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Socio-Economic and Health Indicators' Relation to Self-Assessed Health: A Case Study of Phai Tha Pho, Phichit Province, Thailand

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Abstract

Background: Self-assessed health (SAH) is used as a common method of sociology research to understand the implications of self-reported health and the link to social factors like education, income, and occupation. The paper explores the impact of socio-economic and health indicators on self-assessed health in the middle-aged to the senior population in a rural community in Thailand. **Methods:** Primary data were collected after conducting a randomized sampling for 100 people using direct interviews in two locations within the sub-district of Phai Tha Pho, Thailand. The target demographic was the middle-age to elderly population. A logit model was applied to the collected samples. **Results:** The study highlights that higher education, income, and sleep are high predictors for positive SAH while high blood sugar level has significant adverse effects on SAH. Detection of metabolic syndrome further indicates degraded overall health perception over time. **Conclusion:** The study demonstrated the relationship between socio-economic indicators and illnesses alongside individual SAH in rural Thailand. Accordingly, policies have been proposed that include targeted subsidies for healthy food alternatives, promoting work-rest balance at all levels, and an expansion of sub-district education up to secondary school. SAH can be performed regularly and expanded across communities including areas of low-income living due to its low implementation costs. It could also be used as a tool to support the government's public health initiatives complementing the existing five-year direct health check-up programme. A comparative study of SAH across regions is recommended for future research.

Keywords

Self-Assessed Health, Metabolic Syndrome, Education, Sleep, Income

1. Introduction

1.1. Understanding Self-Assessed Health

Self-assessed health (SAH) "reflects a person's perception of his or her health at a given point in time" [1]. As a common method of sociology research, SAH is used to understand the implications of self-reported health and the link to social factors such as education, income, and occupation. Although it has been subject to criticism for its limited efficacy in assessing general health, it is not just a tool for population health prediction but also a useful tool for understanding social trends. However, the problem arises in implementing SAH as it often deviates from "underlying true health… [the] same clinical health condition is acknowledged differently according to individual characteristics and is determined by the cultural and historical context, social position, and health experiences of the individual" [2]. By considering the differences in backgrounds concerning health, this paper focuses on studying how various factors influence perceived health status in rural Thailand. The paper also discusses potential policies that could improve health perception among rural people. Due to the intrinsic influence of socioeconomic status (SES) on individual health that impacts SAH, this paper will expand beyond the known relationship between SAH and income, exploring the relationship of perceived health with other socio-economic and health indicators.

1.2. Socio-Economic Background of Thailand

Located in the Southeast Asian region, Thailand has seen consistent economic improvement in the past four decades. Averaging annual gross domestic product (GDP) growth of 5.1% in 2001-2007 [3], Thailand has recently graduated to middle-income status driven by growth in trade.

Yet, despite increasing urbanisation, Thailand continues to face issues with urban and rural disparities, with 49% of the population continuing to live in rural areas [4]. Characterised by less average years of schooling, an agrarian-based economy, and less influences of western modernisation, rural villages in Thailand face the impact of unequal development and disparate incomes levels which have consequential effects on health and access to care. A study dealing specifically with the relationship between socioeconomic factors and the development of hypertension (HT) in Thailand noted that "A low-income group has a higher tendency to develop HT" [5], while an inability to adequately educate the population about health meant that, "in the Northeast, people were seldom aware that they had HT" [5]. Therefore, one can note the relationship between perceived health and economic influences.

2. Methodology and Data

2.1. Methodology

The Logit Model (Logistic Regression Model): A Snapshot

The determinants of the state of SAH are examined using a Logit Model [6].

The ordinary least square (OLS) is not employed as it is not an efficient estimator given the qualitative binary nature of the response, *i.e.*, good health or bad health.

The logit or logistic model can be expressed as:

$$f(Y) = 1/\left(1+e^{-Y}\right) \tag{1}$$

where W is defined as

$$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \cdots + \alpha_k X_k \tag{2}$$

$f(Y)$ = the probability of a particular outcome with values between 0 and 1,

$X's$ = explanatory variables, and

$\alpha's$ = regression coefficients to be estimated.

