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Construct Validity of Health Literacy Scale and Causal Model of Sufficient Health Behavior among NCDs Risk Adults: The Cross-Sectional Study

--Manuscript Draft--

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Abstract:	Background : Over 75% of Thai people's deaths are caused by non-communicable diseases (NCDs), higher than all deaths worldwide (71%). Methods: This cross-sectional exploratory study aimed to construct validate a health literacy (HL) scale and a sufficient health behavior (SHB) scale, and examine the causal relationship model of SHB among people at risk of NCDs in the 20-65 age range. 636 participants were obtained through stratified random sampling. The participants consisted of employees in public and private organizations and local people in urban and semi-urban communities. The research began in September 2021 and ended in March 2022. Confirmatory Factor analysis (CFA) and structural equation modeling (SEM) were used to analyze the data. Results: 1) In respect of construct validity, the 28-item HL Scale achieved an overall Cronbach's alpha of 0.94 and a factor loading ranging between 0.67-0.84; similarly, the 30-item SHB Scale achieved an overall Cronbach's alpha of 0.94 and a factor loading ranging between 0.40-0.82; and 2) The causal relationship model of SHB was consistent with the empirical data; in addition, HL positively influenced SHB at a significance level of 0.05 (direct effect = 0.82) and could 67.00% predict SHB. Conclusion: Both developed scales are high-quality assessment instruments that can be used by healthcare providers in assessing NCD risks and predicting SHB in order to

	organize activities enhancing people’s HL and knowledge about NCD risk behaviors.
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Question	**Response**
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หนังสือรับรองจริยธรรมการวิจัยของข้อเสนอการวิจัย
เอกสารข้อมูลคำอธิบายสำหรับผู้เข้าร่วมการวิจัยและใบยินยอม

หมายเลขข้อเสนอการวิจัย SWUEC- 330/2564E

ข้อเสนอการวิจัยนี้และเอกสารประกอบของข้อเสนอการวิจัยตามรายการแสดงด้านล่าง ได้รับการพิจารณาจากคณะกรรมการจริยธรรมสำหรับพิจารณาโครงการวิจัยที่ทำในมนุษย์ มหาวิทยาลัยศรีนครินทรวิโรฒแล้ว คณะกรรมการฯ มีความเห็นว่าข้อเสนอการวิจัยที่จะดำเนินการมีความสอดคล้องกับหลักจริยธรรมสากล ตลอดจนกฎหมาย ข้อบังคับและข้อกำหนดภายในประเทศ จึงเห็นสมควรให้ดำเนินการวิจัยตามข้อเสนอการวิจัยนี้ได้

ชื่อโครงการวิจัยเรื่อง: การวิจัยและพัฒนาเครื่องมือประเมินความรอบรู้ด้านสุขภาพและพฤติกรรมสุขภาพตามหลักพอเพียงด้วยตนเองทางดิจิทัลและการใช้หลักสูตรส่งเสริมความรอบรู้ด้านสุขภาพเพื่อลดโรคไม่ติดต่อเรื้อรังในกลุ่มเสี่ยงวัยทำงาน

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STROBE

STROBE Statement -checklist of items that should be included in reports of observational studies

Section/topic	Item No.	Recommendation	Page No.
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(a) **Cohort study** -Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up **Case-control study** -Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls **Cross-sectional study** -Give the eligibility criteria, and the sources and methods of selection of participants	3
		(b) **Cohort study** -For matched studies, give matching criteria and number of exposed and unexposed **Case-control study** -For matched studies, give matching criteria and the number of controls per case	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3

Section/topic	Item No.	Recommendation	Page No.
Bias	9	Describe any efforts to address potential sources of bias	3
Study size	10	Explain how the study size was arrived at	3
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	3
		(b) Describe any methods used to examine subgroups and interactions	3
		(c) Explain how missing data were addressed	3
		(d) **Cohort study** -If applicable, explain how loss to follow-up was addressed **Case-control study** -If applicable, explain how matching of cases and controls was addressed **Cross-sectional study** -If applicable, describe analytical methods taking account of sampling strategy	- - 3
		(e) Describe any sensitivity analyses	-
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	4
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	4
		(b) Indicate number of participants with missing data for each variable of interest	-
		(c) **Cohort study** -Summarise follow-up time (eg, average and total amount)	-
Outcome data	15*	**Cohort study** -Report numbers of outcome events or summary measures over time **Case-control study** -Report numbers in each exposure category, or summary measures of exposure **Cross-sectional study** -Report numbers of outcome events or summary measures	4

Section/topic	Item No.	Recommendation	Page No.
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	4
		(b) Report category boundaries when continuous variables were categorized	-
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done -eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	5
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	-
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	5-6
Generalisability	21	Discuss the generalisability (external validity) of the study results	5-6
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	9

* Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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The authors declare no conflicts of interest.

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Construct Validity of Health Literacy Scales and Causal Model of Sufficient Health among NCDs Risk Adults

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Abstract

Background: Over 75% of Thai people's deaths are caused by non-communicable diseases (NCDs), higher than all deaths worldwide (71%).

Materials and Methods: This cross-sectional exploratory study aimed to develop a health literacy (HL) and sufficient health behavior (SHB) scale, and examine the causal relationship model of SHB among adults aged 20-60 at NCD risks. 636 participants were obtained through stratified random sampling. The participants consisted of employees in public and private organizations and local people in urban and semi-urban communities. The research began in August 2021 to March 2022. Confirmatory Factor analysis (CFA), and structural equation modeling (SEM) were used to analyze the data.

Results: 1) In respect of construct validity, the 28-item HL Scale achieved an overall Cronbach's alpha of 0.94 and a factor loading ranging between 0.67-0.84; similarly, the 30-item SHB Scale achieved an overall Cronbach's alpha of 0.94 and a factor loading ranging between 0.40-0.82; and 2) The causal relationship model of SHB was consistent with the empirical data; in addition, HL positively influenced SHB (direct effect = 0.82, $p<.05$), and HL was a key factor, could predict SHB by 67.00%.

Conclusion: Both developed scales are high-quality assessment instruments that can be used by healthcare providers in assessing NCD risks and predicting SHB in order to organize activities enhancing people's HL and knowledge for decreasing NCD risk behaviors.

Keywords: health literacy, sufficient health behavior, non-communicable diseases, NCDs Risk, Construct Validity

Introduction

Non-communicable diseases (NCDs) are the world's health problem in terms of the number of deaths and overall burden of disease. According to WHO [1], the global number of NCD deaths tended to increase from 68% in 2007 to 71% of all deaths worldwide in 2019, and 80% of all deaths from NCDs in 2008 occurred in low- and middle-income countries. Most NCD deaths are caused by cardiovascular diseases (44%), followed by cancers (22%), respiratory diseases (9%), and diabetes (4%). In Thailand, NCDs account for 75% of the Thai people's mortality rate, leading to a rise in disability-adjusted life-years and an immense impact on national economic and social development [2]. According to the Ministry of Public Health, Thailand's reports between 2015-2019, the top three causes of NCD deaths are all types of cancer, stroke, and heart attacks respectively, equivalent to 125.0, 53.0, and 43.7 deaths per 100,000 population [3].

