

A Short Form of the Taiwan Health Literacy Scale (THLS) for Chinese-Speaking Adults

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Abstract—The Taiwan Health Literacy Scale (THLS) was developed to cope with the need of measuring health literacy of Chinese-speaking adults in Taiwan. Although the scale was proven having good reliability and validity, it was not popularly adopted by the practitioners due to the length, and the time required completing. Based on the THLS, this research further invited healthcare professionals to review the original scale for a possible shorten work. Under the logic of THLS, the research adopted an analytic hierarchy process technique to consolidate the healthcare experts' assessments to shorten the original scale. There are fifteen items out of the original 66 items were identified having higher loadings. Confirmed by the experts and passed a pilot test with 40 undergraduate students, a short form of THLS is then introduced. This research then used 839 samples from the major cities of the Hua-lien county in the eastern part of Taiwan to test the reliability and validity of this new scale. The reliability of the scale is high and acceptable. The current scale is also highly correlated with the original, of which provide evidence for the validity of the scale.

Keywords—Health literacy, THLS, health education, STHLS.

I. INTRODUCTION

HEALTH literacy denotes a patient's ability to extract, understand, and use health-related information [1] by which s/he can take proper actions to maintain the health status accordingly. The National Library of Medicine refers the health literacy as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" [2][3]. Alternatively, the World Health Organization illustrated it as "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health" [4][5]. As one of an individual's important capability, the associated abilities could be categorized as three levels. The functional literacy denotes the basic level of reading and writing skills that let someone function effectively in everyday situations. The communicative literacy for certain advanced skills that allow a person to extract information, derive meaning from different forms of communication, and apply new information to changing circumstances. The critical literacy represents a more advanced skill for specifically apprehending

and using information to exert greater control over life events and situations [1] [6]. It had been widely proven that the levels of health literacy resulted in better patient-physician communication, and thus a better medication results could be expected [6]. Healthcare service providers can rely on their understanding on the patient's health literacy levels to deliver more appropriate medical advices or health education [6] [7].

Realizing the importance of health literacy in public health, many countries have developed various measurements for multiple uses. Well-known health literacy scales are many, such as WRAT (Wide Range Achievement Test) [8] [9], REALM (Rapid Estimate of Adult Literacy in Medicine) [10] [11], TOFHLA (Test of Functional Health Literacy in Adults), etc [12]. Time required to complete a test around 30 minutes was a drawback for TOFHLA.

In Taiwan, there were several attempts in developing similar scale for practical and academic use. The first attempt was a direct translation of REALM as a Chinese edition [13]. This scale has several shortcomings because of the base of the original scale was highly context-specific for American people, and the major differences between English and Chinese language systems in terms of word composition, verbal expression (and grammar logic), and phonetic. A more context-specific scale based on the local experience was developed with a support from the National Science Council (NSC) in Taiwan. The Taiwan Health Literacy Scales for Adults (THLS) was developed in 2008 with high reliability and concurrent validity for Taiwan's nationals [7], was confirmed as having better reflection of the nationals' current health literacy levels. Similar to the TOFHLA, a major drawback to the THLS was the time required to complete a test may last as long as fifteen to twenty minutes, of which is always a barrier in a busy and crowded clinic practice in Taiwan.

This research attempted to shorten the THLS without sacrificing the true value of the original scale, with which the healthcare practitioners can use to identify an adult's health literacy status in a speedy way. Just like the STOFHLA for TOFHLA, a STHLS for THLS for rapid application.

II. RESEARCH DESIGN AND SAMPLING

The original Taiwan Health Literacy Scale (THLS) contains 66 items in nice categories. These are eight items in the Pharmaceutical aspect, ten items in a Serious-disease aspect, ten in the General diseases, seven items each in the aspects of Organs, Physiology, Health (disease) symptoms, and Examination, five terms each in the Medical treatment and clinical signs respectively. All of these dimensions were

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measured with acceptable reliability at Cronbach's α higher than 0.89 [7].

Based on the premise of THLS, this research adopted an Analytic Hierarchy Process (AHP) in an attempt to shorten the list of the scale by identifying the items that will have the greatest loading in a respondent's health literacy in one hand, and can represent the majority of variance of the original scale in the other.

