

*Original Research*

# **Investigation and Countermeasures of Residents' Environmental and Health Literacy: a Case Study of Wudang Mountain Special Zone in Shiyan City, Hubei Province**

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## **Abstract**

It's important to see the impact of environment on human health and it is getting more and more Government attentions. There is no more research on these issues in developing countries. This research was carried out in Wudang Mountain Special Zone, Shiyan City, Hubei Province, one of the pilot areas of environmental and health management in China as a Core Test of Citizen Environmental and health Literacy Assessment compiled by the Ministry of Ecology and Environment of China and to investigate the level of environmental and health literacy of residents in Wudang Mountain special Zone. The results showed that the level of ecological environment and health literacy of residents in Wudang Mountain special Zone was 33.59%, which was generally low. Among them, the classification literacy level of basic concept, basic knowledge and basic skills were 53.44%, 10.86% and 50.78% respectively. The low classification literacy level of basic knowledge was an important reason for the low overall level of ecological environment and health literacy of people in Wudang Mountain Special Zone. The ecological environment and health literacy of residents showed obvious group differences in gender, age, education level, etc. Despite the significant ( $P < 0.01$ ) gender difference, there was no significant difference in basic concept. Significant differences lie in the total score and dimensions of environmental and health literacy among residents of different age groups ( $P < 0.001$ ), and the higher the age, the lower the score. There were significant differences in the total score and dimensions of environmental and health literacy among residents with different educational levels ( $P < 0.001$ ), and the higher the level of education, the higher the score of environmental and health literacy. However, there was no difference in environmental and health literacy scores among residents with different average monthly income levels. Therefore, the article suggested the following possible solutions: strengthening the education and publicity of environmental and health knowledge, promoting public rational

understanding of the relationship between environment and health while improving risk communication efficiency and public event response ability, and enhancing residents' sense of value in participating in environmental and health management.

**Keywords:** environment and health literacy, environment and health management, countermeasures, Wudang Mountain Special Zone

## Introduction

Millions of people would become ill or have shorter lives by 2050 due to pollutants in water, air and soil unless stronger environmental protection measures are taken, according to the assessment of the UN's Global Environmental Outlook VI (2019). International organizations estimate that 40 percent of deaths and up to 70 percent of illnesses are linked to environmental damage. Environmental and health issues have become the top priority in the construction of the national health system. Instead of passive response, the government and society should coordinate actively, by paying attention to the health impact, health effect and health value of the ecological environment, strengthening the ecological environment and health management and integrating the concept of public health protection and risk management into the current ecological and environmental governance system [1-2]. It can be said that the coordination of the relationship between environment, health and economy has become a new standard to test the environmental policy practice. As common people, they are not only the beneficiaries of environmental and health management, but also the promoters and participants of environmental and health management, who play a key role in environmental and health management. At present, the research on environmental and health management is more extensive. The results of cluster analysis showed that the research directions of environmental and health management could be divided into seven different categories: soil pollution and health [3-6], water pollution and health [7-11], air pollution and health [12-15], food, medicine and health [16-20], indoor environment and health [21-25], urban environment and health [26-30], and environmental governance and health [31-33]. The research hotspots and frontiers in the field of environmental health problems mainly focused on indoor air pollution and control [34-40], treatment of schistosomiasis and veterinary drug residues [41-46], control and treatment of inhalable particulate matter in the atmosphere [47-49], monitoring, and risk assessment and management of environmental health problems [50-53]. According to the trend of Burst analysis chart, it is predicted that there will be more research literature on environmental health monitoring, risk assessment and governance in the field of environmental health governance in the next few years.

Environmental and health literacy means that people acquire and understand the basic knowledge of environment and health, and use this knowledge to

make correct judgments on common environmental and health problems, establish scientific concepts, and be capable of taking actions to protect the environment and maintain their own health [54]. Environment and health literacy includes the correct concept of environment and health, the basic knowledge of environment and health and the basic skills to promote environment and health. Setting up correct concepts is the basis for improving environmental and health literacy, mastering basic knowledge is the premise for understanding and judging environmental and health problems, and learning relevant skills, forming relevant behaviors and lifestyles is an important embodiment of environmental and health literacy [55]. It can be said that residents' environmental and health literacy directly determines their environmental and health value orientation, behavioral characteristics and attitudes to environmental and health management [56]. Based on this, attention must be paid to the improvement of residents' environmental and health literacy in the implementation of environmental and health management. At present, only a few scholars have conducted studies on residents' environmental and health literacy (EHL). Biswas Aindrila [57] verified the relationship between environmental literacy, environmental attitude and healthy living, and [58] studied the methods to improve the attitude and knowledge of environmental health. Some scholars [59-61] proposed to address health literacy in key nursing settings, improve awareness and knowledge of environmental health issues in childcare institutions, and build knowledge and skills to protect health. Based on this, it is necessary to understand the current level of environmental and health literacy of residents, as well as its enlightenment on environmental and health management.

