

Health literacy and its socio-demographic risk factors in Hebei

A cross-sectional survey

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Abstract

This study aimed to evaluate the prevalence of low health literacy in Hebei Province of China, and to investigate its socio-demographic risk factors.

This study was a community-based, cross-sectional questionnaire survey with a multiple-stage randomization design and a sample size of 10,560. Participants' health literacy status was evaluated by a questionnaire based on the 2012 Chinese Resident Health Literacy Scale. Meanwhile, participants' socio-demographic characteristics were also collected by the questionnaire.

A total of 9952 participants provided valid questionnaires and were included in the final analyses. The mean health literacy score was 63.1 ± 17.1 points; for its subscales, the mean basic knowledge and concepts score, lifestyle score, health-related skills score were 31.7 ± 9.0 , 17.2 ± 4.8 , 14.3 ± 4.1 , respectively. Meanwhile, low health literacy prevalence was 81.0%; for its subscales, low basic knowledge and concepts prevalence (70.6%) was numerically reduced compared to low lifestyle prevalence (87.4%) and low health-related skills prevalence (86.1%). Further analyses showed that age, male, and rural area were positively associated, but education level and annual household income were negatively associated with low health literacy prevalence. Further multivariate logistic regression analyses showed that higher age, male, lower education level, lower annual household income, and rural area were closely correlated with the risks of low total health literacy or low health literacy in subscales in Hebei Province.

The prevalence of low health literacy is 81.0% in Hebei Province. Meanwhile, higher age, male, lower education level, lower annual household income, and rural area closely associate with low health literacy risk.

Abbreviations: ANOVA = analysis of variance, CI = confidence interval, PPS = Probability Proportionate to Size, SD = standard deviation.

Keywords: China, health literacy, Hebei Province, risk factors, socio-demographic

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QY and SY contributed equally to this work.

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1. Introduction

Health literacy is an emerging concept defined as “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” by the World Health Organization.^[9] According to previous studies, low health literacy is closely correlated with an individual's worse self-management, inferior health status, more hospitalization and medical costs, which greatly influences his/her quality of life.^[11,16] Moreover, since health literacy clearly reflects public health education and deeply affects health resource utilization, it has become a crucial public health concern and has raised extensive attention in the past few years.^[1,3] Besides, the information on local low health literacy prevalence is critical for local government to formulate policy and to allocate resources.^[3]

Although health literacy overview in several western countries has been reported by previous studies, the health literacy status among Chinese citizens is still far from clear.^[8,17] According to the latest national survey of health literacy status among Chinese citizens in 2012, 91.2% of Chinese residents are of low health literacy.^[10] However, given the imbalanced development among different regions of China, local health literacy status in different regions could vary greatly.^[18,24] Indeed, 1 previous study illustrates that the prevalence of low health literacy status in

Jiangsu Province is 47.5%, and another study reveals that the prevalence of inadequate health literacy status in Beijing is 59%; however, the cut-off of low health literacy differed a lot among different studies.^[19,22] Therefore, it is critical to perform survey that acquires the local health status to help the local government polishing relevant policies and improve the overall health status of local residents.^[2,12]

Hebei Province is a big inland province located in north China with a permanent resident population of 75.92 million. Typically, Hebei Province is considered as the representative regarding economy and culture of northern China.^[23] However, the local low health literacy prevalence of Hebei province is not clear. Therefore, the aim of this study was to investigate health literacy in Hebei Province, and to explore its socio-demographic risk factors.

2. Methods

2.1. Study population

This study was carried out in Hebei Province of China, where there were 75.92 million permanent residents in 2019. The study was conducted between January 2019 and December 2019, and a total of 10,560 residents in Hebei Province participated in this cross-sectional survey. All study populations were permanent residents with age between 16 and 75 years in Hebei Province, where the permanent resident was defined as the resident who had lived in the Hebei Province for more than 12 months, regardless of whether they had a local household registration or not. While the residents who collectively resided in military bases, hospitals, prisons, nursing homes, or dormitories, were not included in the study. This study was approved by the Research Ethics Committee of Hebei Provincial Centers for Disease Control and Prevention. All participants signed informed consents.

