

นิพนธ์ต้นฉบับ

Original Article

Health Literacy on Diabetes and Hypertension and Health Behavior among the Elderly in the Upper Central Region of Thailand

Sawanya Siriphakhamongkhon

Faculty of Liberal Arts (Public Health), Krirk University

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Abstract

The increasing number of elderly are more likely to experience chronic diseases, which can have a significant impact on their quality of life. This study investigated the factors related to health literacy and behaviors in the elderly and developed a model of the causal relationship that influences health behaviors. A mixed-methods approach, Exploratory Sequential Design, was used, consisting of a qualitative study with twelve key informants and a cross-sectional survey with 400 participants aged 60–79 years. The key informants reported practicing good health behaviors daily, and they were able to adjust and evaluate their health literacy to improve their health. The survey results showed that health literacy, beliefs and attitudes, received media, education, status, knowledge, income, health history, and neighborhood were all positively associated with health behaviors at a significant level. The developed model showed that health literacy had a direct effect of 58.0% on health behavior, while knowledge, beliefs and attitudes had an indirect effect of 26.0%. All variables in the model could explain 33% of the variance in health behavior. The model was also statistically significant ($\chi^2 = 45.757$, $P = 0.055$, $DF = 32$, $CMIN/DF = 1.430$, $RMR = 0.167$, $GFI = 0.980$, $AGFI = 0.960$, $RMSEA = 0.033$). These findings suggest that health literacy is an important factor in promoting healthy behaviors in the elderly. The developed model can be used to guide interventions that target the relevant factors to improve health outcomes in this population.

Correspondence: Sawanya Siriphakhamongkhon

E-mail: siri.sawanya@gmail.com

ความรอบรู้โรคเบาหวานและความดันโลหิตสูง และ พฤติกรรมสุขภาพ ของผู้สูงอายุ เขตภาคกลางตอนบน ประเทศไทย

สวรยา สิริคมงคล

คณะศิลปศาสตร์ สาขาสาธารณสุขศาสตร์ มหาวิทยาลัยเกริก

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บทคัดย่อ

การเพิ่มจำนวนผู้สูงอายุทำให้ปัญหาโรคเรื้อรังมีแนวโน้มเพิ่มขึ้น วัตถุประสงค์การวิจัยสองประการ คือ เพื่อทดสอบความสัมพันธ์ของปัจจัยกับความรอบรู้และพฤติกรรมสุขภาพ และ วิเคราะห์ความสัมพันธ์เชิงโครงสร้างที่มีอิทธิพลต่อพฤติกรรมสุขภาพของผู้สูงอายุ รูปแบบการวิจัยผสานวิธีแบบแผนขั้นตอนเชิงสำรวจ ประกอบด้วย การวิจัยเชิงคุณภาพเก็บข้อมูลจากผู้ให้ข้อมูลสำคัญเป็นผู้สูงอายุที่มีสุขภาพแข็งแรง จำนวน 12 คน ด้วยวิธีการสัมภาษณ์อย่างแบบอ้างอิงด้วยบุคคลและผู้เชี่ยวชาญ เก็บข้อมูลด้วยการสนทนากลุ่ม และสัมภาษณ์เชิงลึก 3 คนจาก 12 คน ร่วมกับการสังเกตแบบไม่มีส่วนร่วม เครื่องมือที่ใช้เป็นทั้งโครงสร้างประกอบด้วย 3 ประเด็น 14 ข้อคำถาม สำหรับการศึกษาแบบตัดขวาง เครื่องมือเป็นแบบสัมภาษณ์ประกอบด้วย 52 ข้อ ประกอบด้วย ความเชื่อและทัศนคติ, ความรู้ และ พฤติกรรม อย่างละ 10 ข้อ และ ความรอบรู้ 12 ข้อ สุ่มตัวอย่างแบบหลายขั้นตอน กลุ่มตัวอย่างจำนวน 400 คนอายุระหว่าง 60-79 ปี เก็บรวบรวมข้อมูล ระหว่างเดือน พฤษภาคม ถึง กันยายน 2565 วิเคราะห์ข้อมูลด้วย วิเคราะห์เนื้อหา สถิติเชิงพรรณนา และ เชิงวิเคราะห์ ด้วยสมการเชิงโครงสร้าง ผลการศึกษา พบว่า 1) ผู้ให้ข้อมูลสำคัญ พฤติกรรมสุขภาพดีทุกวันการบริโภคอาหาร การออกกำลังกาย การดื่มแอลกอฮอล์และสูบบุหรี่สามารถประยุกต์และประเมินผลทักษะความรอบรู้ระดับสุขภาพตนเอง 2) ปัจจัยที่มีความสัมพันธ์ทางบวกกับพฤติกรรมสุขภาพของผู้สูงอายุ ได้แก่ ความรอบรู้(0.39) ความเชื่อและ ทัศนคติ(0.26) การได้รับสื่อ(0.21) จำนวนปีที่ศึกษา(0.14) สถานภาพสมรส(0.12) ความรู้เรื่องโรค(0.10) รายได้ (0.09) ประวัติสุขภาพ(0.09) และความสัมพันธ์ทางลบคือ เขตที่อยู่อาศัย(-0.13) ที่ระดับนัยสำคัญทางสถิติ (p -value < 0.05 0.01 0.001) 3) รูปแบบความสัมพันธ์เชิงสาเหตุต่อพฤติกรรมสุขภาพผู้สูงอายุพบว่า ความรอบรู้ ส่งผลทางตรง ร้อยละ 58.0 และ ความรู้ ความเชื่อและทัศนคติและความรอบรู้ส่งผลทางอ้อม ร้อยละ 26.0 ตามลำดับ ภาพรวมสามารถอธิบายรูปแบบความสัมพันธ์เชิงสาเหตุได้ร้อยละ 33.0 โมเดลมีความสอดคล้องกับข้อมูลเชิงประจักษ์ที่ $\chi^2=45.757$, $P = 0.055$ $DF = 32$, $CMIN/DF = 1.430$, $RMR = 0.167$, $GFI = 0.980$, $AGFI = 0.960$, $RMSEA = 0.033$ หน่วยงานที่เกี่ยวข้อง ควรนำผลที่ได้จากการวิจัยมาพัฒนารูปแบบการปรับเปลี่ยนพฤติกรรมสุขภาพของผู้สูงอายุ ด้วยการจัดลำดับความสำคัญการดำเนินงานตามปัจจัยจากการศึกษาครั้งนี้

