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Prevalence and risk factors of low health literacy in residents of Anhui province

A cross-sectional survey

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Abstract

This survey aimed to evaluate the prevalence of low health literacy and correlations of demographic characteristics with low health literacy risk in residents of Anhui province.

A total of 5120 residents of Anhui province were interviewed in this cross-sectional survey, and 4816 (94.1%) gave valid responses. Sociodemographic characteristics were collected. Health literacy and its 3 subscales, including basic knowledge and concepts, lifestyle, and health-related skill, were assessed. Low health literacy was defined as <80.0% of the total score or score of each subscale.

Mean total health literacy score was 62.7±17.2 (maximum 100 points), and was 31.5±9.0 (maximum 47 points), 17.0±4.8 (maximum 28 points), and 14.2±4.1 (maximum 25 points) in terms of basic knowledge and concepts score, lifestyle score, and health-related skill score, respectively. The prevalence of low health literacy was 81.4%, and was 71.3% in terms of basic knowledge and concepts subscale, 87.9% with regard to lifestyle subscale, and 86.3% in view of health-related skill subscale. In addition, older age ($P = .001$), male ($P < .001$), decreased education level ($P < .001$), lower annual household income ($P < .001$), and location at rural area ($P < .001$) associated with increased risk of low health literacy. Moreover, multivariate logistic regression revealed that male, lower education level, and location at rural area were independent risk factors of low health literacy (all $P < .05$).

The prevalence of low health literacy is high in residents of Anhui province, and male, lower education level, as well as location at rural area are independent risk factors of low health literacy.

Abbreviations: RAHL = rapid assessment of health literacy, SD = standard deviation.

Keywords: Anhui province, low health literacy, prevalence, residents, risk factors

1. Introduction

Health literacy is the ability of an individual to collect, handle, and follow the information of health and to make proper decisions regarding health issues. A deficiency of health literacy, namely low health literacy, is harmful for both individual and the public. Low health literacy is a worldwide problem, for instance, a review reports that in roughly 30 thousands healthy Americans, there are about 40.0% of them have inadequate health literacy.[1] In China, the researches of health literacy in general population are very limited, and these researches display an unfavorable health literacy level in several provinces in China, such as Hebei Province and Hubei Province.[2,3] In addition, a nation-wide survey conducted in China also reveals unfavorable health literacy in Chinese residents.[4]

A low health literacy is harmful in terms of multiple aspects, such as an elevation of mortality rate, unfavorable adherence to disease secondary prevention, and unfavorable quality of life in patients, as well as elevated health risk behaviors in general population.[2,5–7] Despite the increasing delivery of health-related knowledge by the media, clinicians, and public health workers, it seems not enough to enhance the ability of individuals to obtain and use the knowledge properly, indicating large needs in investigating and improving the current situation of health literacy in the public.[8,9] Anhui province, locating in East China, is one of the most predominant parts of the Yangtze River Delta with a large population of about 62.55 million (until 2017). The location and large population size make Anhui province a crucial district for health literacy investigation. However, to our best knowledge, no study has been done to analyze the prevalence of low health literacy and its risk factors in the Anhui province.

Therefore, we conducted this cross-sectional survey to evaluate the prevalence of low health literacy and correlations

