

# Study on the Status of Health Literacy and its Relationship with Chronic Diseases in Poor Areas

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## Research article

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# Abstract

## Aims

We conducted an epidemiological survey of health literacy and chronic diseases among people in poverty-stricken areas in China to understand the current status of health literacy among poor individuals and the epidemic characteristics of chronic diseases.

## Methods

In June 2018, multistage stratified random sampling was used to conduct a face-to-face questionnaire survey of 1,700 residents (response rate: 97.71%) in 7 national-level poverty-stricken counties in Henan Province, China. The questionnaire assessed social demographics, health literacy, health-related behaviours, and the status of chronic diseases (such as diabetes, hypertension, and heart disease). Structural equation models were used to examine the relationships among health literacy, health-related behaviours, and chronic diseases. Statistical analysis was performed using IBM SPSS Statistics 21.0 and Mplus 7.0.

## Results

There were 69 people with sufficient health literacy in poverty-stricken areas, accounting for 4.15% of the total sample, with an average score of  $31.95 \pm 11.81$  points. Individuals who were male, older, poorer, less educated and suffering from chronic diseases were less likely to have sufficient health literacy. A total of 574 patients had chronic diseases, accounting for 34.56% of the total sample. The health literacy score was related to the number of chronic diseases ( $\beta = 0.041$ , 95% confidence interval [CI]: 0.033 ~ 0.049), while health literacy and health-related behaviour were indirectly related ( $\beta = -0.002$ , 95% CI: -0.003 ~ -0.001). Health-related behaviours mediated the relationship between health literacy and the number of chronic diseases.

## Conclusions

It is possible to further increase the health literacy level of residents in poverty-stricken areas by increasing the promotion of health literacy knowledge and avoiding unhealthy behaviours, thereby reducing the incidence of chronic diseases and improving their health status.

## 1 Background

"Health literacy", proposed in 1974, is playing an increasingly important role in the field of public health <sup>[1]</sup>. The European Health Literacy Survey Alliance (HLS-EU) defines health literacy (HL) as a skillset that requires people to have the knowledge, motivation and sufficient ability and health promotion to improve

their quality of life when they make decisions about health care and disease prevention in their daily life and when they obtain, understand, evaluate and implement health information<sup>[2]</sup>. Additionally, the Institute of Medicine (IOM) defines health literacy as "An individual's ability to access, process, and understand basic health information and services needed to make sound health-related decisions and follow treatment guidelines." This study used the definition given by the World Health Organization, i.e., the extent to which individuals have the cognitive and social skills necessary to obtain, understand and apply basic health information and services to promote and maintain good health<sup>[3-4]</sup>. Today, health literacy remains inadequate in many countries and regions, especially among the most vulnerable socioeconomic groups<sup>[5-7]</sup>. More than half of the German population has reported difficulty processing health-related information, and with a limited awareness of health, the prevalence of limited health literacy was particularly high among individuals with low self-assessed social status<sup>[6]</sup>. Approximately 80 million American adults have limited health literacy, which puts them at risk of poor health, with the rate of limited health literacy being higher among poor individuals<sup>[7]</sup>.

Most young people from poor areas in China go to work in economically developed areas as floating populations, and the health literacy of the elderly individuals and left behind children in rural areas is generally low<sup>[8-9]</sup>. Low health literacy results in excessive risky behaviour and poor health outcomes, including poor health awareness, an increased incidence of non-communicable diseases (NCDs), poor labelling of intermediate diseases and the inadequate use of preventive measures in health services<sup>[1,10-13]</sup>. As such, improving health literacy has evolved as a public health goal, and many countries have taken measures to improve the level of health literacy of their citizens<sup>[14,15]</sup>.

