

## RESEARCH ARTICLE

# Status and Determinants of Health Literacy among Adolescents in Guangdong, China

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### Abstract

**Background:** Previous studies for non-communicable disease control, including cancer, have mostly relied on health literacy in adults. However, limited studies are available for adolescents. This study aimed to assess the status and determinants of health literacy in in-school adolescents in Guangdong, China. **Materials and Methods:** A total of 3,821 students aged 13-25 years were selected by multi-stage cluster sampling. After the questionnaire of health literacy was answered, the total scores for health knowledge (18 questions), skills (5 questions) and behaviors (14 questions) were determined. The total scores for health literacy and each subscale were recoded into adequate and inadequate subgroups, and logistic regression models were used to identify factors associated with each outcome variable. **Results:** The prevalence of adequate health literacy was 14.4%, and the prevalences for adequate knowledge, skills and behavior were 22.4%, 64.7% and 6.6%, respectively. Students coming from prestigious schools and having parents with higher education had higher odds of having adequate knowledge, skills and behaviors. Female students had higher odds of having adequate knowledge and behaviors. Students in grade 7-8 had higher odds of having adequate knowledge and skills. The health knowledge was positive associated with health skills (odds ratio [OR] =2.1, 95% confidence interval [CI] 1.7-2.5) and behaviors (OR=3.0, 95% CI 2.3-4.0), and health skills were positive associated with health behaviors (OR=2.6, 95% CI 1.8-3.8). **Conclusions:** Further efforts should be made to increase adolescents' health knowledge and behaviors, especially for low grade and male students in non-prestigious schools.

**Keywords:** Health literacy - health knowledge - health behavior - adolescents

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### Introduction

Health literacy has become an important public health issue. People with adequate health literacy have better health status than those with limited health skills (Morrow et al., 2006; Baker et al., 2007). So there has been increased national attention on health literacy. The United States conducted two nationwide surveys of adult health literacy in 1992 and 2003 respectively (Kirsch et al., 1993; National Center for Education Statistics, 2006). Australia, Canada and other developed countries had drawn up their own health monitoring indicators and conducted nationwide surveys according to their own culture and health care system (Australian Bureau of Statistics, 2006; Paasche-Orlow et al., 2009).

In China, the researches on health literacy started relatively late, and the first government documents defining health literacy was not published until 2008 (Ministry of Health of the people's republic of China, 2008). Although it is well known about health literacy in adults, little is known about the status and determinants of health literacy among adolescents in China. It is

noteworthy that adolescents are at a crucial stage of development characterized by many physical and psychosocial changes, which will impact on their quality of life in adulthood. In addition, adolescents with low literacy level are less likely to seek health care and more likely to use weapons (Davis et al., 1999; Fortenberry et al., 2001; Harirchi et al., 2012). So we needed to pay attention to health literacy in adolescents. To explore the status and determinants of health literacy among in-school adolescents in Guangdong province, a cross-sectional survey was carried out from September 2009 to November 2010, so as to provide scientific basis for carrying out health intervention among adolescents.

### Materials and Methods

#### *Study population*

This was a school-based survey targeting 13- to 25-year-old students. A multistage sample design was used to obtain a representative sample of students. At the first stage, schools were selected with probability proportional to their enrollment size. At the second stage, classes

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in the selected schools were randomly sampled and all students in sampled classes were eligible to participate. The study was approved by the ethics committee of Guangdong Pharmaceutical University, and this survey was qualified as involving no risks to participants. A verbal informed consent regarding the goals of the study and the willingness to participate was given to the participants.

### Questionnaire

The questionnaire prepared by the Ministry of Health of China was used for this study (Wang et al., 2010), and included demographics and personal information, health knowledge (18 items), skills (5 items) and behaviors (14 items). The Cronbach's alpha (good at coefficient  $\geq 0.7$ ) for this questionnaire was 0.86, so the questionnaire had high internal consistency.

