Development of a Health Literacy Scale for Chinese-Speaking Adults in Taiwan

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Abstract—Background, measuring an individual's Health Literacy is gaining attention, yet no appropriate instrument is available in Taiwan. Measurement tools that were developed and used in western countries may not be appropriate for use in Taiwan due to a different language system. Purpose of this research was to develop a Health Literacy measurement instrument specific for Taiwan adults. Methods, several experts of clinic physicians; healthcare administrators and scholars identified 125 common used health related Chinese phrases from major medical knowledge sources that easy accessible to the public. A five-point Likert scale is used to measure the understanding level of the target population. Such measurement is then used to compare with the correctness of their answers to a health knowledge test for validation. Samples, samples under study were purposefully taken from four groups of people in the northern Pingtung, OPD patients, university students, community residents, and casual visitors to the central park. A set of health knowledge index with 10 questions is used to screen those false responses. A sample size of 686 valid cases out of 776 was then included to construct this scale. An independent t-test was used to examine each individual phrase. The phrases with the highest significance are then identified and retained to compose this scale. Result, a Taiwan Health Literacy Scale (THLS) was finalized with 66 health-related phrases under nine divisions. Cronbach's alpha of each division is at a satisfactory level of 89% and above. **Conclusions,** factors significantly differentiate the levels of health literacy are education, female gender, age, family members of stroke victims, experience with patient care, and healthcare professionals in the initial application in this study..

Keywords—Health literacy, health knowledge, REALM, THLS.

I. INTRODUCTION

EFFECTIVE communication between healthcare services providers and receivers is a core to quality of a healthcare service. Such effectiveness could be reached by jointly effort of both healthcare professionals and healthcare consumers. Recent healthcare professional training has noticed the need and accordingly included relevant training in incubation education or on the job program of using plain terms or words while communicating with patients or consumers. Service providers may perform a better job when deliver medical advices or health education messages to patients as long as they have good knowledge on the patient's level of knowledge or literacy on health related services [1]. Although a service provider could use as plain as possible words to communicate their patients, yet the communication could be more effective if the service provider would include the patient's health literacy in his/her message encoding stage. Consequently, a quality care could be expected, and error-free medical dispute could be proportionally lowered. Many western countries have developed certain measurements for various purposes. A physician may use this information of health Literacy level to perform healthcare service deliveries and to give home care advices. Public health department of a government can also use this as a reliable tool to assess and deliver appropriate health related information. Taiwan has launched her National Health Insurance Policy in 1995 with great success in caring her nationals' health, of which is one of the best systems in the world. In the meantime, Taiwan has also devoted numerous resources in health education. Unfortunately, Taiwan has no Chinese-specific scale available for use to assess her national's health literacy. This research aims to develop a health literacy scale that specific for Chinese in Taiwan.

A. Literacy, Health Literacy, and Functional Literacy

Discussions on Health literacy (HL) related issues could be traced back to the studies on literacy, and some 3,500 articles had addressed this particular topic as of the year of 2002 [2]. In 1930s and 1940s, literacy is generally defined as a composite capability of 'reading', 'writing', 'listening', and ' speaking' of mandating particular language while communicating with others. Some scholars further argued that literacy is not static but dynamic, and should accompany with an abstract thinking capability [3] [4] [5] [6]. Past research has also generally indicated that the level of literacy of a person could be affected by many different factors such as years of education [7], social education [8] among others. In 1991, the National Literacy Act of United States broadens the concept of literacy by including the computational capability as part of literacy, and further add a purpose of such literacy as to solve a problem and accordingly to develop a person's potential and to fulfill a personal objective [5][7]. This means a person's literacy is not only representing the capabilities of reading, writing, listening, and speaking but also data collecting and information interpreting, and adopt the information in solving a problem and achieving personal goals [8]. Today, many works have adopted the concept of literacy in relating with an object's self efficacy,

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motivation, choice, and many other attitudinal and behavioral constructs [2]. Functional literacy that used by the United Nations Educational, Scientific, and Cultural Organization of (UNESCO) could be viewed analogically the same as health literacy. Both functional literacy and health literacy are illustrating a set of capability that is used by the person to solve the problem and to achieve or fulfill personal goals. Apparently, the health literacy is the specifically more concern on a person's health status.