In the Outline of the "Healthy China 2030 Blueprint", the Chinese government has set a goal of increasing health literacy to 30% by 2030. Henan Province has a large population but has poor medical and health conditions<sup>[16]</sup>. In 2018, there were 53 poverty-stricken counties in this province, including 31 national-level poverty-stricken counties, and more than 1 million residents in poverty-stricken areas suffered from diseases, accounting for 50.69% of the province's population of poor individuals. In this survey, seven state-level poverty-stricken counties in Henan Province were surveyed to assess the health literacy level, health-related behaviours and prevalence of NCDs among local residents and to explore the relationship among the these three factors to improve the health literacy of residents in poor areas, reduce the incidence of chronic diseases and improve the quality of life of low-income groups in poor areas through increasing health knowledge.

## **2 Materials And Methods**

### **2.1 Participants and sampling**

This cross-sectional study was conducted in June 2018. The survey was administered in 7 national-level poverty-stricken counties in Henan Province. All non-community residents who were aged 15 ~ 69 years and had been living continuously in these countries for more than 6 months were eligible to participate.

According to the sample size calculation formula:  $N = \frac{u_{\alpha}^2 \times p(1-p)}{\delta^2} \times deff$ , urban and rural areas are divided into two layers. Here,  $u_{\alpha}=1.96$ ,  $\delta=2\%$ ,  $deff = 2$ , the health literacy level of Henan Province in 2016 (weighted rate 7.8%,  $p = 7.8\%$ ). Based on this formula, the minimum effective sample size was calculated as 1380. Considering the possible allowable error and missing data, the sample size was increased by 20%, so we determined that the number of people surveyed should be 1,700.

We used multistage stratified random sampling to recruit the study population (Table 1). A total of 1700 residents were surveyed face-to-face by trained investigators; of these, we obtained and analysed 1661 (97.71%) valid responses.

Table 1  
Sampling steps

Sampling stage	Sample allocation	Sampling method
□	Sampling to counties: 7 counties randomly selected from 31 national poverty counties	Simple random sampling
□	Sampling to towns: 3 towns in each county	PPS(Probability Proportionate to Size Sampling)
□	Sampling to villages: 2 villages in each township	PPS
□	Sampling to households: 41 households are selected from each village.	Simple random sampling
□	Sampling to people: randomly select one person from each family to investigate	KISH

## 2.2 Measure

The questionnaire assessed social demographics, health literacy, health-related behaviours and NCDs.

### 2.2.1 Health literacy

This survey used the "National Resident Health Literacy Questionnaire" issued by the National Health Commission of the People's Republic of China. The content includes three aspects of literacy health, i.e., knowledge (23 items, 29 points), health behaviour (15 items, 20 points), and health skills (12 items, 16 points), and 6 types of health problems, i.e., scientific and healthy ideas (7 items, 9 points), prevention of infectious diseases (6 items, 7 points), chronic disease prevention (10 items, 14 points), safety and first aid (10 items, 14 points), basic medical information (12 items, 14 points), and health information (5 items, 7 points). A total of 56 items were included, and the maximum total score was 65 points. The scale had a Cronbach's alpha coefficient of 0.875.

Judgement questions and single-choice questions are awarded one point for correct answers, and wrong answers are not scored; for multiple-choice questions, two points are given for correct answers. Wrong choices, multiple choices, or fewer choices are not scored. According to the scoring standard of the Chinese health literacy monitoring survey, when the correct score of the health literacy assessment reaches more than 80% of the full score, it is determined that the survey subject has sufficient health literacy. This standard applies to the determination of all three aspects of health literacy and all six types of health problems.

## 2.2.2.2 Health-related behaviours

According to research by Alden Yuanhong Lai<sup>[17]</sup>, Machi Suka<sup>[18]</sup>, Yong-Bing Liu<sup>[19]</sup> and other scholars, smoking and drinking were included in health-related behaviours herein. We assessed the frequency of smoking behaviour on a scale of 1 (never) to 4 (frequently). We assessed the frequency of drinking behaviour on a scale of 1 (never) to 5 (frequently). The sum of these two items (2 ~ 9 points) was used as an indicator of health-related behaviours: higher scores indicated a greater behavioural risk.