In our empirical work, one estimates the following:

$$Logit(Pi) = \ln\left[Pi/(1-Pi)\right] = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \cdots + \alpha_k X_k + u_I \tag{3}$$

where,

P = the probability that the event occurs,

$Pi/(1-Pi)$ = the odds ratio, and

u = the error term.

The partial derivative of the probability with respect to any of the explanatory variables is marginal effect.

$$\mathrm{d}Pi/\mathrm{d}Xi = \alpha_i \mathrm{e}^{-Y} \Big/ \left[1+\mathrm{e}^{-Y}\right]^2 \tag{4}$$

To translate the odd to probability (likelihood) using (5)

$$P = \mathrm{e}^{Y}/\left(1+\mathrm{e}^{Y}\right) \tag{5}$$

Goodness of fit model employed Pseudo R^2 along with other inferences.

2.2. Data

Located in the lower Northern region, Phichit is a landlocked province with a population of 525,944 [7]. With a labour force that is dependent on the agricultural sector, accounting for 54.3% of the working population. As typical of Thai provinces, Phichit can be broken down into 16 districts (*amphoes*), and further into 89 sub-districts (*tambons*); the focus of this study will centre on the *Pho Prathap Chang* administrative district and the *Phai Tha Pho* sub-district which consists of 12 villages and population size approximately 6300 [8].

We have used primary data; conducting randomized sampling for 100 people and used direct interviews in two locations within the sub-district (**Figure 1** and **Figure 2**) (N.B. optimal sample size based on 90% confidence and 7% - 8% margin-of-error) [9]:

1) at the community health center of the Ministry of Health.

2) at a health mobile station for those who came for the last COVID vaccination.

The survey results on which this study is based are produced in the **Supplementary** Table S1.

Figure 1. Phichit Province on Map of Thailand ("Phichit Province", 2023, map adapted from Wikipedia).

Figure 2. Pho Prathap Chang District on Map of Phichit Province. Phai Tha Pho is a subdistrict of Pho Prathap Chang ('Pho Prathap Chang District', 2022, map adapted from Wikipedia).

Data was collected randomly and aimed at the mid-to-older age category; this was done keeping in mind Thailand's increasingly aging society [10]. Understanding this group will pave the way for improved targeted public healthcare initiatives. The variables and definitions used for the statistical assessment are provided in Table 1.

Table 1. Definition of analysis variables.

Variable	Definition
Gender	Gender at birth; 0 if male (n = 38), 1 if female (n = 62)
Age	In year; 0 if less or equal 60 (n = 43), 1 if more than 60 (n = 57)
Education	Schooling; 0 if <9 years in school (n = 72), 1 if 9+ years (28) (note: 9 is mandatory)
Profession	Professional sector; 0 for all professions except agriculture (n = 81), 1 if agriculture (19)
OOP	Monthly out of pocket spend on healthcare related expenses; Expressed in thousand Thai Baht (80% spent less than 1000 Thai Baht)
Income	Money earned per month from any sources; expressed in thousand Thai Baht (30% in the range of 1000 - 2000 Thai Baht)
Sugar level	Fasting blood sugar level in mg/dL as indicated in the health book; 0 ≤ 100 mg/dL as normal (n = 60), 1 = 100+ mg/dL as higher than normal (n = 40)
Cholesterol	Total cholesterol in adults measured in mg/dL; 0 if <200 mg/dL as normal (n = 60), 1 if above 200 mg/dL as higher than normal (n = 40)
Blood pressure	Diastolic/Systolic (mmHg) as noted in the health book; 0 if 80 - 89/120 - 130 (n = 52), 1 if off-range (n = 44)
Sleep hour	Number of sleeping hours; 0 if <6 hours (n = 18), 1 if ≥6 hours per night (n = 82)
SAH_current	SAH at the point of interview; 0 if often sick (n = 26), 1 if normal-to-good (n = 74)
SAH_PY2	SAH at the point of the interview to compare with health condition in the previous two years; 0 if weak to much weaker (n = 31), 1 if same-stronger-much stronger (n = 69)
Metabolic syndrome risk	Metabolic syndrome is a condition including a cluster of risk to cardiovascular diseases—high blood pressure, high blood sugar level, high total cholesterol; 0 if only one risk is shown, 1 if at least two are shown indicating higher risk

OOP: Out of pocket; SAH: Self assessed health.

