (3.3.1), will perform the β_i values denoting the linear influence of X_i on Y – the BMI value in this study, specifically.

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Acknowledgments

The author would like to thank research staff of Vuong & Associates for their efficient assistance in preparing the data set for this study, namely Dam Thu Ha, Do Thu Hang, Vuong Thu Trang, Nguyen Thi Phuong, Nghiem Phu Kien Cuong and Do Phuong Ngoc.

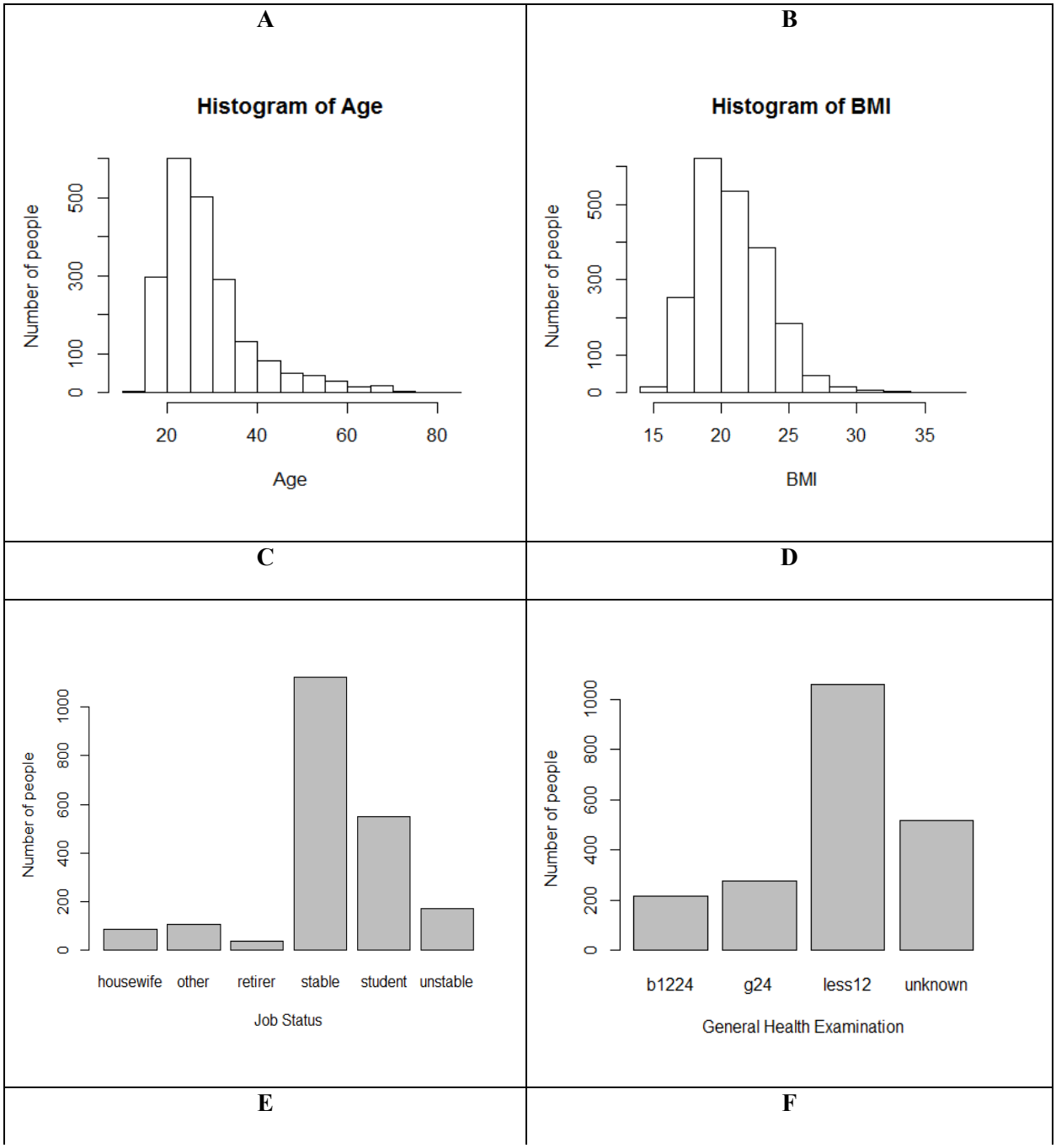
Figures and Tables

Three figures and three tables are used for this study. Their placement has been marked concretely within the body of the article.