## 2.2.3 Health status

The assessment of health status included whether an individual was suffering from NCDs, how many NCDs the individual had, self-reported of health status, etc. Whether an individual had a chronic disease was represented by a binary classification variable (0 = no, 1 = yes), and the self-assessed health status was expressed by the item "How do you think your health is?" The response options were 3 = good, 2 = moderate, and 1 = poor.

## 2.3 Research hypothesis

Based on the related models combined with other health literacy studies<sup>[1-2,17-19]</sup>, it is assumed that the level of health literacy directly affects health-related behaviours and the chronic disease prevalence of residents in poor areas, and the health-related behaviours of residents in poor areas directly affect the prevalence of NCDs. A model of the relationships among health literacy, health-related behaviours and NCDs mediated by healthy behaviours was established (Fig. 1).

## 2.4 Statistical analysis

First, we used Epi Data 3.1 to enter the questionnaire data(double-entry method is adopted, and check after entry is completed) and then used SPSS Statistics 21.0 to perform descriptive statistical analysis (frequency, percentages, mean and standard deviation) and single-factor statistical analysis (chi-square test). A test level of  $\alpha = 0.05$  and  $P < 0.05$  were considered statistically significant. Finally, Mplus 7.0 was used to build the structural equation model (SEM), the maximum likelihood estimation method was used to test the hypothesis, and the total scores of health literacy and health-related behaviours were used as potential variables. To test whether the estimated model was suitable for the data, we 4 fit indices and their criteria<sup>[20]</sup>: root mean square approximation error (RMSEA)  $< 0.05$ ; Tucker-Lewis index (TLI) and comparative fit index (CFI) values  $> 0.90$ ; standard root mean square residual (SRMR)  $< 0.05$ ;  $\chi^2/df < 3$ . If

all index values are close to or higher than these critical values, the model is considered to be a good fit for the data.

## 3 Results

### 3.1 Participants and health literacy status

In this survey, the mean age of the participants was  $50.90 \pm 12.97$  years, with 56.53% women, 50.09% rural, and 97.17% Han respondents. The majority of participants had a primary school education level and below (49.91%), followed by junior high school (37.87%), senior high school (8.49%) and college or above (3.73%). Most participants were married (90.43%), and most were farmers and workers (89.22%). The vast majority of participants' personal monthly income was between 1001 ~ 3000 CNY (39.92%), and 98.31% were local residents. A total of 51.54% had 3–5 people in their family, 31.61% had 6 or more, and only 16.86% had 2 or less. A total of 34.56% participants had NCDs. A total of 55.09% of the participants rated their health status as good, 34.86% as moderate, and 10.05% as poor. Fifteen hundred ninety-two (95.85%) participants had limited health literacy. Those who had limited literacy were more likely to be male, older, poorer, less educated, and suffering from NCDs ( $P < 0.05$  for all comparisons; Table 2).

The average scores of key variables in the whole sample: The mean scores for health literacy and health-related behaviours were  $31.95 \pm 11.81$  and  $3.06 \pm 1.99$ , respectively. The mean value for the number of NCDs was  $0.04 \pm 0.20$  (Table 3).

The results of this survey showed that 574 (34.56%) participants had one or more NCDs, of which 397 (69.16%) had 1 type of chronic disease, 129 (22.47%) had 2 types of chronic disease, and 48 (8.36%) had 3 types or more. According to the types of NCDs, the most common disease was hypertension (36.18%), followed by heart disease (15.10%), hyperlipidaemia (14.01%), cerebrovascular disease (12.06%) and diabetes (7.67%) (Fig. 2).