One of the leading causes of NCD sickness and death is health risk behavior. People of all ages should be encouraged to engage in healthy lifestyle behavior, i.e. healthy eating, exercising, no drinking/smoking, controlling emotions, nurturing positive relationships with others, sacrificing for the greater good, and doing volunteer work to grow spiritually [4,5,6]. Health behavior is influenced by many factors such as population characteristics, psychological characteristics, and surrounding environments, including health literacy (HL) which is significantly linked with one's health behavior [7,8,9]. Therefore, in order to improve people's health behavior, their HL should be enhanced to build their long-term capacity for self-care and the ability to predict potential health risks. The fact that most people in the country have low HL can negatively affect the national health status such as high mortality, hospitalization, and the cost of treatment. People's lack of self-care ability can lead to a growing number of NCD patients [10]. In Intarakamhang and colleagues' studies related to HL and health behavior from 2014-2018, several scales were developed i.e. HL scale for childhood overweight, HL scale for Thai adults, the HL scale for unwanted pregnancy prevention of Thai females aged 15-21 Years, and Environmental HL scale for homebound and bedbound Elder [7,11,12,13]. All of the scales had high reliability and validity and the studies' results confirmed that HL was associated with health behavior among all age groups. In addition, good health behaviors from the perspective of sustainability mean the action of developing and maintaining well-being, consisting of being self-reliant, being actively engaged with society, developing spiritual wisdom, maintaining a healthy lifestyle, engaging in active learning, building up financial security, and strengthening family [14]. Therefore, the sufficient Thai lifestyle for good health is based on the sufficiency economy philosophy to provide people with immunity and protection against diseases by promoting people's HL throughout their lifespan [15,16]. The researchers found only one qualitative study investigating Thai people's health behavior based on the philosophy of sufficiency economy [17]. No quantitative instrument has yet been developed for assessing sufficiency health behavior (SHB) focused on living the middle way (living a simple, careful life) to avoid health risk factors. This study aimed to 1) develop the HL and SHB scale, and 2) examine the causal relationships model of SHB. Under the research hypothesis, the measurement model and the causal relationship model were consistent with the empirical data

Materials and Methods

This cross-sectional exploratory study was carried out from August 2021 to March 2022. The population and sample group were Thai adults with NCD risks, living in Sing Buri, Sa Kaeo provinces, and Bangkok where levels of HL were low and risks of NCDs were high from previous surveys in 2016 [18].

The sample size was determined based on the size required to confirm a causal relationship model, with 200 people in each group [19]. The total sample consisted of 600 Thai adults at risk of NCDs aged 20-65 years old, working age groups were selected through a quota-stratified random sampling technique for making sure that participants were selected equally into 3 groups; 1) working in government organizations, 2) working in private organizations, and 3) people in the community from 3 provinces in equal proportions. In this research, the sample size was increased by 10% to prevent data loss, the total number of samples was 660, and when collected 636 complete questionnaires were returned, representing 96.36%.

The Inclusion - exclusion criteria were 1) aged between 20-65 years 2) had not non-chronic communicable diseases such as diabetes mellitus, hypertension, and heart disease, 3) able to read, write and agree to provide health information, 4) have a smartphone that can communicate with Line Application and able to do online questionnaires. The exclusion criteria were 1) reluctance or hesitation in providing information, 2) inability to complete the measurement and 3) withdrawal from the study.

Data collection: Data collection: After obtaining the Human Research Ethics Certificate. Therefore, it coordinates with health personnel in the targeted areas to obtain information about the adult population at risk of NCDs in the area. Once the data is obtained, a simple random sampling is performed, according to the selection criteria of the research participants and according to the specified sample size. The researchers contacted participants by asking the Village Health Volunteers (VHVs) to set up times to meet with participants in the local meeting room. The researcher assistants explained how to answer the online questionnaire via line application on a smartphone to each participant and ask for cooperation to answer all questions. During the questionnaire, if you are worried, you can withdraw from the research.

Instruments and quality assessment: The details are as follows:

1) Demographic Questionnaire. The questionnaire gathered data on gender, age, marital status, education level, occupation, monthly income, living conditions, and NCD risks;

2) HL Scale was developed from HL assessments for adults [11,20], the 28-item scale assessed four elements of HL: 1) access to health information and services, 2) understanding of health information and services, 3) verification of health information and services, and 4) use of health information and services. The scale items were rated on a 5-point scale from lowest (1 point) to highest (5 points). The content validity of the scale was reviewed by three experts. The scale achieved an IOC ranging between 0.60-1.00 and overall reliability of 0.94.

3) SHB for NCD Prevention Scale, the 30-item scale assessed desirable behavior based on the philosophy of sufficient economy. Three elements of SHB were investigated: 1) sufficient living behavior, 2) safe behavior, and 3) self-care behavior. The scale items were rated on a 5-point scale from never (1 point) to regularly (5 points). The content validity of the

scale was reviewed by three experts. The scale achieved an IOC ranging between 0.60-1.00 and overall reliability of 0.94.

Data Analysis: Basic statistics were used to analyze Basic data analysis of variables such as mean, standard deviation. Confirmatory factor analysis (CFA) used to analyze the measurement model were consistent with the empirical data and uses structure equation model (SEM) to analyze the causal relationship model were consistent with the empirical data, the model fit was determined based on the following benchmarks: a statistically significant chi-square (χ^2), $\chi^2/df < 5$, RMSEA ≤ 0.08, SRMR < 1.00, CFI > 0.90, GFI > 0.90, and NFI > 0.90 (19)

Research ethics: This study was granted a certificate of ethical approval for research involving human subjects by Srinakharinwirot University (SWUEC-330/2564E). Before beginning the data collection process, the researchers asked for the participants' consent for study participation and explained the significant details about the study, including the reason and method of selecting participants. The researchers also protected the data confidentiality by excluding names and sources of data and explained the potential impact of each step of the research to protect the participants from any harm that might occur.

Results

1. General Characteristics of the Sample

The sample consisted of 636 participants. The majority of participants were female (67.30%), married (52.52%), and aged between 41-50 years (32.08%). Most of them reported holding a Bachelor's degree as their highest level of education (66.35%), working in a public organization (38.68%), having an adequate income with savings (32.39%), and without savings (32.23%).

2. Quality Assessment of the Scales

2.1 The 28-item HL Scale assessed four elements of HL: 1) access to health information and services, 2) understanding of health information and services, 3) verification of health information and services, and 4) use of health information and services. The scale items had discriminating power ranging between 0.50-0.86; the Cronbach's alpha for each element fell between 0.67-0.84; and the overall reliability of the scale equaled 0.94. In respect of construct validity, the CFA results indicated that the model fit the empirical data (Chi-square =1020.59, df=336, P=0.00, Chi-square/df= 3.03, RMSER=0.05, SRMR=0.02, GFI=0.90, CFI=0.99, NFI=0.99). Moreover, all of the scale items had factor loadings ranging from 0.67-0.84 which are all above acceptable levels as presented in Table 1.

