Observational Study

The prevalence and related factors for low health literacy in Xingtai
A cross-sectional survey in prefecture-level city

Changhong Wang, MM\(^a\), Guoxiao Gu, MM\(^b\), Qiuixia Yang, MM\(^{a, c}\), Shuli Yu, MM\(^d\), Huihui Liu, MB\(^c\), Ziwen Yang, MB\(^b\), Hui Yang, MM\(^e\), Yu Qiao, MM\(^f\), Lijing Yu, MB\(^a\)

Abstract
This study aimed to evaluate the low health literacy prevalence and its socio-demographic related factors in Xingtai. This study was a community-based, cross-sectional survey performed in Xingtai, with a sample size of 960. Participants’ socio-demographic characteristics were collected, and their health literacy status was evaluated by the questionnaire designed by the 2012 Chinese Resident Health Literacy Survey.

There were 904 (94.2%) participants who provided valid questionnaires and they were included in the analyses. The mean health literacy score was 63.0±16.6; for its subscales, the mean scores of health literacy of basic knowledge and concepts, lifestyle, and health-related skills were 31.6±8.7, 17.1±4.7, and 14.3±3.9, respectively. Low total health literacy prevalence was 83.1%; as for its subscales, the prevalence of low health literacy of basic knowledge and concepts, lifestyle, and health-related skills was 72.5%, 87.8%, and 87.4%, respectively. Meanwhile, age, male and rural location were positively correlated, but education level and annual household income were negatively correlated with low health literacy risk. Further multivariate analysis revealed that lower education level was the only independent related factor for low total health literacy, and the most important independent related factor for low total health literacy of basic knowledge and concepts, lifestyle and health-related skills.

Low health literacy prevalence is 83.1%, and lower education level is the most critical related factor for low health literacy in Xingtai.

Abbreviations: CI = confidence interval, PPS = Probability Proportionate to Size.

Keywords: cross-sectional survey, education level, low health literacy, socio-demographic related factor, Xingtai

1. Introduction
Health literacy, the concept first raised in the 1970s, refers to an individual’s ability to gain, understand and utilize information on health to enhance and sustain his/her health status.\[^{[1,2]}\] Several previous studies reveal that health literacy reflects an individual’s health quality and closely associates with healthcare utilization.\[^{[3-5]}\] For example, it is suggested that low health literacy is connected with an individual’s worse self-management and inferior health status.\[^{[3,4]}\] Meanwhile, low health literacy is a strong predictor for hospital admission, indicates worse public health education and lower health resource utilization.\[^{[5,6]}\] Therefore, low health literacy issues have received broad attention during the past decades.

Currently, only a few studies have focused on the related factors of low health literacy prevalence.\[^{[7,8]}\] For example, previous studies show that several factors including higher age, lower education level, rural location, lower level of physical exercise, lower income and limited health information access are associated with low health literacy.\[^{[9,10]}\] Another study indicates that adolescents with younger age, male, whose parents have lower education level, and from non-prestigious schools tend to have low health literacy.\[^{[11]}\] However, most of these researches are regional-based and their results could not represent other regions.

Xingtai, located in the south part of Hebei Province of China, is an ancient prefecture-level city with a history of over 3500 years. The population of permeant residents in Xingtai city is approximately 7.40 million, among which about 51% permeant residents are urban residents. Xingtai city is one of the most important industrial cities in Hebei Province (and the latter one is also a large industrial province in China).\[^{[12,13]}\] Therefore, among Hebei Province, Xingtai city might possess certain representa-
tiveness in the aspects of demographic, economic structure and low health literacy prevalence, however, the local prevalence and related factors of low health literacy are unclear. According to previous studies, understanding the local prevalence of low health literacy and its related factors might help the local government to formulate policies and allocate resources.\(^{[6-8]}\)

Therefore, we performed this cross-sectional survey, aiming to investigate the overall health literacy status, then evaluate the low health literacy prevalence and its socio-demographic related factors among Xingtai residents.

