

Original article

The development and application of the ABCDE-health literacy scale for Thais

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Background: The 7th Global Conference on Health Promotion was held in 2009. The World Health Organization advocated focus on the development of health literacy (HL), which refers to cognitive and social skills of individuals to access, understand, and use information to promote and maintain a healthy life.

Objectives: To synthesize and develop an ABCDE (alcohol, baccy, coping, diet, and exercise) HL Scale for Thai adults, to evaluate their HL, and to determine whether the path model of HL influences health outcomes.

Methods: The synthesis used 12 research articles published in PubMed and Science Direct (1996–2013), and the participants used to test the research hypothesis were Thais aged >15 years. We selected 4,401 participants by systematic sampling, who responded to a 5-point scale for 64 items, with a Cronbach -coefficient of reliability between 0.61 and 0.91.

Results: (1) The HL scales were in a good range of factor loading from 0.326 to 0.861. (2) The overall HL of the subjects was fair for 72.0%. The health outcomes were poor for 53.5% of all participants, fair in 44.7%, and good in 1.8% percent. (3) The path model of HL that influences health outcomes was consistent with the empirical data (χ^2 27.48, with 7 degrees of freedom, $P = 0.003$, and root mean square error of approximation of 0.032).

Conclusions: We recommend application of the ABCDE-HL Scale for Thai Adults as a screening tool to develop HL using a public health promotion policy for Thai adults with low levels of HL.

Keywords: Health behavior, health literacy, health outcome, HL scale, research synthesis

To reduce metabolic diseases, especially obesity, hypertension, and diabetes, it is imperative to focus on promoting positive cognitive and behaviors by encouraging people to be healthy. According to the World Health Organization, about 20 million people will die from cardiovascular disease because of risk factors arising from an unhealthy life style. Improper diet, excessive energy intake, and lack of fruit and vegetable consumption, lack of exercise, increased smoking and drinking, and stress are all major causes of chronic disease [1]. A National Health and Nutrition Examination Survey (NHANES) in the USA found that the prevalence of being overweight and obesity combined (body mass index (BMI) ≥ 25) in the years 2001-2002, 2003-2004, 2005-2006, 2007-2008, and 2009-2010 were 65.7%, 66.3%, 67.0%, 68.0%, and 71.1%, respectively, with the trend increasing each year [2, 3]. In Asia, Berenji et al. [4] found that in 2009 obesity rates (BMI ≥ 30) in Saudi Arabia, Turkey,

Iran, and South Korea were 39.3%, 33.0%, 30.0%, and 14.2% of the total population in their respective countries. Worldwide, there are 1.5 billion people that suffer from hypertension and up to 7 million die from this disease every year. The International Diabetes Federation estimated that 285 million people with diabetes will increase to more than 435 million people by the year 2030. Additionally, the World Stroke Organization found that up to 6.5 million people died from stroke in 2015. Thus, stroke has become a leading cause of death for those aged >60 years [5]. In last decade in Thailand, the number of patients with hypertension had increased by 3.8-fold. In 2009, hypertension was the fourth leading cause of death for people in Thailand after cancer, accidents, and heart disease, respectively. In 2009, diabetes killed 19 people a day. Obesity and abdominal obesity is reaching epidemic proportions in all age groups and continues to increase [5]. Data from the 4th Thai Physical Health Examination in 2008 to 2009 found that nearly 3 of every 10 Thai men and 4 of every 10 Thai women were obese (BMI >25) and the prevalence of high cholesterol has increased from 15.5% to 19%. The

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Department of Health in the Ministry of Public Health based on the latest survey in 2012 found that Thai people had an over nutrition problem leading to obesity, and obesity rose 40%, followed by the age range from 40-50 years, which increased nearly 2-fold [6]. Therefore, it is imperative that Thailand focuses on prevention, and risk factor control, such as reducing smoking and alcohol drinking, improving mental health, promoting good nutrition, decreasing sugar and salt consumption, and increasing fruit and vegetable consumption, and engaging in fitness and physical activity, to control and prevent obesity, and create an environment that establishes rules and regulations to control high risk lifestyles and encourage new patterns of behavior that will develop the health skills of the Thai people and enhance their health literacy (HL). At the 7th World Health Promotion Conference October 26-30, 2009, in Nairobi, Kenya, the World Health Organization put member states on notice to focus on the development of public health knowledge, or health intelligence, with an emphasis on the cognitive and social skills that empowers individuals and enables them to access knowledge, and to understand and use the information to promote and continue to maintain a good and healthy life [7].