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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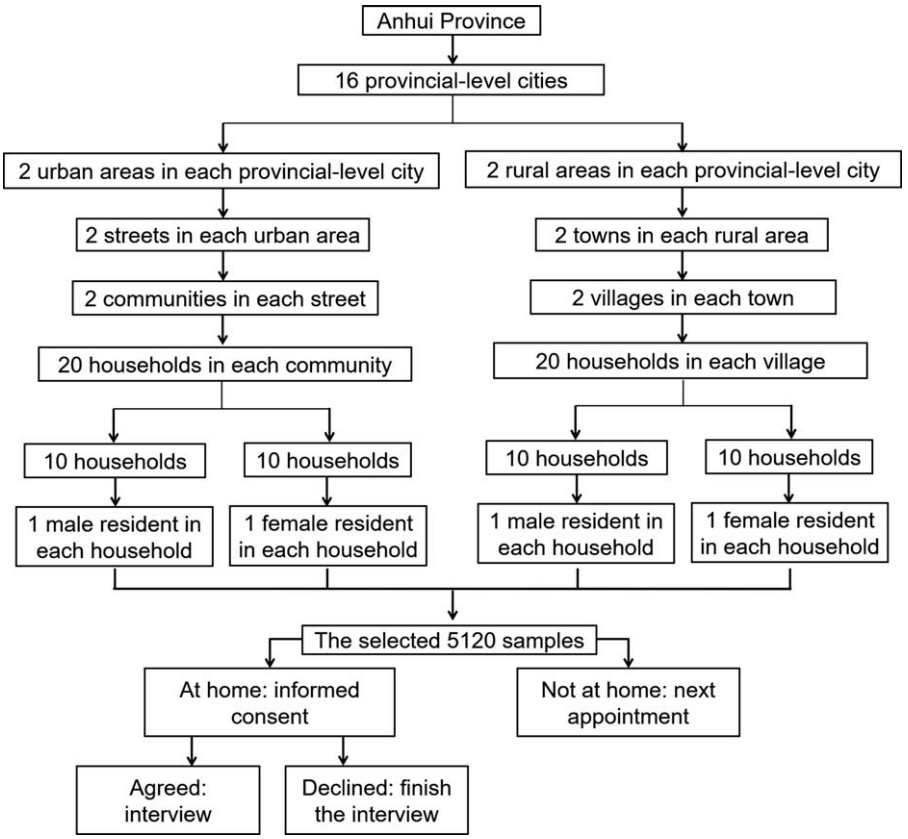

Figure 1. Study flow.

of demo-graphic characteristics with low health literacy risk in residents of Anhui province.

2. Methods

2.1. Participants

This study was a cross-sectional survey. A total of 5120 residents in Anhui province were interviewed from January 2018 to December 2018. The population in Anhui province was 62.55 million, accounting for 4.7% of the total population of China. All study population were residents aged 18 to 69 years and had lived in the Anhui province for >12 months, whereas participants were excluded from the survey if they were military personnel, prisoners, or unable to communicate in Mandarin. The present study was approved by the Research Ethic Committee of Anhui Provincial Centers for Disease Control and Prevention. All participants who agreed to participate in the study signed an informed consent before the beginning of the survey.

2.2. Sample size calculation

The sample size was calculated by the formula[10]: $N = \frac{Z_{1-\frac{\alpha}{2}}^2}{\delta^2} \times \pi(1-\pi) \times deff$, where α was the significance level, $Z_{1-\alpha/2}$ was the (1-α/2)-quantile of the standard normal distribution, π was the percentage of people with low health literacy, δ was the maximum permissible error, and *deff* was the design effect of complex sampling used to adjust the effectiveness loss due to complex sampling instead of simple random sampling. Since the national health literacy survey in 2016 reported that the prevalence of low health literacy was about 89%, the prevalence in this study was expected to be $\pi = 0.89$, maximum permissible error $\delta = 0.1\pi$, significance level $\alpha = 0.05$, $Z_{1-\alpha/2} = 1.96$, and the design effect of complex sampling was $deff = 1.5$. Consequently, the required sample size was $N = 71.22$. Taking into consideration a nonresponse rate of 10%, the actual sample size was increased to $71.22/0.9 = 79.13$, rounded to 80. According to the stratification by provincial-level cities (16), urban and rural (2 stratifications), sex (2 stratifications), the total sample size was obtained: $N = 80 \times 16 \times 2 \times 2 = 5120$.

2.3. Sampling

A multistage random sampling frame was used as shown in Figure 1. There were 16 provincial-level cities in Anhui province, and a simple-random sampling was performed as follows: first, 2 urban areas and 2 rural areas were randomly selected in each provincial-level city; secondly, 2 streets in each sampled urban area and 2 towns in each sampled rural area were randomly selected; thirdly, 2 communities in each sampled street and 2 villages in each sampled town were randomly selected; fourthly, 20 households in each sampled community and 20 households in each sampled village were randomly selected; fifthly, 20 sampled households were further divided into 2 clusters at random, with 10 households in each cluster. Then, in one cluster, 1 male resident in each household was randomly selected; and in the other cluster, 1 female resident in each household was randomly selected. In each randomly selected household, if the selected

member refused to complete the questionnaire, unselected members were not allowed to complete it as a substitution. Finally, 320 participants were selected at random from each provincial-level city, resulting in a total sample size of 5120.