2.2. Sample size estimation

A multistage, stratified sampling method was used to select the study population. The core stratification factors included area (urban and rural), age (16–35 years, 36–55 years, 56–75 years), and gender (male and female). In each stratification, the sample size N was calculated estimated using the formula^[20]: $N = \frac{Z_{1-\alpha/2}^2}{\delta^2} \times p(1-p) \times deff$, where the parameters were set as follows: prevalence $P = .89$ (based on national health literacy survey results, available at: <http://www.nhc.gov.cn/>), maximum permissible error $\delta = 0.1p$, significance level $\alpha = 0.05$, $Z_{1-\alpha/2} = 1.96$, the design effect of complex sampling $deff = 1.5$, the required sample size in each stratification was $N = 71.22$. Considering a refusal rate of 10%, the actual sample size was increased to $71.22/0.9 = 79.13$, rounded to 80. There were 11 province-governed municipalities in Hebei Province, as a result, the total sample size of this study was calculated as: $N = 80 \times 11$ (municipalities) $\times 2$ (area stratifications) $\times 3$ (age stratifications) $\times 2$ (gender stratifications) = 10,560.

2.3. Sampling procedures

As shown in Figure 1, 2 urban areas and 2 rural areas in each province-governed municipality were randomly selected using Probability Proportionate to Size (PPS) sampling. In each chosen urban area, 2 districts were randomly selected with PPS sampling,

then 2 communities were randomly selected with PPS sampling from each chosen district; next, 60 registered households were randomly selected from each chosen community using random number table, and 1 resident was selected from each chosen household with the use of Kish method. In each chosen rural area, 2 towns were randomly selected with PPS sampling, then 2 villages were randomly selected with PPS sampling from each chosen town; next, 60 registered households were randomly selected from each chosen village using random number table, and 1 resident was selected from each chosen household with the use of Kish method. As a result, 960 residents in each province-governed municipality were selected, and there were 11 province-governed municipalities in Hebei, resulting in total 10,560 residents were sampled. Finally, 608 participants were excluded from analysis because they provided invalid questionnaires due to incorrect filling, then 9952 participants (94.2%) provided valid questionnaires and were included in analysis.

2.4. Data collection

A questionnaire was created for this study, and it consisted of 2 parts: part 1 was designed to collect participants' socio-demographic characteristics including age, gender, education level, annual household income, and location; part 2 was the 2012 Chinese Resident Health Literacy Scale derived from the manual of "Chinese Resident Health Literacy-Basic Knowledge and Skills (trial edition)" published by the Chinese Ministry of Health in 2008^[4] The questionnaire was completed by the participants themselves. If the participants were unable to fulfill the questionnaire independently due to low literacy level, the face-to-face interview method was adopted, during which the investigators were allowed to make appropriate explanations without the use of inductive or suggestive expression.

2.5. Health literacy evaluation

The 2012 Chinese Resident Health Literacy Scale comprised of 80 questions including 38 questions about basic knowledge and concepts, 22 questions about lifestyle, and 20 questions about health-related skills.^[10] There were 4 types of questions in the scale: 15 true-or-false questions, 40 single-answer questions, 18 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 the wrong ones, and 0 points were given to wrong or omitted answers. 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 the 3 scores, which was ranging from 0 to 100 points. Low health literacy was defined as the total health literacy score <80 points (80% of total health literacy score, which was in accordance with previous studies).^[10,20] Low health literacy of basic knowledge and concepts was defined as the total basic knowledge and concepts score <38 points (which was 80% of total basic knowledge and concepts score). Low health literacy of lifestyle was defined as the total lifestyle score <23 points (which was 80% of total lifestyle score). Low health literacy of health-related skills was defined as the total health-related skills score <20 points (which was 80% of health-related skills score).

