Effects of Health Literacy on Health Promotion Behavior and Medical Ecology Resource Utilization

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Abstract
Supporting the lifestyle with health promotion has been the issue mentioned by international health organizations. Medical technology has been promoted, while the problem of chronic diseases still could not be broken through. To have healthy body and mind, healthy lifestyles should be first practiced. The exact practice of health promotion would reduce the occurrence of chronic diseases as well as health care expenses for diseases. It is therefore worth of deep research on proper health literacy for the exact practice of more positive health behaviors. Aiming at people in Shanghai as the research objects, total 500 copies of questionnaire are distributed, and 382 valid copies are retrieved, with the retrieval rate 76%. The research results show 1.positive and significant effects of health literacy on health promotion behavior, 2.positive and remarkable effects of health promotion behavior on medical ecology resource utilization, and 3.positive effects of health literacy on medical ecology resource utilization. Finally, suggestions are proposed, according to the results, expecting to help people follow health promotion behaviors to maintain or improve the health status, reduce unnecessary medical ecology resource utilization, and promote the quality of life.
Keywords: health literacy, health promotion behavior, medical ecology, medical resource utilization

INTRODUCTION

Along with the advance of medical technology, the improvement of public health, the extension of life expectancy, and the decrease in fertility rate, supporting the lifestyle with health promotion has been the issue mentioned by international health organizations. When acute health care systems are gradually completed, positive health promotion should be emphasized. Unhealthy lifestyles are the major cause of physical and psychological diseases. Although medical technology is promoted, the problem of chronic diseases still cannot be broken through. The government agencies therefore largely support health promotion activities as the practice of healthy lifestyles is primary for healthy body and mind. The exact practice of health promotion would reduce the occurrence of chronic diseases and decrease health care expenses for diseases. However, people present slow behavior performance on the health promotion process.

The government has invested in a lot of manpower and funds, positively promoted distinct health education and promotion, enhanced people's health awareness, and effectively taught people about correct health behavior to prevent and control health hazard factors. In this case, people need to be able to ask relevant questions. In face of various tasks of medical systems, people should present certain degree of health literacy, such as understanding medical suggestions and courses, following directions, or comprehending medical knowledge booklets, in order to effectively utilize and benefit from the governmental promotion of health care. When people are lack of skills in such basic literacy, it would not be easy to use such information, even though it can be easily accessed. For this reason, individual health literacy plays a critical role in the achievement of personal health. Moreover, health literacy would affect individual concern about personal health. The promotion of health awareness and change in the behavior to improve or control personal health allow an individual being aware of personal physical conditions to practice more positive health behaviors. Consequently, it is worth deep research whether proper health literacy could result in the practice of more positive health behavior and whether inappropriate health literacy means individual bad health confidence, physical health conditions, and health behavior practice. Aiming at the effect of health literacy on health

promotion behavior and medical ecology resource utilization, this study expects to help people follow health promotion behaviors to maintain or improve the health status so as to reduce unnecessary medical ecology resource utilization and promote the quality of life.

LITERATURE REVIEW
Health Literacy

Chen and Chang (2016) pointed out health literacy as an individual being capable of reading and understanding health related information and taking certain actions (e.g. receiving treatment or changing some living habits, such as quitting smoking, proper exercise, and diet control). Intellectuals not in medical professional fields might be lost because of not being familiar with medical terminology. Bazm et al. (2016) stated that health literacy was the focus of medicine, nursing, dentist, and health education in past years, mainly because of the close relationship with patient safety. Ku et al. (2016) mentioned that the definition of health literacy was changing and the meanings were different in different countries and phases; it was defined from early literacy to an individual being able to acquire, explain, and understand basic health information and use such information and service to promote the health. Determann et al. (2016) indicated that differences in definitions were inevitable, but health literacy (1) would be the essential basis to maintain physical health, (2) could assist people in making health service decisions, and (3) generally referred to people's knowledge stocks and ability to deal with health or medical issues.

Referring to Lee et al. (2018), health literacy in this study contains the following dimensions.

(1) Health knowledge: to understand health related terminology and pharmacological words or use.

(2) Critical illness knowledge: to understand advanced disease related terminology and medication or symptoms.

(3) Treatment: to understand medical treatment terminology and the processing or use procedures.