A. Analytic Hierarchy Process

The analytic hierarchy process was developed by Thomas L. Saaty in 1971 for decision problems with multiple decision criteria under the uncertain contexts. Based on a series of systematic pair-wise comparison, the well-defined experts exploit their knowledge specific to the research problems in question to grade the importance of each pair of decision-related criterion or attribute. Since the comparison is limited to a one-to-one pair, the expert will be more confident in making judge. The results obtained from these evaluations would be highly reliable and objective, since these experts were recruited based on their expertise on the question under study. This study adopts the premise of AHP technique in an innovative way. The concept of AHP is used to utilize the healthcare professionals' expertise in identifying the most important items in the original 66-item health literacy scale. The experts were asked to compare each pair of literacy terms based on their knowledge and experience on patient care services. There were fifteen experts from the healthcare industries, include physicians from varied specialization, senior nurses from different hospital departments and clinics, public health scholars, and public health agencies. Average experience in healthcare-related service is 14.6 years. The experts were advised that the patients will be assessed in a Likert scale with 1 to five points of interval, in which "1" represents "never heard", "2" have heard but not understand the meaning; "3" represents have heard and know what the term means; "4" represents understand the meaning and content of the term; and "5" represents the respondent fully understand what the term means as a training health professional.

III. DATA ANALYSES AND RESULTS

A. Samples

Samples are taken from Pingtung and Hwal-ien respectively. Pilot test. This research dispatched 50 questionnaires to the undergraduate students who are aged 20 and above. Students were split into two groups. One group of students major in healthcare management and the other were in the same college yet non-healthcare major. 46 valid responses were collected to test the reliability and validity of the questionnaire.

Formal test. Samples were purposefully collected based on the following criteria: (1) currently reside in Hwa-lien county; (2) aged 18 or above; (3) literate; and (4) agree to cooperate with this project. Hwa-lien is one of three counties in the eastern part of Taiwan with slow economic moving. Compare

to those counties in the western part of Taiwan, population in this county is characterized with a higher percentage of aging and aged people, less and slower economic activities and thus less income per capita, less populated, poorer access to the healthcare or medical as well as educational resources. This area was one of the places that needed hard the health promotion and health education programs. This area had attracted thousands of immigrants who were moderated or highly educated from the western part because of its natural attractions in the mountains and the ocean. This made the distribution of healthcare knowledge in this population highly diverse. Based on a notion of maximizing the variability, this would be an ideal place to test this scale. Samples were taken from ten major cities with higher population density in the county in the period of April and May of 2010.

Cities included are Hwa-lien, Jih-an, Hsiou-lin, Shou-feng, Feng-lin, Kwang-fu, Juei-suei, Yu-lih, Jou-shi, and Fu-lih. 1200 questionnaires were dispatched to and filled by the defined respondents, with the help of one of the researchers of the project. 839 valid responses were collected, at a response rate of 69.97%, as shown in table I.

TABLE I
 GEOGRAPHIC DISTRIBUTION OF RESPONDENTS

Cities	Dispatched	Responses	Rate (%)
Hwa-lien	200	132	15.50
Jih-an	150	92	10.80
Hsiou-lin	100	70	8.30
Shou-feng	100	64	7.50
Feng-lin	100	87	10.30
Kwang-fu	100	94	11.10
Juei-suei	100	78	9.20
Yu-lih	150	88	10.40
Jou-shi	100	72	8.50
Fu-lih	100	72	8.50
Sub-total	1200	839	69.97

