A Population-Based Study on Health Literacy and Health Behaviors in Taiwan

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Abstract
Health literacy has been proved to be associated with various domains of health. The objective is to describe the prevalence and distribution of health literacy and health behaviors and define the association between health literacy and health behaviors in Taiwan. An area sampling was applied in this study. Structured in-person interviews in the respondents' home were conducted to obtain information on patient demographics, health behaviors, and health literacy. The participants were 569 females and 529 males with average age of 35. Over half of them did not use alcohol, had physical activity, and 68.0% kept normal BMI. The logistic regression constructed for health literacy revealed that physical activity and BMI are important factors other than gender, and education. Men have less health literacy than women. The higher educated have higher health literacy. A person who takes physical activity has higher health literacy. And an overweight person has higher health literacy. We must illuminate the causal pathways linking health literacy and health outcomes and use this information to design more comprehensive and effective interventions.

Keywords: Health literacy, health behavior, area sampling, population-based study, health risk behavior

Introduction

Health literacy has been proved to be associated with various domains of health. There are so many related literature on clinical cohorts. Only a handful of studies demonstrated the association between health literacy and poor health behavior in the community. For example, Ownby et al. (2014) recruited community dwelling volunteers and found that persons with lower levels of health literacy reported more health conditions, more frequent physical symptoms, and greater healthcare service utilization. Wolf et al. (2007), Bennet et al. (2009), and Kim and Yu (2010) revealed the correlation between health literacy and preventive health behaviors among community-dwelling older adults, and Chang (2011) analyzed the associations among adolescents. These studies were either designed as purposive sampling, or limited sampling with age.

Health is for all, not limited to specific population. WHO defined health literacy as the cognitive and social skills, which determine the motivation and ability of individuals in ways which promote and maintain good health; it relates to the achievement of a level of knowledge, personal skills, and confidence to take action to improve personal and community health (WHO, 1998). Nutbeam (2008) discussed about the concept of health literacy as a clinical "risk", or a personal "asset", and indicated the science to support the "asset" concept is less well developed. More research is needed in this area to offer convincing evidence for enhancing critical health literacy (Chinn, 2011).

With chronic illnesses replacing infectious diseases as the leading causes of death, prevention of disease has taken the forefront in public health (Satcher and Eve, 2007). There was a shift in the emphasis of public health in response to the new risk factors, and health promotion initiatives for preventing people from adopting high-risk lifestyles came into fashion. The Ottawa charter for health promotion states that 'health is created in the context of everyday life, where people live, love, work and play' (WHO, 1986). Health literacy has been redefined as the ability to make sound health decisions in the context of everyday life – at home, in the community, at the workplace, in the healthcare system, the market place and the political arena (Kickbusch, Wait, and Maag, 2006).

Along with such change in health concept, health promotion and prevention should be integrated into the framework of measurement. Health literacy is more than just the ability to read written material; it should be the ability to comprehend information for managing one's own health. The development of a rapid and inexpensive way to identify persons with limited health literacy would increase the feasibility of assessing a person's health literacy in a community or of conducting large-scale studies that could evaluate the consequences of limited health literacy and identify effective interventions. The scale of health literacy developed and applied in this study includes 12 items of health promotion, physical and drug knowledge.

Suka et al. (2015) indicated that the pathways linking health literacy to health status consisted of two indirect paths; one intermediated by health information access and another intermediated by health behavior. Since health information access is the basis of health behavior in the digital world, and only through simultaneous action could one gain knowledge, health behavior is the focus to be analyzed in this research. The

objective of this study is analyzing a population-based data to describe the frequency of health literacy and health behaviors, and identify the correlation between them.

Method

The sampling frame was nationwide and composed of a stratified (by administrative district) probability sample of over 15 years old persons including outlying islands and mountain townships. The over-all criterion that should be applied in choosing a sampling design is to so design the sample that it will yield the desired information with the reliability required at a minimum cost; or, conversely, that at a fixed cost it will yield estimates of the statistics desired with the maximum reliability possible (Hansen & Hauser, 1945). Because a complete frame of reference was not available, area sampling method was adopted. An area sampling is a method in which the area to be sampled is subdivided into smaller blocks which are selected at random and then subsampled or fully surveyed. The entire 1100 sample came from 17 counties, 7 cities and 1 island. And it is a reasonable random sample of the population of Taiwan. Two respondents who did not complete the questionnaire were not included in analysis.

Structured in-person interviews in the respondents' home were conducted to obtain information on patient demographics, health behaviors, and health literacy. The demographics included gender, age, and education. For health behaviours, 4 items used yes/no response formats to measure smoking, betel nuts, alcohol consumption, and physical activity. BMI was calculated from self-reported body weight and height, and divided into four groups, underweight (<18.5), normal (<=24), overweight (<30), and obese (>=30).