Table 2  
Association between health literacy and characteristics of research objects

<b>variables</b>	<b>N/%</b>	<b>Sufficient health literacy N/%</b>	<b>p</b>
Region			0.914
urban	832(50.09)	35(4.21)	
rural	829(49.91)	34(4.10)	
Gender			0.016*
male	722(43.47)	21(2.91)	
female	939(56.53)	48(5.11)	
Age (years)			0.000*
15 ~ 29	120(7.22)	17(14.17)	
30 ~ 44	367(22.1)	32(8.72)	
45 ~ 59	683(41.12)	16(2.34)	
60 ~ 69	491(29.56)	4(0.81)	
Ethnicity			0.480
ethnic Han	1614(97.17)	68(4.21)	
ethnic minorities	47(2.83)	1(2.13)	
Education			0.000*
Primary school or below	829(49.91)	9(1.09)	
Junior high school	629(37.87)	26(4.13)	
Senior high school	141(8.49)	20(14.18)	
College degree or above	62(3.73)	14(22.58)	
Marital status			0.218
unmarried	64(3.85)	4(6.25)	
married	1502(90.43)	64(4.26)	
divorced and widowed	95(5.72)	1(1.05)	
Occupation			0.000*
institution or government staff	89(5.36)	16(17.98)	
student	16(0.96)	1(6.25)	

<b>variables</b>	<b>N/%</b>	<b>Sufficient health literacy N/%</b>	<b>p</b>
farmer or worker	1482(89.22)	46(3.10)	
others	74(4.46)	6(8.11)	
Income (CNY/month)			0.000*
≤1000	629(37.87)	13(2.07)	
1001 ~ 3000	663(39.92)	22(3.32)	
3001 ~ 5000	314(18.9)	28(8.92)	
>5000	55(3.31)	6(10.91)	
local residents			0.000*
yes	1633(98.31)	64(3.92)	
no	28(1.69)	5(17.86)	
Household size			0.173
≤2	280(16.86)	6(2.14)	
3-5	856(51.54)	38(4.44)	
≥6	525(31.61)	25(4.76)	
Chronic disease			0.000*
no	1087(65.44)	61(5.61)	
yes	574(34.56)	8(1.39)	
Self-assessment of health status			0.004*
good	915(55.09)	49(5.36)	
moderate	579(34.86)	20(3.45)	
poor	167(10.05)	0(0.00)	
Total	1661(100.00)	69(4.15)	
* P < 0.05			

Table 3  
Mean value of health literacy, health-related behaviours and number of NCDs

Variable	Mean ± SD
Health literacy	31.95 ± 11.81
Health knowledge	14.44 ± 5.50
Health behaviour	10.36 ± 4.35
Health skills	7.14 ± 3.38
Scientific and healthy ideas	5.67 ± 2.80
Prevention of infectious diseases	3.26 ± 1.62
Chronic disease prevention	5.05 ± 2.72
Safety and first aid	8.22 ± 3.30
Basic medical information	6.92 ± 2.67
Health information	2.81 ± 1.85
Behaviour	3.06 ± 1.99
Drinking	1.58 ± 1.12
Smoking	1.47 ± 1.22
Number of NCDs	0.04 ± 0.20

## 3.2 Mediation analysis

For the initial structural equation modelling, all models controlled for age, gender, ethnicity, education, and occupation. After controlling for these variables, the error terms were connected based on the correction index data provided by Mplus. The final model showed that all paths were statistically significant, and the model had an acceptable fit, with  $\chi^2 = 67.718$ ,  $p < 0.001$ ,  $\chi^2/df = 2.709$ , RMSEA = 0.04, CFI = 0.986, and TLI = 0.979.

Hypothesis test results show that the best-fitting model demonstrated that health-related behaviour was a partial mediator of the relationship between health literacy and NCDs (root mean square error of approximation = 0.042 and comparative fit index = 0.940). Specifically, this model showed that less smoking and drinking behaviours were associated with higher health literacy ( $\beta = -0.002$ , 95% confidence interval (CI): -0.003~-0.001). The health literacy score is directly proportional to the number of NCDs ( $\beta = 0.041$ , 95% CI: 0.033 ~ 0.049). An analysis of the mediating pathways shows that health literacy and the number of NCDs are mediated by health-related behaviours, which supports our previous assumption (Fig. 3, Table 4).