B. Demographic Distribution

Gender distribution of the respondents in this research is 403 females (48.00%) and 436 males (52.00%) in the 839 valid respondents. Respondents who aged 31~40 is the major age group with 226 (26.90%), followed by the group of 21~30 with 223 (26.60%), 40~50 with 150 (17.90%), 18~20 with 104 (12.40%), 61 and above with 73 (8.70%), and 51~60 with 63 (7.50%). Most the respondents reside in the plain area (697, 83.10%), and the rest in the mountain area (142, 16.90%). 382 (45.53%) respondents were single, 366 (43.63%) married, and 60 (7.14%) and 31 (3.70%) were divorced or widowed respectively. As the previous section noted, this area attracted plenty new residents from the western part, thus make the area multi-raced. Although the population in this area was mainly the aboriginal people, the non-aboriginal races had now become the major population. There are only 231 (27.50%) respondents with aboriginal background, compare to 608 non-aboriginals (such as Hans, Hakais, and early immigrants from mainland China). Educational level is also an interesting indicator showing the diversity of the population with 250 (29.80%) have a high school diploma, 196 (23.36%) respondents were university educated with a bachelor or higher

degree, and followed by 189 (22.52%) respondents have 9th grade, 102 (12.16%) for community college and elementary school respectively. This means over 65 percent of the respondents had been at least high-school educated. The most popular occupations in the respondents were in descending order in service industries (203, 24.20%), resource industries (fishery, agriculture, and husbandry) (164, 19.54%), public services (and government employee) (156, 18.60%), students (138, 16.45%), other non-specified (127, 15.14%), manufacturing employee (30, 3.58%), and healthcare professionals (21, 2.50%).

TABLE II
 DEMOGRAPHIC DISTRIBUTION

Variables	Groups	N	%
Gender	Male	436	52.00
	Female	403	48.00
Age	18-20 yrs.	104	12.40
	21-30 yrs.	223	26.60
	31-40 yrs.	226	26.90
	41-50 yrs.	150	17.90
	51-60 yrs.	63	7.50
	61 yrs. +	73	8.70
Resident area	Plains	697	83.10
	Mountains	142	16.90
Marriage	Single	382	45.53
	Married	366	43.63
	Divorced	60	7.14
	Widowed	31	3.70
Races	Aboriginals	231	27.50
	Non-aboriginals	608	72.50
Education	Elementary	102	12.16
	Junior	189	22.52
	Senior High	250	29.80
	College	102	12.16
	Bachelor +	196	23.36
Occupation	Public services	156	18.60
	Healthcare	21	2.50
	Resources	164	19.54
	Manufacturing	30	3.58
	Services	203	24.20
	Students	138	16.45
	Others(non-specified)	127	15.14
	Monthly income	NT\$20,000 -	484
NT\$20,001~\$40,000	252	30.03	
NT\$40,001+	103	12.30	

Income distribution may also reveal important information on the economic picture of this area, in which most respondents earned NTD 20,000 (around USD 650) or lower per month (484, 57.69%), followed by those earned 20,001~40,000 (252, 30.3%), and the group that earned 40,001 or above per month is the least in the respondents. All these demographic distribution information are shown as in the table II.

C. Results

The study used the Expert Choice 11.5 software package, and identified fifteen items were graded as the top fifteen in the weight of importance, shown as table III and appendix I. This is then termed as STHLS.