Health Promotion Behavior

Chang (2015) defined health promotion that health was the complete physical, psychological, and social comfort, rather than simply not having pain or feeling uncomfortable. As a result, health was the source of daily life, rather than the objective of survival. Lee & Yun (2015) considered that health promotion was to guide self-growth and enhance peaceful health care. Alharbi et al. (2016) pointed out health promotion as the behavior to acquire higher level health. Santini et al. (2017) further proposed that health promotion was not simply the preventive behavior aiming at diseases or special health problems, but presented the actualizing tendency toward positive growth and change, and was the approach behavior to expand health potential. It revealed that an individual positively establishing new behavior modes was the positive attitude to guide the health maintenance or enhancement, self-actualization, and happiness, rather than the behavior of disease prevention or avoiding health problems. Preventive behavior referred to reducing, avoiding, or removing existing risky behaviors (Tharek et al. 2018). Duru et al. (2018) also pointed out the difference between health promotion and disease prevention that the former was not disease or special health problem oriented, but positively expanding health potential to develop individual function to the optimal state, while disease prevention aimed to stop or reduce the hurt on personal health caused by diseases or special health problems. Wang et al. (2016) explained that health promotion behavior was also regarded as individual action to maintain or enhance health for self-actualization and self-satisfaction.

Referring to the idea of Huang et al. (2017), health promotion behavior in this study includes "disease prevention" and "health promotion".

(1) Disease prevention: aiming at negatively reducing or removing high-risk behaviors.

(2) Health promotion: aiming at positively establishing behaviors good for and beneficial to health, e.g. correct food habit, weight control, sports and leisure, not drinking, not smoking, obeying traffic rules, and paying attention to the security and health at workplace.

Medical Ecology Resource Utilization

Chao et al. (2016) pointed out medical ecology resource utilization as the quantity of medical service being actually consumed when needs changed into health-seeking behaviors, covering type of utilization, health-seeking purpose, service location, and utilization frequency. Barello et al. (2015) regarded type of utilization as types of service received, e.g. Chinese medicine and western medicine. Health-seeking purpose reflected different demands for medical care, such as preventive health care, early diagnosis of disease and treatment, and rehabilitation. Shaw (2016) explained service location as the place where people

received medical ecology resource care, e.g. hospital outpatient, emergency, clinics, health centers, pharmacy, nursing homes, and home care. Gebru et al. (2016) pointed out medical ecology resource utilization frequency as the number of times using medical service in a period of time. Liao et al. (2016) stated that there were multiple definitions of medical ecology resource utilization, which could be generally classified into medical expense and utilization frequency. Expenses contained total medical expenses and the details, and utilization frequency covered length of stays and number of outpatients.

Referring to Peng et al. (2017), the following dimensions are required for medical ecology resource utilization in the study.

(1) Number of outpatients: the number of a research object's outpatients in the past year (including Chinese medicine, western medicine, dentist outpatients).

(2) Outpatient medical expenses: total medical expenses of a research object's outpatients (T_AMT) in the past year.

Research Hypothesis

Chen and Chang (2016) discovered that education still presented the effect on health behavior after considering the cognition of health knowledge; in other words, high-education people, with more knowledge, would choose healthier behaviors that the improvement of health was resulted from more health knowledge. Halverson et al. (2016) regarded inadequate health literacy as the obstacle of doctor-patient relationship as people lack of health literacy could not judge, select, and analyze health care providers' information to make decisions for more beneficial support to the physical health; with sufficient health related knowledge, people would no longer engage in behaviors harmful to health (Wimo et al. 2017). Lin and Hsu (2016) explained that, people, when understanding and presenting sufficient health related knowledge, would promote the health awareness and change behaviors, but internal and external environmental information would affect individual concern about personal health to change the behavior and promote the health awareness. More importantly, they would be aware of the physical conditions to make proper adjustment. Lee et al. (2018) indicated that ones with self-health awareness would show more positive living attitudes, actively absorb important physical health and nutrition knowledge, and choose healthier behaviors. Accordingly, it is assumed in this study that

H1: Health literacy shows positive and significant effects on health promotion behavior.

Chang (2015) mentioned that good and healthy lifestyles or health promotion behaviors were the good ways to prevent diseases and release complications for either healthy people or patients suffering from chronic diseases. The research results also revealed that taking hypertensive drugs on time and taking health promotion behaviors, such as sports habit, less drinking, less smoking, and diet control, would better control the medical ecology resource utilization. Julian et al. (2016) pointed out the effect of health behavior on the elderly medical ecology resource utilization that the elderly with health promotion behaviors appeared fewer outpatients and hospitalization medical service utilization. Huang et al. (2017) found out the better health promotion behavior, the higher outpatient and hospitalization utilization, and the better health promotion, the higher western medicine outpatient utilization (O'Dwyer et al. 2016). It is therefore assumed in this study that

H2: Health promotion behavior reveals positive and remarkably effects on medical ecology resource utilization.