In Thailand, research focusing on HL has found that there are different concepts, and various dimensions and components. The Health Education Division of the Department of Health Service Support in Thailand, has sought to synthesize these concepts and components and create a tool to measure HL, to assess the level of health literacy among adults before seeing a behavioral health therapist, and enable therapists to create an effective strategy to develop HL. Therefore, the aims of this study were (1) to develop an index by which to measure the HL of Thais, (2) to evaluate the level of the HL in Thais, and (3) to investigate the causal relationship model of factors in HL that effect positive health outcomes.

Material and methods

After ethical consideration, this research was approved by the institutional review board (IRB) of Srinakharinwirot University consistent with the ethical principles for research in humans as proposed in the Declaration of Helsinki (certificate of approval No. SWUEC/E-039/2558). Written informed consent was obtained from all of the participants, or their legal guardians if they were <18 years old, before their inclusion in this study. Documented assent was

obtained from all participants who could not provide their legal consent.

This study included 4,401 people aged >15 years. The participants were selected by systematic random sampling over 2 steps, the first step with simple random sampling in a province to establish a representative pool to recruit in the 4 regions, and in each region, 3 provinces. All 12 provinces and Bangkok were included. The second step was stratification random sampling by using a quota for each province for 300-350 participants.

This research was a mixed methods study and divided the process into 3 phases.

Phase 1: The synthesis of the HL based on the concepts of ABCDE behavior using qualitative research methods focused on theoretical publications. Research was related to indices of HL. Content was analyzed as a step toward drafting a HL Index based on the concept of ABCDE behavior for risk reduction. The draft was presented to a panel of 5 HL experts for their assessment. Finally, HL data was analyzed and summarized to improve the measurement of HL in the community.

Phase 2: A methodological tool to measure HL was built and developed based on the concepts of ABCDE behavior for risk reduction. In this phase, qualitative research methods were used to synthesize the methodological tool for assessing HL. Focus groups were held for researchers with the aim of drafting and implementing a high quality methodological tool, through a process of refinement.

Phase 3: Investigation of the consistency between the causal models for measuring HL based on the concept of ABCDE behavior for risk reduction with the empirical data.

Measurement model

We created a synthesis of the HL indices used to measure changes of health behavior as published in articles cited in PubMed and Science Direct indexes between 1996 and 2013. There were 29 studies published in full text and used as the basis of the synthesis including [7-23]. We found several factors were associated with HL, and these could be separated into 3 levels as: individual level, interpersonal relationships level, and society/community level. Defining the components to measure the HL, 6 aspects were established and another 2 factors related to health outcomes based on the ideas of the WHO [24], Nutbeam [11, 18], and Edward et al. [22] were used.

This research based the structure of HL measurement and development on the principles of promoting diet, managed exercise, reducing alcohol consumption, and ceasing smoking into the ABCDE-HL Scale for Thai Adults. In which, A is for alcohol, B for baccy (smoking), C for coping, D for diet, and E for exercise as shown in **Figure 1**.

Synthesis of the HL index

1. An HL index was synthesized after a systematic literature review beginning with a review of all related research and evidence-based data through a keyword search for example, HL and model, and HL conceptual framework, using the PubMed and Science Direct databases to read the text of selected abstracts. The procedures for the research selection were as shown in **Figure 2**.

2. Tools to measure HL related to health behavior (ABCDE-HL scale) were created and developed. Beginning with qualitative research and case studies using in-depth interviews with high-risk subjects, data of those that were diagnosed with diabetes and hypertension for <5 years was combined with the results from the qualitative research together with the literature review related to HL to create a template.

3. The quality of the content analysis was checked by the 5 experts in behavioral measurement, public health, and medicine. Then, the tools were trialed with participants with chronic high risk in 4 regions with 500 participants to assess the quality, validity of results, and understanding of the questionnaire. Testing the discriminatory power of each requiring a correlation

coefficient score significant at the level of 0.05 and confidence of the KR20 coefficient and Cronbach's α greater than 0.6 and exploratory factor analysis-EFA dismissing items lower than 0.3. Subsequently adjusting the questionnaire for use as a research tool in the sample group from the 13 provinces for a total of 4,500 participants. A total of 4,401 completed questionnaires were returned (97.8%) on a confirmatory factor analysis (CFA).