TABLE III
 WEIGHT DISTRIBUTION OF THLS

Factor	Health Literacy Terms	Criteri	Scores	Rank	
Pharma. (0.114) (3)	Anodyne	0.150	0.19	16	
	Non-steroid antiphlogistic	0.144	0.19	17	
	Antibiotics	0.175	0.23	4*	
	Nicotine	0.068	0.09	56	
	Diuretics	0.113	0.15	33	
	Antacids	0.101	0.13	39	
	Steroid	0.158	0.20	12*	
	Viartril S	0.089	0.12	41	
Serious diseases (0.115) (1)	Hepatitis b	0.082	0.15	34	
	Carbon monoxide poisoning	0.083	0.15	35	
	Cirrhosis of liver	0.080	0.14	37	
	Diabetes mellitus	0.113	0.20	13*	
	Chronic blocking pneumonia	0.064	0.11	43	
	Hypertension	0.107	0.19	18	
	Pulmonary tuberculosis	0.080	0.14	38	
	Kidney failure	0.103	0.18	20	
	Cerebral apoplexy	0.123	0.22	5*	
	Cancer	0.165	0.29	1*	
	General diseases (0.09) (8)	Parkinson's disease	0.083	0.08	62
Alzheimer's disease		0.083	0.08	63	
Systemic lupus erythematosus,		0.103	0.10	47	
Osteoporosis		0.100	0.10	48	
Degenerative arthritis		0.090	0.09	57	
Gout		0.086	0.08	64	
Hemorrhoid		0.068	0.07	65	
AIDS		0.180	0.18	21	
Gastric ulcer		0.118	0.12	42	
Hernia		0.091	0.09	58	
Organs (0.09) (9)	Thyroid gland	0.117	0.10	49	
	Blood platelets	0.125	0.10	50	
	Placenta	0.084	0.07	66	
	Pelvic cavity	0.120	0.10	51	
	Coronary arteries	0.213	0.17	25	
	Circulatory system	0.201	0.16	31	
	Prostate gland	0.140	0.11	44	
	Physio. (0.13) (2)	Autoimmunity	0.185	0.26	2*
		Systolic pressure	0.147	0.21	8*
Cholesterol		0.174	0.25	3*	
Insulin		0.129	0.18	22	
Urate (Uric Acid)		0.123	0.17	26	
Hormone		0.121	0.17	27	
Sodium ion		0.121	0.17	28	
Exam. (0.11) (6)	Large intestine mirror	0.167	0.21	9*	
	Cervical smear test	0.165	0.21	10*	
	Computerized tomography	0.155	0.20	14*	
	Magnetic resonance	0.136	0.17	29	
	Ultrasonography	0.137	0.17	30	
	Gastroscopy	0.125	0.16	32	
Med. treatment (0.11) (5)	Angiography	0.115	0.15	36	
	High filament food	0.223	0.22	6*	
	Chemotherapy	0.210	0.20	14*	
	Heart rhythm regulator	0.191	0.19	19	
	Hospice care	0.188	0.18	23	
Health symptoms (0.11) (4)	Influenza vaccine	0.188	0.18	24	
	Angina Pectoris	0.252	0.22	7*	
	Aphasia	0.151	0.13	40	
	Climacterium / menopause	0.122	0.11	45	
	Vertigo	0.120	0.11	46	
	Urinary incontinence	0.120	0.10	52	
	Compulsive behaviour	0.115	0.10	53	
Clinical S. (0.11) (7)	Allergy	0.120	0.10	54	
	Brain death	0.353	0.21	11*	
	Albuminuria	0.171	0.09	55	
	Hemoptysis	0.158	0.09	59	
	Fatty liver	0.160	0.09	60	
	Jaundice	0.158	0.09	61	

*indicated the top 15 items

These are Cancer, Autoimmunity, Cholesterol, Antibiotics, Cerebral apoplexy, High filament food, Angina Pectoris, Systolic pressure, Large intestine mirror inspection, Cervical

smear test, Brain death, Steroid, Diabetes mellitus, Computerized tomography scans (CT scans), and Chemotherapy with the C.R. and C.R.H were less than 0.1., indicated that the result has an acceptable reliability.

D. Correlation Coefficient of Original and Short Form Scales

This research then used both the original and short-form questionnaire in a study with 839 samples (and 40 samples in a pilot test). The result shows that these two instruments are positively correlated ($r = 0.982$). The correlation of coefficient information is shown in table IV.