Model Specification

The study investigates five challenging issues:

1) how gender and education influence self-assessed response.

2) how current OOP expenditure, income, and profession influence the way people assess their health.

3) how basic health indicators influence the way people assess their health.

4) how the current state of health affects the dynamic change of SAH.

Table 2 presents the five model specifications used for the logistic regression, wherein Model 5 allows all variables in the analysis.

Table 2. Logistic regression model specification.

	Model 1	Model 2	Model 3	Model 4	Model 5
	General Profile	OOP and Income	Health Profile	Chronic Impact	Overall Variables
Gender	X	-	-	-	X
Education	X	-	-	-	X
Profession	-	X	-	-	X
OOP	-	X	-	-	X
Income	-	X	-	-	X
Sugar Level	-	-	X	-	X
Cholesterol	-	-	X	-	X
Blood Pressure	-	-	X	-	X
Sleep Hour	-	-	X	-	X
SAH_current	-	-	-	X	-
Metabolic syndrome	-	-	-	X	-

OOP: Out of pocket; SAH: Self assessed health.

3. Empirical Results

Log-likelihood is used for the estimation, McFadden's R-squared and Akaike information criteria are reported. Table 3 presents the estimated logit regression. We allowed three levels of significance (90%, 95%, 99%) in the result. Individuals perceive good health when the education factor has a positive coefficient with education level past junior high school (9th grade). Similarly, for the income factor when the income was higher health was better perceived. A negative coefficient with higher OOP was indicative of a tendency of people to perceive health worsening, while a positive coefficient for sleep (>6 hours) improves perception on individual's health. A negative coefficient detecting high blood sugar level led to people perceiving worsening health conditions. Individuals having a negative metabolic syndrome risk coefficient with two or more of the conditions of high blood pressure, high blood sugar, and cholesterol perceived worsening of health while cholesterol and blood pressure separately did not seem to affect their health perception.

From the likelihood standpoint:

- Those aware of their high sugar level conditions had an increased probability of reporting worsened health by 40%.
- Sufficient sleep improved the change of good health perception by 90%.
- The presence of metabolic syndrome increases the chance of worsening SAH by 17% (for instance, a respondent stated "I am feeling healthier now, but because of high sugar, high cholesterol, and high BP, I still do not see I am as good as two years ago").
- Better education increased the likelihood of positive SAH by 24% in both genders on average.

- With increasing incomes, individuals are 77% more likely to report positive SAH; however, a rise in health expenses causes this percentage to fall to 67%.

Table 3. Odd-ratio coefficients.

	Model 1	Model 2	Model 3	Model 4	Model 5
	General Profile	Expense and Income	Health Profile	Chronic Impact	All variables
Dependent variable (*binary*)	SAH_current	SAH_current	SAH_current	SAH_PY2 Years	SAH-current
Intercept	**1.047** (0.445)**	0.249 (0.508)	0.624 (0.690)	**−1.877*** (0.771)**	−1.216 (1.325)
Gender	−0.515 (0.519)	-	-	-	−0.556 (0.726)
Education	**1.803*** (0.778)**	-	-	-	0.700 (1.001)
Profession	-	−0.081 (0.513)	-	-	0.413 (0.752)
OOP Health Spend	-	**−0.395* (0.233)**	-	-	−0.577 (0.550)
Income	-	**0.112** (0.045)**	-	-	**0.211*** (0.073)**
Sugar Level	-	-	**−1.021** (0.559)**	-	**−1.775** (0.720)**
Cholesterol	-	-	−0.378 (0.571)	-	−0.474 (0.643)
Blood Pressure	-	-	0.003 (0.051)	-	0.512 (0.664)
Sleep Quality Hour	-	-	**1.500*** (0.636)**	-	**2.150*** (0.906)**
SAH_Current	-	-	-	**1.479*** (0.794)**	
Metabolic Syndrome Risk	-	-	-	**−1.250** (0.539)**	