ติดต่อผู้พิมพ์: สวรยา สิริคมงคล

อีเมล: siri.sawanya@gmail.com

Keywords	คำสำคัญ
Health Literacy	ความรู้ด้านสุขภาพ
Health Behavior	พฤติกรรมสุขภาพ
Diabetes and Hypertension	เบาหวานและความดันโลหิตสูง
the Elderly	ผู้สูงอายุ

Introduction

The aging population is a global phenomenon caused by declining mortality, increasing life expectancy, and declining birth rates.⁽¹⁾ In ASEAN countries, Singapore has the highest proportion of elderly people (19.9%), followed by Thailand (18.5%). The trend of rapid population aging is particularly evident in the number of people aged eighty and over. In Thailand, the number of elderly in this age group was 1.3 million in 2019 and is projected to reach 3 million by 2039. Thailand entered the stage of full population aging in 2020, with the proportion of the population aged sixty and over exceeding 20.0%.⁽²⁻³⁾ The aging population has led to a deterioration of health, as evidenced by declining physical condition, impaired organ function, and unhealthy lifestyles from adolescence that lead to chronic diseases such as hypertension and diabetes.

According to a survey on the health status of the elderly between 2002 and 2017, the number of cases of hypertension and diabetes increased by 1.7 and 2 times, respectively.⁽⁴⁾ This has led to a significant increase in healthcare costs, amounting to 79,263 and 47,596 million baht per year, respectively.⁽⁵⁾ In the Regional Health Office 3, which includes the provinces of Nakhon Sawan, Phichit, Kamphaeng Phet, Chai Nat, and Uthai Thani, the prevalence rate of diabetes among older adults has been consistently high from 2017 to 2021, at 20.45%, 19.11%, 19.48%, 19.91%, and 20.45%, respectively. Moreover, the prevalence rate of hypertension has increased sharply during the same period, from 49.28% to 50.44% to 51.24% to 52.20% to 53.06%, respectively⁽⁶⁾.