Table 1 Quality Assessment of HL Scale

Health Literacy Items		Correlation Coefficient (r)	Factor Loading
Element 1: Access to Health Information and Services (Cronbach's Alpha = 0.90)			
1.1	I can seek self-care information by myself to treat my health problems.	0.84	0.73
1.2	I can seek reliable health information from different sources such as experts, printed materials, and the Internet.	0.81	0.78

Health Literacy Items		Correlation Coefficient (r)	Factor Loading
1.3	I can seek the latest health information and am open to new information to stay healthy.	0.74	0.78
1.4	I can seek health information or healthcare providers by myself.	0.60	0.75
1.5	I can seek healthcare providers that can provide the health care I need.	0.83	0.80
1.6	I can always seek advice from a doctor or a healthcare provider.	0.50	0.67
1.7	I can access healthcare services that suit my needs or problems.	0.63	0.71
Element 2: Understanding of Health Information and Services (Cronbach's Alpha = 0.86)			
2.1	I understand information on food or drug labels i.e. how to consume the food or drug, expiry dates, deterioration, and health benefits or side effects.	0.61	0.71
2.2	I can explain information about diseases and their symptoms obtained from different sources such as health manuals, brochures, posters, and prescriptions to other people.	0.62	0.76
2.3	I understand and fill out health information forms given by healthcare providers correctly.	0.62	0.84
2.4	I understand online health information that is available on the Internet, YouTube, videos, Facebook, Line, etc.	0.64	0.80
2.5	I understand healthcare providers' advice on diseases and health care.	0.78	0.84
2.6	I understand health warnings from the government sector such as avoiding sweet, fatty, and salty food, exercising regularly, no smoking/drinking, vaccination, and disease prevention.	0.50	0.74
2.7	I understand health information presented through symbols, graphs, tables, diagrams, numbers, words or signs in healthcare facilities or other places.	0.60	0.82
Element 3: Verification of Health Information and Services (Cronbach's Alpha = 0.87)			
3.1	I think carefully and consult my family before choosing a healthcare provider.	0.58	0.79
3.2	I compare the pros and cons of health products and services before believing or using them.	0.61	0.78
3.3	When I receive new health information, I will verify the source of information before believing or using the information.	0.69	0.74
3.4	I usually compare health information from different sources to verify the information before passing it to others.	0.64	0.80
3.5	I can logically analyze the pros and cons of health information and services recommended by others before believing or using the information or services.	0.63	0.76
3.6	I review the benefits and reliability of health information before believing or using the information.	0.75	0.78
3.7	Before using health information, I can verify it by consulting healthcare providers about proper health care.	0.57	0.84
Element 4: Use of Health Information and Services (Cronbach's Alpha = 0.93)			
4.1	I use the health information I have to enhance my own health.	0.75	0.82

Health Literacy Items		Correlation Coefficient (r)	Factor Loading
4.2	I can choose health information or services to help me adjust my behavior or lifestyle for better health.	0.86	0.81
4.3	I use the health information I have to prevent disease and restore my health effectively.	0.71	0.81
4.4	I use health information to help me make decisions to reduce/stop my health risk behaviors.	0.77	0.83
4.5	I choose appropriate health services for myself and my families such as specialized clinics and traditional Thai medicine.	0.73	0.80
4.6	I use health information to create an effective self-care plan such as eating healthy, working out, reducing stress, and resting.	0.83	0.82
4.7	I use the health information I have to discuss with my doctor to ensure that I receive treatments that suit my lifestyle.	0.76	0.78
Overall Reliability of the Scale = 0.94			

2.2 The 30-item SHB Scale assessed three elements of SHB: 1) sufficient living behavior, 2) safe behavior, and 3) self-care behavior. The scale items had discriminating power ranging between 0.20-0.74; the Cronbach's alpha for each element fell between 0.83-0.87, and the overall reliability of the scale equaled 0.94. In respect of construct validity, the CFA results indicated that the model fit the empirical data (Chi-square= 1223.56, df= 385, P= 0.00, Chi-square/df= 3.17, RMSER= 0.05, SRMR = 0.02, GFI= 0.90, CF = 0.99, NFI= 0.98). Moreover, all of the scale items had factor loadings ranging from 0.40-0.82 which are all above acceptable levels as presented in Table 2.

Table 2 Quality Assessment of SHB Scale

Sufficient Health Behavior Items		Correlation Coefficient (r)	Factor Loading
Element 1: Sufficient Living Behavior (Cronbach's Alpha = 0.87)			
1.1	I live a simple life and spend wisely by buying only affordable or necessary things.	0.55	0.61
1.2	I plan my daily routine based on reliable and reasonable health information.	0.64	0.70
1.3	I control my food intake based on how much energy I need a day.	0.71	0.74
1.4	I cook only what I need and finish my plate to avoid food waste.	0.61	0.66
1.5	I focus on nutritional values rather than preferences or prices.	0.74	0.75
1.6	I mostly eat home-cooked meals and hardly buy readymade food.	0.27	0.69
1.7	I prefer local, seasonal fruit and vegetables to imported or expensive ones.	0.62	0.73
1.8	I apply the middle way approach when making decisions and handling my health problems.	0.74	0.72
1.9	I spend time on healthy activities to boost my immune system.	0.61	0.76

Sufficient Health Behavior Items		Correlation Coefficient (r)	Factor Loading
1.10	I do physical activities that require no expensive equipment such as walking to work, doing activities that require physical power, moving around, running, and jump roping.	0.52	0.81
Element 2: Safe health Behavior (Cronbach's Alpha = 0.83)			
2.1	I avoid eating foods high in carbs, sugar and fat such as fried foods, sausages, instant noodles, baked goods, sweets, and snacks.	0.53	0.77
2.2	I eat organic food to avoid chemicals.	0.67	0.80
2.3	I follow exercise safety guidelines such as warming up, using exercise equipment or doing exercises that suit my age and physical condition, and exercising for an appropriate amount of time.	0.56	0.72
2.4	I monitor my body and emotions to prevent sickness and control symptoms.	0.58	0.79
2.5	I eat fresh, clean food and freshly cooked meals to avoid toxin or bacteria contamination.	0.72	0.79
2.6	I live cautiously to minimize health risks.	0.68	0.76
2.7	I sleep for at least 6-8 hours a day to restore my health and reduce health risk factors.	0.68	0.72
2.8	I create a safe home environment to prevent health or life hazards such as accidents, fires, disease-carrying animals, and other dangers.	0.48	0.77
2.9	I avoid smoking or breathing in smoke from cigarettes and toxic chemicals.	0.27	0.73
2.10	I avoid alcoholic drinks.	0.20	0.75
Element 3: Self-Care Behavior (Cronbach's Alpha = 0.86)			
3.1	I control my health behavior such as controlling weight, having an annual check-up, thinking positive, avoiding unhealthy food, and exercising regularly.	0.63	0.81
3.2	I take care of my health to protect myself from disease.	0.62	0.82
3.3	I do regular health checks at home and will consult a doctor or a health expert once I find something wrong.	0.37	0.81
3.4	I eat tasteless food and always avoid adding sugar, fat or salt to my food.	0.57	0.80
3.5	I eat at least half a kilogram of fruit and vegetables a day or always fill half my plate with fruit and vegetables.	0.74	0.82
3.6	I eat a variety of foods to get the nutrients my body needs.	0.67	0.80
3.7	I exercise until I feel tired or sweat for at least 30 minutes a day.	0.59	0.81
3.8	I use positive thinking and optimism to manage my stress.	0.62	0.79
3.9	I control my emotions and adapt well to different situations.	0.45	0.40
3.10	I do health-related activities with my family or friends.	0.57	0.55
Overall Reliability of the Scale = 0.94			