2. Methods

2.1. Study population

This study was conducted between January 2019 and December 2019 in Xingtai. It was reported that the permanent residents of Xingtai were 7.40 million in 2019. A total of 960 residents in Xingtai were invited to participate in this cross-sectional survey. Subjects were eligible to participate in this study if they were permanent residents in Xingtai and had age within 16 to 75 years. The permanent resident was defined as the resident who had lived in the Xingtai 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

The study population was selected using a multistage, stratified sampling method. The considered stratification factors included area (urban and rural), age (16~35 years, 36~53 years, 56-75 years) and gender (male and female). In each stratification, the sample size was estimated using the formula\(^{[14]}\):

\[ N = \frac{n \times p(1 - p) \times df}{\chi^2} \]

where the parameters were set as follows: prevalence \(P = 0.89\) (based on the results of national health literacy survey, 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 \(df = 1.5\) (based on a previous study\(^{[14]}\)), the required sample size in each stratification was \(N = 71.22\). Considering a refusal rate of 10%, the sample size was increased to 80. Total sample size of this study was calculated as: \(N = 80 \times 2 \times 3 \times 3 = 960\).

2.3. Sampling procedures

The outline of sampling procedures was shown in Figure 1. Two urban areas and 2 rural areas in Xingtai 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. Consequently, 960 residents were sampled. Finally, 56 participants were excluded from analysis, among which 34 (3.5%) participants were unwilling to participate (non-responders) and 22 (2.3%) participants provided invalid questionnaire due to incorrect filling, then 904 participants (94.2%) provided valid questionnaire and were included in the analysis.

2.4. Data collection

A questionnaire designed for the survey was used to collect information, which 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.\(^{[15]}\) The questionnaire was completed by the participants themselves. If the participants were unable to fulfill the questionnaire independently due to low cultural level or other reasons, the face-to-face interview was performed to collect information.

2.5. Health literacy evaluation

The 2012 Chinese Resident Health Literacy Scale comprised 80 questions including 38 questions about basic knowledge and concepts, 22 questions about lifestyle, and 20 questions about health-related skills.\(^{[16]}\) 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 (which was 80% of total health literacy score).\(^{[14-16]}\) Low health literacy of basic knowledge and concepts was defined as the total basic knowledge 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).

2.6. Statistical analysis

SPSS 24.0 (IBM, Chicago, IL) was used for statistical analysis, and GraphPad Prism 8.01 (GraphPad Software Inc., San Diego, CA, USA) was used for graphics making. Socio-demographic characteristics data and low health literacy prevalence were described as number and percentage. The distribution of health literacy score was displayed by the histogram and determined by Kolmogorov-Smirnov (K-S) test. Since the score was approximately normally distributed, it was described by mean with standard deviation. The
comparison of health literacy scores among subjects with different characteristics was determined by one-way analysis of variance or Student t test. The comparison of low health literacy prevalence among subjects with different characteristics was determined by the Chi-Squared test. Considering the design effect by complex sampling, factors related to low health literacy risk were analyzed by the general linear mixed model (GLMM) analysis (by lme4 package in R software), in which the sampling unit (communities or villages) was considered as random effect and other factors were fixed. P value <.05 was considered significant.

3. Results

3.1. Description of participants’ characteristics

Among the 904 analyzed participants, 305 (33.7%) of them had age of 16 to 35 years, 290 (32.1%) of them had age of 36 to 55 years, and 309 (34.2%) of them had age of 56 to 75 years; 434 (48.0%) of them were female, and 470 (52.0%) of them were male. As to education level, 230 (25.4%) participants had education level of primary school or below, 352 (38.9%) participants had education level of junior high school, 219 (24.2%) participants had education level of high school, and 103 (11.4%) participants had education level of university or above. Regarding annual household income, 75 (8.3%) participants had income less than ¥10000, 462 (51.1%) participants had income of ¥10000-¥29999, 217 (24.0%) participants had income of ¥30000-¥49999, and 150 (16.6%) participants had income higher than or equal to ¥50000. For resident location, 443 (49.0%) participants were from rural area and 461 (51.0%) participants were from urban area (Table 1).

3.2. Description of participants’ health literacy status and low health literacy prevalence

The health literacy score distribution of all analyzed participants was shown in Figure 2A. In detail, 7 (0.8%) participants had
Table 1
Characteristics. Participants (N = 904)

| Characteristics       | Participants (N = 904) |
|-----------------------|------------------------|
| Age, No. (%)          |                        |
| 16–35 years           | 305 (33.7)             |
| 36–55 years           | 290 (32.1)             |
| 56–75 years           | 309 (34.2)             |
| Gender, No. (%)       |                        |
| Female                | 434 (48.0)             |
| Male                  | 470 (52.0)             |
| Education level, No. (%) |            |
| Primary school or below | 230 (25.4)           |
| Junior high school    | 352 (38.9)             |
| High school           | 219 (24.2)             |
| University or above   | 103 (11.4)             |
| Annual household income, No. (%) |        |
| <¥10000               | 75 (8.3)               |
| ¥10000–¥29999         | 462 (51.1)             |
| ¥30000–¥49999         | 217 (24.0)             |
| ≥¥50000               | 150 (16.6)             |
| Location, No. (%)     |                        |
| Rural                 | 443 (49.0)             |
| Urban                 | 461 (51.0)             |

¥, RMB.