Previous studies have not provided a clear answer to the problem of the increasing number of elderly patients with hypertension and diabetes. However, a previous systematic review study found that health literacy is the individual's ability to obtain and understand knowledge and information to maintain and improve health in a way that is appropriate to the individual and their situation. Health literacy consists of three important components: knowledge of health and health systems, the ability to evaluate and use various health-related information, and the ability to manage one's health and follow the advice of healthcare professionals.⁽⁷⁾

This study is based on Sørensen et al.'s concept of health literacy, which includes four components: the ability to access health information and data, understand information on health risk factors, evaluate information on health risk factors, and apply health information to develop and

maintain continuous health improvement.⁽⁸⁾ The Health Systems Research Institute's report on the health literacy of the Thai population aged fifteen and older in 2019 found that the average health literacy score was 65%, with older people having the highest level of inadequate health literacy at 39.8%. Age was the most critical factor associated with low health literacy, with those aged sixty and over having the lowest level of knowledge.⁽⁹⁾

Studies have found a positive significant association between health literacy and health status in older adults with chronic diseases.⁽¹⁰⁻¹¹⁾ Moreover, elderly people with chronic illnesses are more likely to have low health literacy than those without chronic illnesses.⁽¹²⁻¹³⁾ To date, no research has been conducted on health literacy regarding diabetes and hypertension in the elderly in the upper central region of Thailand. The findings of this study will be used to develop guidelines for improving knowledge of diabetes, hypertension, and health behavior modifications among the elderly in this region. This mixed-methods study has two aims: 1) to examine the factors associated with health literacy and behavior, and 2) to analyze a causal relationship model that influences health behavior among the elderly in the upper central region of Thailand.

Methodology

Study design and participants

This exploratory sequential mixed-methods study began with a quantitative phase to investigate the daily health lifestyles, information-seeking behaviors, health-promoting practices, and family and social support of older adults. The results of this phase were used to design a subsequent quantitative study. The qualitative phase investigated the relationships between the variables related to diabetes and hypertension and health behaviors among the elderly. Data collection was conducted through three methods: in-depth interviews with 3 individuals out of 12 participants, group discussions with 12 participants, and non-participatory observations to cross-validate the data collected. The selection of the key informants was based on the following criteria: Thai older adults range age between 60 and 79 years old, living in the target area for at least 1 year, being able to complete activities of daily living by themselves, and being members of the elderly club. The snowball sampling technique was the method for the inclusion of participants; these healthy individuals gave the details of other healthy individuals that they knew, then continued to tap as many healthy individuals as possible through the reference provided till collected enough data.

Next, the quantitative data collection focused on the elderly population in the upper central region. The data, obtained in 2020 from the Department of Local Administration, Ministry of Interior, consists of five provinces: Chai Nat, Kamphaeng Phet, Phichit, Uthai Thani, and Nakhon Sawan. The total population of these provinces was 605,038 individuals. The data analysis was

performed using Structural Equation Modeling (SEM). SEM requires a large and appropriate sample size. The sample size must be greater than twenty times the number of variables in the model.

For this research, there were ten observable variables in the model. This resulted in a total sample size of approximately two hundred individuals. Additionally, the multistage cluster random sampling method was used. A sample size adjustment was made using a Design effect (Deff) of 2. This resulted in a total sample size of four hundred people. The detail of 5-stage simple random sampling was stage1:selecting 3 from 5 provinces(Kamphaeng Phet, Nakhon Sawan, and Uthai Thani provinces), stage 2: selecting 2 districts in each province(6 districts), stage 3: selecting 2 subdistricts in each district (12 subdistricts), stage 4: selecting 4 villages in each subdistrict (48 villages), and stage5: selecting older adults from name listing (Kamphaeng Phet(126 persons), Nakhon Sawan (209 persons)and Uthai Thani provinces (65persons).

The criteria for inclusion of volunteer participants for the project were as follows: Thai elderly individuals aged between 60 and 79 years old, residing in the target area being conducted for at least 1 year, and having received two doses of the COVID-19 vaccine. The criteria for excluding volunteers were people with mental health issues, intellectual disabilities, and serious illnesses who could not provide information.