3. Analysis of the Causal Relationship Model of SHB

The results showed that the causal relationship model fit the empirical data and all values reached acceptable levels (Chi-square= 6.3 5 , df=10, p-value=0.78, χ^2 /df= 0.63, RMSEA=0.00, SRMR 0.01, CFI= 1.00, NFI=1.00, GFI=1.00). In addition, health literacy had a positive direct effect on SHB at a significance level of 0.05 with an effect size of 0.82 and could explain 67.00% of the variation insufficient health behaviors as follow in figure 1

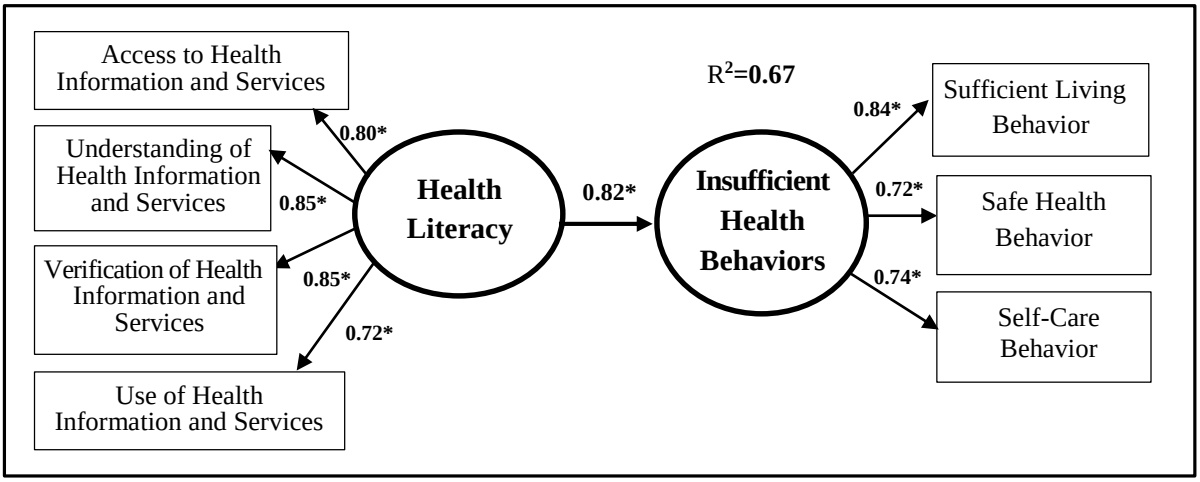

Figure 1 Causal Relationship Model of Sufficient Health Behavior

Discussion

In regard to the HL Scale, the researchers developed the scale items based on the structural elements of HL concepts by Sorensen et al. [20] and Osborne et al. [21] and designed the item content based on the Thai context [11]. Each element consisted of 7 items, totaling 28 items. The scale had item reliability ranging from 0.86-0.93 and overall reliability of 0.94, which is considered excellent according to George and Mallery [22] and therefore a high-quality instrument for data collection. Also, the factor loadings of the items fell between 0.67-0.84, higher than the acceptable level of 0.30 [23]. The scale's construct validity was verified by the confirmatory factor analysis (CFA). The results indicated that the developed HL scale is practical and suitable for people at risk of NCDs.

The SHB Scale was developed based on the philosophy of sufficiency economy and the item content was designed based on Thai people's health behavior [24]. The scale assessed three elements of SHB. Each element consisted of 10 items, totaling 30 items. Similarly, the scale had item reliability ranging from 0.83 -0.8 7 and overall reliability of 0.94, which is considered excellent according to George and Mallery [22] and therefore a high-quality instrument for data collection. The factor loadings fell between 0.40-0.82, passing Kline's acceptable level [23]. The developed scale, as confirmed by the CFA results, can assess the actual levels of health-risk behaviors that may lead to NCDs among working-age groups.

Moreover, consistency between the causal relationship model of SHB and the empirical data was found, along with HL's positive direct effect on SHB at a significance level of 0.05. The results are consistent with a previous study that found HL's positive direct effect on health behavior and indirect effect on family well-being through health behavior [24]. Similar results were also found in Ginggeaw & Prasertsri 's study on the relationships between HL and

health behavior among adults with chronic diseases [25]. The study found a statistically significant association between HL and health behavior with a correlation coefficient (r) of 0.46. The results are also confirmed by several foreign studies that investigated the relationships between HL and health behavior. For example, in Brega et al.'s study on the relationship between HL and glycemic control in American Indians and Alaska Natives, HL was found to have a statistically significant direct effect on health behavior and health outcomes[8]. Similarly, a study by Wanchen Hsu et al. found that health status, health awareness, and HL had statistically significant direct effects on health behavior [26]. Moreover, the results were also relevant to the finding of Lee & Oh [27], factors affecting a higher health-related quality of life were HL, self-efficacy, and health-promoting behavior in adults. HL was associated with more health-related behavior on the internet among Minnesotan adults with an affected size of 0.35[28]

Conclusion

Both developed scales are high-quality assessment instruments that can be used by healthcare providers in assessing NCD risks and predicting SHB in order to organize activities enhancing people's HL and knowledge about reducing NCD risk behaviors.

What is already known on this topic?

The research clearly supports that HL has a high influence on Thai people's SHB. If the government agencies can promote Thai people to have a high level of HL, the result of the development in Thai people having SHB is up to 67%. Therefore, this knowledge should be a policy direction for people's health promotion. Health providers and health professionals should continually organize learning activities to improve the HL of Thai people of all ages. Thai people are able to rely on themselves and have immunity to self-health care in accordance with the Thai lifestyle based on the sufficiency economy philosophy.

What does this study add?

Researchers extend the studying area by healthcare providers using these high-quality scales to assess risk factors for NCDs in order to organize activities promoting HL and health behavior that match working-age people's lifestyles. The yielded results can be used in designing relevant future research such as an exploratory study in which the researchers may use the developed scales before and after the experiment or focus on enhancing HL due to predict health behavior, or a qualitative study in which the researchers study people with high levels of HL and SHB to develop a guideline insufficient health living for NCD risk reduction.

Limitations

This research collected data using online questionnaires. As a result, some respondents did not answer all the questions. Therefore, data collection must be increased by 10% to prevent data loss, and the number of samples was consistent with the statistical techniques used to analyze.

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Conflicts of interest

The authors declare no conflict of interest.

