

Functional health literacy among left-behind students in senior high schools in an ethnic minority area

A cross-sectional study

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Abstract

To verify the validity of functional health literacy scale and analyze what influences functional health literacy.

Using convenience sampling method based on cross-sectional data to select 589 left-behind senior high-school students in an ethnic minority area, using the functional health literacy scale.

The scale results were relatively strong, and the absolute fitness index, value-added fitness index, and simple fitness index reached the fitness standards. The overall functional health literacy score was (0.65 ± 0.12), which falls within the upper middle class. Gender ($t=2.40, P<.05$), ethnicity ($t=4.28, P<.001$), place of residence ($t=4.51, P<.001$), mother's education level ($F=3.608, P<.05$), self-assessment of grades for 1 year ($F=25.781, P<.001$), and whether the participant liked the health education content ($F=9.416, P<.001$) had impacts on overall functional health literacy.

The study results show that relatively satisfactory reliability and validity and can be applied further analysis for improving students functional health literacy levels.

Abbreviations: ANOVA = analysis of variance, NVS = the Newest Vital Sign, REALM-Teen = the Rapid Estimate of Adolescent Literacy in Medicine, TOFHLA = Test of Functional Health Literacy.

Keywords: health literacy, health promotion, minority health, public health, students

1. Introduction

Health literacy is currently drawing increasing attention in contemporary practice, research, and policy.^[1,2] A persons level of health literacy affects his/her health outcomes,^[3] health knowledge, and health behaviors.^[4] Studies have shown that

health literacy can predict peoples health level, the incidence of diseases, infant morbidity and mortality.^[5] Health status can be improved by improving peoples health literacy level, such as raising peoples level of awareness of diseases, providing treatment adherence,^[6] enhancing self-management ability,^[7] improving tobacco control, and reducing lack of physical activities.^[8,9] According to the 2015 Youth Risk Behavior Surveillance System, adolescents take more risks, such as binge-drinking, cigarette smoking, inadequate fruit and vegetable intake, insufficient physical activity, and risky sexual behavior.^[10] Teenagers with low health literacy levels are also more likely to display aggressive and antisocial behaviors.^[11,12] Studies suggest that such risks can affect the adolescents developing brain.^[13,14] Despite its importance, little research has focused on adolescent health literacy in China, especially that of left-behind students.

Studies have documented “detrimental effects of parental absence on childrens emotional and psychological functioning”.^[15,16] Children with absent parents have higher incidence rates of loneliness,^[15] low self-esteem,^[17,18] study weariness,^[19] anxiety and depression,^[20–22] interpersonal barriers,^[23,24] and some physical problems.^[25,26] Most researchers who study left-behind children in China provide definitions such as the following: “Left-Behind Children (LBC) refers to children or young people (under 16 years old) who have been left behind at home by either both parents or 1 parent who has migrated for work in other cities or countries, and they need to be taken care of by an adult or a guardian”.^[27–29] Although different researchers have different opinions on the definition of left-behind children, they share the same focus. All such researchers focus on the healthy state of left-behind children or early teenagers. Students

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(above 16 years old), however, receive little scholarly attention, and we think this topic deserves more attention. Students (above 16 years old) generally refer to senior high-school students, who face substantial study pressure, college entrance exams, the need for interpersonal adaptability and further social cognition, and less communication with parents. Therefore, our study is aimed at this special group, senior high-school students. We defined “left-behind” students in senior high schools as students with one or more parents who had moved to other regions for more than 6 months.

Yanbian area is located at South-Eastern part of Jilin Province, China. It is an autonomous region and an ethnic minority for the vast inhabitation of ethnic Korean populations, which are characterized by large populations of poor people who are very mobile. Due to geographical and language factors, most Koreans in the Yanbian area choose to work abroad for relatively long periods of time, which results in an increasing number of left-behind students; the healthy development and social stability of left-behind students are often seriously affected by this situation.^[13] I have lived in the Yanbian area for many years and am thus more interested in this area. Due to this personal interest, we aimed to study this area.