B. Health Literacy Scales

WRAT is well known for its high reliability and validity while identifying an individual's understanding on general English in terms of pronunciation and spelling. This scale has been proven having good criteria related validity with years of education. The major drawback for WRAT was that the terms used in the scale are not health-specific [9][10]. A WRAT test may take around 10 minutes.

Similar to WRAT, REALM is a scale based on the understanding of English pronunciation and spelling, but further on health-specific terms. Items used in this scale were drawn from health-education material, including public health and primary care. This scale has been proven having satisfactory levels of reliability and criteria related validity with years of education as well, and is good to be used to identify those individuals with low health literacy. Unfortunately, this scale is not able to measure to what extent an individual understands the meanings of the terms in the scale [9][10]. Although a Chinese version has been translated in 2007 [11], it is doubtful that the scale could be used in a proper way since Chinese and English are two languages with totally different structure.

TOFHLA is a scale aims to reflect the health literacy of an adult. This scale uses a method of Cloze by enquiring into a respondent to fill out proper words in a five- to seven- words phrases. Besides, testing of an individual's computation capability is also included. This makes TOFHLA distinctive that can identify the respondent's reading, comprehension, and calculating capability in one test. A drawback for this scale is the required time, of which may need around 30 minutes to complete.

As noted earlier in this paper, REALM has been translated into Chinese in Taiwan. The Chinese version REALM has at least three shortcomings. First and could be the major drawback, REALM is developed with health-education materials who are popular in USA, which is highly context-specific. Healthcare professional generally agreed that types of healthcare need may be widely varied from one nation to another. American nationals may share identical or similar experiences of living and education under a similar environment. Second, English and Chinese are two totally different language system with visible differences in terms of word composition, verbal expression (grammar system), and phonetic. These differences could be exacerbated when terms or words were given and been accepted by others with additional meaning or metaphor that originated from a shared living experience.

Main purpose of this research is to develop a scale that truly reflects the health literacy status of an adult who had interacted with the health and healthcare environment of Taiwan, and that identifies an adult's capability in communicating with healthcare professionals and gaining sufficient health and healthcare information in Taiwan. This scale could be further verified with acceptable reliability and validity, and could be used to identify specifically the health literacy level of an adult in Taiwan.

II. RESEARCH DESIGN AND SAMPLING

A. Research Design

Based on the definition of health literacy of World Health Organization, this research collects data with a focus on the materials that have been widely used in health-related issues in Taiwan. A health literacy panel is created. Main source of the panel is derived from the Bureau of Health Promotion (http://www.bhp.doh.gov.tw), a subsidiary of the National Health Department with the most comprehensive and widest range of collection of health related information in Taiwan. Five dimensions of health related terms are considered as major contributors to a useful health literacy scale. The first dimension includes popular and simple terms about human organs, physiology, and biochemistry that frequently appear in essential health education programs. The second dimension involves top ten death causes in Taiwan. The third dimension regards general diseases that are popular in Taiwan. The fourth dimension focus on the causes and prevention of major illnesses, and the fifth dimension covers the major health issues that currently prevail in Taiwan.

Each member of the research team first chooses 100 terms from the literacy panel. All terms are then consolidated as one list. Five healthcare clinicians and experts are then invited to examine the list. These experts are physicians from the family medicine, the obstetrics & gynecology, neurology, and a surgeon of physical medicine & rehabilitation, and a vice director of a medical center who is an expert of public health. The 90 terms that concurrently appear in every individual list are kept, and 50 additional terms are then added as suggested by the expert group. After two rounds of Delphi technique and discussion, 125 items reached a common agreement. In the last stage, five items were replaced based on an initial reliability test. In the meantime, we develop a health knowledge scale to screen those unreliable responses. The health knowledge scale contains 10 questions that are popular in clinical offices. This scale is used to assure the truth of a respondent's reaction to the self-response scale. Additionally, the health knowledge scale may provide additional evidence to the validity of the health literacy scale by examining the mutual relationship of health knowledge and health literacy.

B. Item Analyses

The consensus 125 items are then categorized into nine factors of pharmaceutical, top ten death causes, general diseases, organs, physiological, physical examination, medical treatment, disease symptoms, and superficial characteristics of disease. This research further simplifies the scale by reducing

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125 items to 66 items as other popular scales did. The nine categories remain. Methods used in this analysis are factor analysis, descriptive, and critical ratio. The critical ratio method is found to have a better discriminate capability than the others [12].