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การตรวจสอบคุณภาพเครื่องมือความรอบรู้ด้านสุขภาพและโมเดลเชิงสาเหตุของพฤติกรรมสุขภาพพอเพียงของผู้ใหญ่กลุ่มเสี่ยงโรคไม่ติดต่อเรื้อรัง

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บทคัดย่อ

ภูมิหลัง: อัตราการตายด้วยโรค NCDs ของคนไทยร้อยละ 75 ซึ่งสูงกว่าประชากรทั่วโลกคิดเป็นร้อยละ 71

วิธีการ: ในการวิจัยเชิงสำรวจภาพตัดขวางครั้งนี้ มีวัตถุประสงค์เพื่อพัฒนาแบบวัดความรอบรู้ด้านสุขภาพและพฤติกรรมสุขภาพพอเพียง และทดสอบรูปแบบความสัมพันธ์เชิงสาเหตุของพฤติกรรมสุขภาพพอเพียงของกลุ่มผู้ใหญ่อายุ 20-65 ปี เสี่ยงโรคไม่ติดต่อเรื้อรัง ประกอบด้วยกลุ่มคนทำงานในองค์กรภาครัฐภาคเอกชนและกลุ่มประชาชนอาศัยในชุมชนเขตเมืองและชุมชนกึ่งเมือง ดำเนินการในช่วงเดือนสิงหาคม 2564- มีนาคม 2565 ที่ได้มาจากการสุ่มแบบแบ่งชั้นภูมิตามกลุ่มรวมจำนวน 636 คน วิเคราะห์ข้อมูลด้วยการวิเคราะห์องค์ประกอบเชิงยืนยัน (CFA) และสมการเชิงโครงสร้าง (SEM)

ผลวิจัย: 1) ผลการตรวจสอบความตรงเชิงโครงสร้างของแบบวัด พบว่า แบบวัดความรอบรู้ด้านสุขภาพประกอบด้วย 28 ข้อคำถาม มีค่าความเชื่อมั่นทั้งฉบับ (Cronbach's Alpha) เท่ากับ 0.94 และมีค่าน้ำหนักองค์ประกอบ (Factor Loading) อยู่ระหว่าง 0.67-0.84 แบบวัดพฤติกรรมสุขภาพพอเพียงประกอบด้วย 30 ข้อคำถาม มีค่าความเชื่อมั่นทั้งฉบับเท่ากับ 0.94 และมีค่าน้ำหนักองค์ประกอบอยู่ระหว่าง 0.40-0.82 และ 2) ผลการตรวจสอบรูปแบบความสัมพันธ์เชิงสาเหตุพบว่ามีความสอดคล้องกับข้อมูลเชิงประจักษ์ และปัจจัยความรอบรู้ด้านสุขภาพมีอิทธิพลเชิงบวกต่อพฤติกรรมสุขภาพพอเพียงอย่างมีนัยสำคัญทางสถิติที่

ระดับ 0.05 โดยมีค่าสัมประสิทธิ์อิทธิพลเท่ากับ 0.82 และความรอบรู้ด้านสุขภาพเป็นปัจจัยสำคัญที่สามารถทำนายพฤติกรรมสุขภาพพอเพียงได้ถึงร้อยละ 67.00

ข้อสรุป: แบบวัดครั้งนี้มีคุณภาพสูง ผู้ให้บริการสุขภาพสามารถนำไปใช้ในการวัดระดับความเสี่ยงและทำนายพฤติกรรมสุขภาพพอเพียงเพื่อจัดกิจกรรมส่งเสริมความรอบรู้ด้านสุขภาพและความรู้เพื่อลดพฤติกรรมเสี่ยงต่อโรค NCDs ได้

คำสำคัญ: ความรอบรู้ด้านสุขภาพ พฤติกรรมสุขภาพพอเพียง โรคไม่ติดต่อเรื้อรัง กลุ่มเสี่ยงโรค NCDs ตรวจสอบเครื่องมือวัด

Construct Validity of Health Literacy Scales and Causal Model of Sufficient Health among NCDs Risk Adults

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Abstract

Background: Over 75% of Thai people's deaths are caused by non-communicable diseases (NCDs), higher than all deaths worldwide (71%).

Materials and Methods: This cross-sectional exploratory study aimed to develop a health literacy (HL) and sufficient health behavior (SHB) scale, and examine the causal relationship model of SHB among adults aged 20-60 at NCD risks. 636 participants were obtained through stratified random sampling. The participants consisted of employees in public and private organizations and local people in urban and semi-urban communities. The research began in August 2021 to March 2022. Confirmatory Factor analysis (CFA), and structural equation modeling (SEM) were used to analyze the data.

Results: 1) In respect of construct validity, the 28-item HL Scale achieved an overall Cronbach's alpha of 0.94 and a factor loading ranging between 0.67-0.84; similarly, the 30-item SHB Scale achieved an overall Cronbach's alpha of 0.94 and a factor loading ranging between 0.40-0.82; and 2) The causal relationship model of SHB was consistent with the empirical data; in addition, HL positively influenced SHB (direct effect = 0.82, $p<.05$), and HL was a key factor, could predict SHB by 67.00%.

Conclusion: Both developed scales are high-quality assessment instruments that can be used by healthcare providers in assessing NCD risks and predicting SHB in order to organize activities enhancing people's HL and knowledge for decreasing NCD risk behaviors.

Keywords: health literacy, sufficient health behavior, non-communicable diseases, NCDs Risk, Construct Validity

Introduction

Non-communicable diseases (NCDs) are the world's health problem in terms of the number of deaths and overall burden of disease. According to WHO [(1)], the global number of NCD deaths tended to increase from 68% in 2007 to 71% of all deaths worldwide in 2019, and 80% of all deaths from NCDs in 2008 occurred in low- and middle-income countries. Most NCD deaths are caused by cardiovascular diseases (44%), followed by cancers (22%), respiratory diseases (9%), and diabetes (4%). In Thailand, NCDs account for 75% of the Thai people's mortality rate, leading to a rise in disability-adjusted life-years and an immense impact on national economic and social development [(2)]. According to the Ministry of Public Health, Thailand's reports between 2015-2019, the top three causes of NCD deaths are all types of cancer, stroke, and heart attacks respectively, equivalent to 125.0, 53.0, and 43.7 deaths per 100,000 population [(3)].

