Association between Socioeconomic Status and Major Risk Factors of Stroke: Thai Epidemiologic Stroke (TES) Study

Boonchai Pipatvanichgul MD*,
Suchat Hanchaiphiboolkul MD*, Pimchanok Puthkhao MSc*,
Tasanee Tantirittisak MD*, Somchai Towanabut MD*

* Prasat Neurological Institute, Department of Medical Services, Ministry of Public Health, Bangkok, Thailand

Objective: To investigate the association of socioeconomic status (SES) (education, personal income, and occupation) with four major risk factors of stroke, those are diabetes, hypertension, hypercholesterolemia, and current smoker.

Material and Method: The Thai Epidemiologic Stroke Study is a community-based cohort study, which recruited participants from the general population from five geographic regions around the country. Cross-sectional baseline data of 19,997 (6,803 men and 13,194 women) participants, aged 45 to 80 years were included in the present analysis. Multiple logistic regression analysis was used to estimate association of socioeconomic indicators with the major risk factors of stroke.

Results: SES was associated with a major risk factor of stroke. Among three indicators of socioeconomic status, education was more consistently associated with the risk factors than personal income and occupation, particularly in women. Education significantly inversely associated with diabetes ($p = 0.015$ in men and 0.002 in women, respectively), and current smoker in both sexes ($p<0.001$), and with hypertension in women ($p = 0.011$). By contrast, education was significantly positively associated with hypercholesterolemia in women ($p<0.001$).

Conclusion: The differences in the prevalence of the major risk factors of stroke between SES groups were important, and should be considered in the development of policies or tailored strategies for prevention of stroke.

Keywords: Socioeconomic status (SES), Cardiovascular risk factors, Stroke, Epidemiology, Thailand

Stroke is the second most common cause of death worldwide[1]. A recent systematic review of 119 relevant studies[2], published between 1990 and 2010, in 21 world regions, shows that, although stroke mortality rates have decreased in the past two decades, the global burden of stroke in term of the absolute number of people affected every year, stroke survivors, related deaths, and disability-adjusted life-years (DALYs) lost are great and increasing, with most of burden in low-income and middle-income countries. In Thailand, stroke is a major health problem, and ranked first as a cause of death for both males and females[3]. Although the data on stroke incidence in Thailand is not currently available, a study in 2011 showed that the stroke prevalence in Thailand was 1.88% in people aged 45 to 80 years[4], which had increased from previous study in the elderly (1.12%) in 1998[5]. For reducing the burden of stroke, effective primary prevention remains the best approach because >76% of strokes are first events[6]. Knowledge of existing disparities in stroke risk factors burden is important for effective stroke prevention and management[7], particularly in term of identifying subgroup of individuals at high risk for appropriate interventions.

Socioeconomic status (SES) is an individual's position relative to others, usually based on education, income, and occupation[8]. While there is abundant evidence for the existence of an inverse relationship between SES and cardiovascular risk factors in developed countries, with only few exceptions[9], very little research has been conducted in developing countries[10]. In addition, associations of SES with cardiovascular risk factors which were found in developing countries are less consistent[10], for example, in China[11], SES are inversely associated with cardiovascular risk factors (hypertension, obesity, and smoking), whereas dyslipidemia, diabetes (men only), and hypertension (women only) are positively associated with SES in India[12].

In Thailand, a previous study showed that level of income, but not education, was inversely

Correspondence to:
Hanchaiphiboolkul S, Prasat Neurological Institute, Department of Medical Services, Ministry of Public Health, 312 Rajavithi Road, Bangkok 10400, Thailand.
Phone: +66-81-8434502, Fax: +66-2-3545357
E-mail: suchathanc@yahoo.com

related to prevalent hypertension, and education was inversely related to hypertension incidence[13]. Smoking prevalence among male is inversely associated with education[14,15] and job levels[15]. However, there are still limited data on the association between socioeconomic status and major risk factors of stroke in Thailand. The purpose of the present study was to investigate the association of education, personal income, and occupation, with four major risk factors of stroke; those are diabetes, hypertension, hypercholesterolemia, and current smoker.