4. We verified the Path Analysis Model with the health outcomes in a structural equation model (SEM) using LISREL.

Results

Results of the interviews by experts found that the participants were limited and obstructed by basic factors of, an inability to learn, a lack of awareness in the pursuit of knowledge, timidity and passivity, not asking for information when meeting medical staff, and simply accepting the information given as it related to self-care. Patients do not like to ask questions because they feel obligated to their physician, thereby missing an opportunity to gain knowledge. The research found that the health services users had basic HL and the interaction resulted in patients being unable to consistently control their blood sugar levels or high blood pressure.

The result of quality monitoring and the omission of the items of low veracity meant that the ABCDE-HL scale had validity and confidence at an acceptable level as shown in **Tables 1 and 2**.

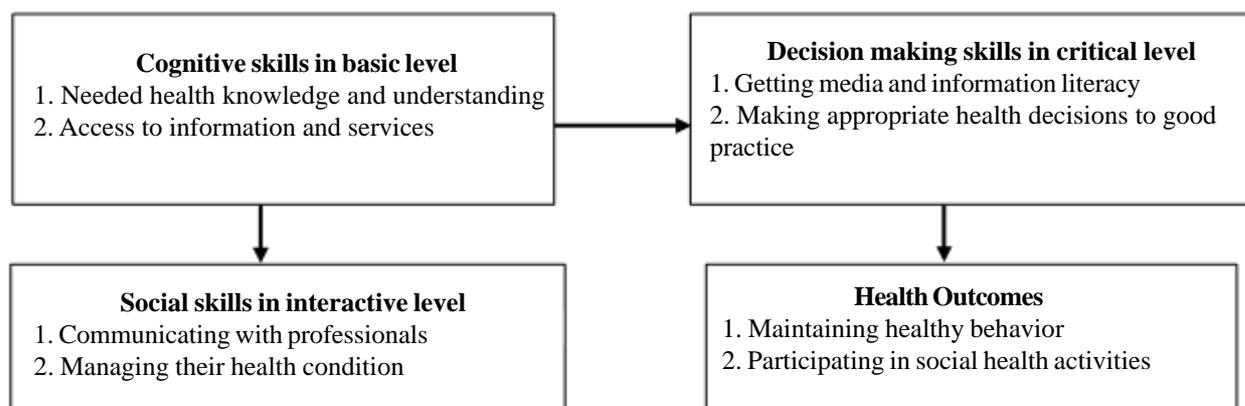


Figure 1. The measurement model with the 3 levels of HL that effect health outcomes