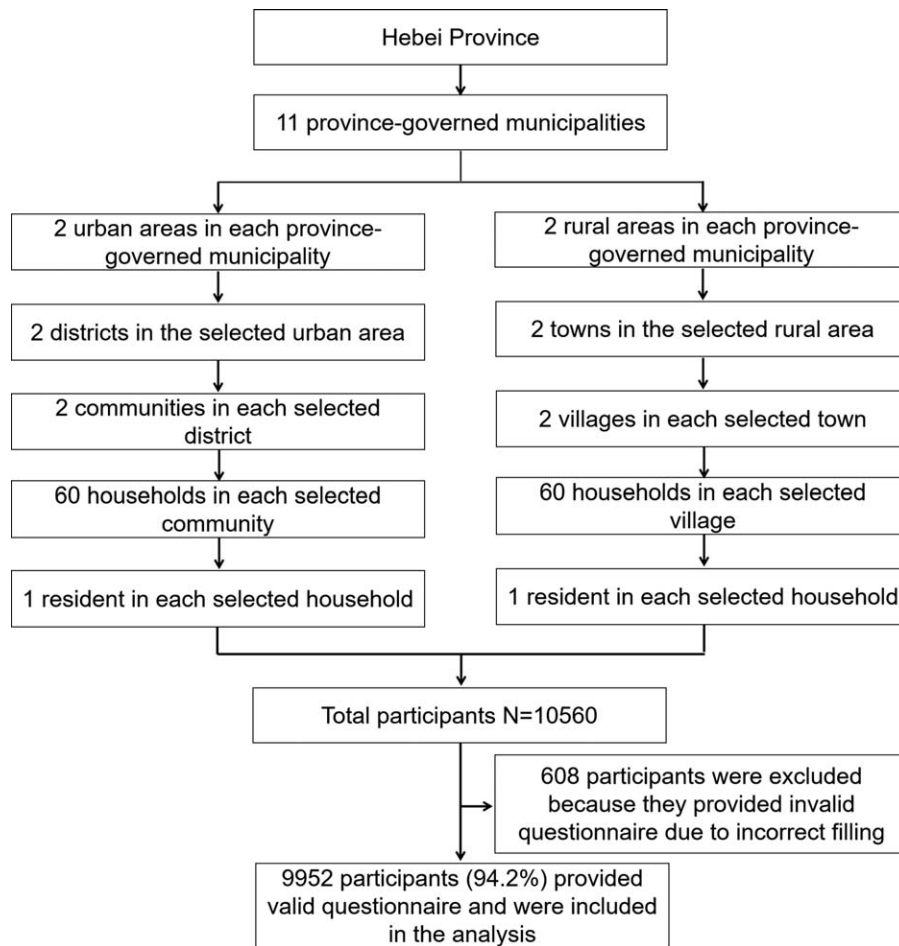


Figure 1. Study sampling process.

2.6. Statistical analysis

All statistical analyses were carried out using SPSS 24.0 (IBM, Chicago, IL), and figures were plotted using GraphPad Prism 8.01 (GraphPad Software Inc., San Diego, CA). Socio-demographic characteristics and low health literacy prevalence were described as number and percentage. The distribution of total health literacy score was displayed by histogram, and the detailed scores including total health literacy score, basic knowledge and concepts score, lifestyle score, and health-related skills score, were described by mean with standard deviation (SD). Comparison of health literacy scores among subjects with different characteristics was determined by one-way analysis of variance (ANOVA) or Student *t* test. Comparison of low health literacy prevalence among subjects with different characteristics was determined by the Chi-Squared test. Factors related to low health literacy risk were analyzed by the univariate and forward stepwise multivariate logistic regression model. *P* value <.05 was considered significant.

3. Results

3.1. Description of the participants' characteristics

Among the 9952 analyzed participants, 3329 (33.5%) of them were 16 to 35 years old, 3327 (33.4%) of them were 36 to 55

years old, and 3296 (33.1%) of them were 56 to 75 years old. Meanwhile, there were 4887 (49.1%) females and 5056 (50.9%) males. As to education level, 2641 (26.5%) participants had primary school education level or below, 4011 (40.3%) participants had junior high school education level, 2180 (21.9%) participants had high school education level, and 1120 (11.3%) participants had university education level or above. Regarding annual household income, 818 (8.2%) participants had income below ¥10,000, 5085 (51.1%) participants had income between ¥10,000 to ¥29,999, 2470 (24.8%) participants had income between ¥30,000 to ¥49,999, and 1579 (15.9%) participants had income equal to or greater than ¥50,000. As to resident location, 4883 (49.1%) participants were from rural area and 5069 (50.9%) participants were from urban area (Table 1).