Material and Method

Study population

Baseline survey data of the Thai Epidemiologic Stroke (TES) Study were studied as cross-sectional analyses. The TES Study was a community based cohort study, an ongoing process to investigate the association between various risk factors, lifestyles, and incident stroke in Thailand. The detailed description of the study population and methods had been published elsewhere[4]. Briefly, individuals from the general population aged 45 to 80 years were enrolled on the voluntary basis from the following five geographic regions of the country: Bangkok (capital city), Chiang Mai province (northern region), Khon Kaen province (northeastern region), Chachoengsao province (central region), and Nakhon Si Thammarat province (southern region). Although our study sample was not established by random sampling but it covered all major demographic strata of the Thai general population aged 45 to 80 years[4].

The study was approved by the Ethical Review Committee for Research in Human Subjects, Ministry of Public Health, Thailand. All participants gave informed consent.

Baseline survey

Baseline survey data were collected at a community place between 2004 and 2006. Measurements of blood pressure and anthropometric data, collection of blood sample after overnight fast, and in person to interview assessing demographic information and medical history were performed following standard procedures by a well-trained staff. On the basis of stroke screening questionnaire, participants who were suspected to have a stroke were interviewed and examined by board-certified neurologists for determining stroke status. The details of stroke screening questionnaire and the method for verification of stroke status have been described in

our previous publication[4,16]. Blood pressure was measured three times with one minute between each measurement using an automated blood pressure device (Omron HEM-907; Omron Healthcare, Singapore) after participants had rested for at least five minutes. Venous blood samples were obtained after a 12-hour overnight fast. Analyses for glucose and lipid profile were performed at the Division of Clinical Chemistry, Faculty of Medicine Ramathibodi Hospital, which was certified by the Centers for Disease Control, USA - National Heart, Lung and Blood Institute Lipid Standardization Program.

Definitions

Education, personal income, and occupation were used as indicators of SES. Education was classified as illiterate, primary, secondary, and university levels. Personal income was categorized using monthly income cutoffs at less than 5,000 Thai baht as low personal income (35 Thai baht ≈ 1 US dollar in 2009 and 33 Thai baht ≈ 1 US dollar in 2014). Occupation was classified as follows: non-manual, manual class, agricultural class, and unemployed/house work class. Diabetes was defined as a fasting plasma glucose level ≥7.0 mmol/L (126 mg/dL) or history of treatment for diabetes. For hypertension, the average of three measurements was used in this analysis, and hypertension was defined as blood pressure ≥140/90 mmHg or self-reported use of antihypertensive medication. Hypercholesterolemia was defined as a fasting cholesterol level ≥5.2 mmol/L (200 mg/dL) or self-reported use of medication for hypercholesterolemia. Current smoker was defined as having smoked 100 or more cigarettes in a lifetime and smokes cigarettes currently. The criteria for the diagnosis of stroke were those given by the World Health Organization, which were defined as ''rapidly developed clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than of vascular origin''[17].

Statistical analysis

Continuous variables were presented as the mean and standard deviation, while categorical variables were described as percentages. The differences in baseline characteristics between men and women were analyzed using independent sample t-test for continuous variables and Chi-square test for categorical variables.

Multiple logistic regression analysis was applied to estimate the associations of socioeconomic

indicators with the prevalence of each major risk factor of stroke; those are diabetes, hypertension, hypercholesterolemia, and current smoker. Considering sex may have interactions with other variables, models were fitted by men and women separately. Variables included in each model were socioeconomic indicators (education, personal income, and occupation), age, and geographic area. Odds ratios (ORs) and 95% confidence intervals (CIs) are used to measure associations.

All reported p-values were based on two-sided test, and the significance level was placed at 0.05. All statistical analyses were performed using SPSS for Windows version 16.0 (IBM, Armonk, NY).