One of the leading causes of NCD sickness and death is health risk behavior. People of all ages should be encouraged to engage in healthy lifestyle behavior, i.e. healthy eating, exercising, no drinking/smoking, controlling emotions, nurturing positive relationships with others, sacrificing for the greater good, and doing volunteer work to grow spiritually [4,5,6]. Health behavior is influenced by many factors such as population characteristics, psychological characteristics, and surrounding environments, including health literacy (HL) which is significantly linked with one's health behavior [7,8,9]. Therefore, in order to improve people's health behavior, their HL should be enhanced to build their long-term capacity for self-care and the ability to predict potential health risks. The fact that most people in the country have low HL can negatively affect the national health status such as high mortality, hospitalization, and the cost of treatment. People's lack of self-care ability can lead to a growing number of NCD patients [10]. In Intarakamhang and colleagues' studies related to HL and health behavior from 2014-2018, several scales were developed i.e. HL scale for childhood overweight, HL scale for Thai adults, the HL scale for unwanted pregnancy prevention of Thai females aged 15-21 Years, and Environmental HL scale for homebound and bedbound Elder [7,11,12,13]. All of the scales had high reliability and validity and the studies' results confirmed that HL was associated with health behavior among all age groups. In addition, good health behaviors from the perspective of sustainability mean the action of developing and maintaining well-being, consisting of being self-reliant, being actively engaged with society, developing spiritual wisdom, maintaining a healthy lifestyle, engaging in active learning, building up financial security, and strengthening family [14]. Therefore, the sufficient Thai lifestyle for good health is based on the sufficiency economy philosophy to provide people with immunity and protection against diseases by promoting people's HL throughout their lifespan [15,16]. The researchers found only one qualitative study investigating Thai people's health behavior based on the philosophy of sufficiency economy [17]. No quantitative instrument has yet been developed for assessing sufficiency health behavior (SHB) focused on living the middle way (living a simple, careful life) to avoid health risk factors. This study aimed to 1) develop the HL and SHB scale, and 2) examine the causal relationships model of SHB. Under the research hypothesis, the measurement model and the causal relationship model were consistent with the empirical data

Materials and Methods

This cross-sectional exploratory study was carried out from August 2021 to March 2022. The population and sample group were Thai adults with NCD risks, living in Sing Buri, Sa Kaeo provinces, and Bangkok where levels of HL were low and risks of NCDs were high from previous surveys in 2016 [18].

The sample size was determined based on the size required to confirm a causal relationship model, with 200 people in each group [19]. The total sample consisted of 600 Thai adults at risk of NCDs aged 20-65 years old, working age groups were selected through a quota-stratified random sampling technique for making sure that participants were selected equally into 3 groups; 1) working in government organizations, 2) working in private organizations, and 3) people in the community from 3 provinces in equal proportions. In this research, the

sample size was increased by 10% to prevent data loss, the total number of samples was 660, and when collected 636 complete questionnaires were returned, representing 96.36%.

The Inclusion - exclusion criteria were 1) aged between 20-65 years 2) had not non-chronic communicable diseases such as diabetes mellitus, hypertension, and heart disease, 3) able to read, write and agree to provide health information, 4) have a smartphone that can communicate with Line Application and able to do online questionnaires. The exclusion criteria were 1) reluctance or hesitation in providing information, 2) inability to complete the measurement and 3) withdrawal from the study.

Data collection: Data collection: After obtaining the Human Research Ethics Certificate. Therefore, it coordinates with health personnel in the targeted areas to obtain information about the adult population at risk of NCDs in the area. Once the data is obtained, a simple random sampling is performed, according to the selection criteria of the research participants and according to the specified sample size. The researchers contacted participants by asking the Village Health Volunteers (VHVs) to set up times to meet with participants in the local meeting room. The researcher assistants explained how to answer the online questionnaire via line application on a smartphone to each participant and ask for cooperation to answer all questions. During the questionnaire, if you are worried, you can withdraw from the research.

Instruments and quality assessment: The details are as follows:

1) Demographic Questionnaire. The questionnaire gathered data on gender, age, marital status, education level, occupation, monthly income, living conditions, and NCD risks;

2) HL Scale was developed from HL assessments for adults [11,20], the 28-item scale assessed four elements of HL: 1) access to health information and services, 2) understanding of health information and services, 3) verification of health information and services, and 4) use of health information and services. The scale items were rated on a 5-point scale from lowest (1 point) to highest (5 points). The content validity of the scale was reviewed by three experts. The scale achieved an IOC ranging between 0.60-1.00 and overall reliability of 0.94.

3) SHB for NCD Prevention Scale, the 30-item scale assessed desirable behavior based on the philosophy of sufficient economy. Three elements of SHB were investigated: 1) sufficient living behavior, 2) safe behavior, and 3) self-care behavior. The scale items were rated on a 5-point scale from never (1 point) to regularly (5 points). The content validity of the scale was reviewed by three experts. The scale achieved an IOC ranging between 0.60-1.00 and overall reliability of 0.94.

Data Analysis: Basic statistics were used to analyze Basic data analysis of variables such as mean, standard deviation. Confirmatory factor analysis (CFA) used to analyze the measurement model were consistent with the empirical data and uses structure equation model (SEM) to analyze the causal relationship model were consistent with the empirical data, the model fit was determined based on the following benchmarks: a statistically significant chi-square (χ^2), $\chi^2/df < 5$, RMSEA ≤ 0.08, SRMR < 1.00, CFI > 0.90, GFI > 0.90, and NFI > 0.90 [19]

Research ethics: This study was granted a certificate of ethical approval for research involving human subjects by Srinakharinwirot University (SWUEC-330/2564E). Before beginning the data collection process, the researchers asked for the participants' consent for

study participation and explained the significant details about the study, including the reason and method of selecting participants. The researchers also protected the data confidentiality by excluding names and sources of data and explained the potential impact of each step of the research to protect the participants from any harm that might occur.

Results

1. General Characteristics of the Sample

The sample consisted of 636 participants. The majority of participants were female (67.30%), married (52.52%), and aged between 41-50 years (32.08%). Most of them reported holding a Bachelor's degree as their highest level of education (66.35%), working in a public organization (38.68%), having an adequate income with savings (32.39%), and without savings (32.23%).

2. Quality Assessment of the Scales

2.1 The 28-item HL Scale assessed four elements of HL: 1) access to health information and services, 2) understanding of health information and services, 3) verification of health information and services, and 4) use of health information and services. The scale items had discriminating power ranging between 0.50-0.86; the Cronbach's alpha for each element fell between 0.67-0.84; and the overall reliability of the scale equaled 0.94. In respect of construct validity, the CFA results indicated that the model fit the empirical data (Chi-square =1020.59, df=336, P=0.00, Chi-square/df= 3.03, RMSER=0.05, SRMR=0.02, GFI=0.90, CFI=0.99, NFI=0.99). Moreover, all of the scale items had factor loadings ranging from 0.67-0.84 which are all above acceptable levels as presented in Table 1.

2.2 The 30-item SHB Scale assessed three elements of SHB: 1) sufficient living behavior, 2) safe behavior, and 3) self-care behavior. The scale items had discriminating power ranging between 0.20-0.74; the Cronbach's alpha for each element fell between 0.83-0.87, and the overall reliability of the scale equaled 0.94. In respect of construct validity, the CFA results indicated that the model fit the empirical data (Chi-square= 1223.56, df= 385, P= 0.00, Chi-square/df= 3.17, RMSER= 0.05, SRMR = 0.02, GFI= 0.90, CF = 0.99, NFI= 0.98). Moreover, all of the scale items had factor loadings ranging from 0.40-0.82 which are all above acceptable levels as presented in Table 2.