2.4. Data collection

One survey team in each provincial-level city was built before initiation of study, and each survey team comprised of a coordinator, 4 investigators, and a quality controller. All these team members received training for the sampling method, research tools, and quality control. Face-to-face interviews were conducted by the team to collect information from participants using 2012 Chinese Resident Health Literacy Scale developed based on a manual "Chinese Resident Health Literacy-Basic Knowledge and Skills (trial edition)" published by the Chinese Ministry of Health in 2008.[11] Before completion of the Scale, participants were led to fulfill a questionnaire for collection of sociodemographic characteristics (including age, gender, education level, and average household income). The Scale was completed by the participants themselves. If the participants were unable to complete the Scale independently, face-to-face inquiry was adopted.

2.5. Health literacy score calculation

The 2012 Chinese Resident Health Literacy Scale contains 80 items covering 3 dimensions[12]: basic knowledge and concepts (38 questions), lifestyle (22 questions), and health-related skills (20 questions). And there are 4 types of questions among 80 items: 15 true-or-false questions, 40 single-answer questions (only 1 correct answer in multiple-answer questions), 18 multiple-answer questions (>1 correct answer in multiple-answer questions), and 7 situation questions (including 5 single-answer questions and 2 multiple-answer questions). For true-or-false and single-answer questions, 1 point was assigned for a correct answer, and 0 points were assigned for an incorrect answer. For multiple-answer questions, 2 points were assigned if the response contained all correct answers without wrong ones, and 0 points were assigned otherwise. For situation questions, participants had to read passages and answer single- or multiple-answer questions about it. A 0 was given to wrong or omitted answers, 1 point was assigned for a correct answer for the 5 single-answer question, and 2 points were assigned if the response contained all correct answers without wrong ones for the 2 multiple-answer question. The total basic knowledge and concepts score was 47 points, the total lifestyle score was 28 points, and the total health-related skills score was 25 points. The total health literacy score was the sum of 3 dimensions scores, ranging from 0 to 100 points. In addition, the samples of questionnaires (with total score <60 points, between 60 and 79, and ≥80) were presented in the appendix.

2.6. Low health literacy definition

The definition for health literacy was based on the definition published by world health organization (WHO): the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health.[13] As for low health literacy, it was defined as the total health literacy score <80 points (100 × 80% = 80) according to 2 previous, similar, large-scale studies conducted in Chinese population.[10,12] Low health literacy of basic knowledge and concepts was defined as the total basic knowledge and concepts score <38 points (47 × 80% = 37.6). Low health literacy of lifestyle was defined as the total lifestyle score <23 points (28 × 80% = 22.4). Low health literacy of health-related skills was defined as the total health-related skills score <20 points (25 × 80% = 20).

2.7. Statistical analysis

Among 5120 participants surveyed, a total of 4816 (94.1%) gave valid responses. Hence, 4816 participants were included in the analysis. Data were described as number and percentage or mean and standard deviation (SD). Correlation of participants' characteristics with low health literacy risk was determined by χ^2 test and Wilcoxon rank sum test. Variables affecting low health literacy risk were analyzed by the univariate and forward stepwise multivariate logistic regression model. All statistical analyses were performed on the SPSS 22.0 (IBM, Chicago, IL), and figures were plotted using GraphPad Prism 7.02 (GraphPad Software Inc., San Diego, CA). P value <0.05 was considered as significant.

3. Results

3.1. Participants' characteristics

In the total 4816 respondents, the numbers (percentages) of participants with an age between 18 and 29 years, 30 to 49 years, and 50 to 69 years were 928 (19.3%), 2166 (45.0%), and 1722 (35.7%), respectively (Table 1). As for the other characteristics, there were 2301 (47.8%) females and 2515 (52.2%) males. The numbers of participants with an education level of primary school or below, junior high school, high school, and university or above were 1374 (28.5%), 1984 (41.2%), 942 (19.6%), and 516 (10.7%), respectively. In addition, the annual household

Table 1

Characteristics of participants.