3.2. Health literacy status

The health literacy score distribution of all participants was shown in Figure 2A. Specifically, there were 58 (0.6%) patients with score 10 to 20, 346 (3.5%) participants with score 21 to 30, 668 (6.7%) participants with score 31 to 40, 1287 (12.9%) participants with score 41 to 50, 1754 (17.6%) participants with score 51 to 60, 2154 (21.7%) participants with score 61

Table 1
Characteristics.

Characteristics	Participants (N = 9952)
Age, No. (%)	
16–35 yr	3329 (33.5)
36–55 yr	3327 (33.4)
56–75 yr	3296 (33.1)
Gender, No. (%)	
Female	4887 (49.1)
Male	5069 (50.9)
Education level, No. (%)	
Primary school or below	2641 (26.5)
Junior high school	4011 (40.3)
High school	2180 (21.9)
University or above	1120 (11.3)
Annual household income, No. (%)	
<¥10,000	818 (8.2)
¥10,000–¥29,999	5085 (51.1)
¥30,000–¥49,999	2470 (24.8)
≥¥50,000	1579 (15.9)
Location, No. (%)	
Rural	4883 (49.1)
Urban	5069 (50.9)

¥ = RMB.

to 70, 1935 (19.4%) participants with score 71 to 80, 1474 (14.8%) participants with score 81 to 90, and 276 (2.8%) participants with score 91 to 100 (Fig. 2A).

Meanwhile, the mean total health literacy score was 63.1 ± 17.1 points. As to subscales, the mean basic knowledge and concepts score was 31.7 ± 9.0 points, the mean lifestyle score was 17.2 ± 4.8 points, and the mean health-related skills score was 14.3 ± 4.1 points (Fig. 2B). Besides, the prevalence of total low health literacy was 81.0% (95% confidence interval [CI]: 80.1%–81.6%). The subscale analyses further revealed that the prevalence of low basic knowledge and concepts was 70.6% (95% CI: 69.5%–71.7%), the prevalence of low lifestyle was 87.4% (95% CI: 86.7%–88.1%), and the prevalence of low health-related skills was 86.1% (95% CI: 85.4%–86.8%) (Fig. 2C).

3.3. Correlation analysis between participants' characteristics and low health literacy

As respect to health literacy score, age was negatively correlated, while female, education level, annual household income and resident in urban area were positively correlated with total health literacy score, as well as its subscales including basic knowledge and concepts score, lifestyle score and health-related skills score (all $P < .001$) (Table 2).

Regarding low health literacy prevalence, age was positively associated, but female, education level, annual household income and resident in urban area were negatively associated with low total health literacy prevalence, as well as its subscales low basic knowledge and concepts prevalence, low lifestyle prevalence and low health-related skills prevalence (all $P < .001$) (Table 3).

3.4. Risk factors related to low health literacy

Higher age (36–55 years vs 16–35 years, $P < .001$; 56–75 years vs 16–35 years, $P < .001$), male (male vs female, $P < .001$), lower education level (high school vs university or above, $P = .005$; junior high school vs university or above, $P < .001$; primary school or below vs university or above, $P < .001$), lower annual household income (¥30,000–¥49,999 vs ≥¥50,000, $P = .093$; ¥10,000–¥29,999 vs ≥¥50,000, $P < .001$; <¥10,000 vs ≥¥50,000, $P < .001$) and rural location (rural vs urban, $P < .001$) were risk factors for low health literacy. Further multivariate logistic regression showed that higher age (36–55 years vs 16–35 years, $P < .001$; 56–75 years vs 16–35 years, $P < .001$), lower annual household income (¥30,000–¥49,999 vs ≥¥50,000, $P = .089$; ¥10,000–¥29,999 vs ≥¥50,000, $P < .001$; <¥10,000 vs ≥¥50,000, $P < .001$) and rural location (rural vs urban, $P < .001$) were independent risk factors for low health literacy (Table 4).