Results

Characteristics of the study population were summarized in Table 1. Nineteen thousand nine hundred ninety seven participants comprised of 6,803 men and 13,194 women with mean age 59.0 years (SD 9.0 years), and ranged 45 to 80 years were included in the present study. The majority had primary educational level (78.5%) and low personal income (70.6%). Educational level, low personal income, and occupation were significantly different between

men and women ($p<0.001$). Illiteracy and low personal income were higher in women than in men (3.6% vs. 1.1%, and 74.4% vs. 63.2%, respectively). Unemployment/house work (33.7%) and living in Bangkok (capital city) (12.3%) were found in women, whereas men were higher in agricultural class (40.5%).

Among the study population, there were 16.2% prevalence of diabetes, 43.8% of hypertension, 65.9% of hypercholesterolemia, and 13.9% of current smoker. The prevalence of diabetes, hypertension, and hypercholesterolemia were higher in women ($p = 0.010$, 0.005, and <0.001, respectively), whereas prevalence of current smoker was higher in men (35.9% in men, 2.7% in women, $p<0.001$) (Table 1).

With regard to the prevalence of major cardiovascular risk factors by SES (Table 2), the prevalence of hypertension and current smoker was higher in both sexes whose education level was illiterate, whereas the prevalence of hypercholesterolemia was higher in university level. In both sexes, higher prevalence of current smoker was found in low income group, whereas higher prevalence of hypercholesterolemia was found in higher income group. Regarding occupation, the prevalence of

Table 1. Characteristics of the study population

	Total (n = 19,997)	Men (n = 6,803)	Women (n = 13,194)	p-value
Age in years, mean (SD)	59.0 (9.0)	59.9 (9.2)	58.5 (8.8)	<0.001
Education level (%)				<0.001
Illiterate	2.8	1.1	3.6	
Primary	78.5	74.8	80.4	
Secondary	11.9	17.5	9.0	
University	6.9	6.6	7.1	
Low personal income (<5,000 Thai baht*/month, %)	70.6	63.2	74.4	<0.001
Occupation (%)				<0.001
Unemployed/house work	29.0	19.9	33.7	
Agricultural class	30.4	40.5	25.1	
Manual class	35.2	33.8	36.0	
Non-manual class	5.4	5.8	5.2	
Geographic area (%)				<0.001
Bangkok	10.8	7.8	12.3	
Central region	24.3	21.8	25.6	
Southern region	12.2	13.7	11.5	
Northern region	22.0	25.3	20.2	
Northeastern region	30.7	31.4	30.4	
Diabetes (%)	16.2	15.2	16.7	0.010
Hypertension (%)	43.8	42.4	44.5	0.005
Hypercholesterolemia (%)	65.9	55.8	71.1	<0.001
Current smoker (%)	13.9	35.9	2.7	<0.001
Stroke (%)	1.9	2.9	1.4	<0.001

* 35 Thai baht ≈ 1 US dollar in 2009 and 33 Thai baht ≈ 1 US dollar in 2014

cardiovascular risk factors was generally higher in both sexes whom were unemployed/house work, with some exception of hypercholesterolemia was higher prevalent among non-manual class, and prevalence of current smoker was higher among men in agricultural class (Table 2). In men, the higher prevalence of diabetes was found in higher income group. By contrast, in women, the higher prevalence was found in lower income individuals.

In multiple logistic regression analysis, after adjustment for age, geographic area and all other socioeconomic indicators (Table 3), men with primary (OR = 1.69; 95% CI 1.18-2.40) and secondary education (OR = 1.76; 95% CI 1.25-2.48) had higher risk for diabetes compared to university education. Slightly higher risk for hypercholesterolemia (OR = 1.34; 95% CI 1.01-1.78) was found in men with secondary education. In men, hypertension was not associated with education ($p = 0.096$). Lower education was significantly associated with current smoker in both sex ($p<0.001$) (Table 3, 4). In women,

education was significantly associated with diabetes, hypertension, and hypercholesterolemia ($p = 0.002$, 0.011, and <0.001, respectively). Women with lower education seemed to have higher risk for diabetes, hypertension, and current smoker, whereas illiterate (OR = 0.49; 95% CI 0.35-0.69) and primary education (OR = 0.74; 95% CI 0.56-0.98) were protective for hypercholesterolemia.