Students in senior high schools have strong plasticity in their personal world views, life views, and values, as adolescence represents a key period of knowledge and skills acquisition. They can access health-related information and skills for self-development using mass media.^[14] Their health condition is directly related to living quality, public health and the future of society. Improving their health literacy level may result in social and global health development. Studies have shown that health literacy interventions are likely to improve health behaviors.^[4] Thus, we aim to find an effective measurement tool to explore the status of health literacy.

Health literacy is defined as “the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions”.^[30] Based on social cognition theory, interdependence theory, and Freire empowerment education model, health literacy can be divided into 3 categories: functional health literacy, communicative/interactive literacy, and critical health literacy, based on the different development stages.^[31] To date, most studies in China have focused on functional health literacy.

The understanding of the concept of students health literacy is basically consistent with that of adults, all approaches emphasize the ability to assess and promote health, but most of them emphasize students self-development^[32] and the employment of all available resources to gradually realize personal health management and maintenance, as well as the advocacy and promotion of environmental and other peoples health. However, due to different values, living conditions, needs, and behavioral characteristics, the meanings and levels of health literacy reflected vary, so a specific evaluation framework and tool may be needed for different people, such as students in senior high schools.^[33] Many studies have focused on children and adolescents with different needs or social problems.^[34] In this study, functional health literacy includes health knowledge, health concepts, health skills, and health behavior.^[35]

Several instruments have been used to measure health literacy, such as the Test of Functional Health Literacy (TOFHLLA),^[36] the Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen)^[37] and the Newest Vital Sign (NVS).^[38] The TOFHLLA is intended to measure patients health literacy, mostly for adults, and the REALM-Teen is limited to adolescents with learning

disabilities.^[39] In China, the NVS has been validated only with adults. There is a demonstrable lack of general and local health measurement tools for Chinese students in senior high schools. To help left-behind students in senior high schools and the general population improve their health literacy levels, it is necessary to verify a tool of functional health literacy and explore the influencing factors of functional health literacy.

This study had 3 primary objectives:

1. to find an effective measurement tool to explore the status of health literacy of left-behind students in senior high schools,
2. to verify the measurement tool of functional health literacy, and
3. to analyze what influences functional health literacy and give a policy implications.

2. Materials and methods

2.1. Study design

A cross-sectional design was used in this study. And we have used the STROBE cross-sectional reporting guidelines.^[40]

2.2. Participants

Data collection for the present study took place in 3 small cities (Yanji, Longjing, and Hunchun) of Yanbian areas, which is home to a large ethnic-minority population of Koreans. Participants confirming to the following inclusion criteria were adopted for the study:

1. who knew about and agreed to participate in the study,
2. all participants were required to be left-behind students in senior high schools (Senior 1 and Senior 2). Because students in Senior 3 schools face the pressures of entrance examinations, relevant policies and regulations and other issues, they were not included in the investigation.

The exclusion criteria were as follows:

1. who was students in Senior 3 schools,
2. who were absent from the schools for various reasons during the investigation.

Ethical approval of this study was obtained from the West China Hospital of Sichuan University Biomedical Research Ethics Committee (Ethics number: 2016–272).

All participants participated in the study according to the informed consent.

2.3. Instruments

Functional health literacy was measured by using a questionnaire assessment compiled by a well-known Chinese scholar, Xiaoming Yu.^[41,42] The assessment has 5 parts, including 7 general demographic characteristics (gender, ethnicity, place of residence, mothers education, self-assessment of grades for 1 year, and whether the participant liked health education content and lived at school), and the following 4 dimensions: health knowledge (28 items), health concepts (7 items), health skills (11 items), and health behavior (22 items). Each item was assigned a score ranging from 0 to 1. The Cronbach alpha coefficient of the questionnaire was 0.847, the Spearman-Brown binary reliability was 0.670, and the Cronbach alpha coefficient of each dimension ranged from 0.446–0.808.