3.5. Analyses of risk factors for low health literacy in basic knowledge and concepts, health lifestyle and health-related skills

Additionally, we had investigated the independent risk factors for low health literacy in subscales, which was shown in Table 5.

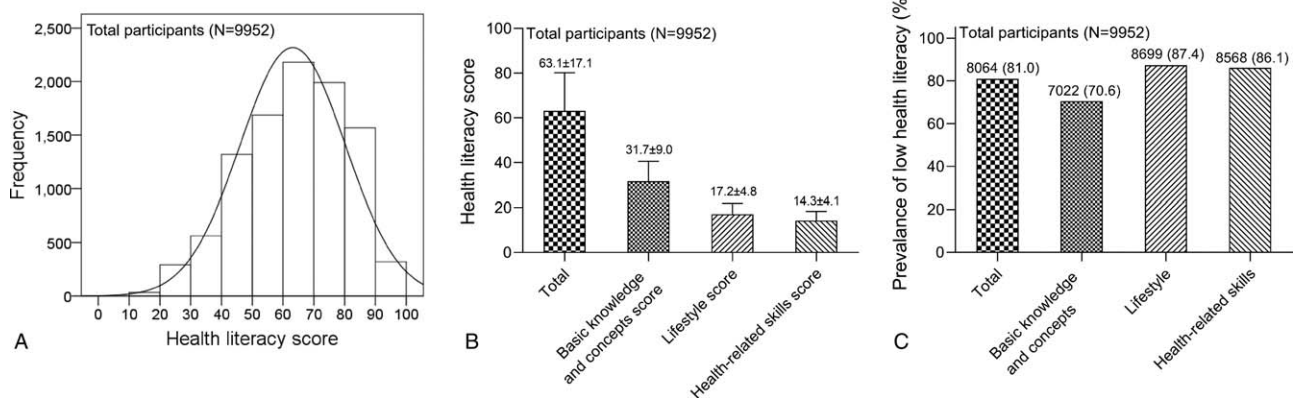


Figure 2. Health literacy status in Hebei Province. A: The health literacy score distribution of all participants; B: The mean total health literacy score, basic knowledge and concepts score, lifestyle score, and health-related skills score; C: The prevalence of participants with low health literacy, as well as low health literacy in basic knowledge and concepts, health lifestyle and health-related skills.

Table 2
Correlation of participants' characteristics with health literacy score.

Characteristics	Total health literacy score		Basic knowledge and concepts score		Lifestyle score		Health-related skills score	
	Mean ± SD	P value	Mean ± SD	P value	Mean ± SD	P value	Mean ± SD	P value
Age		<.001		<.001		<.001		<.001
16–35 yr	66.6 ± 16.1		33.3 ± 8.4		18.1 ± 4.6		15.1 ± 4.0	
36–55 yr	63.4 ± 16.9		31.9 ± 8.8		17.2 ± 4.7		14.4 ± 4.0	
56–75 yr	59.4 ± 17.6		29.8 ± 9.3		16.1 ± 4.9		13.4 ± 4.1	
Gender		<.001		<.001		<.001		<.001
Female	66.2 ± 15.9		33.2 ± 8.3		18.0 ± 4.5		15.0 ± 3.9	
Male	60.2 ± 17.7		30.2 ± 9.3		16.3 ± 4.9		13.6 ± 4.2	
Education level		<.001		<.001		<.001		<.001
Primary school or below	54.0 ± 17.8		27.1 ± 9.4		14.7 ± 4.9		12.2 ± 4.0	
Junior high school	63.0 ± 16.2		31.6 ± 8.5		17.1 ± 4.6		14.3 ± 3.9	
High school	69.2 ± 14.2		34.7 ± 7.5		18.8 ± 4.1		15.7 ± 3.5	
University or above	73.1 ± 12.9		36.7 ± 6.7		19.8 ± 3.7		16.6 ± 3.5	
Annual household income		<.001		<.001		<.001		<.001
<¥10,000	52.6 ± 17.6		26.3 ± 9.2		14.3 ± 5.0		11.9 ± 4.0	
¥10,000–¥29,999	59.9 ± 17.2		30.0 ± 9.0		16.3 ± 4.8		13.6 ± 4.0	
¥30,000–¥49,999	67.6 ± 15.2		34.0 ± 8.0		18.3 ± 4.4		15.3 ± 3.7	
≥¥50,000	71.8 ± 13.1		36.1 ± 6.8		19.5 ± 3.8		16.3 ± 3.5	
Location		<.001		<.001		<.001		<.001
Rural	58.3 ± 17.5		29.2 ± 9.2		15.9 ± 4.9		13.2 ± 4.1	
Urban	67.7 ± 15.4		34.0 ± 8.1		18.4 ± 4.4		15.4 ± 3.8	