### Measurement of health literacy

Health literacy had three subscales including health knowledge (Table 1), skills (Table 2) and behaviors (Table 3). For single-answer questions, a correct response was scored as one point, and incorrect, missing, or "do not know" responses were scored with zero points. For multiple-answer questions, the correct response rate equal to or greater than 60% was scored as one point, and else were scored with zero points. The total score for health literacy was 37 points, and an adequate level (Wang et al., 2010) was considered to be 30-37 points (equal to or greater than 80% overall correct answers). Similarly, the sum scores for each subscale of health literacy were recoded into adequate (equal to or greater than 80% overall correct answers) and inadequate (less than 80% overall correct answers) subgroups.

### Data collection and quality control

All interviewers in each area were centrally trained to

ensure that operation procedures were identical across all areas. After obtaining verbally informed consent, eligible students were asked to complete a face-to-face survey by trained interviewers. In order to evaluate the feasibility of investigation, a pilot study was carried out before formal investigation. Two levels of a quality control system, quality controller and quality leader, were used to check for potential errors in the questionnaires.

### Data analysis

All data were entered in duplicate into the EpiData version 3.1 database, and data entry screens were used to revise incorrect entries (i.e., input and logic errors). The models for the rates of adequate knowledge, skills and behaviors were binary outcome equations, and logistic regression models were used to identify factors associated with each outcome variable. A two-sided P value of less than 0.05 was considered to indicate statistical significance. A Venn diagram was used to show overlapping subscales of adequate health literacy (such as adequate knowledge, adequate skills or adequate behaviors). All analyses were performed using STATA V.13.0 (StataCorp LP, College Station, Texas, USA).

## Results

### Sample characteristics

A total of 3821 students aged 13-25 years were enrolled in the study, and the effective response rate was 98.2% (3754/3821). Participants' mean age was 18.9 years and 58.0% were male students. Overall, the proportion of students from urban areas (19.4%) was lower than the proportions from rural areas (47.4%) and towns (33.2%). Only 22% of the students were the only child in their family and 49.2% were from prestigious schools.

**Table 1. Responses to Questions Related to Health Knowledge Among Students in Guangdong Province, China**

Questions related to health knowledge	Correct response		Incorrect response	
	n	%	n	%
Questions related to infectious disease prevention				
The transmission routes of AIDS	3480	92.7	274	7.3
Do you think hand-washing will help prevent influenza	3160	84.2	594	15.8
Statement of tuberculosis symptoms	3055	81.7	699	18.3
Statement of children vaccination	2933	78.3	821	21.7
Do you think the treatment for tuberculosis is free	1401	37.8	2353	62.2
Statement of vector-borne diseases	542	14.4	3212	85.6
Questions related to chronic disease prevention				
Statement of quit smoking	3302	88.0	452	12.0
Statement of healthy lifestyle	3232	86.1	522	13.9
Diseases caused by passive smoking	2270	60.5	1484	39.5
Do you think weight loss is an early signal of cancer	1041	27.7	2713	72.3
Questions related to general knowledge				
Concept of health	3364	89.6	390	10.4
Do you think psychological problems are not illnesses	3249	86.7	505	13.3
The normal value scope of axillary temperature in adults	2979	79.5	775	20.5
Do you think the therapeutic effect of injection is better and faster than that of medication	2906	77.5	848	22.5
The normal value scope of pulse frequency in adults	2813	75.2	941	24.8
Is it harmless for adults to donor 200ml blood	2367	63.1	1387	36.9
The normal value scope of blood pressure	2087	55.6	1667	44.4
Is there a law dedicating to the protection of the right of workers engaged in toxic work	1982	52.9	1772	47.1

### Health Literacy

Adequate health literacy was found in 541 (14.4%) students. Adequate knowledge, skills and behaviors were found in 839 (22.4%), 2430 (64.7%) and 249 (6.6%) students, respectively.