3. Analysis of the Causal Relationship Model of SHB

The results showed that the causal relationship model fit the empirical data and all values reached acceptable levels (Chi-square= 6.3 5 , df=10, p-value=0.78, χ^2 /df= 0.63, RMSEA=0.00, SRMR 0.01, CFI= 1.00, NFI=1.00, GFI=1.00). In addition, health literacy had a positive direct effect on SHB at a significance level of 0.05 with an effect size of 0.82 and could explain 67.00% of the variation insufficient health behaviors as follow in figure 1

Discussion

In regard to the HL Scale, the researchers developed the scale items based on the structural elements of HL concepts by Sorensen et al. [20] and Osborne et al. [21] and designed the item content based on the Thai context [11]. Each element consisted of 7 items, totaling 28 items. The scale had item reliability ranging from 0.86-0.93 and overall reliability of 0.94,

which is considered excellent according to George and Mallery [22] and therefore a high-quality instrument for data collection. Also, the factor loadings of the items fell between 0.67-0.84, higher than the acceptable level of 0.30 [23]. The scale's construct validity was verified by the confirmatory factor analysis (CFA). The results indicated that the developed HL scale is practical and suitable for people at risk of NCDs.

The SHB Scale was developed based on the philosophy of sufficiency economy and the item content was designed based on Thai people's health behavior [24]. The scale assessed three elements of SHB. Each element consisted of 10 items, totaling 30 items. Similarly, the scale had item reliability ranging from 0.83 -0.8 7 and overall reliability of 0.94, which is considered excellent according to George and Mallery [22] and therefore a high-quality instrument for data collection. The factor loadings fell between 0.40-0.82, passing Kline's acceptable level [23]. The developed scale, as confirmed by the CFA results, can assess the actual levels of health-risk behaviors that may lead to NCDs among working-age groups.

Moreover, consistency between the causal relationship model of SHB and the empirical data was found, along with HL's positive direct effect on SHB at a significance level of 0.05. The results are consistent with a previous study that found HL's positive direct effect on health behavior and indirect effect on family well-being through health behavior [24]. Similar results were also found in Ginggeaw & Prasertsri 's study on the relationships between HL and health behavior among adults with chronic diseases [25]. The study found a statistically significant association between HL and health behavior with a correlation coefficient (r) of 0.46. The results are also confirmed by several foreign studies that investigated the relationships between HL and health behavior. For example, in Brega et al.'s study on the relationship between HL and glycemic control in American Indians and Alaska Natives, HL was found to have a statistically significant direct effect on health behavior and health outcomes[8]. Similarly, a study by Wanchen Hsu et al. found that health status, health awareness, and HL had statistically significant direct effects on health behavior [26]. Moreover, the results were also relevant to the finding of Lee & Oh [27], factors affecting a higher health-related quality of life were HL, self-efficacy, and health-promoting behavior in adults. HL was associated with more health-related behavior on the internet among Minnesotan adults with an affected size of 0.35[28]

Conclusion

Both developed scales are high-quality assessment instruments that can be used by healthcare providers in assessing NCD risks and predicting SHB in order to organize activities enhancing people's HL and knowledge about reducing NCD risk behaviors.

What is already known on this topic?

The research clearly supports that HL has a high influence on Thai people's SHB. If the government agencies can promote Thai people to have a high level of HL, the result of the development in Thai people having SHB is up to 67%. Therefore, this knowledge should be a policy direction for people's health promotion. Health providers and health professionals should continually organize learning activities to improve the HL of Thai people of all ages. Thai people are able to rely on themselves and have immunity to self-health care in accordance with the Thai lifestyle based on the sufficiency economy philosophy.

What does this study add?

Researchers extend the studying area by healthcare providers using these high-quality scales to assess risk factors for NCDs in order to organize activities promoting HL and health behavior that match working-age people's lifestyles. The yielded results can be used in designing relevant future research such as an exploratory study in which the researchers may use the developed scales before and after the experiment or focus on enhancing HL due to predict health behavior, or a qualitative study in which the researchers study people with high levels of HL and SHB to develop a guideline insufficient health living for NCD risk reduction.

Limitations

This research collected data using online questionnaires. As a result, some respondents did not answer all the questions. Therefore, data collection must be increased by 10% to prevent data loss, and the number of samples was consistent with the statistical techniques used to analyze.

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Conflicts of interest

The authors declare no conflict of interest.

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การตรวจสอบคุณภาพเครื่องมือความรอบรู้ด้านสุขภาพและโมเดลเชิงสาเหตุของพฤติกรรมสุขภาพพอเพียงของผู้ใหญ่กลุ่มเสี่ยงโรคไม่ติดต่อเรื้อรัง

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บทคัดย่อ

ภูมิหลัง: อัตราการตายด้วยโรค NCDs ของคนไทยร้อยละ 75 ซึ่งสูงกว่าประชากรทั่วโลกคิดเป็นร้อยละ 71

วิธีการ: ในการวิจัยเชิงสำรวจภาพตัดขวางครั้งนี้ มีวัตถุประสงค์เพื่อพัฒนาแบบวัดความรอบรู้ด้านสุขภาพและพฤติกรรมสุขภาพพอเพียง และทดสอบรูปแบบความสัมพันธ์เชิงสาเหตุของพฤติกรรมสุขภาพพอเพียงของกลุ่มผู้ใหญ่อายุ 20-65 ปี เสี่ยงโรคไม่ติดต่อเรื้อรัง ประกอบด้วยกลุ่มคนทำงานในองค์กรภาครัฐภาคเอกชนและกลุ่มประชาชนอาศัยในชุมชนเขตเมืองและชุมชนกึ่งเมือง ดำเนินการในช่วงเดือนสิงหาคม 2564- มีนาคม 2565 ที่ได้มาจากการสุ่มแบบแบ่งชั้นภูมิตามกลุ่มรวมจำนวน 636 คน วิเคราะห์ข้อมูลด้วยการวิเคราะห์องค์ประกอบเชิงยืนยัน (CFA) และสมการเชิงโครงสร้าง (SEM)

ผลวิจัย: 1) ผลการตรวจสอบความตรงเชิงโครงสร้างของแบบวัด พบว่า แบบวัดความรอบรู้ด้านสุขภาพประกอบด้วย 28 ข้อคำถาม มีค่าความเชื่อมั่นทั้งฉบับ (Cronbach's Alpha) เท่ากับ 0.94 และมีค่าน้ำหนักองค์ประกอบ (Factor Loading) อยู่ระหว่าง 0.67-0.84 แบบวัดพฤติกรรมสุขภาพพอเพียง

ประกอบด้วย 30 ข้อคำถาม มีค่าความเชื่อมั่นทั้งฉบับเท่ากับ 0.94 และมีค่าน้ำหนักองค์ประกอบอยู่ระหว่าง 0.40-0.82 และ 2) ผลการตรวจสอบรูปแบบความสัมพันธ์เชิงสาเหตุพบว่ามีความสอดคล้องกับข้อมูลเชิงประจักษ์ และปัจจัยความรอบรู้ด้านสุขภาพมีอิทธิพลเชิงบวกต่อพฤติกรรมสุขภาพพอเพียงอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 โดยมีค่าสัมประสิทธิ์อิทธิพลเท่ากับ 0.82 และความรอบรู้ด้านสุขภาพเป็นปัจจัยสำคัญที่สามารถทำนายพฤติกรรมสุขภาพพอเพียงได้ถึงร้อยละ 67.00