Regarding health literacy score, age was negatively correlated, while female, education level, annual household income and urban location were positively correlated with health literacy score, as well as its subscales including basic knowledge and concepts score, lifestyle score and health-related skills score distribution of all analyzed participants was shown in Supplementary Figure 1A–C, http://links.lww.com/MD/F822, respectively.

3.3. Correlation between socio-demographic characteristics and health literacy score and low health literacy prevalence

Regarding health literacy score, age was negatively correlated, while female, education level, annual household income and urban location were positively correlated with 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).

As to low health literacy prevalence, female, education level, annual household income and urban location were negatively associated with low health literacy prevalence, as well as its subscales including basic knowledge and concepts prevalence, low lifestyle prevalence and low health-related skills prevalence (all P < .05). Meanwhile, age was positively associated with low health literacy prevalence, as well as the prevalence of low health literacy of basic knowledge and concepts, and health-related skills (all P < .05), but not lifestyle (P = .081) (Table 3).

3.4. Related factors for low health literacy risk

Univariate fixed variables in GLMM showed that higher age (36–55 years vs 16–35 years, P = .136; 56–75 years vs 16–35 years, P = .002), male (male vs female, P < .001), lower education level (high school vs university or above, P = .003; junior high school vs university or above, P < .001; primary school or below university or above, P < .001), lower annual household income (¥30000–¥49999 vs ≥¥50000, P = .021; ¥10000–¥29999 vs ≥¥50000, P < .001; < ¥10000 vs ≥¥50000, P < .001), and rural location (rural vs urban, P < .001) were related factors for low health literacy. Forward stepwise multivariate fixed variables in GLMM revealed that lower education level (high school vs university or above, P = .003; junior high school vs university or above, P < .001;
primary school or below vs university or above, \( P < .001 \) was the only independent related factor for low health literacy (Table 4).

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

Forward stepwise GLMM analysis showed that lower education level was the only independent related factor for low health literacy of lifestyle and health-related skills (all \( P < .05 \)), respectively (Table 5).

4. Discussion

In the present study, we found that:
1. the mean total health literacy score was \( 63.0 \pm 16.6 \), and low health literacy prevalence was 83.1% in Xingtai;

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

| Characteristics            | Total       | \( P \) value | Basic knowledge and concepts | \( P \) value | Lifestyle | \( P \) value | Health-related skills | \( P \) value |
|----------------------------|-------------|---------------|------------------------------|---------------|-----------|---------------|-----------------------|-------------|
| Age, No. (%)               |             |               |                              |               |           |               |                       |             |
| 16–35 years                | 242 (78.3)  | .007          | 205 (66.3)                   | .001          | 261 (84.5) | .081          | 255 (82.5)            | .003         |
| 36–55 years                | 254 (83.3)  |               | 219 (71.8)                   |               | 274 (89.8) |               | 269 (88.2)            |             |
| 56–75 years                | 255 (87.9)  |               | 231 (79.7)                   |               | 259 (89.3) |               | 266 (91.7)            |             |
| Gender, No. (%)            |             |               |                              |               |           |               |                       |             |
| Female                     | 339 (78.1)  | <.001         | 339 (78.1)                   | <.001         | 366 (84.3) | 0.002         | 359 (82.7)            | <.001        |
| Male                       | 412 (87.7)  |               | 412 (87.7)                   |               | 428 (91.1) |               | 431 (91.7)            |             |
| Education level, No. (%)   |             |               |                              |               |           |               |                       |             |
| Primary school or below    | 217 (94.3)  | <.001         | 208 (90.4)                   | <.001         | 221 (96.1) | <.001         | 221 (96.1)            | <.001        |
| Junior high school         | 307 (87.2)  |               | 260 (73.9)                   |               | 319 (90.6) |               | 321 (91.2)            |             |
| High school                | 166 (75.8)  |               | 138 (63.0)                   |               | 182 (83.1) |               | 179 (81.7)            |             |
| University or above        | 61 (59.2)   |               | 49 (47.6)                    |               | 72 (69.9)  |               | 69 (67.0)             |             |
| Annual household income, No. (%) |         |               |                              |               |           |               |                       |             |
| <¥10000                   | 71 (94.7)   | <.001         | 66 (88.0)                    | <.001         | 72 (96.0)  | <.001         | 74 (98.7)             | <.001        |
| ¥10000–¥29999              | 414 (89.6)  |               | 373 (80.7)                   |               | 425 (89.0) |               | 423 (91.6)            |             |
| ¥30000–¥49999              | 167 (77.9)  |               | 137 (63.1)                   |               | 183 (84.3) |               | 183 (84.3)            |             |
| ≥¥50000                   | 99 (66.0)   |               | 70 (52.7)                    |               | 114 (76.0) |               | 110 (73.3)            |             |
| Location, No. (%)          |             |               |                              |               |           |               |                       |             |
| Rural                      | 399 (90.1)  | <.001         | 365 (82.4)                   | <.001         | 407 (91.9) | <.001         | 409 (92.3)            | <.001        |
| Urban                      | 352 (76.4)  |               | 200 (62.9)                   |               | 387 (83.9) |               | 381 (82.6)            |             |
### Table 4
Factors related to low health literacy risk.