¥ = RMB, SD = standard deviation.

Briefly, higher age, male, lower education level, lower annual household income and rural area were independent risk factors for low basic knowledge and concepts (all $P < .05$). Meanwhile, higher age, lower education level and rural area were independent risk factors for low lifestyle (all $P < .05$). Furthermore, higher age, lower education level, lower annual household income and rural area were independent risk factors for low health-related skills (all $P < .05$) (Table 5).

4. Discussion

This study was the first to explore the health literacy prevalence and its socio-demographic risk factors in Hebei Province, China to the best of our knowledge. Meanwhile, this study was province-based and had a relatively large sample size, which might assist the local health care workers and government to better understand the health literacy status in Hebei Province. In

Table 3
Correlation of participants' characteristics with low health literacy prevalence.

Characteristics	Low health literacy							
	Total	P value	Basic knowledge and concepts	P value	Lifestyle	P value	Health-related skills	P value
Age, No. (%)		<.001		<.001		<.001		<.001
16–35 yr	2507 (75.3)		2140 (64.3)		2776 (83.4)		2716 (81.6)	
36–55 yr	2694 (81.0)		2336 (70.2)		2907 (87.4)		2848 (85.6)	
56–75 yr	2863 (86.9)		2546 (77.2)		3016 (91.5)		3004 (91.1)	
Gender, No. (%)		<.001		<.001		<.001		<.001
Female	3836 (78.5)		3199 (65.5)		4160 (85.1)		4082 (83.5)	
Male	4228 (83.5)		3823 (75.5)		4539 (89.6)		4486 (88.6)	
Education level, No. (%)		<.001		<.001		<.001		<.001
Primary school or below	2395 (90.7)		2278 (86.3)		2502 (94.7)		2499 (94.6)	
Junior high school	3311 (82.5)		2843 (70.9)		3535 (88.1)		3478 (86.7)	
High school	1592 (73.0)		1313 (60.2)		1803 (82.7)		1772 (81.3)	
University or above	766 (68.4)		588 (52.5)		859 (76.7)		819 (73.1)	
Annual household income, No. (%)		<.001		<.001		<.001		<.001
<¥10,000	752 (91.9)		723 (88.4)		768 (93.9)		784 (95.8)	
¥10,000–¥29,999	4355 (85.6)		3917 (77.0)		4615 (90.8)		4553 (89.5)	
¥30,000–¥49,999	1827 (74.0)		1503 (60.9)		2065 (83.6)		2025 (82.0)	
≥¥50,000	1130 (71.6)		879 (55.7)		1251 (79.2)		1206 (76.4)	
Location, No. (%)		<.001		<.001		<.001		<.001
Rural	4248 (87.0)		3882 (79.5)		4464 (91.4)		4446 (91.1)	
Urban	3816 (75.3)		3140 (61.9)		4235 (83.5)		4122 (81.3)	

¥ = RMB.

Table 4
Factors related to low health literacy risk.