Research instrument and variables

The qualitative data collection aimed to collect the state of daily health lifestyle among older adults using quantitative approaches, examine the relationships between the measured variables, and determine the causal relationships between variables. It was collected through three methods: 1) in-depth interviews with 3 individuals out of 12 persons, 2) group discussions with 12 participants, and 3) non-participatory observations to cross-validate the collected data. The tools were semi-structured interview questionnaires and observation forms. The details consisted of 3 items and 14 questions: daily health lifestyle, receiving information media, the practices for improving their health behavior, and family and social support. The data collection was concluded when the obtained information converged on the same issues and there was no more new data. The tool of quantitative data was an interview that was divided into 5 sections. Consisting of 52 items; section 1 included socio-demographic factors such as age, gender, education, marital status, occupation, socioeconomic status, chronic illnesses, and previous knowledge about diabetes and hypertension. Section 2 focused on beliefs and attitudes toward diabetes and hypertension. The scoring ranged from 10 to 40 points. Section 3 evaluated knowledge about diabetes and hypertension, with scoring criteria of 1 point for correct answers and 0 points for incorrect or unknown answers. Section 4 assessed the level of health literacy about diabetes and hypertension, and Section 5 examined the health behaviors related to diabetes and hypertension at the individual, family, community, and societal levels. The scoring ranged from 10 to 40 points. The average score of the two sections was used to

measure the level of health behavior. The validation of the tests was approved for their content validity by five experts and reliability by a tryout of 80 persons who were characteristically like the sample group. The item objective congruence ranged in value from 0.80 to 1.00. In addition, the analysis was performed using the Cranach alpha method. The reliability coefficient of the interview varied between 0.80 and 0.84.

Data analysis

Data was collected from May 25 to September 30, 2022. Qualitative and quantitative data were analyzed using content analysis, descriptive statistics, and inferential statistics. Pearson's correlation coefficient and structural equation modeling (SEM) were used to examine the relationships between the measured variables and determine the causal relationships between variables. SEM was used after all relevant assumptions were met. The fit of the hypothesized model was evaluated using several criteria, including the chi-square test (χ^2 , $p > 0.05$), the normed chi-square (χ^2/df) with a desired range of 2–5, the root mean square error of approximation (RMSEA) ≤ 0.05 , the comparative fit index (CFI) ≥ 0.90 , the normed-fit index (NFI) ≥ 0.90 , the standardized root mean square residual (SRMR) ≤ 0.05 , and the goodness-of-fit index (GFI) ≥ 0.90 . Statistical significance was set at $p < 0.05$ for all analyses.

Ethical consideration

The ethical approval for the mixed-method study was granted by the Department of Disease Control Human Research Ethics Board (project code: FWA 00013622) on March 9, 2022.

Results: the research findings can be summarized as follows.

1) Qualitative results for designing quantitative research.

Twelve individuals (six women and six men) participated in the study. They had an average age of 64 years with a range from 60 to 72 years. The themes of coping with their daily health lifestyle, getting health information and improving their health behavior, and receiving health support from their families and community emerged through the conversations with twelve older adults and the following transcribing and content analysis. Daily Health Lifestyle: the elderly manage their lifestyles properly regarding food consumption and exercise. Overall, they did not drink alcoholic beverages or smoke cigarettes. Only one man still drinks a bit of alcoholic beverages with his friends, while his friends come to his house, but he does not drink while driving a car. "I start with eating one or two pieces of bananas and drinking one or two glasses of warm water." "Both breakfast and lunch, I always eat common foods such as boiled vegetables, and steamed fish, with one or two plates of rice." "In the evening, I eat fruit salad, a cup of milk, or two spoons of rice with boiled vegetables and chili sauce, without monosodium glutamate." "I always have activity

around 30 minutes to one hour for exercise every day.” “We have activities in different ways based on their experience such as working in their farms or houses, riding a bicycle, walking, doing yoga, or doing exercise with equipment.” “The main reason why we always do exercise is because I want to stay healthy.” “Only 2 of us used to drink alcohol and smoke cigarettes.” “One of them has given up smoking and drinking alcoholic beverages and the other is still drinking a bit of alcohol when his friends came home.” “He does not drink, while he is driving a car.” Receiving information media and improving their health behavior: the healthy participants were able to search for health information from many data sources such as personal media (healthcare workers, village health volunteers, or their sons) or social media (television, internet, Line, and YouTube) and printing media (book, posters, or brochures). Moreover, they had the skills to analyze, evaluate, and make decisions regarding health media with their families and neighbors. “I received knowledge by asking healthcare workers, and village health volunteers.” “After receiving social media from Line or YouTube, I usually confirm it again from healthcare workers or village health volunteers.” I always watch the Health Care Television Program and talk to my family and friends.” “I believe only media from reliable sources and be careful of Fake News.” Family and Social Support; overall participants have good relationships with their families and neighborhood, so they always communicate about their health status and apply to practice properly to their daily lives. “I usually complain about my health with my family when I have some questions.” “If I have an illness such as headache, or fever, I will go to consult health care workers.” Since the COVID-19 outbreak in my community, I have received more health information from the neighborhood and village health volunteers, and persuaded me to be interested in myself more and more.”