Every term received a score based on the scores the respondents answered. 'Simple' is given to the terms that receive the first quartile of all scores, 'Rather simple' for those in second highest quartile, 'Rather difficult' for those in the third quartile, and 'Difficult' for the quartile that receive lowest score. We use this grading to check the relationship with health knowledge, and found a need to amend the distribution of these health terms and the content of the scale items. Some items are deleted base on the criteria of item-to-total analysis and a consensus of terms that having a similar discriminate capability, and more terms are added (e.g. Jaundice, carbon monoxide poisoning, Alzheimer's disease, Cancer, Brain death, Computerized tomography scan [CT scan], and Paranoia, etc.). We then add additional terms to reflect the current medical advancement, terms of this kind such as Magnetic resonance inspection (MRI), Hospice care, and others to reach a 66-item scale. Every item in each category is characterized with a good discriminate capability. A 66-item under nine categories scale is then finalized, shown as appendix 1. and a further test shows that score for pharmaceutical terms are significantly lower than those in other categories. Rest of the categories shows no significant differences between each other. The scale is termed as Taiwan Health Literacy Scale for Adults or in an abbreviated form as THLS. Internal consistency, shown as Cronbach's α, for each category is high at from 0.851 (Superficial characteristics) to 0.931 (Critical care medicine), and overall reliability is 0.976.

C. Ethics of Research

Personal data of respondents were all treated with strictly confidential manner. All researchers have signed an affidavit to confirm their strict follow the rules of ethic. Interviewers shall obtain an informed consent of each respondent before the survey. Respondents were advised the purpose of the research as well as the promises of not releasing any of personal data before they started to fill the questionnaire.

D. Samples

Samples are taken from Pingtung County. Common characteristics all groups are respondents shall be 18 years old and over, residents of Pingtung County, having average communication capability, and are mentally healthy. To maximize the variance, this research purposefully selects varied groups that are apparently different in healthcare knowledge. The research successfully obtained 776 samples, in which 90 of them were deleted because of some missing data and 686 valid samples remain for further analysis, as shown in table I. These groups are 1. Residents of Chian- Jin Li of Pingtung City, where most residents are aged farmers. 88 samples in total and 12.83% of entire sample 2. Visitors to and sport activities participants in the Pingtung Park. This group

has 186 samples, 27.11% of correspondents. 3. Patients and their escorts to a local hospital. This group has 205 samples with 29.88% of entire sample. 4. Collegiate students from two universities and one technological college. This group is the largest one with 207 samples or 30.17% of the entire sample. Testing is conducted between January 20th and April 31st of 2007.

TABLE I
SAMPLE GROUPS

Groups	Void		Passed		S. total	
	n	%	n	%	n	%
Hospital patient	12	5.2	211	91.7	230	100
Citizen, park	20	9.5	183	86.7	211	100
Citizen, community	4	4.0	85	85.0	100	100
Students, college	5	7.7	54	83.1	65	100
Student, college	1	1.4	66	94.3	70	100
Student, under	4	4.0	87	87.0	100	100
Sum	46	5.9	686	88.4	776	100

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III. DATA ANALYSES AND RESULTS

A. Age, Gender, Education

Among all 687 respondents, 329 (or 48.0%) are male, 364(53.0%) female with age ranges from 18 to 88 with average age of 41.8 for male, and 35.8 for female. Educational degree in this survey covers a full range from illiteracy to doctor degree. 17(or 2.5%) are illiterate, 16(2.4%) have some literacy, 51(7.5%) have elementary education, 48(7.0%) completed junior high and 112(16.4%) senior high schools education, collegiate at 348 (51.1%) as the major group, and masters and doctorate degrees are 11(1.6%). Male, and female are not significant different in education, as shown in table II.

B. Sample Representation

Samples included in developing this scale are taken from hospital patients and their relatives, sports or leisure population in the park, senior citizens in community, and college students. These four groups are believed roughly representing a vast proportion of Taiwan's population in terms of living style and levels of health knowledge.

Consistent to the national distribution, gender of respondents in this research has no significant difference in education. Male has a higher rate of chronic disease than that of female, and the female is more experienced in taking care of ill family members than the male.

C. Source of Health Knowledge

Gender has no significant difference in the source of heal knowledge. Major sources are news report of TV channels (85.1%), newspapers (66.7%), hospitals or clinics (33.5%), and the website of National Healthcare Bureau (7.6%). It appears that respondents with lower education incline to obtain

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healthcare information from TV or relatives, whereas respondents with higher education (i.e. collegiate or higher) receive healthcare information from published materials (books, booklets) or websites.