### Health knowledge

The overall status of health knowledge (Table 1) showed that the knowledge related to infectious disease

prevention was widely understood, except for the vector-borne diseases (14.4%) and the treatment for tuberculosis (37.8%). In terms of chronic disease prevention, the students exhibited a satisfactory understanding of quit smoking and healthy lifestyle which may decrease the risk of chronic diseases, but a low level of knowledge of the early signal of cancer (27.7%). For questions related to general knowledge, the accuracy rates ranged from 52.9% to 89.6%; among these, the accuracy rate of concept of health earned the highest rate.

In the multiple logistic regression analysis of health knowledge (Table 4), students with adequate knowledge were more likely to be female (odds ratio [OR]=1.3, 95% confidence interval [CI] 1.1-1.6), to be in grade 7-8 (OR=2.4, 95%CI 2.0-2.9), to have one parent (OR=1.3, 95%CI 1.1-1.6) or both parents with higher education (OR=1.3, 95%CI 1.0-1.6), and to be from prestigious schools (OR= 2.1, 95%CI 1.8-2.5).

**Table 2. Responses to Questions Related to Health Skills Among Students in Guangdong Province, China**

Questions related to health skills	Correct response		Incorrect response	
	n	%	n	%
The treatment of fire accident	3575	95.2	179	4.8
The emergency medical call	3497	93.8	257	6.2
How to measure body temperature	3118	83.1	636	16.9
The meaning of some safe logos	2081	55.4	1673	44.6
The meaning of OTC on the medicine boxes	1710	46.0	2044	54.0

**Table 3. Responses to Questions Related to Health Behaviors Among Students in Guangdong Province, China**

Questions related to health behaviors	Correct response		Incorrect response	
	n	%	n	%
The safe driving modes	3373	90.1	381	9.9
The treatment of expired food	3278	87.9	476	12.1
The habit of using towels with others	3156	84.2	598	15.8
The treatment of gas poisoning	3057	81.4	697	18.6
The statements of antibiotics use	2759	73.5	995	26.5
The habit of brushing teeth	2645	70.7	1109	29.3
How to handle wounds when bitten by a cat or dog	2630	70.1	1124	29.9
Using separate cutting boards for raw and cooked food	2618	70.0	1136	30.0
The statements on infant feeding	2168	57.8	1586	42.2
The diseases caused by contaminated drinking water	2123	56.6	1631	43.4
Do you have physical examination periodically	1957	52.4	1797	47.6
The healthy dose of salt intake	987	26.3	2767	73.7
The physical examination frequency of pregnant women	523	14.0	3231	86.0
The healthy dose of alcohol intake in male adults	448	11.9	3306	88.1

**Table 4. The relations of Health Knowledge, Skills and Behaviors (Adequate vs Inadequate) with Samples' Characteristics**

Characteristics	n (%)	Adequate knowledge (n=839)		Adequate skills (n=2430)		Adequate behaviors (n=249)	
		%	AOR (95%CI)	%	AOR (95%CI)	%	AOR (95%CI)
Sex							
Male	2177 (58.0)	20.0	1.0	63.9	1.0	5.4	1.0
Female	1577 (42.0)	25.6	1.3 (1.1-1.6)	66.0	1.1 (0.9-1.3)	8.4	1.5 (1.1-1.9)
Grade							
1-3	1606 (42.8)	18.7	1.0	56.4	1.0	6.9	1.0
4-6	1351 (36.0)	19.0	1.2 (0.9-1.4)	69.4	1.9 (1.6-2.2)	5.6	0.8 (0.6-1.1)
7-9	797 (21.2)	35.3	2.4 (2.0-2.9)	73.7	2.0 (1.6-2.4)	7.9	0.8 (0.6-1.1)
Only-child							
No	2937 (78.0)	21.4	1.0	63.4	1.0	6.0	1.0
Yes	817 (22.0)	26.2	1.1 (0.9-1.3)	70.3	1.1 (0.9-1.4)	9.3	1.2 (0.9-1.7)
Region							
Rural	1778 (47.4)	19.8	1.0	62.3	1.0	5.2	1.0
Town	1247 (33.2)	22.5	1.0 (0.8-1.2)	66.0	1.1 (0.9-1.3)	7.5	1.2 (0.8-1.6)
Urban	729 (19.4)	28.7	1.1 (0.9-1.4)	69.2	1.0 (0.8-1.2)	8.6	1.1 (0.7-1.6)
Parents' education							
Neither from high school	1605 (42.7)	18.6	1.0	61.6	1.0	5.6	1.0
One from high school	1043 (27.8)	24.5	1.3 (1.1-1.6)	65.2	1.0 (0.9-1.2)	5.3	0.8 (0.5-1.1)
Both from high school	1106 (29.5)	25.8	1.3 (1.0-1.6)	68.9	1.1 (1.1-1.4)	9.4	1.4 (1.1-2.0)
Prestigious school							
No	1906 (50.8)	15.9	1.0	61.2	1.0	4.4	1.0
Yes	1848 (49.2)	29.0	2.1 (1.8-2.5)	68.4	1.4 (1.2-1.6)	8.9	1.6 (1.2-2.1)
Health knowledge							
Inadequate	2915 (77.6)			60.8	1.0	4.3	1.0
Adequate	839 (22.4)			78.3	2.1 (1.7-2.5)	14.7	3.0 (2.3-4.0)
Health skills							
Inadequate	1324 (35.3)					2.9	1.0
Adequate	2430 (64.7)					8.7	2.6 (1.8-3.8)