Figures

Fig.1 is established using the original data in R(3.3.1) and Excel MS. Fig.2 and Fig.3 are rendered in Excel MS, using data in Table S1 and Table S2, respectively.

Figure 1: Statistical description figures for a few variables



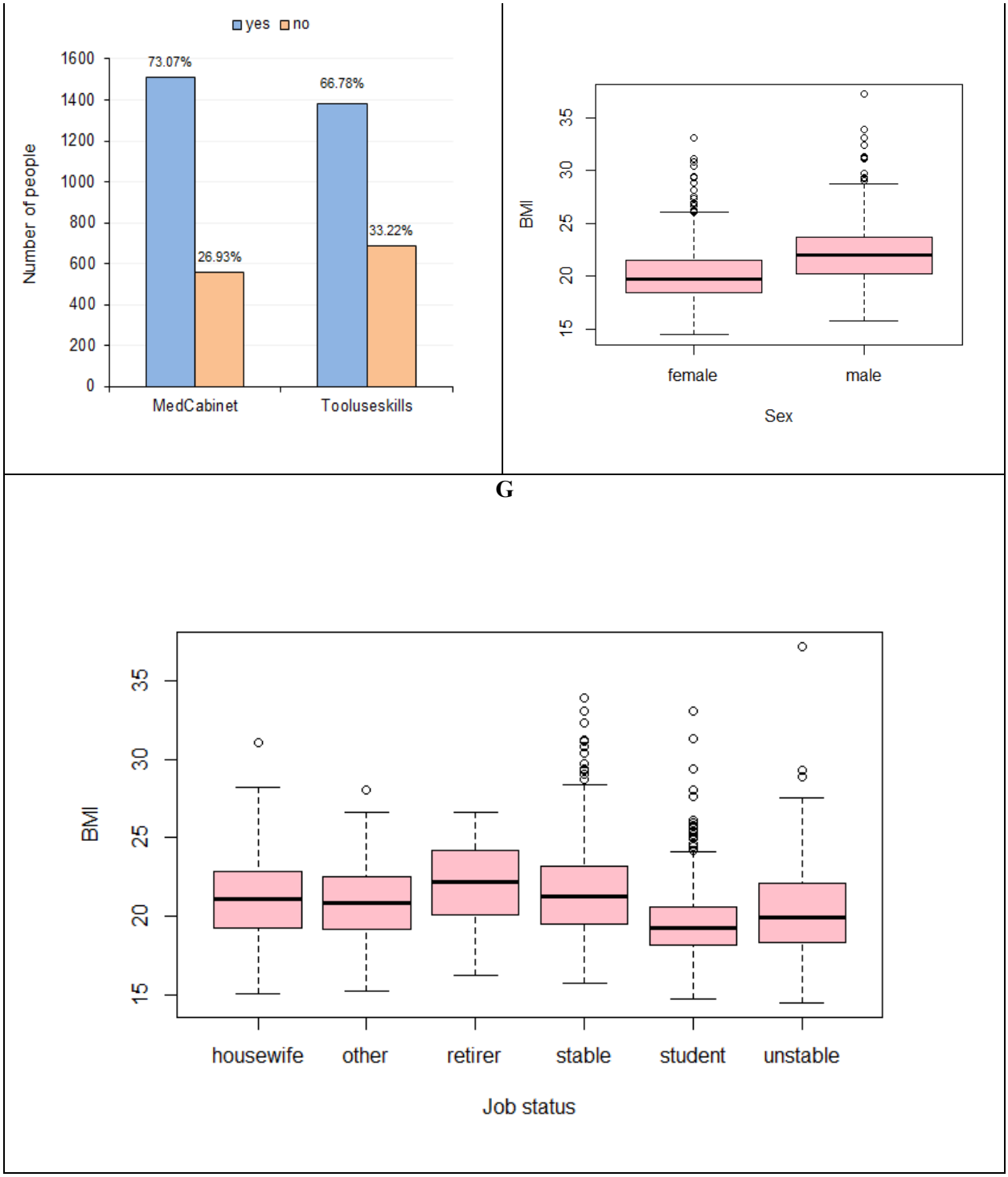


Figure 2. Probabilities of time since most recent periodic GHE by other factors

A **B**

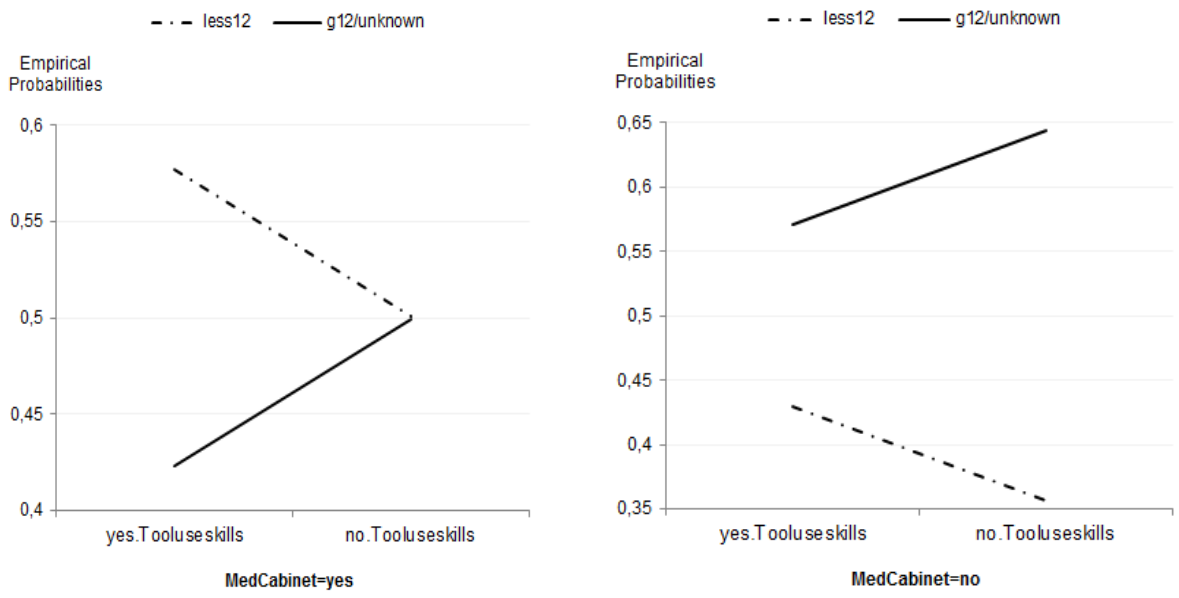
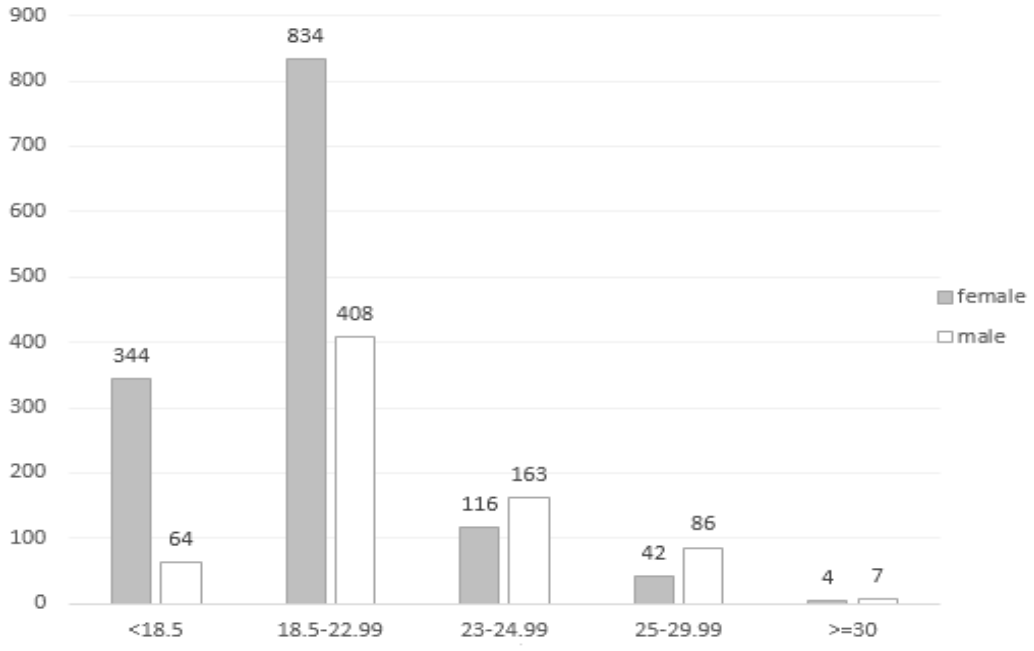