D. Health Hazardous Behavior

Hazardous behaviors are found in the research, among which 38.4% of male and 5.9% of female smoke cigarette, and 16.1% of male and 2.5% of female habitually drink alcoholic products. Gender is significant different in these behaviors, as shown in table II.

TABLE II
KNOWLEDGE SOURCE AND HAZARDOUS BEHAVIORS BY GENDER

		F		M		S. total	
Respondents		357		329		686	
Avg. age (s.d.)		35.8 (18.2)		41.8(19.5)		38.7(19.1_	
Source of Health Knowledge							
Sources		F		M		S. total	
		N	%	N	%	N	%
TV news		313	87.9	269	82.0	582	85.1
Radio		88	24.7	67	20.4	155	22.7
Book		203	57.0	144	43.9	347	50.7
Newspapers		249	69.9	207	63.1	456	66.7
Magazines		159	44.7	112	34.1	271	39.6
Sch. Edu.		114	32.0	68	20.7	182	26.6
Friends		133	37.4	88	26.8	221	32.3
Primary care		30	8.4	22	6.7	52	7.6
Hospitals		129	36.2	100	30.5	229	33.5
Internet web		140	39.3	119	36.3	259	37.9
DOH		30	8.4	22	6.7	52	7.6
Poster		50	14.0	32	9.8	82	12.0
Speech		39	11.0	24	7.3	63	9.2
Others		12	3.4	13	4.0	25	3.7
S. total		356	100.0	328	100.0	684	100.0
Hazardous Behaviors							
Descriptions		F		M		S. total	
		N	%	N	%	N	%
Smoke	N	336	94.1	202	61.6	538	78.5
	Y	21	5.9	126	38.4	147	21.5
Alcoholic	Non	317	89.5	202	61.4	519	76.0
	Heavy	9	2.5	53	16.1	62	9.1
	Light	28	7.9	74	22.5	102	14.9
Betel nut chewing	N	355	99.4	290	89.9	650	94.9
	Y	2	0.6	33	10.1	35	5.1
Any of above	N	328	91.9	186	56.5	514	74.9
	Y	29	8.1	143	43.5	172	25.1

E. Scores of Health Knowledge and Health Literacy

Females have a better score than their male counterparts in the tests of health knowledge and health literacy score. AS far as the health knowledge test concern, female reply with more correct answers in 8 out of 10 questions of the test. In the 125 items of the initial THLS, the female has a better score in 92 items than the mail. The male has a better score in only two items, the terms of Nicotine and Impotence. The rest items are not significantly different.

IV. TAIWAN HEALTH LITERACY SCALE

A. Factors on Score of Health Literacy

To reveal the determinants of health literacy and health knowledge, this research takes an average score of health

literacy (125 items) and the health knowledge as dependent variables. Independent variables that act as predictors are demographic variables, the experience of caring caner and / or paralysis patients, the experience of having family members that are cancer and / or paralysis patients, and whether the correspondent or any family members work as a healthcare professional. The result of logistic regression shows that a good educational level, a healthcare professional, the experience of caring paralysis patients, and female in gender are significant predictors of health literacy and health knowledge, shown as in table III.

TABLE III
COEFFICIENTS OF THLS SCORES AND PERSONAL FACTORS

Model	Non-standardize		Standar	t
	B est.	Sd.	*Beta*	
Independent variables				
Constant	1.903	0.149		12.735[***]
Cancer patient care	0.087	0.077	0.048	1.000
Ill family member in cancer	-0.036	0.067	-0.022	-0.538
Paralysis patient care	0.211	0.077	0.122	2.730[**]
Ill family member in	0.010	0.071	0.006	0.144
Family in HC service	0.056	0.058	0.034	0.978
Personal in HC service	0.501	0.097	0.181	5.147[***]
Gender	-0.167	0.050	-0.113	-3.339[**]
Age	-0.002	0.002	-0.057	-1.402
Education	0.170	0.018	0.375	9.364[***]

R=.517, R^2=.267, AdjR²=.257, F=27.032, p<.001
Dependent variable: Health literacy score (125 items)

*p<.05, **p<.01, ***p<.001*

B. Age, Education, and THLS

In general, an individual receives health education in his / her school educational program, and the government-support health promotion campaigns are always executed through school education system. This means an individual's knowledge on health and healthcare will be accumulated along with his / her education. Therefore, any scale aims to assess the health literacy level should substantially reflect the respondents' educational experience. This research first categorizes respondents into six different levels of education from illiterate to doctorate, and then conducts a correlation with score levels of THLS. The result shows that higher educational levels appear with better THLS scores, as shown in table IV.