ข้อสรุป: แบบวัดครั้งนี้มีคุณภาพสูง ผู้ให้บริการสุขภาพสามารถนำไปใช้ในการวัดระดับความเสี่ยงและทำนายพฤติกรรมสุขภาพพอเพียงเพื่อจัดกิจกรรมส่งเสริมความรอบรู้ด้านสุขภาพและความรู้เพื่อลดพฤติกรรมเสี่ยงต่อโรค NCDs ได้

คำสำคัญ: ความรอบรู้ด้านสุขภาพ พฤติกรรมสุขภาพพอเพียง โรคไม่ติดต่อเรื้อรัง กลุ่มเสี่ยงโรค NCDs ตรวจสอบเครื่องมือวัด

JMATHAI-D-22-00068 Journal of the Medical Association of Thailand

Article Title: "Construct Validity of Health Literacy Scale and Causal Model of Sufficient Health Behavior among NCDs Risk Adults: The Cross-Sectional Study"

Reviewer's comment	Edited
Reviewer # 1 1. Please identify research hypotheses.	Put the sentences to explain on page 2, paragraph 2 of Introduction: "Under the research hypothesis, the measurement model and the causal relationship model were consistent with the empirical data."
2. The sentences describing the study objectives in abstract, and background are not the same. Although the comprehended to be the same, but it can be misleading. Please reconsider to write the same sentences (Optional).	Delete the original sentence and add a new sentence on page 1 in Materials and Methods on Abstract "…This cross-sectional exploratory study aimed to develop a health literacy (HL) and sufficient health behavior (SHB) scale, .." Delete the original sentence and add a new sentence on page 2 paragraph 2 of Introduction. " 2) examine the causal relationships model of SHB."
3. To clearly understand for readers, please give more explanation why 200 participants were allocated into each group.	Delete the original sentence and add a new sentence on page 3, paragraph 1 of Materials and Methods "~~Population and Sample: The population consisted of adults at risk of NCDs living in Sing Buri, Sa Kaeo, and Bangkok, all of which obtained low scores on HL and health behavior in 2016 according to the Department of Health Service Support, Ministry of Public Health.~~ " "This cross-sectional exploratory study was carried out from August 2021 to March 2022. The population and sample group were Thai adults with NCD risks, living in Sing Buri, Sa Kaeo provinces, and Bangkok where levels of HL were low and risks of NCDs were high from previous surveys in 2016 [18]." Delete the original sentence and add a new sentence on page 3 Materials and Methods "~~The sample consisted of working-age adults aged between 20-65 years who were at risk of NCDs and living in urban and semi-urban communities in the three provinces. Obtained through stratified random sampling, the sample was divided into three groups: 1) employees in public organizations, 2) employees in private organizations, and 3) local people. The sample size was determined as suggested by Hair et al. [18]; therefore, two hundred participants were allocated into each group, totaling 600 participants. The researchers, however, increased the sample size by 10% to 660 participants to prevent data loss. A total of 636 questionnaires (96.36%) were completed and returned.~~" "The sample size was determined based on the size required to confirm a causal relationship model, with 200 people in each group [19]. The total sample consisted of 600 Thai adults at risk of NCDs aged 20- 65 years old, working age groups were selected through a quota- stratified random sampling technique for making sure that

Reviewer's comment	Edited
	participants were selected equally into 3 groups; 1) working in government organizations, 2) working in private organizations, and 3) people in the community from 3 provinces in equal proportions. In this research, the sample size was increased by 10% to prevent data loss, the total number of samples was 660, and when collected 636 complete questionnaires were returned, representing 96.36%."
4. Please give more details about inclusion criteria, especially adults at risk of NCDs, what NCDs include. Is there any exclusion criteria? Please explain more. This will be valuable for generalization.	Put the sentences to explain on page 3: Materials and Methods "The Inclusion - exclusion criteria were 1) aged between 20-65 years 2) had not non- chronic communicable diseases such as diabetes mellitus, hypertension, and heart disease, 3) able to read, write and agree to provide health information, 4) have a smartphone that can communicate with Line Application and able to do online questionnaires. The exclusion criteria were 1) reluctance or hesitation in providing information, 2) inability to complete the measurement and 3) withdrawal from the study."
5. Please explain method of data collection.	Put the sentences to explain on page 3 Materials and Methods " **Data collection**: After obtaining the Human Research Ethics Certificate. Therefore, it coordinates with health personnel in the targeted areas to obtain information about the adult population at risk of NCDs in the area. Once the data is obtained, a simple random sampling is performed, according to the selection criteria of the research participants and according to the specified sample size. The researchers contacted participants by asking the Village Health Volunteers (VHVs) to set up times to meet with participants in the local meeting room. The researcher assistants explained how to answer the online questionnaire via line application on a smartphone to each participant and ask for cooperation to answer all questions. During the questionnaire, if you are worried, you can withdraw from the research."
6. Are there limitations of this study? Please give more details about this.	Put the sentences to explain on page 9: **Limitations** This research collected data using online questionnaires. As a result, some respondents did not answer all the questions. Therefore, data collection must be increased by 10% to prevent data loss, and the number of samples was consistent with the statistical techniques used to analyze.

Reviewer # 2 1. Details for methodology. Formulation of ideas, tool development, tool verification, exclusion/inclusion, statistical proof.	**Exclusion/inclusion**: Put the sentences to explain on page 3: Materials and Methods "The Inclusion - exclusion criteria were 1) aged between 20-65 years 2) had not non- chronic communicable diseases such as diabetes mellitus, hypertension, and heart disease, 3) able to read, write and agree to provide health information, 4) have a smartphone that can communicate with Line Application and able to do online questionnaires. The exclusion criteria were 1) reluctance or

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	hesitation in providing information, 2) inability to complete the measurement and 3) withdrawal from the study." **Statistical proof:** Deleted the sentence and add a new sentence on page 4 Materials and Methods ~~Data analysis: Basic statistics were used to analyze the quality of the assessment instruments, confirmatory factor analysis (for evaluating the latent variable model's goodness of fit), and structural equation modeling (for evaluating the assumption-based causal model's goodness of fit with the empirical data). In structural equation modeling or SEM, the model fit was determined based on the following benchmarks: a statistically significant chi-square (χ^2), χ^2/df < 5, RMSEA ≤ 0.08, SRMR < 1.00, CFI > 0.90, GFI > 0.90, and NFI > 0.90 [20].~~ Data Analysis: Basic statistics were used to analyze Basic data analysis of variables such as mean, standard deviation. Confirmatory factor analysis (CFA) used to analyze the measurement model were consistent with the empirical data and uses structure equation model (SEM) to analyze the causal relationship model were consistent with the empirical data, the model fit was determined based on the following benchmarks: a statistically significant chi-square (χ^2), χ^2/df < 5, RMSEA ≤ 0.08, SRMR < 1.00, CFI > 0.90, GFI > 0.90, and NFI > 0.90 [19]