2.4. Quality control

Before the survey, we selected a high-school class for a preliminary investigation with which to modify the questionnaire based on the experimental results. Before data collection, we conducted unified training to avoid bias caused by investigators. With the approval of the administrative department of education, we contacted the selected schools and obtained the assistance of head teachers. We made adequate precautions to minimize the missing data. Ad hoc imputation was used when missing data was low (10%). In this study, EpiData 3.1 (The EpiData Association, Denmark) was used to ensure the accuracy of the data.

2.5. Data collection

The data were collected from March to June 2015 by using a convenience sampling. After explaining the purpose and significance of the study, participants participated in the study according to the informed consent, they may took 25–30 minutes to fill out the questionnaires. Because we lacked the data for left-behind students for reference, we estimated an average of 40 students each class, and an average of 8 classes each school, we added the sample by 20% for missing data. Overall, 768 questionnaires were sent out.

2.6. Statistical analyses

2.6.1. Structural equation model analysis. The model was analyzed by maximum likelihood to verify the relationships and predictions with the assumption that functional health literacy was normally distributed. Measurement errors of path model analysis were also considered. The good fitness standard of path model analysis was judged by absolute fitness index ($X^2 < 3.84$, $RMR < 0.05$, $RMSEA < 0.05$, $GFI > 0.09$, $AGFI > 0.09$),

value-added fitness index ($NFI > 0.90$, $RFI > 0.90$, $IFI > 0.90$, $TLI > 0.90$, $CFI > 0.90$), simple fitness index ($PGFI > 0.50$, $PNFI > 0.50$, $PCFI > 0.50$, $CN > 200$, $X^2/df < 2.00$). It is necessary to modify the path model to improve the model fit when the modification indices are larger than 4.

2.6.2. Primary analysis. The scores for functional health literacy, descriptive statistics, *t* tests, one-way analysis of variance (ANOVA), multiple linear regression, and the tool were used to address by SPSS 22.0 (IBM Corp, Armonk, NY, USA). Statistical significance was set at $P < .05$, two-tailed.

3. Results

3.1. Sample characteristics

In this study, 589 questionnaires were suitable for statistical analysis after eliminating non-left-behind students. The inclusion of 589 left-behind students were consistent with the rules that more than 200 samples should be obtained for Structural Equation Model.^[43] Our population included 328 girls and 261 boys. The average age was 17.54 ± 0.87 . A total of 88.8% students were Korean. Rural left-behind senior high-school students accounted for 79.8% of the participants. Fewer respondents mothers had college education level. Most respondents did not live at school and reported that their health was in good condition, and thought their scores were at an average level. More than 60% of respondents reported that they liked health education content, while only 2.9% of respondents reported that they did not like health education content.

3.2. Scale of functional health literacy

The results show no negative variance or large standard error in the model confirmation, so the model does not violate the identification rules. The model indexes had only a moderately good level of fit with the data. Although the root mean residual (RMR) does not meet the standard of less than 0.05, the smaller the RMR is, the better the model. The RMR is easily affected by the measurement variables unit and often indicates inconsistent data. Aside from the factor loading of health behavior not reaching 0.5, the other 3 indexes all ranged between 0.50 and 0.95. Their reliability indexes ranged from 0.19 to 0.45 (Table 1, Fig. 1).

3.3. Scores of functional health literacy scale

Table 2 shows the scores for functional health literacy, the average score indicated that the students had a high level of health literacy. However, health behavior had the highest scores, and health concepts had the lowest scores.

3.4. Results analysis of social-demographic characteristics

The ANOVA results show that gender, ethnicity, place of residence, mothers education, self-assessment of grades for 1 year, and whether the participant liked health education content all have an impact on overall functional health literacy (Table 3).

4. Discussion

To our knowledge, this is the first study considering functional health literacy among left-behind students in senior high schools in China, and we expanded pilot areas to the ethnic minority, which are easily overlooked but have distinct characteristics. Our 3 primary objectives:

1. to find an effective measurement tool to explore the status of health literacy of left-behind students in senior high schools,
2. to verify the measurement tool of functional health literacy, and
3. to analyze what influences functional health literacy and give a policy implications.