| Items                               | GLMM analysis | 95% CI   |
|-------------------------------------|---------------|----------|
|                                     | $P$ value     | OR Lower | Higher   |
| **Univariate fixed variables in GLMM** |               |          |
| Age                                 |               |          |
| 16–35 years                         | Reference     | –        | –        |
| 36–55 years                         | .136          | 1.367    | 0.906    | 2.071    |
| 56–75 years                         | .002          | 2.047    | 1.308    | 3.252    |
| Gender                              |               |          |
| Female                              | Reference     | –        | –        |          |
| Male                                | <.001         | 2.082    | 1.450    | 3.015    |
| Education level                    |               |          |
| University or above                 | Reference     | –        | –        |          |
| High school                         | .003          | 2.157    | 1.307    | 3.560    |
| Junior high school                  | <.001         | 4.697    | 2.644    | 7.784    |
| Primary school or below             | <.001         | 11.493   | 5.949    | 23.568   |
| Annual household income             |               |          |
| $\geq\text{¥50,000}$               | Reference     | –        | –        |          |
| $\text{¥30,000}\text{–¥49,999}$    | .021          | 1.721    | 1.084    | 2.737    |
| $\text{¥10,000}\text{–¥29,999}$   | <.001         | 4.443    | 2.832    | 6.994    |
| $<\text{¥10,000}$                  | <.001         | 9.144    | 3.533    | 31.245   |
| Location                            |               |          |
| Urban                               | Reference     | –        | –        |          |
| Rural                               | <.001         | 2.808    | 1.937    | 4.133    |
| Forward stepwise multivariate fixed variables in GLMM | | |
| Education level                    |               |          |
| University or above                 | Reference     | –        | –        |          |
| High school                         | .003          | 2.157    | 1.307    | 3.560    |
| Junior high school                  | <.001         | 4.697    | 2.644    | 7.784    |
| Primary school or below             | <.001         | 11.493   | 5.949    | 23.568   |

CI = confidence interval, GLMM = general linear mixed model, OR = odds ratio; ¥, RMB.

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

| Items                                              | Forward stepwise GLMM analysis | 95% CI   |
|----------------------------------------------------|-------------------------------|----------|
|                                     | $P$ value  | OR Lower | Higher   |
| **Low health literacy of basic knowledge and concepts** |               |          |
| Education level                                  |               |          |
| University or above                              | Reference     | –        | –        |
| High school                                      | .026          | 1.727    | 1.069    | 2.802    |
| Junior high school                               | <.001         | 2.932    | 1.596    | 4.231    |
| Primary school or below                          | <.001         | 7.632    | 3.992    | 14.972   |
| Location                                          |               |          |
| Urban                                             | Reference     | –        | –        |          |
| Rural                                             | .049          | 1.444    | 1.002    | 2.085    |
| **Low health literacy of lifestyle**              |               |          |
| Education level                                  |               |          |
| University or above                              | Reference     | –        | –        |
| High school                                      | .007          | 2.118    | 1.219    | 3.671    |
| Junior high school                               | <.001         | 4.462    | 2.391    | 7.251    |
| Primary school or below                          | <.001         | 10.573   | 4.991    | 24.562   |
| **Low health literacy of health-related skills** |               |          |
| Education level                                  |               |          |
| University or above                              | Reference     | –        | –        |
| High school                                      | .004          | 2.205    | 1.289    | 3.768    |
| Junior high school                               | <.001         | 5.102    | 2.942    | 8.902    |
| Primary school or below                          | <.001         | 12.110   | 5.753    | 27.992   |

CI = confidence interval, GLMM = general linear mixed model, OR = odds ratio; ¥, RMB.
2. higher age, male, lower education level, lower annual household income and rural location were closely associated with low health literacy risk in Xingtai;
3. lower education was the only independent related factor for low total health literacy, and was an important independent correlation factor for low health literacy in subscales in Xingtai.