Figure 3. Distribution of BMI by gender



Tables

Table 1. Estimation results

	Intercept	"MedCabinet"	"Tooluseskills"
		"yes"	"yes"
	β_0	β_1	β_2
logit(b1224|less12)	-0.812*** [-5.481]	-0.575*** [-3.420]	-0.547*** [-3.443]
logit(g24|less12)	-0.949*** [-6.335]	-0.413** [-2.594]	-0.126 [-0.834]
logit(unknown|less12)	-0.021 [-0.188]	-0.691*** [-5.578]	-0.298* [-2.513]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; z-value in square brackets; baseline category for: ".MedCabinet"= "no", "Tooluseskills" = "no". Residual deviance: 1.677 on 3 degrees of freedom			

Table 2. Probabilities of time since most recent periodic GHE by basic medical equipment and skills

"RecPerExam"	"less12"		"b1224"		"g24"		"unknown"	
"MedCabinet"|"Tooluseskills"	"yes"	"no"	"yes"	"no"	"yes"	"no"	"yes"	"no"
"yes"	0.577	0.501	0.083	0.125	0.130	0.128	0.210	0.246
"no"	0.429	0.356	0.111	0.158	0.147	0.138	0.313	0.348

Table 3. Estimation results

	Intercept	"age"	"sex"	"MaritalStt"	"job"				
			"male"	"other"	"student"	"stable"	"unstable"	"retired"	"other"
	β_0	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8
BMI	20.521*** [55.719]	0.019** [2.595]	1.846*** [16.272]	-0.965*** [-6.319]	-0.806* [-2.566]	-0.199 [-5.723]	-1.269*** [-3.904]	-0.687 [-1.351]	-0.789* [-2.240]
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; z-value in square brackets; baseline category for: "sex" = "female", "MaritalStt" = "married", "job" = "homemaker". Residual standard error: 2.381 on 2059 degrees of freedom.									

Multiple R-squared: 0.2173, Adjusted R-squared: 0.2142

Supplementary Materials

Supplementary Tables

Table S1. Probabilities of time since most recent periodic GHE by other factors (Data used for Fig.2)

"MedCabinet"	"yes"		"no"	
"Tooluseskills"	"less12"	"g12/unknown"	"less12"	"g12/unknown"
"yes"	0.577	0.423	0.429	0.571
"no"	0.501	0.499	0.356	0.644

Table S2. Distribution of BMI by gender (Data used for Fig. 3)

BMI	"female"	"male"
<18.5	344	64
18.5-22.99	834	408
23-24.99	116	163
25-29.99	42	86
>=30	4	7