Confidence *(90%), **(95%), ***(99%). Numbers in brackets is standard deviation. McFadden-R^2 in range of 0.15 - 0.28 and Akaike criteria 1.1 - 1.2. OOP: Out of pocket; SAH: Self assessed health.

4. Discussion

Building upon previous publications like Gan-Yadam *et al.* [12] which highlighted the social influences of SAH in developing countries, including gender and household composition, the present study furthers the small sample of SAH use in developing countries, highlighting specifically the importance of sleep, income, and education in contributing to individuals having a better perception of health.

We observed that sleep has a very strong relationship with the perceived health of the individual, this is in alignment with observations in previous studies [11]-[13]. While Stefan *et al.* reiterate poor health arising from <7 hours of sleep [13] Kim *et al.* mention it as <5 hours of sleep [14]; we corroborate these two studies in concluding the necessary 6 hours of sleep to indicate positive health outcomes. Sleep is intuitively a necessary component of good mental and physical health. An uninterrupted period in which the body can repair itself, sleep is 1 of the 3 lifestyle behaviours which influence one's health [15]. Considering the largely elderly age group surveyed in this study, a by-product of Thailand's rural village population trends, we reiterate the conclusion drawn by the National Institute of Health [16] which indicates that increasing age coincides with a susceptibility to sleep disorders

and a risk of impairment of immune systems, further worsening illnesses. Furthermore, Yokoyama *et al.* reiterate the "positive linear relationship between subjective sleep sufficiency and the mean Philadelphia Geriatric Center (PGC) Morale Scale score" [17]. As longer sleep duration indicates higher morale, the outcome of the present survey is thus justified given that with less sleep, elderly individuals are more likely to perceive themselves to have worse-off health, a by-product of actual physical deterioration and reduced mental morale. This study has focused on the broad implications of sleep, addressing the more quantifiable aspect of duration; however, the study of sleep is a wide-ranging field that can be further addressed in relation to SAH in the future by surveying perceived sleep quality, depth, and frequency of night awakenings, an issue which becomes increasingly prevalent with age.

Our observations in the present study on the relationship of education with SAH are in line with another study [18] that reiterates the positive relationship between education and perceived health. In Thailand, unequal education provision exists between the urban and rural areas, with a disproportionate emphasis on the former, this issue is worsened due to government spending "more money per student at the university level" [19]. The cut-off points in ability to assess health occurs in the secondary school age group, this is reiterated in the present study. Tisnower states that a shortage of schools in rural areas contributes to limited educational opportunities [19]. This extends to limited access to secondary schools, which are "available only in main districts", [19] leading to a hurdle in extending access to compulsory education in local sub-districts. Indeed "only Bangkok offer[ed] the six years [compulsory education]. All other regions report numerous tambons not offering such education" [19]. By evidencing the importance of education in being a key factor in assessing individual health, the current study highlights the necessity for the expansion of state-funded education into local sub-districts. Taking influence from countries like Japan, where teachers are hired by prefectures (analogous to Thai provinces), the government can "direct high-performing teachers to disadvantaged areas" [20], enabling not only an improvement in the propagation of education but also an improvement in quality of education.

Income and SAH have a positive relationship, those with higher incomes will be more likely to access superior healthcare, lifestyles, and environments [21]. In the context of rural Thailand, this will mean greater opportunities to purchase medication from private pharmacies and obtain alternative treatment as opposed to relying on public health services.