2)The characteristics of the samples

The demographic data of the sample showed that 67.0% of participants were female, 67.3% were aged 60–69 years (mean = 67.0, SD $\pm$ 4.74), 84.0% had an elementary school education (mean = 4.0, SD $\pm$ 2.65), 65.7% were married, 67.3% were working in agriculture (46.3%), the labor force (12.3%), or as merchants (8.8%), 76.8% had an adequate monthly income, and 71.0% were living with chronic diseases, such as diabetes (37%) and hypertension (54.0%). Participants had high levels of knowledge (mean = 6.70, SD $\pm$ 2.12) and agree levels of attitude (mean = 31.9, SD $\pm$ 3.95). However, older adults had slightly lower health literacy (mean = 31.11, SD $\pm$ 6.73). Considering age groups, education, marital status, and chronic diseases, the majority of the sample who had a high level of knowledge, strongly agreed attitude, and excellent level of health literacy were aged 60–69 years (37.9%, 30.5%, and 10.8%, respectively), had secondary education or higher (58.1%, 35.5%, and 12.9%, respectively), were married (44.1%, 30.4%, and 12.6%, respectively), and had chronic diseases (39.8%, 30.3%,

and 11.6%, respectively). While gender, 40.2% of males had a high level of knowledge, 47.0% had an agreed level of attitude, and 26.5% had a sufficient level of health literacy. Considering occupation, workers had a high level of knowledge (39.8%), while unemployed participants had a strongly agreed attitude (40.5%) and an excellent level of health literacy (11.5%). Regarding income, inadequate income samples had a high level of knowledge and strongly agreed attitude (44.1% and 30.1%, respectively), while adequate income samples had excellent levels of health literacy (10.1%). The details are presented in Table 1.

3) The associated factors with health literacy and behavior

Factors such as health literacy (0.39), belief and attitude (0.26), media (0.21), education(0.14), status(0.12), knowledge(0.10), income(0.09), and health history(0.09) and area of residence(-0.13) were positively and negatively associated with health behavior at a significant level ($p < 0.05, 0.01, 0.001$). Factors such as sex, age, and occupation were not associated with health behavior. The details are presented in Table 2.

Table1. Characteristics of Samples Stratified by Knowledge, Attitude & Health Literacy Level