Different age group appears to have significant different in THLS score as well. The age group of 20-29 years old is a block that has typically completed collegiate education, and is hence having higher score in THLS. THLS score is then decreasing along with older ages.

C. Reliability

Internal consistency test appears to have a good result. Pharmaceutical terms receive the lowest score among the nine categories of health literacy scale with corrected item-total correlation (I-T) at 0.828, Serious diseases(0.900), General diseases (0.921), Organs (0.908), Physiological terms (0.920), Examination (0.905), Medical treatment (0.900), Health symptoms (0.910), Clinical signs (0.879), and an overall Cronbach's **α** is high at 0.98.

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During the scale development process, the respondents fill the scale with a 5-point Likert scale. "1" represents the respondent has never heard this term, "2" represents the respondent has ever heard about but do not understand the meaning of the term, "3" represents the respondent has ever heard about and somehow understand the meaning of the term, "4" represents the respondent has heard about and fully understand the meaning of the term, "5" represents the respondent has sufficient knowledge about the meaning so as the application (equivalent level of a healthcare services professional). In order to prevent blind responses or disguise that may misguide the interpretation; we attach a general health knowledge testing with 10 simple questions to the health literacy questionnaire. Four terms of the literacy scale were included in the knowledge testing, Systemic Lupus Erythematosus (SLE), Degenerative arthritis, Steroid, and Urate (Uric Acid). Answers to these fours questions and terms will be used to compare. We then delete those samples with inconsistent answers.

TABLE IV
THLS SCORES BY EDUCATIONAL LEVELS

| Edu. levels | n | THLS average scores | | | | | Lower limit of THLS |
		Bottom 25%	Middle	Top 75%	Average	s.d.	Avg – s.d (Est. limit)
Illiterate	30	1.66	2.28	2.67	2.24	0.58	1.66 (1.70)
Primary	51	1.70	2.21	2.55	2.13	0.50	1.63 (1.70)
Junior H.	48	1.81	2.45	2.87	2.35	0.67	1.68 (1.70)
Senior H.	190	2.27	2.81	3.11	2.76	0.67	2.09 (2.10)
College	351	2.61	3.00	3.56	3.07	0.71	2.36 (2.50)
Masters+	11	3.20	3.52	3.86	3.61	0.51	3.10 (3.00)
S. total	681	2.33	2.82	3.35	2.84	0.75	2.09 (2.10)

Notice: This research suggests that a 3.00 point {in bracket} of score in THLS as the average score to have acceptable quality of communication with healthcare professionals, whereas THLS scored lower than a 1.7 point would be viewed as a seriously poor in health literacy level, and a 2.0 point of sore as a moderate, and a 2.5 point as a slightly poor in health literacy level.

D. Validating the THLS

Unlike REALM that measures the subject's health literacy level by a phonetic method, the current scale assesses the subject's understanding on the meaning (and the associated medical treatment) of the terms in question. The current scale embraces the differences of two language system, and further explores the subject's true understanding on the meaning of a healthcare term. Initial validation that was conducted with hospital patients, the correlation between scores of health knowledge (10 questions) and health literacy scale (66 terms) appears to have an acceptable value at 0.69.

To further validate the validity of this scale, we took several demographic factors that have been proofed having strong relationship with an individual's health knowledge and health literacy level to test the correlation with the scale.

Education. The higher education level an individual has, the better of the health literacy will be. This may stem from an individual will accumulate the health knowledge and increase health literacy level along with regular education, as those found in Al-Tayyib et al.(2002) when developing REALM [13].

Gender. In general, female is superior to male in terms of health literacy and health knowledge, particular about those types of knowledge associated with medical treatments. Consistent to Al-Tayyib [13], this research has found the female received significantly better score in 46 out of 66 terms (another 18 terms are not significant at $P < 0.05$). This means the female is more concerned about the health issues than the male.