Items	Participants (N = 4816)	
	Number	Percentage (%)
Age, y		
18–29	928	19.3
30–49	2166	45.0
50–69	1722	35.7
Sex		
Female	2301	47.8
Male	2515	52.2
Education level		
Primary school or below	1374	28.5
Junior high school	1984	41.2
High school	942	19.6
University or above	516	10.7
Annual household income		
<¥10,000	367	7.6
¥10,000–¥29,999	2475	51.4
¥30,000–¥49,999	1217	15.3
≥¥50,000	757	15.7
Location		
Rural	2329	48.4
Urban	2487	51.6

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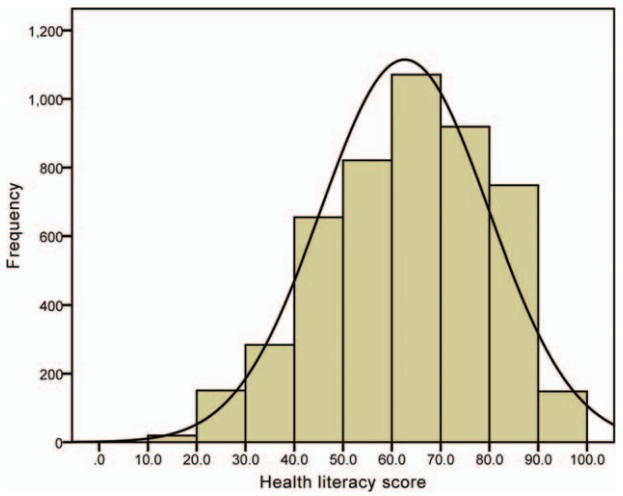

Figure 2. Distribution of health literacy score of 4816 valid respondents. The distribution of health literacy score in different intervals among 4816 respondents.

income was <¥10,000, ¥10000 to ¥29999, ¥30,000 to ¥49,999, and ≥¥50,000 in 367 (7.6%), 2475 (51.4%), 1217 (15.3%), and 757 (15.7%) participants, respectively. And there were 2329 (48.4%) participants who came from rural area, the remaining 2487 (51.6%) participants came from the urban area.

3.2. Health literacy score in participants

The distribution of total health literacy score was presented in Figure 2, the number of participants who had a health literacy score below 60 was 1930 (40.0%), and there were 1990 (41.3%) participants with health literacy score between 60 and 79 as well as 896 (18.7%) participants who had a health literacy score between 80 and 100. Moreover, mean total health literacy score was 62.7 ± 17.2 (95% confidence interval [CI]: 62.2–63.1), as for the 3 dimensions of health literacy score, the mean values of basic knowledge and concepts score, lifestyle score, and health-related skill score were 31.5 ± 9.0 (95% CI: 31.2–31.7), 17.0 ± 4.8 (95% CI: 16.9–17.1), and 14.2 ± 4.1 (95% CI: 14.1–14.3), respectively (Fig. 3A). Subsequently, we defined the total health literacy score <80 as low health literacy according to a previous study, and found that the prevalence of low health literacy was 81.4% (95% CI: 80.2%–82.6%) regarding total health literacy score, 71.3% (95% CI: 69.8%–72.8%) in terms of basic knowledge and concepts score, 87.9% (95% CI: 86.9%–88.9%) in view of lifestyle score, and 86.3% (95% CI: 85.3%–87.3%) regarding health-related skill score (Fig. 3B).[10,12]

3.3. Associations between participants' characteristics and the risk of low health literacy

Older age ($P = .001$), male ($P < .001$), decreased education level ($P < .001$), lower annual household income ($P < .001$), and location at rural area ($P < .001$) associated with increased risk of low health literacy (Table 2). Similar trends were seen in the correlation of sociodemographic characteristics with low health literacy of basic knowledge and concepts, low health literacy of lifestyle, or low health literacy of health-related skills (all $P < .001$).

3.4. Risk factors of low health literacy

Univariate logistic regression disclosed that older age, male, lower education level, decreased annual household income, and location at rural area were risk factors of low health literacy (all $P < .05$) (Table 3). Using forward stepwise multivariate logistic regression, male, decreased education level, and location at rural area were found to be independent risk factors of low health literacy (all $P < .05$).

4. Discussion

Apart from our study, other nation-wide survey in China or survey conducted in other provinces might provide some information of health literacy in general population or in patients with certain diseases. A previous study performed in Guangdong province reveals that the percentage of community residents with low health literacy (using a rapid assessment of health literacy questionnaire, low health literacy is defined as score <75.0% of the total score, which is 100 points) is 77.97%.[14] Another study conducted in junior middle school