Characteristic	Knowledge Level (n=400) (%)			Attitude Level (n=400) (%)			Health Literacy Level (n=400)(%)			
	LOW	MEDIUM	HIGH	NOT AGREE	AGREE	STRONGLY	INADEQUATE	PROBLEMATIC	SUFFICIENT	EXCELLENT
	(0.0 – 50.0%)	(51.0– 75.0%)	(76.0 – 100.0%)	($\bar{X}$ =1.00– 1.66)	($\bar{X}$ =1.67– 2.33)	AGREE	($\bar{X}$ =1.00–1.75)	($\bar{X}$ =1.76 – 2.50)	($\bar{X}$ =2.51 – 3.25)	($\bar{X}$ =3.26 – 4.00)
	n=109 (%)	n= 141 (%)	n=150 (%)	n=118 (%)	n=165 (%)	($\bar{X}$ =2.34–3.00)	n=24 (%)	n=228 (%)	n=108 (%)	n=40 (%)
						n= 117(%)				
SEX										
Male	29 (22.0%)	50(37.9%)	53(40.2%)	35(26.5%)	62(47.0%)	35(26.5%)	3(2.3%)	82(62.1%)	35(26.5%)	12(9.1%)
Female	80(29.9%)	91(34.0%)	97(36.2%)	83(31.0%)	103(38.4%)	82(30.6%)	21(7.8%)	146(54.5%)	73(27.2%)	28(10.4%)
Age (Year)										
60–69	73(27.1%)	94(34.9%)	102(37.9%)	81(30.1%)	106(39.4%)	82(30.5%)	15(5.6%)	153(56.9%)	72(26.8%)	29(10.8%)
70–79	36(27.5%)	47(35.9%)	48(36.6%)	37(28.2%)	59(45.0%)	35(26.7%)	9(6.9%)	75(57.3%)	36(27.5%)	11(8.4%)
Education										
Uneducated	20(57.1%)	9(25.7%)	6(17.1%)	13(37.1%)	11(31.4%)	11(31.4%)	9(25.7%)	19(54.3%)	5(14.3%)	2(5.7%)
Elementary	86(25.7%)	122(36.5%)	126(37.7%)	101(30.2%)	138(41.3%)	95(28.4%)	13(3.9%)	195(58.4%)	92(27.5%)	34(10.2%)
Secondary- higher	3(9.7%)	10(32.3%)	18(58.1%)	4(12.9%)	16(51.6%)	11(35.5%)	2(6.5%)	14(45.2%)	11(35.5%)	4(12.9%)
Marital Status										
Married	55(20.4%)	96(35.6%)	119(44.1%)	69(25.6%)	119(44.1%)	82(30.4%)	14(5.2%)	147(54.4%)	75(27.8%)	34(12.6%)
Single/widowed	54(41.5%)	45(34.6%)	31(23.8%)	49(37.7%)	46(35.4%)	35(26.9%)	10(7.7%)	81(62.3%)	33(25.4%)	6(4.6%)
Occupation										
Workers	72(26.8%)	90(33.5%)	107(39.8%)	83(30.9%)	122(45.4%)	64(23.8%)	11(4.1%)	157(58.4%)	76(28.3%)	25(9.3%)
Unemployed	37(28.2%)	51(38.9%)	43(32.8%)	35(26.7%)	43(32.8%)	53(40.5%)	13(9.9%)	71(54.2%)	32(24.4%)	15(11.5%)
Income										
inadequate	29(31.2%)	23(24.7%)	41(44.1%)	31(33.3%)	34(36.6%)	28(30.1%)	7(7.5%)	54(58.1%)	23(24.7%)	9(9.7%)
adequate	80(26.1%)	118(38.4%)	109(35.5%)	87(28.3%)	131(42.7%)	89(29.0%)	17(5.5%)	174(56.7%)	85(27.7%)	31(10.1%)
Chronic disease										
Yes	72(25.4%)	99(34.9%)	113(39.8%)	85(29.9%)	113(39.8%)	86(30.3%)	18(6.3%)	149(52.5%)	84(29.6%)	33(11.6%)
No	37(31.9%)	42(36.2%)	37(31.9%)	33(28.4%)	52(44.8%)	31(26.7%)	6(5.2%)	79(68.1%)	24(20.7%)	7(6.0%)

Table 2. Mean, standard deviation, and Spearman's and Pearson's correlation coefficients for health literacy and behavior (n = 400)

Factors	Mean	S.D.	Correlation Coefficients	
			Health literacy	Health behavior
Health behavior	28.43	5.655	0.39***	1.00
Health literacy	31.11	6.729	1.00	0.39***
Beliefs & attitudes	31.91	3.949	0.27***	0.26***
Media(received=1)	0.80	0.398	0.11**	0.21***
Education	4.41	2.651	0.27***	0.14**
Status(married=1)	0.68	0.469	0.15***	0.12**
Knowledge	6.71	2.125	0.23***	0.10*
Income(adequate=1)	0.77	0.423	0.12**	0.09*
Health history (healthy=1)	0.29	0.454	-0.02	0.09*
Area of residence				
(outside municipality=1)	0.85	0.355	-0.12**	-0.13**
Sex(male=1)	0.33	0.047	0.07	-0.04
Age	67.70	4.742	-0.05	-0.01
Occupation(unemployed=1)	0.33	0.470	-0.07	0.06

*P < 0.05, **P < 0.01, ***P < 0.001

4) A causal relationship model that influences health behavior among the elderly in the central region upper region of Thailand.