Table 1: Principal component analysis results of health literacy items

Item	Construct		
	HP	PHY	DRUG
5 servings of vegetables and fruits per day	***.795***	.225	.232
Ideal body weight	***.792***	.196	.194
Fitness	***.781***	.202	.163
Influenza vaccine	***.721***	.278	.409
Pap smear	***.640***	.301	.368
Coronary	.181	***.830***	.223
Prostate	.158	***.802***	.301
Hormone	.435	***.685***	.201
Menopause	.381	***.670***	.293
Nicotine	.287	.213	***.809***
Antibiotics	.261	.306	***.791***
Cholesterol	.304	.379	***.725***

The scale of health literacy included 12 items, namely five servings of vegetables and fruits per day, ideal body weight, fitness, influenza vaccine, Pap smear, coronary disease, prostate, hormone, menopause, nicotine, antibiotics, and cholesterol. Principal component analysis indicated that scale items loaded on 3 factors, corresponding to health promotion, physical and drug knowledge. And five-point Likert anchored scales ("1 = never heard", "2 = slightly sure", "3 = moderately sure", "4 = very sure", "5 completely sure") were used for evaluation. The international

consistency reliability coefficient is 0.93. The range of health literacy was 12-60. And was classified into 3 groups, less (12-36), median (37-47), and high (48-60).

Result

As table 2, the participants were 569 females and 529 males with average age of 35. Most of them were 20 to 39 years old. More than 62% of them were graduated from university, and 28.4% from high school, the rest from senior high school. There were 26.3% of low health literacy, 44.8% of middle health literacy, and 28.9 of higher health literacy. Most of them did not smoke, or use betel nuts. Over half of them did not use alcohol, had physical activity, and 68.0% kept normal BMI.

Bivariate analysis revealed that gender, education, smoking, physical activity were correlated with the level of health literacy, as table 3. Females' health literacy was higher than males'. The correlation between health literacy and age were not significant as the variable of age was classified into 6 groups. The more educated persons had higher health literacy. The persons who had physical activity or did not smoke had higher health literacy. And there were no significant relations between health literacy and having betel nuts, alcohol, and BMI.

The logistic regression model was used to estimate the odds ratios for the health behaviors with higher, median or lower health literacy. The dependent variable is health literacy, a discrete and comprised of three values and less health literacy as the reference group. The independent variables are health behaviors, including smoking, betel nuts, drink, physical activity, and BMI. Gender, age and education are used as controlling variables.

Table 2. Description of participants

variables	N	%	variables	N	%
Gender			Smoking		
Male	529	48.2	No	916	83.4
Female	569	51.8	Yes	182	16.6
Education			Betel Nuts		
Junior high	96	8.7	No	1054	96.0
Senior high	312	28.4	Yes	44	4.0
University	690	62.8	Alcohol		
Health literacy			No	616	56.1
Less	289	26.3	Yes	482	43.9
Median	492	44.8	Physical activity		
High	317	28.9	No	525	47.8
BMI(kg/m^2)			Yes	573	52.2
				Mean	SD
Underweight	105	9.6	Age	35.3	12.6
Normal	747	68.0			
Overweight	204	18.6			
Obese	42	3.8			

As table 4, individuals with middle health literacy were more likely to be female, higher educated, having physical activity, and overweight. The probability of median health literacy for males is 0.568 times likely than for females. The probability of median health literacy for persons with junior high was 0.329 times likely than

persons of university graduates. The probability of median health literacy for persons without physical activity is 0.615 times likely than for persons with physical activity. And the probability of median health literacy for overweight persons is 1.587 times likely than for normal weighted persons.

Table 3. Health behaviors by health literacy level

	Less (289)		Median (492)		High (317)		Chi-square	p
variables	N	%	N	%	N	%		
Gender							22.639	<.001
Male	168	58.1	238	48.4	123	38.8		
Female	121	41.9	254	51.6	194	61.2		
Education							36.328	<.001
Junior high	44	15.2	38	7.7	14	4.4		
Senior high	94	32.5	145	29.5	73	23.0		
University	151	52.2	309	62.8	230	72.6		
Smoking							12.680	.002
No	223	77.2	415	84.3	278	87.7		
Yes	66	22.8	77	15.7	39	12.3		
Betel Nuts							3.820	.148
No	276	95.5	468	95.1	310	97.8		
Yes	13	4.5	24	4.9	7	2.2		
Alcohol							0.600	.741
No	157	54.3	277	56.3	182	57.4		
Yes	132	45.7	215	43.7	135	42.6		
Physical activity							7.692	.021
No	158	54.7	227	46.1	140	44.2		
Yes	131	45.3	265	53.9	177	55.8		
BMI(kg/m^2)							6.477	.372
Underweight	22	7.6	50	10.2	33	10.4		
Normal	231	73.7	327	66.5	207	65.3		
Overweight	43	14.9	97	19.7	64	20.2		
Obese	11	3.8	18	3.7	13	4.1		

Individuals with higher health literacy were more likely to be female, older aged, not graduated from university, having physical activity, and overweight. The probability of high health literacy for males is 0.345 times likely than for females. The probability of high health literacy for persons with junior high was 0.111 times likely than persons of university graduates. The probability of high health literacy for persons without physical activity is 0.506 times likely than for persons with physical activity. And the probability of high health literacy for overweight persons is 1.833 times likely than for normal weighted persons.