n, number of students surveyed; %, the proportion of students surveyed; AOR, adjusted odds ratio for adequate vs inadequate; CI, confidence interval

Health skills

With regard to health skills (Table 2), the students demonstrated a good understanding of the treatment of fire accident, the emergency medical call and the measurement of body temperature, obtaining accuracy rates ranged from 83.1% to 95.2%. However, the students showed insufficient understanding of the meaning of OTC and some safe logos, with accuracy rates of 46% and 55.4% respectively.

The multiple logistic regression analysis of health skills (Table 4) showed that students with adequate skills were more likely to be in grade 4-6 (OR=1.9, 95%CI 1.6-2.2) or grade 7-8 (OR=2.0, 95%CI 1.6-2.4), to have both parents with higher education (OR=1.1, 95%CI 1.1-1.4), to be from prestigious schools (OR=1.4, 95%CI 1.2-1.6), and to have adequate knowledge (OR=2.1, 95%CI 1.7-2.5).

Health behaviors

With regard to health behaviors (Table 3), the students widely understood of behaviors related to safe driving modes (90.1%), treatment of expired food (87.9%), the habit of using towels (84.2%) and treatment of gas poisoning (81.4%), but a low level of knowledge of the physical examination frequency of pregnant women (14%) and healthy dose of salt (26.3%) and alcohol intake (11.9%).

The multiple logistic regression analysis of health behaviors (Table 4) indicated that students with adequate behaviors were more likely to be female (OR=1.5, 95%CI 1.1-1.9), to have both parents with higher education (OR=1.4, 95%CI 1.1-2.0), to be from prestigious schools (OR=1.6, 95%CI 1.2-2.1), to have adequate knowledge (OR=3.0, 95%CI 2.3-4.0), and to have adequate skills (OR=2.6, 95%CI 1.8-3.8).

Composition of adequate health literacy

The Venn diagram (Figure 1) revealed three groups: students with adequate scores in one subscale (49.5%), those with adequate scores in two subscales (17.9%), and those with adequate scores in all three subscales (2.9%). Students with good scores only in one subscale included 44.5% only with adequate skills, 4.4% only with adequate knowledge, and 0.6% only with adequate behaviors. Students with good scores in two subscales included 14.7% with both adequate skills and knowledge, 2.8% with both adequate skills and behaviors, and 0.4% with

both adequate knowledge and behaviors.

Discussion

This is the first study to examine the status and determinants of health literacy in a population of adolescents in China at the time. The findings indicated that the prevalence of adequate health literacy was 14.4%. To note, the prevalence of adequate skills was high (64.7%), but the prevalences of adequate knowledge (22.4%) and behaviors (6.6%) were still low, especially for low grade and male students in non-prestigious schools. In addition, the health knowledge was positive associated with health skills and behaviors, and the health skills were also positive related with health behaviors.