The independent variables were knowledge, beliefs and attitudes, and health literacy. The dependent variable was health behavior, which was assessed by interviews created by researchers. The development model was the result of the analysis of the observed data compared to the analytic model. To understand the results, show the meaning of the symbolism and variables in this model, as follows:

Symbolic instant value statistic: n =the number of samples, χ^2 = Chi-Square, DF = Degree of Freedom

P = Signification level, GFI= Goodness of Fit Index, AGFI=Adjusted Goodness of Fit Index,

RMR= Root of Mean Square Residual, CMIN/DF = Relative Chi-Square, RMSEA = Root Mean Square Error of Approximate

Symbolic instant variables:  Latent Variables  Observed Variables

K = Knowledge , K1= cause of disease , K2=complication , K3=prevention & treatment

B&A=Beliefs & Attitudes , B&A1=consumption ,B&A2=alcohol& cigarette ,

B&A3=take care themselves& their families

HL=Health literacy, HComAcce=access/understand , HEvaApp=evaluation/application

HB = Health behavior , HBPrevent = prevention, HBProtect = protection , HBSupport = support

The results of a causal relationship model with confirmatory factor analysis showed that the knowledge component was influenced by K2, K3, and K1, with standardized regression weights of 0.53, 0.51, and 0.33, respectively. The beliefs and attitudes component was influenced by B&A1, B&A3, and B&A2, with standardized regression weights of 0.83 and 0.57, respectively. The health literacy component was influenced by HEvaApp and HComAcce, with standardized regression weights of 0.95 and 0.76, respectively. The health behavior component was influenced by HBPrevent, HBSupport, and HBProtect, with standardized regression weights of 0.71, 0.64, and 0.34, respectively. The details are presented in Figure 1.

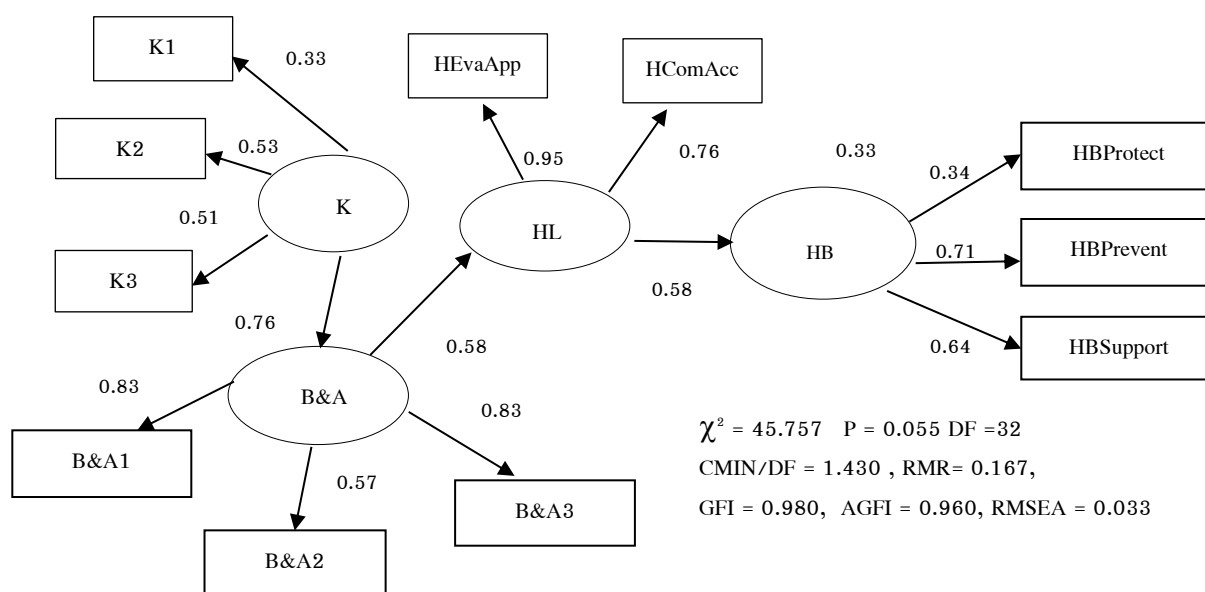


Figure 1: Causal relationship model that influences health behavior among the elderly in the central region upper region of Thailand.