We found the tool results were relatively strong according to the results of Structural Equation Model, and may effectively measure the status of health literacy. The overall functional health literacy score falls within the upper middle class, and identified several sociodemographic characteristics of functional health literacy. The study suggests that our results also provided the basis for the deep and broad development of health literacy in China.

We took functional health literacy as the potential variable and health knowledge, health concepts, health skills, and health behaviors as the observation variables to verify the reliability and validity of this model through data analysis. Theoretically, this study's measurement reflects the overall health literacy level of the sample very well, as it was developed specifically for the participants, and all the reliability and validity indexes reached the basic fitness standards. However, only 19% of health behavior variables were explained by potential variables. Some scholars have suggested that some indicators should be considered for deletion when the factor loading is less than

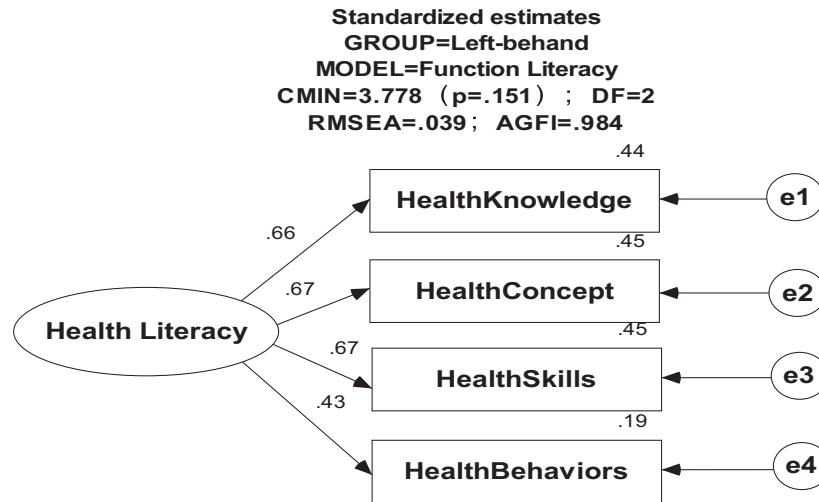


Figure 1. Functional health literacy model for left-behind students in senior high schools (n=589). *Note:* The potential variable means functional health literacy in the paper, and the observational variables are health knowledge, health concept, health skills, and health behaviors. The numbers on the straight arrows indicate the standard path coefficients.

0.45. Usually, such indicators contribute very little to a model.^[44] However, if 1 index is deleted, which would result in several items being deleted, the questionnaires integrity could be affected. Therefore, such deletions should be considered carefully. In addition, structural equation models aim to test whether the sample data are applicable to the proposed hypothesis model and address the overall model fit, so it is necessary to consider multiple indicators.

Some scholars in China have reported that health literacy levels are low^[45] and have suggested improving the overall health literacy level and creating the necessary support conditions to do so. However, 1 report presented a higher health literacy level among adolescents in Shanghai than among general urban residents.^[46] After in-depth analysis, this difference could be related to the different measurement tools and regional

development levels as well as the national economic and social development levels because all individuals and families and all of levels of society advocate healthy diets, healthy lifestyles and green consumption. However, left-behind students health literacy involves numerous problems, so the specific level of health literacy of left-behind students must be analyzed in detail to obtain better results.

According to the one-way ANOVA results, girls have higher scores than boys ($P < .05$) in terms of health concepts, health behavior and health literacy, which is consistent with the findings of other researchers.^[47,48] One intervention study for left-behind children showed that girls had higher resilience, better physical health, better academic performance, and higher communicative competence than boys who also received the same intervention.^[15] One possible explanation for this difference is that girls

Table 1
Validation of the instrument for left-behind students in senior high schools (n=589).