Chao et al. (2016) indicated that people not aware of the lack of correct medical knowledge or not understanding to cooperate with treatment and health education would not help their health, meaning that people should realize that they had to be responsible for personal health. Jane (2017) stated that health literacy was used, in past years, for discussing people's preventive and protective medical ecology resource utilization for the health. King et al. (2015) considered that ones with low literacy might not understand the information of specific disease tests to notice the benefit of test results; they therefore seldom participated in specific medical ecology resource utilization or other preventive health care activity. Peng et al. (2017) also proposed that those with low literacy showed higher risks to suffer from specific diseases and lower general medical ecology resource utilization. As a result, it is assumed in this study that

H3: Health literacy appears positive effects on medical ecology resource utilization.

SAMPLE AND MEASUREMENT INDEX
Research Sample and Object

Aiming at people in Shanghai as the research objects, total 500 copies of questionnaire are distributed, and

Table 1. Model fit analysis

Fit Indices	allowable range	this research model	model fit judgment
χ2 (Chi-square)	the smaller the better	16.55	
χ2-degree of freedom ratio	<3	1.16	matched
GFI	>.9	0.95	matched
AGFI	>.8	0.87	matched
RMSEA	<.08	0.02	matched
CFI	>.9	0.92	matched
NFI	>.9	0.91	matched

382 valid copies are retrieved, with the retrieval rate 76%.

Reliability and Validity Test

Confirmatory Factor Analysis (CFA) is an important part in SEM analysis. For this reason, two-stage mode is preceded. When preceding CFA, the measurement model should be first tested during the structural model evaluation. The second step, SEM evaluation, is further preceded when the model fit is acceptable. The dimension analyses with CFA in this study reveals the factor loadings in .60~.80, the component reliability in .70~.90, and the average variance extracted in .60~.70, conforming to the standards of 1. factor loading higher than .5, 2. component reliability higher than .6, and 3. average variance extracted higher than .5. The dimensions therefore present convergent validity.

EMPIRICAL RESULT ANALYSIS
Structural Model Analysis

Structural model analysis contains model fit analysis and explanatory power of the overall research model. Referring to researchers' opinions, 7 numerical indicators are used for testing the overall model fit, including chi-square (χ2) test, χ2-degree of freedom ratio, goodness of fit index, adjusted goodness of fit index, root mean square error, comparative fit index, comparative hypothesis model, and chi-square difference of independent model. The overall result analysis is organized in **Table 1**.

According to above descriptions, χ2-degree of freedom ratio is used for testing the model fit, which is the smaller the better; this research model shows χ2-degree of freedom ratio<3 (1.16). GFI and AGFI are better close to 1 and have no absolute standards to judge the model fit. GFI>.9 and AGFI>.8 are acceptable; GFI and AGFI of this research model reveal .95 and .87, respectively. RMSEA in .05-.08 presents good model and reasonable fit; this research model shows RMSEA=.02. CFI>.9 is the allowable standard; CFI of this research model appears .92. NFI should be at least

Table 2. Overall linear structural model analysis result

evaluation item	parameter/evaluation standard		result
preliminary fit	health literacy	health knowledge	0.66★
		critical illness knowledge	0.68★
		treatment	0.62★
	health promotion behavior	disease prevention	0.65★
		health promotion	0.67★
	medical ecology resource utilization	number of outpatients	0.73★★
		outpatient medical expenses	0.75★★
internal fit	health literacy→health promotion behavior		0.88★★
	health promotion behavior→medical ecology resource utilization		0.83★★
	health literacy→medical ecology resource utilization		0.85★★

Note: ★ stands for p<0.05, ★★ for p<0.01, and ★★★ for p<0.001

higher than .9; this research model reveals NFI=.91. Overall speaking, the fit indices conform to the standards, revealing that the research model is acceptable. The research sample data therefore could be used for explaining the actual observation data.

From previous overall model fit indices, the structured model shows favorable goodness-of-fit with observation data that the theoretical model could fully explain the observation data. For this reason, the correlation coefficient and coefficient estimated value of health literacy to health promotion behavior and medical ecology resource utilization could be further understood after passing the model fit test.