Table 4  
Confidence intervals of the model results

Model pathways	Standardized coefficient	95% CI
<b>Total effects</b>		
HL→NCDs	0.041	0.033 ~ 0.049
HL→Behaviour	-0.002	-0.003~ -0.001
<b>Indirect effects</b>		
HL→Behaviour	-0.002	-0.003~ -0.001
<b>Direct effects</b>		
HL→NCDs	0.041	0.033 ~ 0.049
<b>Effects from HL to NCDs via Behaviour</b>		
HL→Behaviour→NCDs	-0.013	-0.027~ -0.001

## 4 Discussion

Having sufficient HL might be more important than ever before because people are expected to participate in health decisions and to take responsibility for their own health despite more complicated health problems and the need to navigate a more complex health system<sup>[21-23]</sup>. In this survey, only 4.15% (31.95 ± 11.81 points on average) of the residents in poor counties achieved sufficient health literacy. However, in the same period, the adequate health literacy of Chinese residents was 17.06%, and that of Henan residents was 14.38%<sup>[24]</sup>. Hence, the level of health literacy of poor county residents in Henan Province is far lower than that of the whole country and other regions in the same province. With respect to health knowledge, health behaviour and health skills, sufficient health knowledge was most common (10.36%), followed by health behaviour (5.30%) and health skills (5.54%). This finding indicates that residents in poor areas do not engage in sufficiently healthy behaviours, and more health guidance is needed. Studies in Europe and other countries have also found that the proportion of certain groups with limited health literacy is higher than that of the general population, especially individuals with less money<sup>[25]</sup>. The single-factor  $\chi^2$  test indicated that the effects of 8 factors, including gender, age, education, occupation, monthly income, locality census register, chronic disease, and self-assessment of health status, on health literacy are statistically significant. Among the participants, those with lower health literacy levels were more likely to be male, older, poorer, less educated, and suffering from chronic diseases. This is consistent with the research results of Liu L<sup>[1]</sup>, Verney SP<sup>[9]</sup>, S rensen K<sup>[25]</sup> and other scholars.

The survey results showed that 19.51% of the participants were smokers, 80.56% of whom smoked every day. Additionally, 16.32% of the participants were drinkers, 24.35% of whom drank every day, which is similar to the health-related behaviour results of Japanese and Chinese surveys by Suka M<sup>[18]</sup> and Liu

YB<sup>[19]</sup>. As such, the two unhealthy behaviours (smoking and drinking) were not higher in poorer areas than in the general population.

NCDs (such as cardiovascular disease, cancer, and diabetes) are the major source of the global burden of disease and mortality, and their share of the total global disease burden has steadily increased from 44% in 1990 to 61% in 2016<sup>[11, 26]</sup>. Multiple chronic conditions (MCC) further reduce the quality of life of patients and cause a huge economic burden<sup>[27]</sup>. In this survey, 34.56% of the participants had chronic diseases, and 30.84% had two or more diseases. The prevalence of chronic diseases in poor areas is high, and more than one-third of residents suffer from multiple chronic diseases, which is higher than that in non-poor areas of China<sup>[28-29]</sup>.

The structural equation model showed that the health-related factors were mediating variables with weak effects. There was a negative correlation between health-related behaviours and health literacy and a positive correlation between health literacy and the types of chronic diseases. The higher the score of health literacy is, the lower the score of health-related behaviours, which means that residents with a high level of health literacy engage in fewer unhealthy behaviours<sup>[2,30-31]</sup>. Improving the health literacy of residents in poor areas can reduce unhealthy behaviours, and people's lifestyle will be healthier<sup>[32-34]</sup>. Thus, the results of this study show that health literacy scores are positively correlated with the types of NCDs, which is contrary to expectations. However, patients with NCDs tend to pay more attention to healthy living habits and avoid unhealthy behaviours because they have acquired health knowledge from doctors or are already ill, so their health literacy scores are higher, which is consistent with the research results of Liu L, Qin L and Villaire M<sup>[1,35-36]</sup>.