Absolute fitness index			Value-added fitness index			Simple fitness index		
Items	Fitness standard	Present model	Items	Fitness standard	Present model	Items	Fitness standard	Present model
χ^2	$P > .05$	3.778	NFI	> 0.90	0.991	PGFI	> 0.50	0.332
RMR	< 0.05	0.108	RFI	> 0.90	0.972	PNFI	> 0.50	0.330
RMSEA	< 0.05	0.039	IFI	> 0.90	0.996	PCFI	> 0.50	0.332
GFI	> 0.90	0.997	TLI	> 0.90	0.987	CN	> 200	933
AGFI	> 0.90	0.984	CFI	> 0.90	0.996	NC	< 2.00	1.889

* AGFI = adjusted goodness-of-fit index, CFI = comparative fit index, CN = critical N, DF = degrees of freedom, GFI = the goodness-of-fit index, IFI = incremental fit index, NFI = norm fit index, PCFI = parsimony comparative fit index, PGFI = parsimony goodness-of-fit index, PNFI = parsimony-adjusted norm fit index, RFI = relative fit index, RMR = root mean square residual, RMSEA = root mean square error of approximation, SD = standard deviation, TLI = Tucker-Lewis index, $\chi^2/DF(NC)$ = likelihood ratio.

Table 2
Scores of functional health literacy among left-behind students in senior high schools (n=589).

Item	Range	Minimum	Maximum	M	SD
Health literacy	0–68	10.50	59.74	0.65	0.12
Health behaviour	0–22	6.00	21.33	0.70	0.10
Health knowledge	0–28	3.00	26.58	0.64	0.17
Health skills	0–11	0.75	11.00	0.62	0.19
Health concepts	0–7	0.00	7.00	0.58	0.20

Table 3
Results analysis of social-demographic characteristics of left-behind students in senior high schools (n=589).

	Group	n	Health knowledge	Health concepts	Health skills	Health behaviors	Health literacy
Gender	Boys	261	0.64±0.17	0.55±0.22	0.60±0.20	0.69±0.10	0.64±0.12
	Girls	328	0.65±0.17	0.60±0.19	0.63±0.17	0.71±0.10	0.66±0.11
t			-1.16	-2.49*	-1.46	-3.06**	-2.40*
Ethnicity	Han	66	0.72±0.13	0.63±0.17	0.66±0.17	0.72±0.10	0.70±0.09
	Korean	523	0.64±0.17	0.57±0.21	0.61±0.19	0.70±0.10	0.65±0.12
t			4.72***	2.49*	1.82	1.29	4.28***
Residence	Urban	119	0.72±0.12	0.61±0.20	0.64±0.17	0.70±0.10	0.69±0.09
	Rural	470	0.63±0.18	0.57±0.21	0.61±0.19	0.70±0.10	0.64±0.12
t			6.38***	2.05*	1.85	0.28	4.57***
Mother's educational level	① ≤ Junior high school	254	0.63±0.17	0.57±0.19	0.61±0.18	0.70±0.10	0.64±0.12
	② Senior high school/Technical school/technical secondary school	262	0.66±0.17	0.60±0.20	0.63±0.19	0.71±0.10	0.67±0.11
	③ ≥ College	73	0.64±0.17	0.52±0.26	0.51±0.18	0.68±0.12	0.63±0.13
F			2.103	4.694**	3.339*	1.471	3.608*
Tukey			② > ③**	② > ③*		② > ③*	
Self-assessment of grades for one year	① > Average	178	0.70±0.14	0.62±0.16	0.67±0.17	0.72±0.11	0.69±0.10
	② Average	212	0.64±0.17	0.59±0.20	0.62±0.18	0.71±0.10	0.65±0.11
	③ < Average	199	0.60±0.18	0.53±0.23	0.57±0.19	0.68±0.10	0.61±0.12
F			20.166***	10.956***	14.541***	7.650***	25.781***
Tukey		① > ② > ③**	① > ③**	① > ③**	① > ③**	① > ② > ③**	
Liked health education content	① Yes	333	0.65±0.18	0.60±0.19	0.65±0.18	0.72±0.10	0.67±0.12
	② Neutral	239	0.64±0.16	0.56±0.21	0.57±0.19	0.68±0.09	0.63±0.11
	③ No	17	0.62±0.21	0.40±0.23	0.57±0.21	0.62±0.16	0.59±0.17
F			0.798	11.274***	12.641***	15.992***	9.416***
Tukey		① > ②*	① > ②*	① > ②***	① > ②***	① > ②***	
			① > ③***		① > ③***	① > ③*	
					② > ③*		
Lived at school	Yes	63	0.63±0.20	0.55±0.18	0.61±0.21	0.67±0.11	0.63±0.14
	No	526	0.65±0.17	0.58±0.21	0.62±0.18	0.71±0.10	0.65±0.11
t			-0.78	-1.32	-0.20	-2.99**	-1.45