The research data are organized in **Table 2**. The overall model analysis results reveal that three dimensions of health literacy (health knowledge, critical illness knowledge, and treatment) could significantly explain health literacy (t>1.96, p<0.05), two dimensions of health promotion behavior (disease prevention and health promotion) could remarkably explain health promotion behavior (t>1.96, p<0.05), and two dimensions of medical ecology resource utilization (number of outpatients and outpatient medical expenses) could notably explain medical ecology resource utilization (t>1.96, p<0.05). Apparently, the overall model presents good preliminary fit.

In terms of internal fit, health literacy shows positive and significant correlations with health promotion behavior (0.88, p <0.01), health promotion behavior

reveals positive and remarkable correlations with medical ecology resource utilization (0.83, p <0.01), and health literacy appears positive and notable correlations with medical ecology resource utilization (0.85, p <0.01) that H1, H2, and H3 are supported.

CONCLUSION

The research results reveal that health literacy stands for individual accumulation of health related knowledge, which is closely correlated to personal health, life, and quality of life, to result in the level of health literacy. For instance, patients' comprehension ability of medical or health related knowledge should be considered in physicians' inquiries, health education from health education staff, and prevention and instruction of chronic diseases for effective communication and the delivery of correct and meaningful treatment and health protection instruction to achieve the objective of health recovery or health care. People with enhanced health literacy would stress more on perceived health status, show better health promotion behaviors, pay more attention to personal health, and present higher medical ecology resource utilization. Nonetheless, those with inadequate health literacy appear worse health information access and the comprehension and application of such information. In this case, medical ecology resource providers could easily appear obstacle on the communication with people with inadequate health literacy and could not have such people with inadequate health literacy present positive health belief and behaviors.

SUGGESTION

From the research results and findings, the following practical suggestions are proposed in this study.

1.   Medical institutions are suggested improving and promoting people's health literacy through life experience and education, enhancing people's understanding of health literacy, and reminding health policy makers to stress on people's health education. For instance, story-telling with pictures or teaching video tapes could be used for the elderly with low education understanding self-care as well as people with inadequate health literacy enhancing the health education and knowledge of diseases. It could also assist in doctor-patient communication to promote the medical quality of medical institutions and reduce medical malpractice claims.

2.   In addition to comprehensively supporting the health promotion behavior of community people in the health promotion programs, health responsibility and sports behavior should be particularly reinforced, the accessibility and availability of health service in remote areas should be paid attention to, and multiple programs, including volunteer service systems, elderly recreation and entertainment centers, and various experience sharing groups, could be promoted. People' health literacy and health status could be evaluated, and various health promotion behavior strategies are applied to enhance the perceived health status, promote the quality of life, and promote preventive medical ecology resource utilization.

3.   Health literacy could test patients' self-growth in the medical care process. Clinical practice could have people understand and prevent diseases as well as find out the best examination and treatment through health literacy. Accordingly, medical care and public health circle, health administration units, and education should commonly make long plans for the issue so that people stress more on personal health. By supporting the health education plan for general people to enhance the health literacy, the enhancing understanding of diseases and health promotion behavior could improve people's health literacy. It would reduce unnecessary medical ecology resource utilization and, more importantly, improve people's health conditions.

REFERENCES

Alharbi NS, Alsubki N, Jones S, Khunti K, Munro N, de Lusignan S (2016) Impact of information technology-based interventions for type 2 diabetes mellitus on glycemic control: A systematic review and meta-analysis.Journal of Medical Internet Research, 18(11): e310.

Barello S, Triberti S, Graffigna G, Libreri C, Serino S, Hibbard J, Riva G (2015) eHealth for patient engagement: A systematic review. Frontiers in Psychology, 6.

Bazm S, Mirzaei M, Fallahzadeh H, Bazm R (2016) Validity and reliability of Iranian version of eHealth literacy scale. Journal of Community Health Research, 5(2): 121-130.

Chang CP (2015) The technology acceptance model and its application in a telehealth program for the elderly with chronic illnesses. Journal of Nursing, 62(3): 11-16.

Chao YH, Huang GT, Wu ZY, Chang YM, Chung CT, Ching HH (2016) Investigation of self-care and related factors for senior patients with type II diabetes. Journal of Health and Architecture, 3(1): 59-68.

Chen YC, Chang P (2016) Using eHealth in the continuity care of chronic kidney disease: Opportunities and considerations.The Journal of Nursing, 63(2): 12.