This study was the first study to explore the prevalence of low health literacy and its related factors in Xingtai to the best of our knowledge, which might provide potential supportive information for the local government of Xingtai to formulate policies and allocate resources to improve local health literacy status.

Health literacy critically affects one's health status. People with low health literacy tend to have worse self-management and inferior health status. Meanwhile, low health literacy is closely associated with several diseases such as diabetes mellitus, hypertension, coronary artery disease, cancer, etc., which leads to more hospitalization and higher medical cost, thus increasing the burden of public health. Therefore, it is of great importance to understand the prevalence of low health literacy and to explore the related factors for low health literacy.

Several studies have been conducted to evaluate the local prevalence of low health literacy in some areas of China, however, the reported low health literacy prevalence varies greatly partly due to the difference in the standard of low health literacy. Meanwhile, no previous study had explored low health literacy prevalence in Xingtai. In order to fill this blank, we performed a cross-sectional questionnaire survey with a multiple-stage randomization design, enrolled 960 participants and analyzed 904 valid data. Moreover, to achieve relative objective evaluation, we adopted the standard of low health literacy published by the Chinese Ministry of Health in 2012. Data showed that the mean total health literacy was 63.0 ± 16.6, and low health literacy prevalence was 83.1% in Xingtai, which was numerically lower than low health literacy prevalence in China mainland in 2012. Possible explanations might be that:

1. as the age increase, people might have worse eyesight, hearing and suffer from dementia; meanwhile, the elderly in China had few opportunities to get literate due to historical reason, which could hinder their ability in receiving and processing key information on improving health status;
2. according to a previous study, the male might face higher occupational pressure compared to female, which might reduce their time in receiving key information on promoting health status;
3. people with lower annual household income might face with higher living pressure, which could also limit their time in absorbing and processing knowledge on promoting and maintaining good health;
4. people living in the rural area might have less access to receiving information to keep them in good health.

Therefore, these socio-demographic factors were closely associated with low health literacy. Notably, multivariate analysis illustrated that lower education level was the only independent related factor for low total health literacy; meanwhile, lower education level was also the most important independent related factor for low health literacy of basic knowledge and concepts, lifestyle and health-related skills. Our data could be explained by that:

1. people with lower education level might have obstacles in understanding and processing information which could keep them in good health status;
2. people with lower education level might have lower annual household income, which further resulted in low health literacy.

Our data indicated that reinforcing the coverage of education might be the main solution to ameliorate the prevalence of low health literacy in Xingtai.

Although we had found lots of interesting results, there were several limitations in this study. Firstly, this was a cross-sectional study, therefore, we could not determine the direct casual inferences and the direction of casualty. Secondly, since this study was based on questionnaires, there might exist bias in participants’ self-evaluation of health literacy, and developing and exploiting more objective evaluation methods could ameliorate this situation. Thirdly, some of the continuous variables were transferred into categorized variables in order to achieve better visualization, which might cause information loss. A future large-scaled longitudinal study could be conducted to recognize the risk factors for low health literacy in Xingtai city. Moreover, although the design effect of the complex sampling procedure was addressed as much as possible by the stratification analysis, as well as univariate and multivariate logistic regression analyses, it may not be completely eliminated, which might cause bias.

To be conclusive, low health literacy is quite prevalent in Xingtai; meanwhile, higher age, male, lower education level, lower annual household income and rural location are related factors for low health literacy, among which lower education level is the only independent related factor of low health literacy, indicating the necessity of reinforcing education coverage.

**Author contributions**

Conceptualization: Qiuxia Yang.
Data curation: Changhong Wang, Shuli Yu.
Formal analysis: Changhong Wang, Guoxiao Gu, Shuli Yu, Hui Yang.
Investigation: Guoxiao Gu, Shuli Yu, Huihui Liu, Yu Qiao, Lijing Yu.
Methodology: Huihui Liu, Ziwen Yang, Lijing Yu.
Resources: Qiuxia Yang, Huihui Liu.
Supervision: Qiuxia Yang.
Validation: Qiuxia Yang, Ziwen Yang, Hui Yang, Yu Qiao, Lijing Yu.
Writing – original draft: Ziwen Yang, Hui Yang.
Writing – review & editing: Qiuxia Yang, Yu Qiao, Lijing Yu.