Regarding income, significant associations of low income with hypercholesterolemia (OR = 0.81; 95% CI 0.72-0.92) and current smoker (OR = 1.60; 95% CI 1.40-1.82) were found in men. In women, low income was associated with diabetes (OR = 1.28; 95% CI 1.12-1.46), hypertension (OR = 1.11; 95% CI 1.00-1.22), and current smoker (OR = 1.92; 95% CI 1.33-2.76), respectively.

Occupation was significantly associated with diabetes, hypertension, and hypercholesterolemia in both sexes ($p<0.001$). Lower risk for diabetes (OR = 0.57; 95% CI 0.40-0.81), and hypercholesterolemia (OR = 0.55; 95% CI 0.41-0.75) was found in agricultural

Table 2. Prevalence of major cardiovascular risk factors, by socioeconomic status

	Diabetes (%)	Hypertension (%)	Hypercholesterolemia (%)	Current smoker (%)
Men				
Education level				
Illiterate (n = 78)	14.1	62.3	55.1	40.3
Primary (n = 5,066)	14.5	41.5	51.5	39.8
Secondary (n = 1,187)	18.6	45.9	68.0	26.0
University (n = 444)	14.6	40.1	71.6	16.5
Personal income				
<5,000 Thai baht*/month (n = 4,259)	14.4	43.3	50.5	40.6
≥5,000 Thai baht*/month (n = 2,481)	16.8	40.6	64.7	27.9
Occupation				
Unemployed/house work (n = 1,348)	21.6	58.3	62.7	26.0
Agricultural class (n = 2,745)	11.4	34.8	48.5	42.9
Manual class (n = 2,293)	15.8	43.3	57.3	35.6
Non-manual class (n = 390)	17.4	35.6	74.0	22.3
Women				
Education level				
Illiterate (n = 470)	21.3	53.3	70.6	9.4
Primary (n = 10,580)	17.7	46.0	69.9	2.8
Secondary (n = 1,182)	13.1	40.4	75.8	1.4
University (n = 929)	6.9	28.0	79.2	0.1
Personal income				
<5,000 Thai baht*/month (n = 9,752)	18.3	47.0	69.6	3.2
≥5,000 Thai baht*/month (n = 3,360)	12.0	36.8	75.7	1.2
Occupation				
Unemployed/house work (n = 4,432)	22.7	54.1	75.2	2.8
Agricultural class (n = 3,308)	14.1	38.0	66.2	1.7
Manual class (n = 4,737)	14.5	43.2	70.0	3.7
Non-manual class (n = 685)	5.1	21.7	76.4	0.4

* 35 Thai baht ≈ 1 US dollar in 2009 and 33 Thai baht ≈ 1 US dollar in 2014

Table 3. Association between socioeconomic status and prevalence of major cardiovascular risk factors in men by logistic regression model*

Men	Diabetes			Hypertension			Hypercholesterolemia			Current smoker		
	Adjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value
Education level			0.015			0.096			<0.001			<0.001
Illiterate	1.52	0.72-3.17		1.39	0.80-2.41		0.94	0.55-1.63		3.05	1.67-5.54	
Primary	1.69	1.18-2.40		1.03	0.79-1.34		0.97	0.73-1.28		2.30	1.65-3.21	
Secondary	1.76	1.25-2.48		1.20	0.92-1.56		1.34	1.01-1.78		1.48	1.06-2.07	
University	1.00	-		1.00	-		1.00	-		1.00	-	
Low personal income (<5,000 Thai baht**/month)	0.89	0.75-1.05	0.164	1.05	0.93-1.20	0.418	0.81	0.72-0.92	0.001	1.60	1.40-1.82	<0.001
Occupation			<0.001			<0.001			<0.001			0.049
Unemployed/house work	1.04	0.73-1.48		1.29	0.97-1.71		0.86	0.63-1.17		0.88	0.63-1.22	
Agricultural class	0.57	0.40-0.81		0.89	0.67-1.17		0.55	0.41-0.75		1.01	0.73-1.39	
Manual class	0.74	0.53-1.05		1.19	0.91-1.57		0.76	0.56-1.02		1.12	0.82-1.54	
Non-manual class	1.00	-		1.00	-		1.00	-		1.00	-	