The results of the causal analysis of the relationships between variables were decomposed into direct effects (DE), indirect effects (IE), and total effects (TE). The results showed that: Health literacy (HL) had a direct effect on the health behavior of the elderly (HB) 58.0%. Knowledge (K), beliefs and attitudes (B&A), and health literacy (HL) had an indirect effect on the health behavior of the elderly (HB) 26.0%. beliefs and attitudes (B&A) and health literacy (HL) had an indirect effect on the health behavior of the elderly (HB) 36.0%. Knowledge (K) had a direct effect on beliefs and attitudes about the disease (B&A) of 76.0%. beliefs and attitudes (B&A) had a direct effect on health literacy (HL) of 58.0%. Additionally, knowledge (K), beliefs and attitudes (B&A), and health literacy (HL) together predicted the health behavior of the elderly (HB) by 33%. Knowledge (K) and beliefs and attitudes (B&A) together predicted health literacy (HL) by 34%. Knowledge (K) predicted beliefs and attitudes (B&A) by 58%. The details are presented in Table 3.

Table 3. Direct effect, indirect effect, and total effect of variables in the model that have achieved a good fit with the empirical data.

Dependent variable	Independent variables								
	Knowledge			Belief & Attitude			Health literacy		
	DE	IE	TE	DE	IE	TE	DE	IE	TE
Health behavior (HB)	0.00	0.26	0.26	0.00	0.36	0.36	0.58	0.00	0.58
Belief & Attitude (B&A)	0.76	0.00	0.76	0.00	0.00	0.00	0.58	0.00	0.58
Health literacy (HL)	0.00	0.44	0.44	0.58	0.00	0.58	0.00	0.00	0.00
R ²	Health behavior (HB)			Belief & attitude(B&A)			Health literacy (HL)		
	0.33*			0.58**			0.34*		

*P-value < 0.05, **P-value < 0.01

Discussion

The older adult characteristics of this study were as follows: female, aged 60–69 with an average age of 67, completed primary education, married, residing outside municipal areas, engaged in agriculture, with sufficient but non-savings income, diagnosed with hypertension and diabetes, used to receive media about the health status, more likely the same characteristics of the health status of elderly and the well-being of the elderly in urban and rural areas of Thailand. ^(14–15)

Health literacy, beliefs and attitudes, and knowledge were the three main factors that influenced health behavior among the elderly in the upper central region of Thailand. Most of the samples had a slight level of health literacy (57%). Additionally, health literacy was associated with education, beliefs and attitudes, knowledge, marital status, income, home residence, and receiving health media. Both knowledge, beliefs and attitudes of the samples were high and strongly agreed levels such as exercise, not smoking cigarettes, or drinking alcoholic beverages, followed by treatment instructions from doctors except for the consumption of sweetmeats and sweet drinks.

The result of previous studies supported that the level of health literacy tends to decrease as age increases, due to the loss of the ability to access, understand, adopt, and evaluate health information. ⁽¹⁶⁾ Factors such as education, income, and home environment were associated with low or high levels of health literacy and behavior, which can affect their health status and longevity. ^(17–19)

Both knowledge, beliefs and attitudes were the main factors that influenced health literacy and behavior in the elderly. The increasing level of knowledge, beliefs and attitudes should likely improve the ability to access, understand, adapt, and evaluate health information for good health practices. ^(19–21)

Most of the sample sometimes practiced proper health behavior. The result of the structural equation model showed that the main direct effect was the health literacy factor (58%) on health

behavior, and the indirect effect was health literacy, beliefs, and attitudes, and knowledge factors (26%) influenced health behavior. Health literacy was the most important factor for the improvement of good health practices among the elderly, based on the concept of health literacy by Sorensen and colleagues. ⁽⁸⁾

The qualitative study, using focus group discussion and in-depth interviews with 12 key informants who live a healthy lifestyle outside the municipality, revealed commendable practices such as proper food consumption, regular exercise, abstaining from smoking and drinking, seeking, and assessing crucial health-related information, and consistent communication with their families and neighbors. Despite the challenges of living in rural areas, some elderly people still maintain a healthy lifestyle. Healthcare workers should promote and support health literacy and healthy aging coverage for every older adult and every community. Health policy agencies should adopt this model for developing health behavior among the aging population by setting health literacy as the top priority. The elderly should be trained in two crucial skills of health literacy consisting of accessing and understanding and evaluation and application skills, followed by attitudes and knowledge, based on the factors identified in this study. At present, knowledge can be searched for health benefits from social media such as Line, YouTube, Facebook, Google, ChatGPT, Bard AI, etc.

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