Hazardous behaviors. A person that has none of any hazardous behaviors of smoking, alcohol abuse, or betel nut chewing appears to have higher score in THLS. Since few of female has these bad behaviors, we are not sure whether the gender will mediate the effect or not. It is also reasonable to assume that people with bad habits may be because they were not well educated, and that responsible for a low THLS score. In other words, it is not the hazardous behaviors that result in a low THLS score, but the factors had brought them to these behaviors. Causal effects may not exist in the relationship between hazardous behavior and low THLS score.

Factors with family. Subjects whose family members work as healthcare professionals, or ill with serious diseases or chronic diseases have higher scores in THLS. Since seeking and receiving information on particular disease and or healthcare services is part of his / her life for this group, no wonder that these people have better chance in correctly answering THLS questions. This has also further validated the THLS.

Personal experience in healthcare providing. THLS scores are also high for the group of people who have experienced in taking care of patients or family members. These people more frequently expose themselves than the others to the healthcare services environment, thus will have better chance in accessing healthcare knowledge.

Healthcare professionals. Healthcare service providers, such as physicians, surgeons, dentists, nurses, medicine technologists, and many others have better THLS than those of non-health care professionals. This fact has also validated the THLS, since health care professionals not only accumulate health and healthcare knowledge throughout their incubating education but also need to attend continuous education as part of their job requirement. Again, better healthcare knowledge will have better scores in THLS.

Age. Consistent again to the Al-Tayyib et al [13], this research gains a similar result that shows the age factor is not a determinant of THLS score. In this research, we found a reverse double U shape relationship between age, and THLS scores. The peak appears at the age of 20-29 as the first and highest point. The first downturn is found at age 30-39; the second peak emerges at the age of 50-59, and downturns again after that point. Official education may play a significant role

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with age factor in differentiating the THLS score.

E. Initial Application of THLS

Levels of THLS scores are found having relationships with some personal factors such as education, gender, and hazardous during the research. This means THLS could be a reliable tool in assessing an individual's need of health education and in evaluating the appropriateness of a health-promotion program. For example, Average scores for groups of illiterate, some literate, and having junior high school education are 1.66, 1.70, 1.81 respectively, and 2.27 for those having senior high school, and 3.07 for those have bachelor degrees. According to the distribution of average scores, score of 3.0 could be viewed as having an average capability in receiving health related information and accordingly utilizing such information and transferring into health knowledge. An individual that is scored lower than a 3.00 score in THLS may have some difficulty in receiving and understanding health related information. Those individuals with scores lower than 1.70 would be a risky group that exposed to a highly risky environment because of less or least capable in accessing and comprehending sufficient health related information.

V. DISCUSSION

Despite that Taiwan is one of the advanced countries in medical service, and is well-known in providing quality healthcare services with a relatively low price for her nationals, she has no reliable health literacy assessment instrument that specific for local Chinese people in Taiwan. Lacking such an instrument may be harmful to the interaction relationship between healthcare service provider and receiver, and consequently, prevent a further quality advancing and expose to a risk of misuse of healthcare resources. Since this is a pioneer research that aims to develop a reliable health literacy scale for local use, it is essential to start from the very beginning by collecting raw material. This research is undertaken by including clinical physicians from the industry and healthcare management scholars from academic throughout the entire process of collecting, screening, discussing, and categorizing, testing, and validating. The initial result has shown that the scale is valid for use in certain contexts of clinical offices and general public. We discuss the possible application, limitation, and future research direction in this section.

A. On The Coverage and Scope of A Term of Health Literacy

WHO defines the health literacy as represents 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 [14]. According to such a definition, health literacy means more than being able to read pamphlets and make appointments with healthcare service providers. Individual with sufficient health literacy shall be able to access and effectively use health information. Although health literacy is mostly dependent upon more general levels of literacy, 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. It is no wonder a high relationship between education and health literacy is generally found in past studies.

Health literacy, as what were expressed by the National Library of Medicine [15], World Health Organization [14], Nutbeam (2000)[16], and *Healthy People 2010*[17], could be concluded to include an adult's reading, writing, listening, expressing, and information searching capabilities. These capabilities are integrative, and that will enhance an individual's perception on personal needs of health, access and acquire health resources, by which in turn maintains and promotes such as person's health. Although current research has been proofed to be a reliable tool in assessing a respondent's literacy level of health, additional function of a tool to assess an adult's expressing and computing capabilities is worth developing for Taiwan.