* Adjusted for age, geographic area, and all other socioeconomic indicators
** 35 Thai baht ≈ 1 US dollar in 2009 and 33 Thai baht ≈ 1 US dollar in 2014

Table 4. Association between socioeconomic status and prevalence of major cardiovascular risk factors in women by logistic regression model*

Women	Diabetes			Hypertension			Hypercholesterolemia			Current smoker		
	Adjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value
Education level			0.002			0.011			<0.001			<0.001
Illiterate	1.81	1.20-2.75		1.03	0.77-1.39		0.49	0.35-0.69		97.22	9.90-954.45	
Primary	1.73	1.22-2.47		1.31	1.04-1.65		0.74	0.56-0.98		33.34	3.48-319.52	
Secondary	1.35	0.93-1.96		1.18	0.93-1.51		0.76	0.57-1.01		16.26	1.72-153.50	
University	1.00	-		1.00	-		1.00	-		1.00	-	
Low personal income (<5,000 Thai baht**/month)	1.28	1.12-1.46	<0.001	1.11	1.00-1.22	0.047	0.98	0.88-1.09	0.707	1.92	1.33-2.76	<0.001
Occupation			<0.001			<0.001			<0.001			0.466
Unemployed/house work	2.30	1.47-3.60		1.80	1.38-2.35		1.42	1.05-1.91		0.35	0.09-1.39	
Agricultural class	1.42	0.90-2.25		1.49	1.13-1.96		1.09	0.80-1.48		0.33	0.08-1.34	
Manual class	1.68	1.07-2.64		1.65	1.26-2.16		1.26	0.94-1.70		0.37	0.09-1.45	
Non-manual class	1.00	-		1.00	-		1.00	-		1.00	-	

* Adjusted for age, geographic area, and all other socioeconomic indicators
** 35 Thai baht ≈ 1 US dollar in 2009 and 33 Thai baht ≈ 1 US dollar in 2014

class in men (Table 3), whereas higher risk for diabetes (OR = 2.30; 95% CI 1.47-3.60), hypertension (OR = 1.80; 95% CI 1.38-2.35), and hypercholesterolemia (OR = 1.42; 95% CI 1.05-1.91) were found in unemployed/house work in women (Table 4).

Discussion

In this community-based cross-sectional study, performed in Thai general population (n = 19,997) aged 45 to 80 years, enrolled from five geographic regions of Thailand, showed that socioeconomic status was significantly associated with the prevalence of major risk factors of stroke. Among three indicators of socioeconomic status, education had a more consistent association with the risk factors, particularly in women. Education was inversely associated with diabetes, and current smoker in both sexes, and with hypertension in women. By contrast, education was positively associated with hypercholesterolemia in women; hypercholesterolemia was more prevalent in university level. The effects of personal income and occupation varied in both sexes. For example, occupation was positively associated with diabetes and hypercholesterolemia in men, whereas inverse associations of occupation with diabetes and hypercholesterolemia were found in women. These findings suggested that education seemed to be the most important of the three socioeconomic indicators in association to cardiovascular risk factors, these are in concordance with other studies[11,18-20], which showed that education was more strong and consistently associated with cardiovascular risk factors than income and occupation. These observations might be because information on education is usually fixed after adulthood, has lower rate of misclassification bias compared with income and occupation[9,21], resulting in better estimation of the associations of SES with risk factors by using education as socioeconomic indicator.