Items	P value	Logistic regression model		
		OR	95%CI	
			Lower	Higher
Univariate logistic regression				
Age				
16–35 yr	Reference	–	–	–
36–55 yr	<.001	1.395	1.241	1.569
56–75 yr	<.001	2.168	1.907	2.464
Gender				
Female	Reference	–	–	–
Male	<.001	1.384	1.251	1.531
Education level				
University or above	Reference	–	–	–
High school	.005	1.251	1.069	1.465
Junior high school	<.001	2.186	1.881	2.540
Primary school or below	<.001	4.499	3.751	5.397
Annual household income				
≥¥50000	Reference	–	–	–
¥30,000–¥49,999	.093	1.129	0.980	1.301
¥10,000–¥29,999	<.001	2.370	2.072	2.712
<¥10000	<.001	4.527	3.441	5.956
Location				
Urban	Reference	–	–	–
Rural	<.001	2.197	1.978	2.440
Forward stepwise multivariate logistic regression				
Age				
16–35 yr	Reference	–	–	–
36–55 yr	<.001	1.442	1.279	1.625
56–75 yr	<.001	2.373	2.082	2.706
Annual household income				
≥¥50,000	Reference	–	–	–
¥30,000–¥49,999	.089	1.132	0.981	1.307
¥10,000–¥29,999	<.001	2.066	1.722	2.480
<¥10,000	<.001	4.768	3.458	6.574
Location				
Urban	Reference	–	–	–
Rural	.043	1.187	1.005	1.402

¥ = RMB, CI = confidence interval, OR = odds ratio.

this study, we found that the mean total health literacy score was 63.1 ± 17.1 points, and the prevalence of low health literacy was 81.0%. Meanwhile, higher age, male, lower annual household income, lower education level and rural area were closely correlated with low health literacy or its subscales.

Health literacy critically reflects an individual’s comprehensive ability in coping with health problems under different circumstances.^[11] Previous studies showed that patients with low health literacy have worse outcomes and occupy more public health resource; they might have poor health status and are more likely to be hospitalized^[18,24]; meanwhile, they may not fully understand the medical system and treatment strategies, and might be unable to follow the instructions to take medicines appropriately, which often leads to the increased occupation of public health resource.^[13] Therefore, understanding the prevalence of local low health literacy could enable local government to make policies and allocate resources.^[1,3]

Due to the differences in the cut-off of low health literacy, the prevalence of low health literacy varies in different studies.^[19,20,22] In order to achieve a comprehensive evaluation, we adopted the standard of low health literacy published by the Chinese Ministry of Health in 2012,^[10] which showed strong

psychometric properties with minor measurement invariance.^[14] In the present study, we found that the mean total health literacy score was 63.1 ± 17.1 points. Meanwhile, the prevalence of low health literacy was 81.0% in Hebei Province, which was numerically lower than the prevalence of low health literacy in China in 2012.^[10] The difference in the prevalence of low health literacy between Hebei Province and China could be explained by the that: Hubei Province is more developed compared to other inland provinces, meanwhile, several developed areas are located beside Hebei Province, such as Beijing; thus, the average annual household income and education level of residents in Hebei Province might be higher than that of Chinese residents, which resulted in a lower prevalence of low health literacy in Hebei Province. However, our data indicated that low health literacy was still widely prevalent in Hebei Province and specific strategies should be made to ameliorate its prevalence.

Recognizing risk factors for low health literacy prevalence is critical for the government to modulate policies and strategies to improve local health literacy.^[15] According to previous studies, the risk factors for low health literacy include race, resident area (rural or urban), the number of individuals in a household, age, physical exercise, education level, occupation, household income,

Table 5
Independent factors related to the risk of low health literacy in basic knowledge and concepts, health lifestyle and health-related skills.