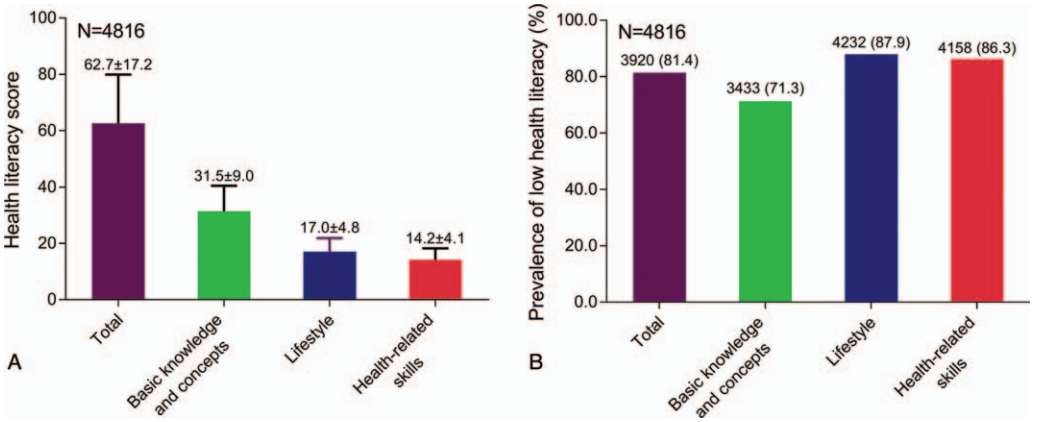

Figure 3. Health literacy score and percentage of low health literacy. The average score of total health literacy, basic knowledge and concepts, lifestyle, and health-related skill (A), the percentage of low health literacy, low health literacy of basic knowledge and concepts, low health literacy of lifestyle, and low health literacy of health-related skill (B).

Table 2

Correlation of participants' characteristics with low health literacy risk.

Items	Low health literacy (n = 3920)	Low health literacy of basic knowledge and concepts (n = 3433)	Low health literacy of lifestyle (n = 4232)	Low health literacy of health-related skills (n = 4158)
Age, y, No. (%)				
18–29	723 (77.9)	620 (66.8)	787 (84.8)	771 (83.1)
30–49	1752 (80.9)	1525 (70.4)	1896 (87.5)	1848 (85.3)
50–69	1445 (83.9)	1288 (74.8)	1549 (90.0)	1539 (89.4)
P	.001	<.001	<.001	<.001
Sex, No. (%)				
Female	1813 (78.8)	1526 (66.3)	1964 (85.4)	1929 (83.8)
Male	2107 (83.8)	1907 (75.8)	2268 (90.2)	2229 (88.6)
P	<.001	<.001	<.001	<.001
Education level, No. (%)				
Primary school or below	1248 (90.8)	1186 (86.3)	1306 (95.1)	1297 (94.4)
Junior high school	1637 (82.5)	1412 (71.2)	1756 (88.5)	1723 (86.8)
High school	683 (72.5)	565 (60.0)	778 (82.6)	760 (80.7)
University or above	352 (68.2)	270 (52.3)	392 (76.0)	378 (73.3)
P	<.001	<.001	<.001	<.001
Annual household income, No. (%)				
<¥10,000	341 (92.9)	328 (89.4)	348 (94.8)	352 (95.9)
¥10,000–¥29,999	2135 (86.3)	1930 (78.0)	2263 (91.4)	2230 (90.1)
¥30,000–¥49,999	905 (74.4)	754 (62.0)	1025 (84.2)	996 (81.8)
≥¥50,000	539 (71.2)	421 (55.6)	596 (78.7)	580 (76.6)
P	<.001	<.001	<.001	<.001
Location, No. (%)				
Rural	2043 (87.7)	1879 (80.7)	2144 (92.1)	2128 (91.4)
Urban	1877 (75.5)	1554 (62.5)	2088 (84.0)	2030 (81.6)
P	<.001	<.001	<.001	<.001

Correlation was determined by χ^2 test or Wilcoxon rank sum test.

students from Chongqing elucidates that the incidence of low health literacy is 25.5% (using health literacy scale developed by Wang Lingyi et al according to the definition of health literacy by World Health Organization) in the total 1774 enrolled students.[15,16] Another study elucidates that proportion of community-dwelling residents in Shanghai with low health literacy is 84.49% (based on the questionnaire "Basic Knowledge and Skills of People's Health Literacy" by the Chinese Ministry of Health, with total score of 65).[10] These studies indicate that in other provinces and all over the country, the average level of health literacy is not gratifying neither in general population nor in patients with some diseases. In addition, there is also study reporting a low incidence of low health literacy (such as the study conducted in junior middle school students from Chongqing), this might derive from that the method for defining the low health literacy is distinctive between their study and our study.[15] The low health literacy is defined as a score less than the first quartile of the total score in the study finding a low health literacy of 25.5% (with a total score of 250), whereas the low health literacy is defined as a score <80% of the total score in our study (with a total score of 100).[15] In addition, the study population is also distinctive between the 2 studies. The study population in theirs is junior middle school students who have sound education; however, the study population in ours is general residents in Anhui province with a half of residents from rural area that cannot ensure an adequate education of health literacy. Thus, there is a big discrepancy in the incidence of low health literacy.