## Methodology

### Survey Area

Based on the scenic area of Mount Wudang, Wudang Mountain Special Zone is rich in natural ecological resources, but it also faces problems such as tourist carrying capacity of the scenic spot, changes of production and life style, transferring water from the south-to-north water-diverging project, as well as the pressure that the economic development brings to the ecological environmental protection. At the same time, Wudang Mountain Special Zone has been actively transforming the health effect of ecological environment

resources and vigorously promoting the development of the health and wellness industry, which puts forward realistic requirements for Wudang Mountain Special Zone to take the close management path of ecological environment and health. Therefore, this study selected Wudang Mountain special Zone as the investigation area.

### Questionnaire

This survey adopted the “Core Test of Environmental and Health Literacy Assessment of Citizens” compiled by the Ministry of Ecology and Environment of China. Table 1 provides the main contents of the survey on environment and health literacy. The correspondence between the test questions and the system in the evaluation index is shown in Table 2.

### Data Collection

The subjects of the survey were permanent residents of Wudang Mountain Special Zone, including urban residents and rural residents, civil servants and non-civil servants, and the questionnaire was distributed according to the population ratio [62]. The survey sample was 1,000, among which 902 valid samples were recovered. See Table 3 for the basic information of the respondents. It can be seen from the table that the respondents were roughly evenly split between men and women, with slightly more men. The respondents were mainly between 25 and 50 years old, accounting for 57.9% of the total respondents. The educational level is mostly between high school and university, accounting for 66.8%. Their monthly income is mostly between

3000 and 6000 yuan. The structure of the investigation subject can basically reflect the actual situation of site where the survey is conducted [63].

The questionnaire was distributed one to one, and residents filled in the questionnaire after the purpose and content of the survey were objectively explained to them. Informed consent was obtained before the investigation, and the questionnaire does not involve personal identity information. The survey used structured questionnaire and open interviews to understand residents' views and evaluation of environmental and health management in Wudang Mountain Special Zone from multiple perspectives [64].

### Data Analysis

#### Validation of Data

SPSS 22 software was used for data analysis in this study. To ensure the quality of research data, reliability and validity tests were carried out before empirical analysis. The Cronbach's  $\alpha$  value of the questionnaire data was 0.814, and the Cronbach  $\alpha$  coefficients of the three latent variables were all higher than 0.5, indicating that the questionnaire was stable and reliable, which could be further analyzed [65]. The dimensions of the environmental and health literacy questionnaire and the Cronbach's  $\alpha$  coefficient can be seen in Table 4.

Overall situation of residents' environmental and health literacy in Wudang Mountain Special Zone. Table 5 presents the residents' environmental and health literacy score of Wudang Mountain Special Zone. The results showed that 33.59% of the residents in Wudang Mountain Special Zone had environmental

Table 1. Contents of survey on environment and health literacy <sup>1</sup>.

Primary indicators	Secondary indicators	Main contents
The basic concept	Basic concept	Basic understanding of the relationship between environment and health, environment and health issues
	Basic attitude	Awareness of prevention and awareness of responsibility in dealing with environmental and health problems
Basic knowledge	Scientific knowledge	Scientific knowledge of the effects of air, soil, water, radiation, noise, environmental hygiene, toxic and harmful substances on health
	Behavioral knowledge	Behavioral knowledge related to reducing environmental pollution and preventing health effects of environmental pollution
Basic skills	Cognitive skills	The ability to acquire, identify, understand and use environmental and health-related information and communication skills
	Operating skills	Skills of emergency response, and skills of rights protection

<sup>1</sup> In August 2020, China Ministry of Ecology and Environment fine-tuned the Environmental and Health Literacy of Chinese Citizens (Trial)” issued by Former Ministry of Environmental Protection, and released a new version of „ Ecological environment and health literacy of Chinese citizens „. But the „ Technical Guide for Citizen Environmental and Health Literacy Assessment (Trial) „, and the „Core test of Citizen Environmental and Health Literacy Assessment” were not adjusted. The survey began in December 2019 and ended in February 2020.

Table 2. Corresponding table of core test in environmental and health literacy assessment.

First-level indicators	Second-level indicators	Third-level indicators	Items of corresponding literacy	Questions of corresponding questionnaire
Basic concepts	Basic cognition	Understanding of environment and health	1, 2, 3, 5	1, 2, 13, 28, 35
		Scientific concept	4, 6	14, 34, 36
	Basic attitude	Value judgment	7, 8	15, 29, 37
		Behavior orientation	7, 8	16, 30
Basic knowledge	Scientific knowledge	Atmospheric environment and health	9, 10, 11, 12	3, 39, 40
		Water environment and health	13, 14, 15	33
		Soil environment and health	17, 18	4
		Radiational environment and health	19	18
		Environmental hygiene and health	21, 22	19, 21
		Biodiversity and health	23	5
	Behavioral knowledge	Behaviors for pollution abatement	10, 14, 18, 20, 21	32, 38, 41
		Behaviors for reducing harm to health	11, 12, 16, 23, 24, 25	31, 17, 42
Basic skills	Cognitive skills	The ability to obtain information	26, 28	20, 27, 12, 23, 25, 26
		Ability to understand and communicate	29, 30	9, 10, 44
	Operating skills	Ability to apply	26, 27	8, 22, 24, 43, 45
		Behavioral ability	30	11, 46, 47