Items	Forward stepwise multivariate logistic regression			
	P value	OR	95%CI	
			Lower	Higher
Low health literacy of basic knowledge and concepts				
Age				
16–35 years	Reference	–	–	–
36–55 yr	<.001	1.304	1.165	1.460
56–75 yr	<.001	1.809	1.552	2.107
Gender				
Female	Reference	–	–	–
Male	.004	1.186	1.054	1.335
Education level				
University or above	Reference	–	–	–
High school	.697	1.047	0.830	1.322
Junior high school	.634	1.076	0.796	1.453
Primary school or below	.021	1.583	1.072	2.336
Annual household income				
≥¥50,000	Reference	–	–	–
¥30,000–¥49,999	.449	1.090	0.872	1.364
¥10,000–¥29,999	.001	1.658	1.232	2.232
<¥10,000	<.001	2.913	1.856	4.570
Location				
Urban	Reference	–	–	–
Rural	<.001	1.356	1.164	1.581
Low health literacy of lifestyle				
Age				
16–35 yr	Reference	–	–	–
36–55 yr	.001	1.260	1.094	1.451
56–75 yr	<.001	1.592	1.350	1.877
Education level				
University or above	Reference	–	–	–
High school	.001	1.345	1.122	1.614
Junior high school	<.001	1.776	1.472	2.142
Primary school or below	<.001	3.559	2.729	4.641
Location				
Urban	Reference	–	–	–
Rural	<.001	1.376	1.184	1.601
Low health literacy of health-related skills				
Age				
16–35 yr	Reference	–	–	–
36–55 yr	<.001	1.320	1.148	1.519
56–75 yr	<.001	2.196	1.799	2.681
Education level				
University or above	Reference	–	–	–
High school	.383	1.140	0.850	1.528
Junior high school	.419	1.165	0.805	1.686
Primary school or below	.023	1.746	1.081	2.821
Annual household income				
≥¥50,000	Reference	–	–	–
¥30,000–¥49,999	.101	1.274	0.954	1.700
¥10,000–¥29,999	.005	1.735	1.180	2.552
<¥10,000	<.001	3.997	2.138	7.473
Location				
Urban	Reference	–	–	–
Rural	.007	1.299	1.073	1.571

¥ = RMB, CI = confidence interval, OR = odds ratio.

health information access, etc.^[5,7,19] In the present study, we found that increased age, male, decreased education level, reduced annual household income and resident in rural area were correlated with lower health literacy score, and higher prevalence of inadequate health literacy. Further logistic regression analyses revealed that age, gender, education level, annual household

income and resident area were closely correlated with low health literacy. Possible explanations might be that:

1. as the age increased, the eyesight and hearing of an individual might get worse, which might hinder his/her ability in receiving and utilizing information to promote and maintain

good health.^[6] Meanwhile, in China, people with higher age might have fewer chances to get literate due to historical reasons;

2. according to a previous study, male face with higher occupational stress compared to female,^[21] which might limit their time on absorbing key information on promoting health status;
3. people with lower education level might have worse ability in utilizing relevant information to keep them in health;
4. people with lower annual household income might have more stressful lives, which limited their time on considering about critical factors for health status;
5. people in rural areas might have fewer chances to receive information about promoting and maintaining good health. Therefore, these factors were closely associated with low health literacy risk, which was consistent with the results of several previous studies.^[5,19,22]

There were several limitations in this study. First of all, this study combined the 2012 Chinese Resident Health Literacy Scale derived from the manual of “Chinese Resident Health Literacy-Basic Knowledge and Skills (trial edition)” published by the Chinese Ministry of Health in 2008 with a multilevel sampling procedure, which could provide a considerable degree of accuracy in the health literacy of Hebei residents; however, this study was based on the questionnaire, which might exist bias in the evaluation of the health literacy status of an individual. Therefore, developing more objective evaluation methods might eliminate this bias. Secondly, in order to achieve higher visualization of the data, some of the continuous variables were converted into categorized variables for statistical analyses, which might cause information loss. Finally, this study was based on a cross-sectional survey, thus, the direct casual inferences and the direction of casualty could not be determined.

Collectively, low health literacy is still commonly prevalent in Hebei Province; meanwhile, higher age, male, lower education level, lower annual household income and rural area closely associate with the risk of low health literacy. The findings of this study may provide potential basis for the local government polishing relevant policies to improve health literacy status of local residents, thus enhancing their overall health conditions.

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