However, this study found a negative relationship between SAH and OOP health expenses. With increasing expenditure on health-related goods, individuals perceived worse SAH regardless of the level of income. The pre-existing inequality in health arising from excessive OOP expenditure is highlighted by Beaugé *et al.* who state that "ultra-poor on average even have higher expenditure than the general population most likely due to their old age, the severity of illness and complex

medical profiles" [22]. Thus, the findings of this study indicate that health expenditure should not be indicative of individual health, considering those that spend more feel worse off and may be influenced by pre-existing illnesses instead. Though the Thai government does bear a partial cost of health expenditure, alongside the aforementioned study, there is evidence that lower income groups will face the resultant burden more significantly, thus contributing to the negative SAH.

An interesting point to highlight in this study, however, is a lack of significance in the relationship between profession and SAH. From the survey population, 40% worked in the agricultural and informal sector, while 60% were "employed" or owned a business. Typically, there is an assumption that agricultural sector workers should have poorer health due to chronic exposure to pesticides, and a propensity to obtain injuries from lifting, and heat stress which are by-products of farm work [23]. However, the limited significance of the relationship could be indicative of acclimatisation to a lower level of health due to long-term exposure to the aforementioned factors, altering their ability to self-identify poor health. This is significant as though agricultural workers may state good SAH, this may rather reflect an adaptation to poor overall conditions—physical health indicators should be utilised simultaneously to validate whether the SAH is accurate. An issue rising from rural agricultural workers is the attainment of metabolic syndrome. Cremonini *et al.* highlighted this relationship resulting from poor eating habits caused by lower incomes, substituting natural foods for cheaper processed foods which are more caloric and potentially obesogenic [24]. Another issue identified in Brazil by Petarli *et al.* highlighted that exposure to pesticide poisoning contributed to worsened mental health, alongside the accepted impact on physical health [25]. In countries like Thailand, where pesticide use has increased 4× in the last decade, [26] the risk of exposure is heightened as farmers may not take adequate precautions such as "adequate protective clothing to prevent exposure" [27]. Thus, poor lifestyle and farming decisions may contribute to worsening overall health; when coupled with long-term exposure and acclimatisation, the resultant inability to identify worsening individual health is a point of concern that needs to be addressed by the government.

The outcome of the relationship of sugar levels to SAH is interesting. Neither cholesterol nor high blood pressure have a significant correlation with SAH as is evident from **Table 3**. In contrast, knowledge of the individual's high blood sugar level is significant (95%), triggering people to report worse health with a 40% probability, indicating the psychological impact of high sugar levels to influence one's perceptions of health. High sugar levels contribute to illnesses including obesity, diabetes, and cardiovascular disease [28]. Though there are similar and related outcomes arising from acquiring cholesterol and high blood pressure, the psychological impact of blood sugar on the individual's perception of a worsened SAH is interesting and warrants for future study exploring this aspect.

5. Policy Implications

Within this paper, three focus points for policy are proposed: blood sugar level, education, and sleep. To address the relationship between known high sugar levels and SAH, the importance of disseminating knowledge about healthy diets in the rural population is critical. Previously, there has been progressed in the expansion of policies like the sugar tax on beverages and The Fatless Belly Thais programme, which raised "public awareness about the benefits of diet and physical activity" [29]. The focus on an awareness of metabolic syndrome prompted "Local government organisations and community leaders [to consider] the poor quality of the food available in their settings" [29]. This has significantly influenced Thais' diets. Since the COVID pandemic, the issues of affordability of healthy foods have become more prominent. "Layoffs and reduced incomes driven by restrictions" and changing prices of staple foods have contributed to the issue [30]. As such rural populations are unable to access good quality foods, and instead substitute them with cheaper, processed, calorie-dense foods that are contributors to health issues. Despite the national movement towards greater healthy eating habits, 48% of rural dwellers consume fruit and vegetables regularly compared to 56% of urban dwellers, indicating continued deviance between rural and urban diets [31]. Striking a balance between interventionism and behavioural nudges represents only the beginning of the government's difficulty in promoting healthier eating.