Data from the developed countries show an inverse association between SES and diabetes, hypertension, hypercholesterolemia, smoking[9,22]. However, data from developing countries are less consistent[10]. Increased prevalence of diabetes was observed in Hong Kong (China) among men and women in the lower SES group[23], whereas in other developing countries, diabetes is more prevalent among individuals of higher SES than among those of lower SES[10]. In Indonesia, hypertension appears to be most prevalent in the urban population and in the richest income quintile of the rural population[24]. In India,

hypertension (women only) is more prevalent in higher SES[12].

By contrast, study from Malaysia revealed that hypertension was inversely associated with education and income, that is, more prevalence of hypertension was found in lower SES group[25]. For hypercholesterolemia, a study from Hong Kong found no significant association between total cholesterol level and education or occupation[23], whereas in China, those with more education were found to have significant higher low density lipoprotein (LDL) cholesterol than those with less education[26]. Regarding smoking, previous studies from Brazil, China, India, South Africa, Viet Nam, Central America[10], and Thailand[14,15] showed an inverse relationship, that is, the prevalence of smoking in low SES group was higher than among high SES group. In the present study, inverse associations of education with diabetes and current smoker were found in both sexes. In women, education was also inversely associated with hypertension. On the other hand, positive association of education with hypercholesterolemia was found in women. However, in men, association between education and hypercholesterolemia was not consistent, that is, illiterate and primary seem to be positively associated with hypercholesterolemia, but no statistical significance, whereas secondary was significantly inversely associated with hypercholesterolemia. These observed interpopulation differences in the direction of associations between SES and the risk factors may be due to difference in culture and lifestyle as well as the stage of epidemiological transition[27]. The direction of these associations seemed to depend on the length of time since the industrialization and affluence of a society[21,27]. In socioeconomically primitive societies, chronic disease risk factors such as diabetes, hypertension, hypercholesterolemia, and smoking are more in high SES subjects[27]. With social and economic development and ongoing epidemiological transition in the countries, the risks factors become more prevalent among the lower SES subjects[27].

Strengths of the study include its large sample size and enrollment of participants from the general population in five regions around Thailand rather than a selected population.

Assessments of all participants were performed by well-trained personnel using standardized protocol. However, the study had some limitations. Participants were recruited on a voluntary basis, so the study sample was not established by random sampling; nonetheless, it covers all major demographic strata of

the Thai general population aged 45 to 80 years[4]. Finally, given its cross-sectional nature, the study was inherently limited in its ability to elucidate causal relationships between exposures and outcomes.

In conclusion, SES was associated with major risk factors of stroke. Among three indicators of SES, education seemed to be the most important, which was significantly inversely associated with diabetes, and current smoker in both sexes, and with hypertension in women. By contrast, education was significantly positively associated with hypercholesterolemia in women. The associations were less consistent in men. These finding are likely to be very important in the development of policies or tailored strategies for prevention of stroke.

What is already known on this topic?

Knowledge of existing disparities in stroke risk factors burden is important for effective stroke prevention and management, particularly in terms of identifying subgroup of individuals at high risk for appropriate interventions. While there is abundant evidence for the existence of an inverse relationship between SES and cardiovascular risk factors in developed countries, with only few exceptions, very little research has been conducted in developing countries. In Thailand, a previous study showed that level of income, but not education, was inversely related to prevalent hypertension, and education was inversely related to hypertension incidence. Smoking prevalence among male is inversely associated with education and job levels. However, there are still limited data on the association between socioeconomic status and major risk factors for stroke in Thailand.

What this study adds?

The present study demonstrated that education had a more consistent association with the major risk factors of stroke compared with personal income and occupation, particularly in women. Education was inversely associated with diabetes, and current smoker in both sexes, and with hypertension in women. In contrast, education was positively associated with hypercholesterolemia in women. The associations were less consistent in men. These finding were likely to be very important in the development of policies or tailored strategies for prevention of stroke.