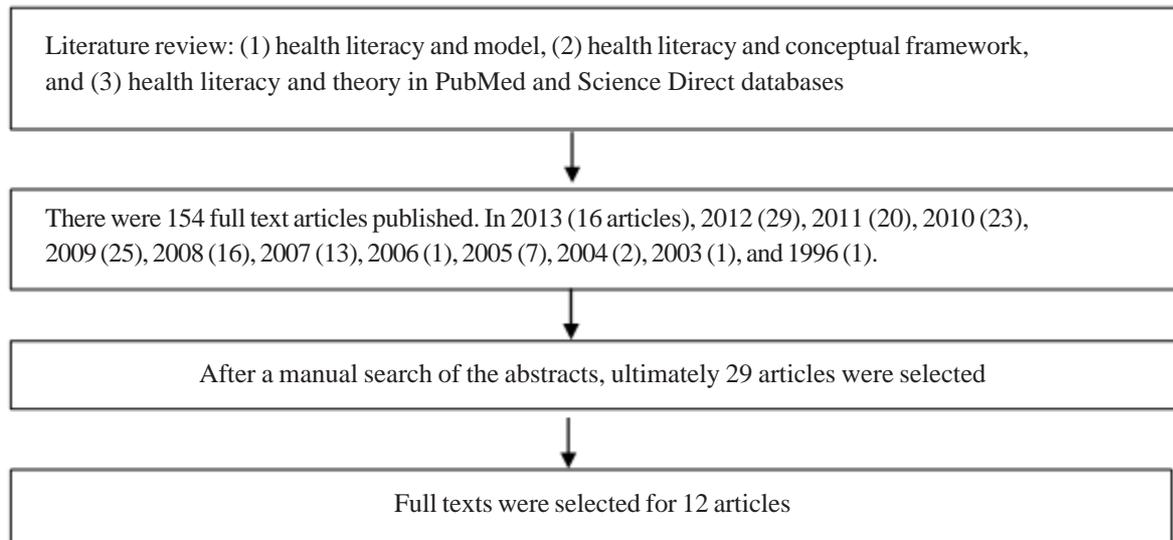


Figure 2. Flow of the process of research selection for synthesis

Table 1. The qualitative measurement of the ABCDE-HL scale

Component No	Item No.	Full mark	Correlation coefficient (r)	Cronbach's α	Factor loading
1. Needed health knowledge and understanding	10	10	0.43–0.77	0.61 (KR-20)	0.39–0.67
2. Accessing information and services	5	20	0.63–0.73	0.86	0.72–0.84
3. Communicating with professionals	6	24	0.55–0.85	0.91	0.74–0.85
4. Managing their health condition	5	20	0.69–0.75	0.89	0.71–0.79
5. Getting media and information literacy	5	20	0.55–0.71	0.83	0.39–0.77
6. Making appropriate health decisions to good practice	5	20	0.22–0.48	0.67	0.69–0.82
7. Participating in social health literacy	5	20	0.60–0.80	0.87	0.68–0.86
8. Maintaining healthy behavior	10	40	0.15–0.52	0.71	0.33–0.61

Table 2. The standard classification separated by the score based on 3 levels of ABCDE-HL

Component	Total score	Interpretation
Basic level	0–14.9 points or <50%	Cognitive skills at middle level
Component 1 and 2 (15 items, 30 points)	15–23.9 points or $\geq 50\%$ – <80%	Cognitive skills at high level
	24–30 points or $\geq 80\%$	Cognitive skills at low level
Interactive level	0–14.9 points or <50%	Low level of social skills or interpersonal relations
Component 3 and 4 (11 items, 44 points)	22–35.1 points or $\geq 50\%$ – <80%	Middle level social skills or interpersonal relations
	35.2–44 points or $\geq 80\%$	High level social skills or interpersonal relations
Critical level	5–19.9 points or <50%	Low level cognitive skills—critical literacy
Component 5 and 6 (10 items, 40 points)	20–31.9 points or $\geq 50\%$ – <80%	Middle level cognitive skills—critical literacy
	32–40 points or $\geq 80\%$	High level cognitive skills—critical literacy

Results of HL were compared with a standard measurement. According to the assessment of the HL of Thai people aged >15 years from a sample of 4,401 participants we found that the majority have an overall HL at the fair level 72.0%, followed by poor

22.9%, and good at 5.1%. We found that health outcomes based on the continued maintenance of good health and participating in social health activities were at the poor level for 53.5%, followed by fair at 44.7%, and good at 1.8%.

When the HL was separated by the level of cognitive and social skills, it was found that considering HL at the individual level, the subjects had the cognitive skills or basic level at the fair level at 62.6% and trending towards the poor level as shown in **Table 3**.

HL at the interactive level found that majority of the subjects were at the fair level at 52.4%, but tended to be poor. HL for those at the level of critically aware was fair at 66.6%, trending towards a good level.

Results of the path analysis model between the components of HL that impact on maintaining in health care behavior and participating in social health activities.

The results shown in the path analysis model are in accordance with the hypothesis (χ^2 27.48, with 7 degrees of freedom, $P = 0.003$, and root mean square error of approximation of 0.032). We found that participating in social health activities significantly influenced the maintenance of a healthy behavior and

showed good results for the subject's good health. These positive indications came through three main routes: **Route 1**. Commencing with the subject (1) had good knowledge and understanding, and (2) applied it to the conditions of health, (3) getting media and information literacy, and (4) making appropriate health decisions to good practice; the effect sizes were 0.49, 0.46, 0.24, and 0.13, respectively. **Route 2** starts from (1) being able to access data and services, and (2) enhancing knowledge to increase communication skills with professionals, (3) managing their health conditions, (4) understanding the media and information, and (5) making appropriated health decision when acting; the effect sizes were 0.71, 0.87, 0.46, 0.24, and 0.03, respectively. **Route 3** beginning with (1) accessing the information and services directly, and (2) understanding the media and information literacy, the effect sizes were 0.23 and 0.70, respectively.