In this sample of adolescents, 64.7% of participants had adequate kills, but only 22.4% had adequate knowledge and even only 6.6% had adequate behaviors. These rates were somewhat higher than statistics on the nationwide survey in China in 2008, which reported 25.2% of adolescents aged 15-24 years with adequate kills, 15.9% with adequate knowledge, and 6.4% with adequate behaviors (Wang et al., 2010). These results indicated that there was a gap in knowledge, skills and behaviors in Chinese population. Full awareness about health knowledge and skills did not mean reasonable behaviors, and this might be related to the issue of assessing to appropriate health behaviors. This was also consistent with the most recently published study that even if women had enough knowledge and positive attitudes toward breast cancer prevention, she would not be able to have mammography since there were no facilities for women to do so (Harirchi et al., 2012).

It was noteworthy that there were only 14.4% participants in our study with adequate health literacy. But this rate was much lower than the 52% found in high school students in Texas US (Ghaddar et al., 2012), and 58% (Cheryl et al., 2011), 72% (Morrow et al., 2006) and 73% (Laramee et al., 2007) in three samples of ambulatory heart failure patients. A recent study conducted in Taiwan found that nearly 41% of adolescents could be classified as high health literacy, 49% moderate, and nearly 10% low (Chang, 2010), and this prevalence was much higher than that found in our study. In addition, the Venn diagram revealed that 49.5% of students had adequate scores in only one subscale of health literacy, 17.9% had adequate scores in two subscales, and 2.9% had adequate scores in all three subscales. This indicated that the comprehensive level of health knowledge, skills and behaviors was obviously low and the situation of health literacy among adolescents in Guangdong province was still very serious.

In order to effectively improve the overall level of health literacy, we should fully understand the awareness of each item of health literacy. To note, the health knowledge of adolescents in Guangdong province was still not comprehensive enough, as the results of other regions in China (Li et al., 2010; Zhan et al., 2011). The awareness rates of healthy lifestyle, psychological problems and transmission routes of infectious diseases (Flu and AIDS) were high, but the knowledge about early signal of cancer, tuberculosis and labor-borne diseases were less than 40%.

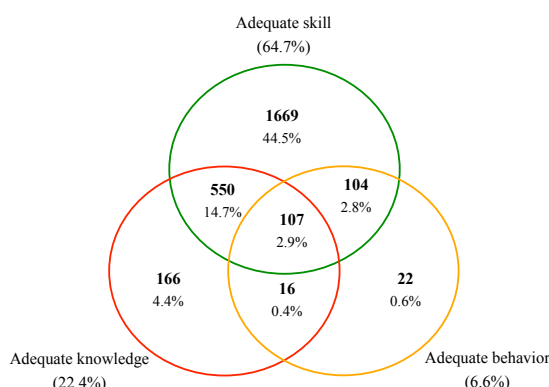


Figure 1. Venn Diagram of the Frequency Distribution of Subscales of Health Literacy with Adequate Scores

The low disease-related health literacy will lead to late presentation of cases and increased disease burden, when little can be done. At present the emphasis is to raise disease-related awareness to overcome ever-increasing burden of the disease (Hamptom et al., 2008; Harirchi et al., 2012; Eguzo and Camazine, 2013). The prevalence of health behaviors was still low. For example, 88.1% didn't know the health dose of alcohol intake in adults and 86% wrong reported physical examination frequency of pregnant women. In general, the prevalence of adequate skills in our study was relatively high, but we did not rule out because health skills only included some basic, common-sense items (such as the emergency medical call, fire treatment, measuring body temperature, and etc.). In summary, it was necessary to carry out health education and health propaganda aimed at health knowledge and behavior, especially for the poor mastering questions.