Potential conflicts of interest

None.

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ความสัมพันธ์ระหว่างสถานะทางเศรษฐกิจและสังคมกับปัจจัยเสี่ยงหลักของโรคหลอดเลือดสมอง: โครงการศึกษาระบาดวิทยาโรคหลอดเลือดสมองในประเทศไทย

บุญชัย พิพัฒน์วนิชกุล, สุชาติ หาญไชยพิบูลย์กุล, พิมพ์ชนก พุฒขาว, ทัศนีย์ ตันติฤทธิศักดิ์, สมชาย โตวณะบุตร

วัตถุประสงค์: เพื่อศึกษาความสัมพันธ์ระหว่างสถานะทางเศรษฐกิจและสังคม (ระดับการศึกษา รายได้ส่วนบุคคล และอาชีพ) กับปัจจัยเสี่ยงหลักสี่ชนิดของโรคหลอดเลือดสมองซึ่งได้แก่ เบาหวาน ภาวะความดันโลหิตสูง ภาวะคลอเลสเตอรอลในเลือดสูง และการสูบบุหรี่

วัสดุและวิธีการ: โครงการศึกษาระบาดวิทยาโรคหลอดเลือดสมองในประเทศไทยเป็นโครงการศึกษาในชุมชนชนิดติดตามไปข้างหน้าซึ่งได้รวบรวมอาสาสมัครที่เป็นประชากรทั่วไปจาก 5 พื้นที่ของประเทศ การศึกษาวิเคราะห์ในครั้งนี้ได้ใช้ข้อมูลการสำรวจสถานะสุขภาพของอาสมัครจำนวน 19,997 คน (ชาย 6,803 คน และ หญิง 13,194 คน) ที่มีอายุตั้งแต่ 45-80 ปี มาวิเคราะห์ในลักษณะภาคตัดขวาง โดยได้วิเคราะห์ประมาณความสัมพันธ์ระหว่างสถานะทางเศรษฐกิจและสังคมกับปัจจัยเสี่ยงหลักของโรคหลอดเลือดสมองโดยใช้สถิติ *multiple logistic regression analysis*

ผลการศึกษา: สถานะทางเศรษฐกิจและสังคมมีความสัมพันธ์กับปัจจัยเสี่ยงหลักของโรคหลอดเลือดสมอง โดยในบรรดา 3 ตัวชี้วัดสถานะทางเศรษฐกิจและสังคมนั้น พบว่าระดับการศึกษามีความสัมพันธ์กับปัจจัยเสี่ยงหลักของโรคหลอดเลือดสมองที่ชัดเจนคงเส้นคงวา *(consistency)* กว่ารายได้ส่วนบุคคลและอาชีพโดยเฉพาะอย่างยิ่งในกลุ่มเพศหญิง โดยระดับการศึกษามีความสัมพันธ์เชิงผกผันกับเบาหวาน *(p = 0.015* ในเพศชาย และ *0.002* ในเพศหญิง ตามลำดับ) และการสูบบุหรี่ในทั้งสองเพศ *(p<0.001)* และกับภาวะความดันโลหิตสูงในเพศหญิง *(p = 0.011)* ในขณะที่ระดับการศึกษามีความสัมพันธ์เชิงบวกกับภาวะคลอเลสเตอรอลในเลือดสูงในเพศหญิง *(p<0.001)*

สรุป: ความแตกต่างกันของความชุกของปัจจัยเสี่ยงหลักของโรคหลอดเลือดสมองในระหว่างกลุ่มของสถานะทางเศรษฐกิจและสังคมที่แตกต่างกันมีความสำคัญ และควรนำมาเป็นประเด็นในการพิจารณาเพื่อกำหนดนโยบาย และยุทธวิธีที่เฉพาะเจาะจงในการป้องกันโรคหลอดเลือดสมอง