*** P < .001.

** P < .01.

* P < .05.

may be more adept at interpersonal competence and may pay more attention to their own health than boys. Other researchers have different views, such as that boys have higher levels of safety and first-aid literacy than girls, which may be related to boys strong practical abilities.^[44] Thus, we should take certain measures and improve health education according to gender characteristics while paying attention to health literacy levels. However, some studies have shown no differences between male and female participants.^[49] For example, Han Chinese students have higher scores than Korean students in health knowledge, health concepts and health literacy, perhaps due to the influence of Korean families living environments. Due to geographical and language factors, most Koreans choose to work abroad for relatively long periods of time and may neglect their childrens care and education. In addition, Korean students caregivers lack health literacy, according to 1 survey.^[50] Therefore, Korean students health literacy awareness may be affected. The finding that urban left-behind students have higher scores than rural students in health concepts and health literacy indicates that the improvement of health literacy is positively related to economic development and educational levels.^[51] The higher the mothers educational background is, the lower the total scores for health concepts, health skills, and health literacy. Mothers with higher educational levels may pay more attention to their childrens

academic performance than mothers with lower educational levels; the finding related to mothers educational backgrounds may also be related to the ethnic regions investigated. Although mothers in ethnic-minority regions have lower educational levels, they are closely connected with developed countries and their unique advantages, so they can be exposed to advanced concepts and cultures. Generally, the better the students grades are, the higher their health literacy level is, which was verified by the results of this study. Students with better grades may pay more attention to the understanding, acceptance, absorption and application of health knowledge and thus have more abilities and interests and better attitudes regarding the acquisition of health knowledge.^[51] The fact that students who do not live at school have better scores in health behavior further shows the importance of family. These students can obtain better support and care from family members. At the same time, this finding also reminds us that the health problems of left-behind senior high-school students are not only a social and school obligation but also a family responsibility.

5. Limitations

This study has several limitations. First, the convenience sample and the cross-sectional nature of the study are limitations. So a

longitudinal research large-scale investigation would be necessary.

Second, the questionnaires might not truly reflect the thoughts of respondents due to self-reported nature of the study. However, the limitation may do not harm the results, as we implemented strict quality control principles, such as anonymity and informed consent, double verification of data.

Third, a small sampling (from 3 cities) might limit the universality of results. Finally, the cross-sectional study design may limit inferences on the directional causality of the influencing factors found in this study.

6. Conclusions

This study was carried out in a large ethnic-minority area. We focus on various aspects of minority groups and contribute to efforts for the realization of health equality by verifying the present tools effectiveness to make it more suitable for use with adolescents. Different views are presented for the analysis of functional health literacy. Health literacy is a variable that is affected by many factors, so further investigation and exploration on a large scale are necessary. In terms of the unbalanced development among different regions, other regions also need to be investigated to draw more accurate conclusions in future studies. We hope to increase the sample size to develop more accurate conclusions and expand the population investigated, such as left-behind students parents, grandparents, and other caregivers, to obtain more detailed answers in future studies. In addition, a combination of quantitative and qualitative research could be an effective approach.

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Author contributions

LC, WC, QC and FZ conceived, designed and coordinated the study. LC, WC and WW carried out the data collection and participated in the data analysis. LC, QC and XH drafted and revised the manuscript. All of the authors read and approved the final manuscript.

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