TABLE IV
CORRELATION OF THE ORIGINAL AND THE SHORT-FROM SCALES

	Original (66)	SF (15)	Antibiotics	Steroid	DM	Cereb. Apop.	Cancer	Autoimmune	Cholesterol	LIMI	CV rest	Chemo	CT scan	HFF	BD	AP	S Pressure
Original (66)	1																
SF (15)	.982**	1															
Antibiotics	.803**	.787**	1														
Steroid	.836**	.850**	.788**	1													
Diabetes mellitus	.839**	.824**	.631**	.773**	1												
Cerebral apoplexy	.848**	.867**	.771**	.754**	.741**	1											
Cancer	.716**	.714**	.650**	.627**	.605**	.684**	1										
Autoimmunity	.808**	.830**	.598**	.744**	.710**	.656**	.380**	1									
Cholesterol	.874**	.887**	.773**	.668**	.583**	.764**	.534**	.701**	1								
Large intestine mirror inspection	.844**	.867**	.538**	.669**	.771**	.700**	.496**	.762**	.745**	1							
Cervical smear test	.694**	.698**	.511**	.476**	.514**	.540**	.498**	.471**	.618**	.649**	1						
Chemotherapy	.739**	.781**	.587**	.569**	.504**	.589**	.753**	.551**	.692**	.622**	.579**	1					
Comp. tomography (CT)	.863**	.846**	.577**	.679**	.773**	.762**	.590**	.648**	.758**	.845**	.613**	.554**	1				
High filament food	.818**	.843**	.620**	.666**	.614**	.759**	.567**	.640**	.805**	.702**	.606**	.658**	.721**	1			
Brain death	.874**	.895**	.728**	.739**	.718**	.671**	.564**	.773**	.818**	.762**	.721**	.781**	.662**	.724**	1		
Angina Pectoris	.805**	.850**	.625**	.647**	.602**	.810**	.435**	.753**	.836**	.778**	.526**	.632**	.691**	.756**	.793**	1	
Systolic pressure	.549**	.582**	.244**	.498**	.449**	.410**	.386**	.528**	.476**	.461**	.219**	.432**	.446**	.433**	.394**	.431**	1

* $p < .05$; ** $p < .01$

E. Levels of Health Literacy

The top three health literacy scores were found for "Cerebral apoplexy", "Diabetes mellitus", and "Cancer", and the lowest scores are found for "Autoimmunity", "Large intestine mirror inspection", and "Systolic pressure". As shown in the table V, these rankings are consistent with the study of original scale [7]. Worthy to note is the average scores for each item are relatively lower than the ideal standard as proposed by Pan et al (2010)[7]. Since the samples that Pan et al (2010) had taken to test the original scale was mainly from the western part of Taiwan[7], to which was recognized as a more resourceful place in terms of medical and educational resources. Whether the differences in the accessibility of medical and educational resources determined such a gap, and whether the ideal levels were district-specific and should be amended based on certain criteria such as geographic factors all remained unknown.

F. Categories of Health Literacy Levels

Average score of the respondents is 43.33, with the highest at 75 and the lowest at 15. This research further categorized the respondents into three groups based on the total score from the simplified scale. The top 27 % of the respondents were grouped as the high score class, the bottom 27% were labelled as the low score class, and the rest as the average or middle class. The high score class is the respondents gained 50 or higher of scores, or gained proper literacy for the health needs.

This has 233 or 27.77% of respondents. The low score class gained 36 or lower of scores, or gained marginal literacy that is insufficient for health needs. This has 238 or 28.37% of respondents. This research indicated that around half of the respondents were not sufficiently literate for their health needs. This is similar to the results of Pan et al (2010).

TABLE V
HEALTH LITERACY SCORES DISTRIBUTION

Items	Mean	s. d.	Ranking
Cerebral apoplexy (腦中風)	3.14	1.07	1
Diabetes mellitus (糖尿病)	3.10	1.08	2
Cancer (癌症)	2.99	1.07	3
High filament food (高纖食品)	2.98	1.10	4
Cholesterol (膽固醇)	2.97	1.00	5
Antibiotics (抗生素)	2.97	1.02	6
Brain death (腦死)	2.96	1.15	7
Comp. tomography (CT) (電腦斷層檢查)	2.92	1.14	8
Cervical smear test(子宮頸抹片)	2.88	1.08	9
Steroid (類固醇)	2.85	1.07	10
Chemotherapy (化學治療)	2.85	1.18	11
Angina Pectoris (心絞痛)	2.78	1.08	12
Systolic pressure (收縮壓)	2.67	1.19	13
Large intestine mirror inspection (大腸鏡檢查)	2.65	1.14	14
Autoimmunity (自體免疫)	2.63	1.09	15