B. Possible Factors Lead To a Better THLS Score

We have found that levels of health literacy score are different in terms of education, gender, age, hazardous behaviors, personal and family member disease experiences, experiences of patient care, and personal occupation. A logistic regression shows that an individual with higher education, female, non-smoker, healthcare professionals, and an ill family member with paralysis will have better health literacy scores and better health knowledge. Given the fact that the female adult has a longer average life expectancy than that of the male adult, it will be interesting to answer a question of whether the health literacy (and so as the level of health-care) rather than the biological difference differentiates an individual's life expectancy [13].

This scale will help academicians identifying the respondents' status of understanding on current healthcare dimensions. Good contribution to the academic studies would be foreseeable, for example, a study that links the levels of health literacy and health status [18].

VI. CONCLUSION

After a long hauling, the initial version of Health Literacy Scale for Taiwan Adults has now been developed with acceptable reliability and validity in some initial contexts with different groups. We wish this THLS may provide contributions in several ways. First, we wish the THLS could be included in the national education program as a guide in editing materials for health education. Second, further experiential research should be undertaken to extend the scale's generalizability, and third, to expand the usage of this scale. The fourth and the most important one, we hope this scale could be tried and modified with samples taken from more Chinese speaking population beyond Taiwan, for example, Hong Kong, China, Macau, and even Singapore. To our best knowledge, health literacy scale remains absent in these areas. Although some dialectic differences may exist, Chinese people in these areas generally share similar Chinese culture. These regions may take THLS as a base to add, edit, amend, delete, or

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simplify to produce distinctive but related health literacy scales, by which these regions are able to have an inter-region cooperation for a health promotion program.

To effectively cope with the progress of healthcare providing, the current scale may need to be tuned along with modern medical advancements on a regular basis, for example, every three years. In the other hand, to make this scale easier and thus to be accepted for use in examining a patient's health literacy in a busy healthcare practice, a 66 items scale may need to be shortened. We thus devote ourselves to further validate the regular scale with varied sample in varied contexts, and in the mean time to shorten the scale that could be completed within five minutes by a patient.

APPENDIX

THLS (WITH ENGLISH TRANSLATION)

止痛藥	Anodyne	骨質疏鬆症	Osteoporosis
尼古丁	Nicotine	高血壓	Hypertension
抗生素	Antibiotics	肺結核	Pulmonary
利尿劑	Diuretics	痔瘡	Hemorrhoid
制酸劑	Antacids	痛風	Gout
非類固醇消炎藥	Non-steroid	一氧化碳中毒	Carbon monoxide
維骨力	Viartril S	尿酸	Urate (Uric Acid)
類固醇	Steroid	腦中風	Cerebral apoplexy
B型肝炎	Hepatitis b	胃潰瘍	Gastric ulcer
腎衰竭	Kidney failure	癌症	Cancer
巴金森氏症	Parkinson's	疝氣	Hernia
肝硬化	Cirrhosis of liver	甲狀腺	Thyroid gland
糖尿病	Diabetes mellitus	收縮壓	Systolic pressure
阿茲海默症	Alzheimer's	血小板	Blood platelets
胰島素	Insulin	自體免疫	Autoimmunity
慢性阻塞性肺炎	Chronic blocking	退化性關節炎	Degenerative
更年期	Climacterium /	心律調節器	Heart rhythm
胎盤	Placenta	高纖食品	High filament food
冠狀動脈	Coronary arteries	血管攝影	Angiography
骨盆腔	Pelvic cavity	超音波檢查	Ultrasonography
荷爾蒙	Hormone	腦死	Brain death
循環系統	Circulatory system	心絞痛	Angina Pectoris
鈉離子	Sodium ion	失語症	Aphasia
膽固醇	Cholesterol	尿失禁	Urinary
攝護腺	Prostate gland	咳血	Hemoptysis
大腸鏡檢查	Large intestine	眩暈	Vertigo
子宮頸抹片	Cervical smear test	脂肪肝	Fatty liver
電腦斷層檢查	Computerized	強迫行為	Compulsive
安寧緩和醫療	Hospice care	蛋白尿	Albuminuria
流感疫苗	Influenza vaccine	黃疸	Jaundice
化學治療	Chemotherapy	過敏	Allergy
紅斑性狼瘡	Systemic lupus erythematosus, SLE	核磁共振檢查	Magnetic resonance inspection
胃鏡檢查	Gastroscopy	愛滋病	Acquired immune deficiency syndrome (AIDS)

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