To the best of our knowledge, this study is the first one to investigate on the health literacy status of residents in impoverished counties in China, and this may kick off in the future. This survey was organized by the Henan Provincial Health Commission, Henan Provincial Center for Disease Control and Prevention and other government departments. The sample selection was standardized, the data quality was high, and health risk behaviors were used as intermediary variables to further study the relationship between health literacy and chronic diseases. At the same time, the survey results should be interpreted cautiously due to the following limitations: First, we are a cross-sectional survey, and there is insufficient comparison with the previous ones. Therefore, we should carefully check the causal inferences; The health literacy measurement tool we used was announced by the Chinese government in 2012. With the continuous development of the concept of health literacy, the measurement tool needs to be updated.

## Conclusion

In summary, individuals living in poverty-stricken areas have a very low level of health literacy, engage in more unhealthy behaviours such as smoking and drinking, and have a high prevalence of NCDs. Health literacy has an impact on both health-related behaviour and NCDs prevalence. The relevant government departments should increase health education efforts to improve residents' health literacy, reduce the prevalence of chronic diseases and improve their quality of life.

# Abbreviations

HL:Health literacy;HLS-EU:The European Health Literacy Survey Alliance;IOM:Institute of Medicine ;NCDs:non-communicable diseases;PPS:Probability Proportionate to Size Sampling;KISH:Kish Grid sampling

# Declarations

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## Contributorship statement

Chen XJ performed preliminary statistical analysis, interpreted results,and drafted the initial manuscript. Shi SH and Yang LY revised manuscript critically for important content. Dong Q and He JY contributed to the study design,reviewed and organized the field work., Zhang YL, was responsible for the field work, data collection and quality control. All authors read and approved the final manuscript.

## Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Availability of data and materials

The data used for this study are not publicly available. Data can be requested from ZhengZhou School of Public Health, but restrictions may apply. Requests should be made directly to Professor Tian Qingfeng, director of the Department of Social Medicine and Health Management of the School of Public Health.

## Ethics and Consent statement

The study protocol was approved by The Ethical Committee of ZhengZhou University School of Public Health. The investigation was performed after the acquisition of informed consents of all participants.