Determann D, de Bekker-Grob EW, French J, Voeten HA, Richardus JH, Das E, Korfage IJ (2016) Future pandemics and vaccination: public opinion and attitudes across three European countries. Vaccine, 34(6): 803-808.

Duru OK, Middleton T, Tewari MK, Norris K (2018) The landscape of diabetic kidney disease in the United States.Current Diabetes Reports, 18(3): 14.

Gebru Z, Gerbaba M, Dirar A (2016) Barriers to cervical cancer screening in Arba Minch Town, Southern Ethiopia: A qualitative study. Journal of Community Medicine & Health Education, 13(12): 1050-1058.

Halverson JL, Martimez-Donate AP, Palta M, Leal T, Lubner S, Walsh MC, Strickland JS, Smith PD, Trentham-Dietz A (2016) Health Literacy and Health-Related Quality of Life Among a Population-Based Sample of Cancer Patients. J Health Commun., 20(11): 1320-9.

Huang CH, Lin PC, Yeh MC, Lee PH (2017) A study on self-care behaviors and related factors in diabetes patients. Journal of Nursing, 64(1): 61-69.

Jane HJ (2017) Long-term care 2.0 version can as a forward looking, innovative, integrated- Elderly community care policy. Public Govemance Quarterly, 5(3): 114-121.

Julian AK, Bethel JW, Odden MC, Thorburn S (2016) Sex differences and risk behaviors among indoor tanners. Preventive Medicine Reports, 3: 283-287.

King EJ, Maman S, Dudina VI, Moracco KE, Bowling JM (2015) Motivators and barriers to HIV testing among street-based female sex workers in St. Petersburg, Russia. Global Public Health: 1-16.

Ku LJE, Pai MC, Shih PY (2016) Economic impact of dementia by disease severity: Exploring the relationship between stage of dementia and cost of care in Taiwan. PLoS ONE, 11(2): e0148779.

Lee HJ, Yun ZS (2015) Consumers' perceptions of organic food attributes and cognitive and affective attitudes as determinants of their purchase intentions toward organic food. Food Quality and Preference, 39: 259-267.

Lee YL, Cui YY, Tu MH, Chen YC, Chang P (2018) Mobile health apps in continuity of patient-centered care of chronic kidney disease: Content analysis. JMIR mHealth and uHealth, 6(4): 1-12.

Liao Q, Lam WWT, Cowling BJ, Fielding R (2016) Psychosocial influences on parental decision-making regarding vaccination against seasonal influenza for young children in Hong Kong: A longitudinal study, 2012–2013. International Journal of Behavioral Medicine: 1-14.

Lin YL, Hsu BG (2016) An overview of diabetic nephropathy and end-stage renal disease. Kidney and Dialysis, 28(2): 53-57.

O'Dwyer ST, Moyle W, Zimmer-Gembeck M, Leo DD (2016) Suicidal ideation in family carers of people with dementia. Aging & Mental Health, 20(11): 1174-1181.

Peng LI, Chiu YI, Liang J, Chang TH (2017) Risky wandering behaviors of persons with dementia predict family caregivers' health outcomes. Aging & Mental Health. doi:10.1080/13607863.2017.1387764

Santini A, Tenore GC, Novellino E (2017) Nutraceuticals: A paradigm of proactive medicine. European Journal of Pharmaceutical Sciences, 96: 53-61.

Shaw K (2016) Exploring beliefs and attitudes of personal service practitioners towards infection control education, based on the Health Belief Model. Environmental Health Review, 59(1): 7-16.

Tharek Z, Ramli AS, Whitford DL, Ismail Z, Mohd MZ, Ahmad SS, ... Jayaraman T (2018) Relationship between self-efficacy, self-care behaviour and glycaemic control among patients with type 2 diabetes mellitus in the Malaysian primary care setting. BMC Family Practice, 19(1): 39-39.

Wang Y, Wu AM, Lau JT (2016) The health belief model and number of peers with internet addiction as inter-related factors of Internet addiction among secondary school students in Hong Kong.BMC Public Health, 16(1): 272. doi: 10.1186/s12889-016-2947-7

Wimo A, Guerchet M, Ali GC, Wu UT, Prina AM, Winblad B, ... Prince M (2017) The worldwide costs of dementia 2015 and comparisons with 2010. Alzheimer's & Dementia, 13(1): 1-7.