IV. DISCUSSION

Lacking sufficient health literacy is harmful for the nationals to gain and use the healthcare resources in an effective and efficient ways, by which cause unhealthy status and possible wastes of precious healthcare resources. Lacking an efficient instrument in detecting a healthcare receiver's health literacy levels prevents an effective communication (and in most cases an efficient way as well) between the healthcare providers and receivers (e.g. physician and patient). As a result, multiple parties loss. This tells why many scales were developed to measure the health literacy. In fact, a literacy scale can not only provide useful information to support diagnosing and prescribing for medical staffs, but also guide the plans of public health education and health promotion program of a nation. Similar to those scales were developed for specific countries, Pan et al (2010) had developed a health literacy scale (THLS) for Chinese-speaking adults in Taiwan [7]. This scale had passed several tests with reliability and validity in detecting a national's sufficiency in health literacy. The major drawback to the THLS was the time required to complete a full length test, of which prevent wide acceptance in general clinical practices. This research shortens the length of the scale, yet not sacrificing the reliability and validity.

A. A Need to Develop Effective Health Education Program

As literature had generally proven, a poor literacy can affect people's health directly by limiting their personal, social and cultural development, as well as hindering the development of health literacy. The root cause for such a marginal health literacy group may stem from insufficient education. However, a health-specific education program designed for the low-educated population will somehow lessen the negative impacts on these minorities. Moreover, a formal educational system without proper health-related ingredients or the course were not delivered with health favor, may deserve for close and careful monitoring and amendment. No matter what levels of education a person received, a health literacy examination should be performed periodically to provide a clearer picture on the person's health literacy level. This would be valuable for the healthcare practitioners as well as the public health educators and the government for healthcare services practices and health policy.

Health literacy is generally referred to the personal capability that integrates an adult's reading, writing, listening, expressing, and information searching capabilities to foster or enhance an individual's perception on personal needs of health, access and acquire health resources for health needs. This notion had widely appeared in various literature, such as the National Library of Medicine [2], World Health Organization [4], Nutbeam (2000) [5], and *Healthy People 2010* [14], etc.

Like as the original THLS, this short form THLS again not includes the computing and expressing capabilities into the scale. These additional capabilities, other than verbal or phrase comprehension could be also an important factor that affects an individual's behavior in proper accessing and using

health-related information or resources. This again needs to be considered as a base in both developing a reliable scale and an educational program.

B. Possible Differences by Geographical Factors

Compare to the original THLS that was mainly adopted the residents in the western part of Taiwan; the health literacy scores gained by the respondents of this research appeared to be lower in average, despite that substantial portion of the eastern respondents were highly educated. Although the items received the top and the lowest scores are similar to each other, the respondents in the east gained comparatively lower scores. This may denote that the efforts in providing resources of health education and healthcare services were insufficient. This appeared as a geographical difference, yet the root cause may stem from the economic status of this particular area for not such that attractive for healthcare providers.

This research did not examine how the scores may differ in terms of the respondents' demographic factors and healthcare experiences as the original THLS had done. However, a similar result could be expected since the high correlation between the original and the short form. Moreover, this short form scale needs less time to complete, thus can be more useful than the original.

V. CONCLUSION

Based on the original health literacy scale for Taiwan adults, this research developed a short form scale for easier and wider usages. The current research has proven this scale has good reliability, and is highly correlated with the original. Further evidence for the applicability of this short form scale could be found is the consistence of the top and the lowest scores of multiple samples in different calendar zones. Like as what Pan and colleagues (2010) expected [7], I wish this scale could be contributive to the scholars and practitioners in all Chinese-speaking areas, such as Hong Kong, China, Macau, and Singapore. Certainly, some modification may be needed for the possible wording differences in healthcare terminology.

Despite the differences in the demographic, geographic, and national boundaries, a policy that to include health-related information into the educational programs should be carefully established and well maintained.

APPENDIX

STHLS (WITH ENGLISH TRANSLATION)

抗生素	Antibiotics	腦中風	Cerebral apoplexy
類固醇	Steroid	癌症	Cancer
糖尿病	Diabetes mellitus	腦死	Brain death
膽固醇	Cholesterol	心絞痛	Angina Pectoris
大腸鏡檢查	Large intestine mirror inspection	電腦斷層檢查	Computerized tomography scan (CT scan)
子宮頸抹片	Cervical smear test	自體免疫	Autoimmunity
收縮壓	Systolic pressure	高纖食品	High filament food
化學治療	Chemotherapy		

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