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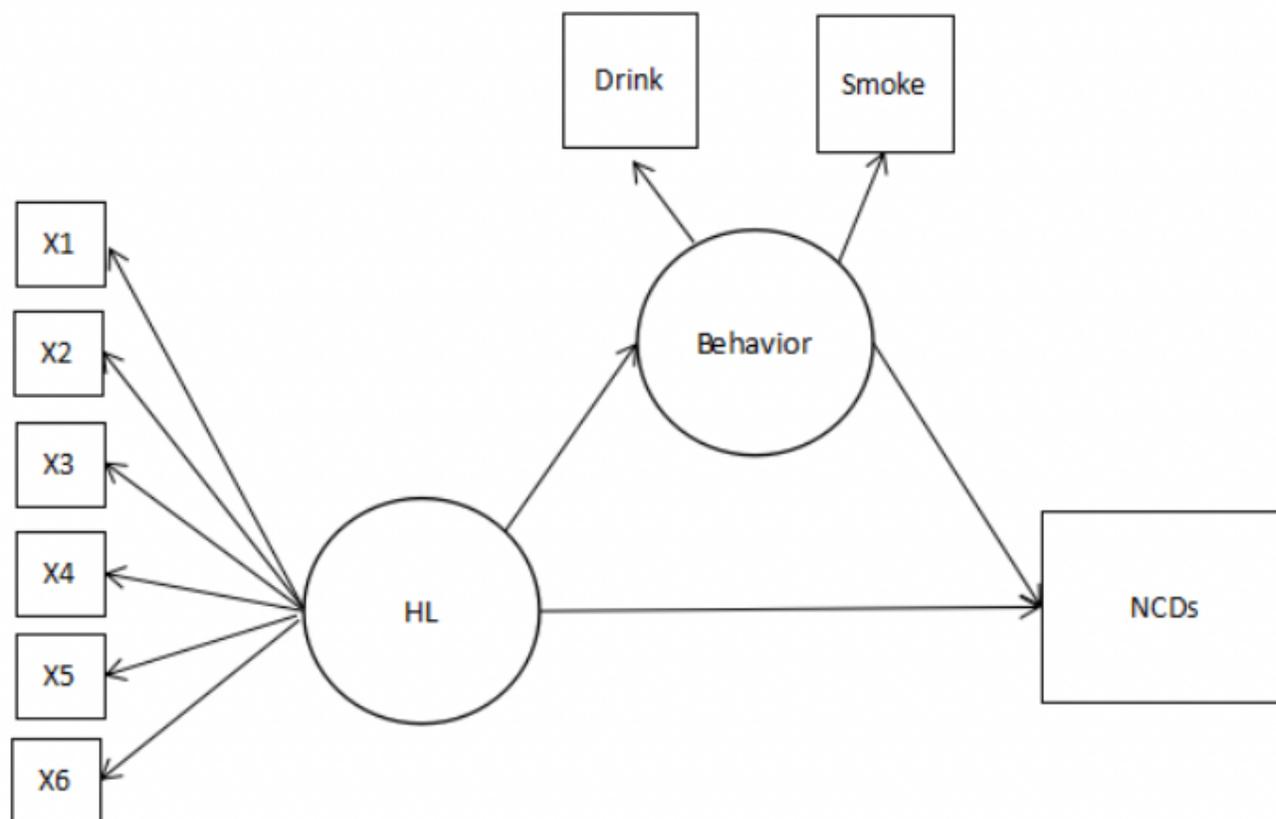
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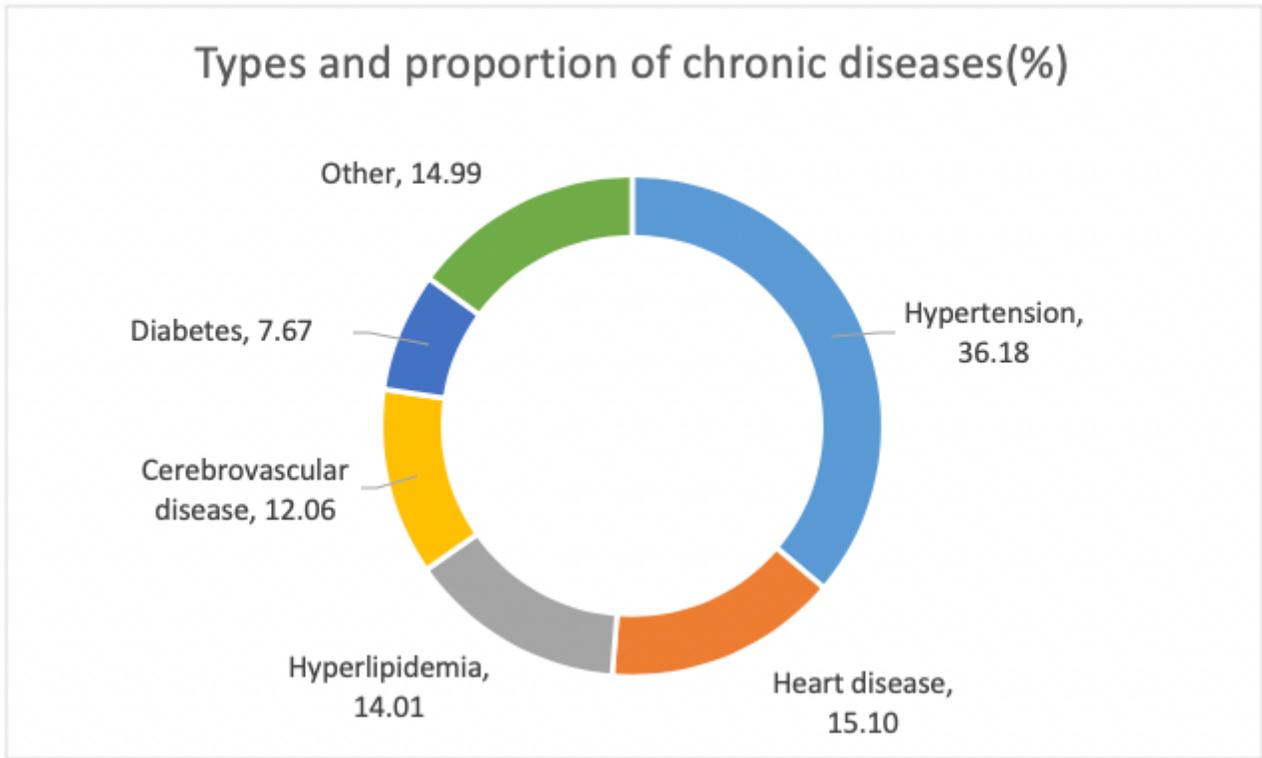
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## Figures