Table 4. Logistic regression models of health literacy

Variables	Health literacy (Median/Less)		Health literacy (High/Less)	
	OR	95% CI	OR	95% CI
Gender (male/female)	0.568*	0.405-0.798	0.345*	0.234-0.509
Age	1.009	0.995-1.022	1.024*	1.009-1.040
Education				
(junior high/university)	0.329*	0.191-0.567	0.111*	0.054-0.230
(Senior high/university)	0.722	0.514-1.015	0.469*	0.317-0.695
Smoking (no/yes)	1.329	0.866-2.041	1.234	0.745-2.044
Betel nuts (no/yes)	0.502	0.231-1.090	0.800	0.285-2.247
Drink (no/yes)	1.005	0.734-1.376	0.959	0.694-1.364
Physical activity (no/yes)	0.615*	0.451-0.838	0.506*	0.356-0.718
BMI(kg/m^2)				
Underweight/normal weight	1.356	0.777-2.366	1.417	0.767-2.618
Overweight/ normal weight	1.587*	1.045-2.409	1.833*	1.153-2.913
Obese/normal weight	1.437	0.645-3.199	1.973	0.819-4.751

Discussion

This is a population-based study to examine the relationship between health literacy and smoking, betel nuts, and alcohol consumption, physical activity, and BMI in Taiwan. Methodologically, the participants came from a nationwide area sampling. A systematic review by Paasche-Orlow et al. (2005) indicated that more than three quarters of the studies were from convenience samples of subjects. Ths strength of this study is the national representative data of a systematically stratifiec probability sampling.

The association of health literacy and gender, age, and education was consistent with most of the other researches. An Australian study indicated that males are significantly less likely than females to recognize symptoms associated with mental illness and more likely to use alcohol for mental health problems (Cotton et al. 2006). In the United States, the assessment revealed that women had higher average health literacy than men (Kutner, et al., 2006). In Japan, the poor mental health literacy in rural communities is strongly associated with being male and a low level of education (Kaneko and Motohashi 2007). And Paasche-Orlow et al. (2006) indicated that limited health literacy is consistently associated with education, ethnicity, and age by a systematically review. However, the assessment in Canada confirms that average health literacy varies significantly by age and education, but not gender (Health Literacy in Canada, 2007). The difference may be due to the difference of both participants and instruments.

The correlation between physical activity and health literacy is significant after controlling gender, age, and education. Many researchers (Lee et al., 2004) proposed the causal pathways of how health literacy influences health. It is suggested that a person with good health literacy will take physical activity and influence his/her health. On the other hand, a person without physical activity had lower health literacy. The result was consistent with finding of Ferguson and Pawlak (2011).

In this study, physical activity is the only one behavior relating to health literacy. The insignificant correlation between health risk behaviors (smoking, betel nuts, and drinking) and health literacy was an important finding. Wolf et al. (2007) indicated that limited health literacy was not independently associated with health risk behaviors among community-dwelling elderly. In these two studies, smoking and drinking were included as health risk behaviors. Though their participants were not the same, the same results cannot be ignored. For health risk behaviors, many factors including life style and psychosocial circumstances, and not health literacy may be more predictive of smoking and drinking.

The results showed that overweight persons had higher health literacy compared to the normal weight ones. The result is inconsistent with other researches. Fro example, Cunha et al. (2014) applied a cross-sectional study and found that participants with inadequate health literacy are those with higher BMI. Chari et al. (2014) conducted a cross-sectional survey and found that obesity in school-aged children is associated with parental factors, and obesity in adolescents is strongly associated with the adolescent's health literacy. Sharif and Blank (2010) concluded that child health literacy was negatively correlated with BMI in overweight children. However, Harrington and Elliott (2009) provided evidence that driving the prevalence of overweight and obesity may be so called obesogenic environments that encourage physical inactivity and unhealthy eating. The environmental factors cannot be ignored.

Conclusion

As chronic illnesses have replaced infectious diseases as the leading causes of death, people have to take responsibility of health promotion. Since these myriad demands placed on patients, wide spread improvements in health and health care communication will likely be necessary to reduce the association between health literacy and mortality. To achieve this goal, we must further illuminate the causal pathways linking health literacy and adverse health outcomes and use this information to design more comprehensive and effective interventions.

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