In this survey, we found that the prevalence of low health literacy in our sample was 81.4%, indicating the majority of the residents of Anhui province in this survey had a low health literacy. Besides, the prevalence of health literacy of basic knowledge and concepts was the lowest, whereas the prevalence of the other 2 dimensions was relatively higher. These findings in our study might result from the 3 reasons. First, the health-related information from the media, clinicians, or public health workers forms a very complicated resource; thus, the information could be too lengthy, containing too many jargons or even lacking scientific evidence. Thus, residents may have problems in obtaining and following the most understandable and scientific health-related information. Second, adequate health literacy requires multiple capabilities, in other words, enhancing the health literacy in the population is a tough task, which might contribute to the high prevalence of low health literacy among residents. Third, programs about health education by the government or public health institutions are lacking, which is a predominant cause of the low health literacy in residents. However, these theories which might be responsible for the high prevalence of low health literacy in residents of Anhui province are still speculations which needed to be validated in the future. In addition, the prevalence of low health literacy of basic knowledge and concepts was numerically decreased compared with the prevalence of the other 2 dimensions. This result may be related to the disparity in the complexity of questions in the questionnaire of the 3 dimensions. To be exact, questions of basic knowledge and concepts were easier to answer compared with those of the other 2 dimensions of health literacy. For instance, the questions about indications for analgesics (lifestyle) or first aid skills (health related skills) were more difficult to answer compared with the questions about the definition of health (basic knowledge and concepts).

Previously, mounting studies have been done to explore risk factors of low health literacy. A study conducted in individuals

Table 3

Logistic regression model analyses of factors affecting low health literacy risk.

Items	Logistic regression model			
			95% CI	
	P	OR	Lower	Higher
Univariate logistic regression				
Age, y				
18–29		Reference		
30–49	.058	1.200	0.994	1.449
50–69	<.001	1.479	1.209	1.809
[0,1-5] Sex				
Female		Reference		
Male	<.001	1.390	1.202	1.608
Education level				
University or above		Reference		
High school	.085	1.229	0.972	1.553
Junior high school	<.001	2.198	1.767	2.735
Primary school or below	<.001	4.615	3.556	5.988
Annual household income				
≥¥50,000		Reference		
¥30,000–¥49,999	.124	1.173	0.957	1.438
¥10,000-¥29,999	<.001	2.540	2.091	3.085
<¥10,000	<.001	5.305	3.455	8.144
Location				
Urban		Reference		
Rural	<.001	2.321	1.991	2.707
Forward stepwise multivariate logistic regression				
[0,1-5] Sex				
Female		Reference		
Male	.037	1.232	1.012	1.500
Education level				
University or above		Reference		
High school	.107	1.219	0.958	1.553
Junior high school	<.001	2.141	1.631	2.810
Primary school or below	<.001	4.383	2.991	6.424
Location				
Urban		Reference		
Rural	.011	1.307	1.063	1.606

CI = confidence interval, OR = odds ratio.

from an urban community reveals that lower education level and more comorbidities correlate with a higher risk of having low health literacy.[17] Another study performed in black Americans illustrates that male, unable to work, and decreased household income are associated with low health literacy.[18] These studies report risk factors of low health literacy that are similar to ours, such as sex and education level. In this study, we found that male, lower education level, and location at rural area were independent risk factors of low health literacy in residents of Anhui province. As for possible explanations of why these factors are correlated with higher risk of low health literacy, here are several interpretations. First is male sex: males are less likely to seek health-related knowledge or medical help probably because they are hold back by virility or the fear of being considered as a weak person. Second is lower education level: residents with lower education level may have problems in following the health-related information or medical instructions, which resulted in applying the right knowledge of health-related information more difficult in daily life compared with residents who have higher education level. Thus, lower education level correlates with high risk of low health literacy. Third is location at rural area: living in rural area means that the residents have less access to health-related information or professional medical help compared with those living in urban area. This is partially due to the limited financial support regarding public health in the rural areas.