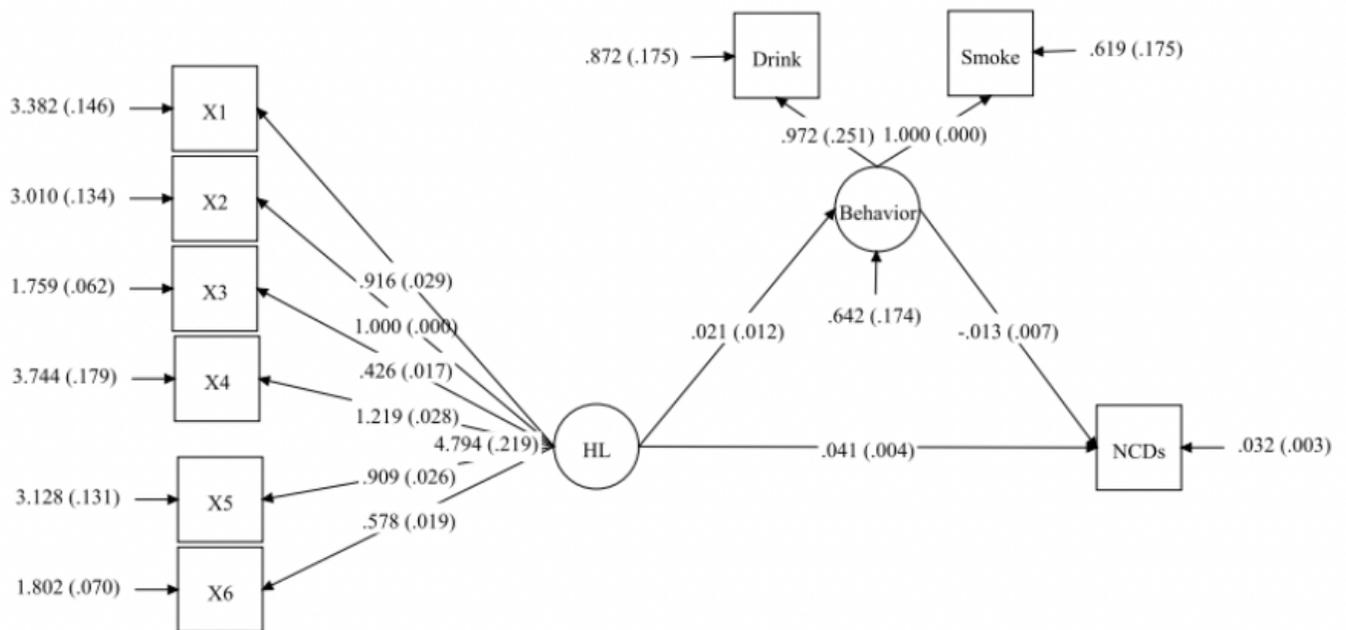
**Figure 1**

Theoretical model and hypotheses. X1=Scientific and healthy ideas, X2=Prevention of infectious diseases, X3=Chronic disease prevention, X4=Safety and first aid, X5=Basic medical information, X6=Health information



**Figure 2**

Types and proportion of NCDs of the surveyed subjects



**Figure 3**

Results of structural equation modelling analysis. X1=Scientific and healthy ideas, X2=Prevention of infectious diseases, X3=Chronic disease prevention, X4=Safety and first aid, X5=Basic medical information, X6=Health information