The Thai government should focus on promoting further healthy eating in rural populations by providing low-cost solutions, based on the evidence produced in the present study. Moving away from disincentivising consumption of sugary and unhealthy foods through regressive taxation, the Thai government could employ "targeted price subsidies [which are argued to be] better at increasing healthy food consumption" [32]. This has been evidently reaffirmed in the US through the Special Supplemental Nutrition Programme for Women, Infants, and Children, which provided "an allowance for purchasing healthy foods". It also emphasised "the importance of the consumer's value of nutrition", [33] thereby stressing the necessity of continued re-education programmes focused on the importance of healthy eating habits to combat disease. Minimising the development of high blood sugar levels amongst the rural Thai population will enable the government to reduce negative health perceptions, ensuring higher morale and physical well-being.

As previously stated, the Thai government should focus on increasing the dissemination of education in sub-districts at the compulsory education (secondary) level. Much has been done to improve higher education within the country, but the unequal opportunity of access to education in rural areas at lower ages adds to the problem of continued inequalities. This study concludes that better SAH is directly related to greater education years; this conclusion can be propagated by ensuring greater access to compulsory levels of education even at sub-district level. However, to provide an increase in quality and quantity, teaching standards should be addressed. Employing teachers provincially and operating under a rota,

high-performing teachers will be able to be redirected to areas of lower opportunity even in districts and sub-districts of the province to equalise the quality of education. This paper has highlighted the importance of education in being able to respond to the rhetoric of public health campaigning as well as the ability to properly assess one's own health.

As represented by the results of this study, the importance of sleep is paramount in influencing perceived health of the individual. However, from the government's perspective for implementation, the intervention largely constitutes nudges and government education schemes which attempt to emphasise the importance of adequate sleep. Thus, this will need to continue, alongside further methods of improving general sleep quality in the form of educational campaigns to strike work-rest balances in life.

6. Conclusions and Future Research

This study has reviewed and demonstrated the relationship between socioeconomic indicators and illnesses alongside individual SAH in rural Thailand. The findings are supported by other contemporary works highlighting the necessity of sleep, education, and income which can improve perceived health. However, further contributions have been made to highlight specifically the impact of blood sugar levels on worsening perceived health, a conclusion that was not met in other co-morbid illnesses. Thus, policy focuses proposed for the Thai government indicate the need to focus on the combination of re-education of the population for healthier lifestyle practices alongside direct intervention through policies.

As a basis for future study, we aim to highlight the utility of SAH as a cheaper and easier method of evaluating the effectiveness of policies, and hence the ways they could be improved in the future. Due to the ease of obtaining perceived health information in comparison to physical health checks utilised by the National Health Survey, which is carried out every five years, the government can use SAH as a means to obtain current information more frequently. This will allow Thai national health to be more agile, adaptive, and more efficient in benefiting people. Future research could, therefore, focus on expanding the approach to other communities (*i.e.*, Tambon and Amphoe) and provinces, allowing for deeper comparative studies that will help draw better targeting health policies over time.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Supplementary

Table S1. Respondent: profile, health condition, and health perception (total sample size 100).

Gender (person)		Age (year)		Education (year)		Profession (person)		Income (THB/month)	OOP health spend (THB/month)
Male	Female	<=60	>60	<9 years	9+ years	Agriculture and informal	Employed & others	Average	Average
38	62	43	57	72	28	40	60	10610	1004

Blood pressure (person)		Sugar level (person)		Cholesterol (person)		Sleep (hour)		Metabolic syndrome detection (person)							
High	Normal	High	Normal	High	Normal	6+	<6	BP	BP, Diabetes	BP, Cholesterol	Diabetes	Cholesterol	Cholesterol, BP, Diabetes	Cholesterol, Diabetes	None and others
44	52	40	60	40	60	80	20	3	11	19	9	6	14	5	30

Self-Health Assessment (person)		Self-Health Assessment (vs. Previous 2 years) (person)	
Good to normal	Often sick	Strong to much stronger	Same to much weaker
70	26	22	74

Source: Primary survey/interview at Phai Tha Pho, Phichit province, Thailand (December 2022 to Jan 2023).