There were several limitations in this cross-sectional survey. First, there might be nonresponse bias in this survey because some patients with a low health literacy intend to ignore the questionnaire, indicating that the real prevalence of low health literacy in residents of Anhui province could be higher. Second, as an observational study, there might be confounding factors.

In conclusion, the prevalence of low health literacy is high in residents of Anhui province, and male, lower education level, as well as location at rural area were independent risk factors of low health literacy.

Author contributions

Conceptualization: Lan Zhou.
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Formal analysis: Chao Wang.
Funding acquisition: Lan Zhou.
Investigation: Chao Wang.
Methodology: Chao Wang.
Resources: Lan Zhou.
Supervision: Lan Zhou.
Writing – original draft: Chao Wang.
Writing – review & editing: Lan Zhou.

References

[1] Paasche-Orlow MK, Parker RM, Gazmararian JA, Nielsen-Bohlman LT, et al. The prevalence of limited health literacy. J Gen Intern Med 2005;20:175–84.
[2] Yang R, Li D, Hu J, et al. Association between health literacy and subgroups of health risk behaviors among chinese adolescents in six cities: a study using regression mixture modeling. Int J Environ Res Public Health 2019;16:3680.
[3] Xie Y, Ma M, Zhang Y, et al. Factors associated with health literacy in rural areas of Central China: structural equation model. BMC Health Serv Res 2019;19:300.
[4] Li Y, Mao Q, Shi Q, et al. The level of health literacy of Chinese residents in 2012: Surveillance results. Chinese Journal of Health Education 2015;217–21.
[5] Fabbri M, Yost K, Finney Rutten LJ, et al. Health literacy and outcomes in patients with heart failure: a prospective community study. Mayo Clin Proc 2018;93:9–15.
[6] Alemayehu YH, Seylani K, Bahramnezhad F. The relationship between health literacy and quality of life among hemodialysis patients: An integrative review. Hum Antibodies 2020;28:75–81.
[7] Lu M, Xia H, Ma J, et al. Relationship between adherence to secondary prevention and health literacy, self-efficacy and disease knowledge among patients with coronary artery disease in China. Eur J Cardiovasc Nurs 2020;19:230–7.
[8] Koh HK, Rudd RE. The arc of health literacy. JAMA 2015;314:1225–6.
[9] Noordman J, van Vliet L, Kaunang M, et al. Towards appropriate information provision for and decision-making with patients with limited health literacy in hospital-based palliative care in Western countries: a scoping review into available communication strategies and tools for healthcare providers. BMC Palliat Care 2019;18:37.
[10] Wu Y, Wang L, Cai Z, Bao L, Ai P, Ai Z, et al. Prevalence and risk factors of low health literacy: a community-based study in Shanghai, China. Int J Environ Res Public Health 2017;14:628.
[11] Li Y. Introduction of 2012 Chinese residents health literacy monitoring program. Chin J Health Educ 2014;30:563–5.
[12] Nie X, Li Y, Li L. Statistic analysis of 2012 Chinese residents health literacy monitoring. Chin J Health Educ 2014;30:178–81.
[13] World Health Organization (WHO) Commission on the Social Determinants of Health. Achieving Health Equity: From Root Causes to Fair Outcomes. WHO; Geneva, Switzerland: 2007.
[14] Zhuang R, Xiang Y, Han T, et al. Cell phone-based health education messaging improves health literacy. Afr Health Sci 2016;16:311–8.

[15] Ran M, Peng L, Liu Q, et al. The association between quality of life (QOL) and health literacy among junior middle school students: a cross-sectional study. BMC Public Health 2018;18:1183.
[16] Wang LY, Wang H, Cheng XT, et al. Development of health literacy scale for middle school students and its reliability and validity analyze(in Chinese). Modern Prevent Med 2016;23:4296–305.
[17] Weaver SB, Maneno M, Chijioke P, et al. Factors associated with health literacy and medication adherence in an urban community. Sr Care Pharm 2019;34:604–12.
[18] Davis SN, Wischhusen JW, Sutton SK, et al. Demographic and psychosocial factors associated with limited health literacy in a community-based sample of older Black Americans. Patient Educ Couns 2020;103:385–91.