Table 3. The number and percentage of the HL level based on the 3 level of learning

Categories	Level of HL	Result	n (persons)	% of total samples
Basic level	Poor	Persons having a low level of cognitive skill	1,196	27.2
	Fair	Persons having a fair level of cognitive skill	2,755	62.6
	Good	Persons having a high level of cognitive skill	450	10.2
Interactive Level	Poor	Person having a low level of social skills or interpersonal relations	1,786	40.6
	Fair	Person having a middle level of social skills or interpersonal relations	2,308	52.4
	Good	Person having a high level of social skills or interpersonal relations	307	7.0
Critical Level	Poor	Persons having a low level of cognitive skill—critical literacy	465	10.5
	Fair	Persons having a middle level of cognitive skill—critical literacy	2,932	66.6

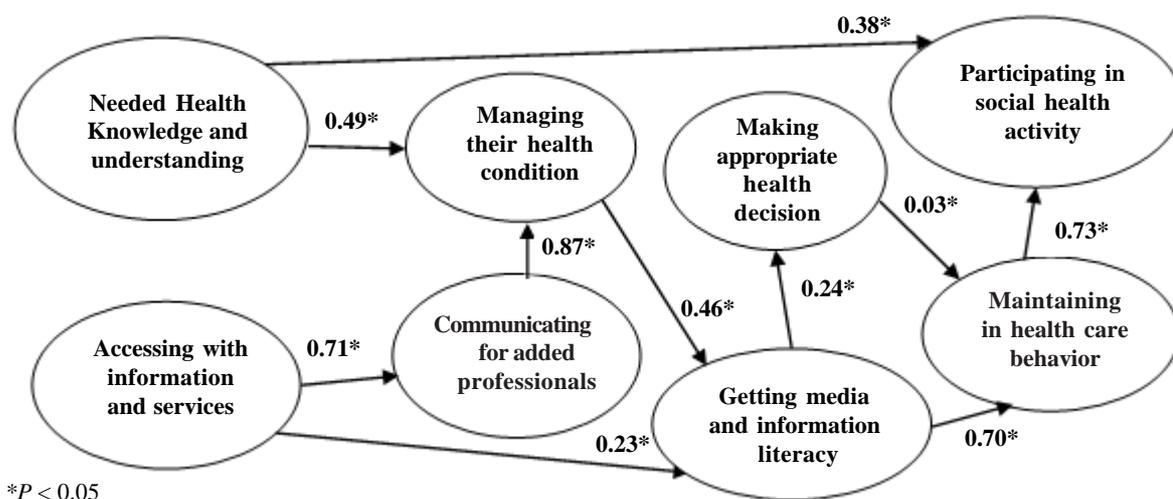


Figure 3. The path analysis model among the components of health literacy that impact on maintaining a health care behavior and participating in social health activities

Discussion

Assessing the quality and validity of the measurement tools and the range of the items found the measurement tools had an acceptable level of validity and reliability with an overall correlation ranging from 0.151 to 0.847, with the reliability of Cronbach's α ranging from 0.611 to 0.912 and the factor loading of the HL at the good level ranging from 0.326-0.861, in association with the criteria at the good level, supporting findings [25] that the factor loading, which is the relationship between the observed variables and the composition variables should be >0.3 based on the analysis of a sample component of more than 1,000 people, and considered as very good [26]. The α coefficient is similar to a measure found by Ishikawa et al. [27] who studied functional, communicative, and critical health literacy of 138 diabetic patients. The items were constructed to directly reflect the definition of HL. Internal consistency of functional, communicative, and critical HL scales were adequately high (α was 0.84, 0.77, and 0.65 respectively).

The results confirmed that the items have a relationship between the hypothesis model with the evidence based data on the factor loading of goodness of fit index (GFI) as reported by Diamantopoulos and Siguaw [25], the GFI values close to 1 or 0.90, and root mean square residual and root mean square error of approximation values should be <0.05 , which indicates that the model has a high level of GFI [28] for standard classified HL for Thais and could be divided into 3 levels, based on the normally distributed data.

A total score of $<50\%$ of total score indicates that HL is not adequate. A score in the range of $\geq 50\%$ to $<80\%$ of the total score indicates that HL is fair, and a score $\geq 80\%$ of the total score, indicates a good level of HL, which is close to the standard classification of criteria for the test of Functional Health Literacy in Adults (TOFHLA) [29].