In our study, the rates of adequate knowledge and health behaviors of female students were higher than those of male students, but there were no gender differences in health skills. Prior studies on health literacy among adolescents and adults found similar results (Davis et al., 2006; Cutilli and Bennett, 2009; Shah et al., 2010). There were several possible explanations for these findings. For one thing, female students were more concerned about health information and were more willing to turn to parents, physician, friends, and magazines for health information (Vardavas et al., 2009). For another, female students paid more attention to details and care personal image. To note in our study, there was no significant difference among the rural, the town and the urban women as far as their health knowledge, skills and behaviors were concerned. This finding was somewhat unexpected, but studies from other Asian countries have also revealed similar homogeneity among the rural and urban populations as far as their knowledge of cancers were concerned (Toan Tran et al., 2011; Basu et al., 2014).

The findings in our study demonstrated that health knowledge, skills and behaviors were all independently associated with education including parents' education and participants' school classification, and past research on the relationship between education and health literacy had drawn similar conclusions. In countries with high rate of illiteracy among women lack of education can influence awareness and also breast cancer prevention behaviors (Thornton et al., 2008; Harirchi et al., 2012). A prior study also showed that family culture predominated as an influence in developing a love of reading (Strommen and Mates, 2004). Other studies had found that the levels of knowledge, behavior, and skill in the general population were significantly higher with a higher level of education (Zhang et al., 2014) and that education was linked to the increased use of preventive care (Parente et al., 2005). In general, as showed in this study less educated people usually show poor health and behaviors compared to better educated people (Harirchi et al., 2012). It was argued that in many circumstances lower education means having less economic resources and thus economic barriers could be an important explanatory factor for disparities on health behaviors. Education also has been interpreted as influencing health through the acquisition of higher

cognitive functions. Education might effect not only on health knowledge and attitudes, but also on the health behaviors (Lahelma et al., 2004). To note in our study, the rates of adequate knowledge, skills and behaviors among students in prestigious schools were higher than those of students in non-prestigious schools. This was quite expected since students with good academic performance and intellectual ability tended to enter prestigious schools and pay more attention to establish health skills and behaviors. In brief, family and school environment played an important role in health literacy of adolescents. In order to improve health literacy of youth, schools should incorporate health literacy into their curricula, educators should take advantage of all educational opportunities to incorporate health-related tasks and materials into existing lesson plans, and parents were encouraged to actively take part in health advocacy.

Health knowledge, skills and behaviors influence each other. Health knowledge is the basis of health behaviors and skills, and health skills promote the formation of health behaviors. Previous studies had provided good evidence that health knowledge was positively correlated with self care behaviors and inversely correlated with violent behaviors (DeWalt and Hink, 2009; Cheryl et al., 2011). Also, the findings from Iran revealed that women's knowledge and attitudes were significant factors in predicating breast prevention behaviors (Harirchi et al., 2012). Another study demonstrated an association between reading level and risky behaviors among adolescents (Fortenberry et al., 2001), and this finding was consistent with our study. Thus health knowledge publicity and education should be strengthened, and at the same time we should pay attention to the driving role for health skills and behaviors from health knowledge.

There were several potential limitations to this study. First, the study was limited by the cross-sectional design, which described a single point in time and was lack of interventions, so it was unable to determine if the associations we found were actual predictors of health literacy. Second, the contents for assessing health skills were relatively simple and incomplete, so further improvement were required in future studies. In addition, if the survey joined with health outcomes and health service use, we can further explore the relations of health outcomes and health service use with health literacy, so that the analysis of health literacy will be more comprehensive and deep. Future studies could be conducted with the inclusion of these contents, as well as employing a better study design such as a longitudinal cohort study that could elucidate whether the association is of a causal nature.

Although there are limitations, our study is among the first in China to investigate the status and determinants of adolescents' health literacy using a large, school-based sample. This study confirms the need to fill the gap in health knowledge and health behaviors among the Chinese adolescents, especially for low grade and male students in non-prestigious schools. In order to promote health literacy of adolescents, health interventions among family, school and community should be implemented simultaneously.

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The authors declare that there is no conflict of interest.

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