References
[1] Marmot M. Commission on Social Determinants of H. Achieving health equity: from root causes to fair outcomes. Lancet 2007;370:1153–63.
[2] Katz A. Health literacy: what do you know? Oncol Nurs Forum 2017;44:521–2.
[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] Zhang Y, Zhang F, Hu P, et al. Exploring Health Literacy in Medical University Students of Chongqing, China: a cross-sectional study. PLoS One 2016;11:e0152547.
[5] Bailey SC, Brega AG, Crutchfield TM, et al. Update on health literacy and diabetes. Diabetes Educ 2014;40:581–604.
[6] Eichler K, Wieser S, Brugger U. The costs of limited health literacy: a systematic review. Int J Public Health 2009;54:313–24.
[7] Magnani JW, Muajid MS, Aronow HD, et al. Health literacy and cardiovascular disease: fundamental relevance to primary and secondary prevention: a scientific statement from the American Heart Association. Circulation 2018;138:e48–74.
[8] O’Meara L, Williams SL, Ames K, et al. Low health literacy is associated with risk of developing type 2 diabetes in a nonclinical population. Diabetes Educ 2019;45:431–41.
[9] Wang X, Gao H, Wang L, et al. Investigation of residents’ health literacy status and its risk factors in Jiangsu Province of China. Asia Pac J Public Health 2015;27:N2764–72.
[10] Hosking SM, Bremman-Olsen SL, Beauchamp A, et al. Health literacy in a population-based sample of Australian women: a cross-sectional profile of the Geelong Osteoporosis Study. BMC Public Health 2018;18:876.
[11] Ye XH, Yang Y, Gao YH, et al. Status and determinants of health literacy among adolescents in Guangdong, China. Asian Pac J Cancer Prev 2014;15:8735–40.
[12] Li L, Lei Y, Pan D, et al. Economic evaluation of the air pollution effect on public health in China’s 74 cities. SpringerPlus 2016;5:402.
[13] Zhang YS, Jin Y, Rao WW, et al. Prevalence and socio-demographic correlates of poor sleep quality among older adults in Hebei province, China. Sci Rep 2020;10:12266.
[14] Wu Y, Wang I, Cai 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.
[15] Li Y. Introduction of 2012 Chinese residents health literacy monitoring program. Chin J Health Educ 2014;30:563–5.
[16] Nie X, Li Y, Li L. Statistic analysis of 2012 Chinese residents health literacy monitoring. Chin J Health Educ 2014;30:178–81.
[17] Wang C, Lang J, Xuan L, et al. The effect of health literacy and self-management efficacy on the health-related quality of life of hypertensive patients in a western rural area of China: a cross-sectional study. Int J Equity Health 2017;16:58.
[18] Papadopoulos V, Tsapakidis K, Riboo Del Galdo NA, et al. The prognostic significance of the hedgehog signaling pathway in colorectal cancer. Clin Colorectal Cancer 2016;15:116–27.
[19] Ghost GLM, Chaves G, Britto RR, et al. Health literacy and coronary artery disease: a systematic review. Patient Educ Couns 2018;101:177–84.
[20] Du S, Zhou Y, Fu C, et al. Health literacy and health outcomes in hypertension: an integrative review. Int J Nurs Sci 2018;5:301–9.
[21] Papadakos JK, Hasan SM, Barnsley J, et al. Health literacy and cancer self-management behaviors: a scoping review. Cancer 2018;124:4202–10.
[22] Samerski S. Health literacy as a social practice: Social and empirical dimensions of knowledge on health and healthcare. Soc Sci Med 2019;226:1–8.
[23] Wu X, Li J. Income inequality, economic growth, and subjective well-being: evidence from China. Res Social Stratification Mobility 2017;52:49–58.
[24] Liu YK, Chen YL, Xue HP, et al. Health literacy risk in older adults with and without mild cognitive impairment. Nurs Res 2019;68:433–8.
[25] Assunciao AA, Abreu MNS. Pressure to work, health status, and work conditions of schoolteachers in Basic Education in Brazil. Cad Saude Publica 2019;35(Suppl 1):e00169517.