To interpret the total score, participants receiving a score of $\leq 59\%$ or less were considered to have inadequate functional health literacy; those scoring 60%-74% to have marginal functional health literacy, and participants scoring $\geq 75\%$ to have adequate functional health literacy. The HL divided into 3 levels as the Functional Communication and Critical Health Literacy Scales (FCCHL) [30] were the basic knowledge, interactive, and the critical levels that were used to measure the HL of patients with diabetes

as proposed by Nutbeam [11], which was measured on a 5 point rating scale on which 1 = never, 5 = always, and measure of the Short Test of Functional Health Literacy in Adults (STOHFLA), classified as having 3 levels: inadequate, marginal, or adequate HL.

Based on the result of the assessment of the HL in Thais aged ≥ 15 years from a sample of 4,401 found that Thai had an overall HL at a fair level (72.0%), followed by poor (22.9%) and good (5.1%); and health outcomes at inadequate (53.5%), followed by fair (44.7%), and good (1.8%), which was by contrast with the Australian 2006 Adult Literacy and Life Skills Survey (ALLS) with 5 levels of HL, reading, comprehension, numeracy from level 1 (lowest) to level 5 (highest) which found that 59% Australians were reported to have inadequate knowledge and skills required to understand and use information relating to health issues [30], which this tool used to measure the levels of reading skills and critical thinking, 60% had inadequate HL.

The tool used in the present research focused on social cognitive skills and specified the HL level for those who have a total score lower than 50%. Therefore, of the study of Kaphingst et al. [31] HL INDEX: development, reliability, and validity stated that there is no consensus on how best to assess the HL demands of health information materials. Although improvement in health information materials is just one aspect of mitigating the effects of limited HL on health outcomes, it is an essential step toward a more health literate public.

The result of the path analysis of HL that influence health outcomes were consistent with the empirical data, which considered that engaging in social health activities has a direct influence in maintaining healthy behavior and also had an overall influence on the knowledge and the understanding of health, access to information and services, enhancing communication skills, managing health conditions, knowing the media and information literacy, and good decisions for action.

Subsequently, once the communication skills had been increased to level 2, interactive literacy and level 3, the critical health levels, respectively, based on proposals by Nutbeam [18] that "Conceptual model of HL as a risk" consists of 6 areas: (1) access to information and service, (2) cognitive skill, (3) communication skill, (4) self-management, (5) media literacy, and (6) decision making skill. All 6 components would result in a person with health control and modifying factors, so as to stay healthy. The results

are consistent with those of Edwards et al. [22] who proposed an HL path analysis model consisting of 6 components: (1) health knowledge, (2) seeking and using active information, (3) actively communicating with health professionals, (4) self-management skills, (5) seeking and negotiating treatment options, (6) decision making that influences HL and health outcomes. Similarly, the HL tool for the medical providers described by Osborne et al. [32], which was a developing a tool beginning with an interview of the patient to identify broad conceptually distinct domains and tested in a calibration sample from community health, home care, and hospital settings as a result of a 9-factor CFA model fitted to these items. Given the restricted nature of the model, the fit was quite satisfactory: $\chi^2 = 2927$, with 866 degrees of freedom, $P < 0.000$, GFI 0.936, and root mean square error of approximation of 0.076. Final scales included: feeling understood and supported by health care providers; having sufficient information to manage health; actively managing health; social support for health; appraisal of health information; ability to actively engage with healthcare providers; navigating the healthcare system; ability to find good health information; and understand health information sufficiently to know what to do with it. The HL Questionnaire covers 9 conceptually distinct areas of HL to assess the needs and challenges of a wide range of people and organizations. The HL questionnaire is likely to be useful in surveys, intervention evaluation, and studies of the needs and capabilities of individuals. In addition, results of survey will be used to design a program of cognitive and health behavioral modification conducted by the participation of medical providers to improve health literacy and to decrease the risk of chronic disease [33].

Conclusion

The majority of the subjects (72.0%) had an overall HL at a fair level. Further the pathways of influence were validated by the empirical data, confirming that participation in social health activities directly influences the maintenance of health, and indicated an overall influence from knowing and understanding health, access to information and services, enhanced communication skills, management of health conditions, knowing media literacy, and making good decisions for good practice.

Acknowledgments

This research was financially supported by Department of Health Service Support, Ministry of Public Health, Thailand.

Conflict of interest statement

The authors declare that there is no conflict of interest in this research.

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