Interpretation of relevant indicators: Those with a score of 70% or above are judged to have environmental and health literacy. The overall level of environmental and health literacy refers to the percentage of people with environmental and health literacy in the assessed population. The classification literacy test score of the classification literacy test score of 70% or more is judged to have environmental and health classification literacy. The literacy level of environmental and health classification refers to the percentage of the people with environmental and health classification literacy in the assessed population.

and health literacy. In the different dimensions of environmental and health literacy, the basic concept was the best, followed by the basic skills, and the basic knowledge was relatively poor. Comparison of environmental and health literacy among residents of Wudang Mountain Special Zone in different demographic variables. An independent sample T-test was conducted on environmental and health literacy of residents of different genders. The results showed that the scores of male residents were higher than female residents in terms of basic knowledge, basic skills and total score of health literacy, and the difference was significant. There was no significant variation between the scores of male and female residents in the basic concept dimension. One-way an OVA was used to compare the scores of residents of different age groups [66]. The results showed that there were significant differences in the total scores and dimensions of environmental and health literacy among residents of different age groups. In terms of the total score of health literacy, the highest scores were among residents aged 16 to 24, while the lowest scores were among residents aged 61 to 69, and the higher the age, the lower the score. A one-way OVA was used to compare the scores

of residents with different cultural backgrounds. The results showed that there were significant differences in the total scores and dimensions of environmental and health literacy among residents with different cultural backgrounds. In terms of the total score of health literacy, the residents with master's degree or above have the highest score, and the residents with primary school or below has the lowest score, and the higher the education level, the higher the score. A one-way OVA was used to compare the scores of residents from different families with average monthly income. The detailed results in Table 6 showed that there was no difference in the scores of residents from different families with average monthly income in the three dimensions of health literacy total score and basic concepts, basic knowledge and basic skills.

## Results and Discussion

The overall level of residents' ecological environment and health literacy is low. According to the survey results, the total score rate of literacy was 33.59%, that is, less than 40 out of 100 people aged 15-69 have the

Table 3. Distribution of gender, age, education level and monthly income of residents in Wudang Special Zone.

Factor/%	Frequency	Effective percentage/%	Cumulative percentage/%
Gender			
Female	462	51.2	51.2
Male	440	48.8	100.0
Age			
16-24	296	32.8	32.8
25-30	150	16.6	49.4
31-40	220	24.4	73.8
41-50	152	16.9	90.7
51-60	58	6.4	97.1
61-69	26	2.9	100.0
Education			
Primary school or below	56	6.2	6.2
Junior high school	180	20.0	26.2
Senior high school/technical school	274	30.4	56.5
Junior college	129	14.3	70.8
Undergraduate	256	28.4	99.2
Master or above	7	0.8	100.0
Monthly income			
<3000	342	37.9	93.0
[3000-6000)	497	55.1	55.1
[6000-9000)	53	5.9	98.9
≥9000	10	1.1	100

Table 4. Dimensions and Cronbach's  $\alpha$  coefficient of environmental and health literacy questionnaire.

Dimension	Number of entries	Cronbach's $\alpha$
Basic idea	14	0.592
Basic knowledge	17	0.553
Basic skills	16	0.641
Overall questionnaire	47	0.814

Table 5. Residents' environmental and health literacy score of Wudang Mountain Special Zone.

Dimension	Score	Mastering conditions ( $\geq 70$ )	
		Number of people	Rate (%)
Basic concept	68.80±16.81	482	53.44
Basic knowledge	51.97±15.43	98	10.86
Basic skills	67.84±16.70	458	50.78
Total literacy score	62.87±13.67	303	33.59

basic ecological environment and health literacy, which is generally low. Among them, the classification literacy levels of basic concepts, basic knowledge and basic skills are 53.44%, 10.86% and 50.78% respectively. It can be seen that the low classification literacy level of basic knowledge is an important reason for the low overall level of people's ecological environment and health literacy in Wudang Mountain Special Zone. In 2015, the Former Ministry of Environmental Protection of China carried out a sampling survey of environmental and health literacy in Beijing, Hubei province and Gansu province. The results showed that the level of residents' environmental and health literacy was 8.41%. In 2018, the Ministry of Ecology and Environment of China conducted a sampling survey on environmental and health literacy in 15 provinces, autonomous regions and municipalities directly under the central government. The results showed that the level of residents' environmental and health literacy was 12.5%. Some scholars selected samples from Hubei province in 2018 for analysis, the results of which showed that the environmental and health literacy level of residents in Hubei province was 18.2%. It can be seen that

Table 6. Comparison of environmental and health literacy of residents in Wudang Mountain Special Zone in different demographic variables.

Gender	Number of people	Basic concept	Basic knowledge	Basic skills	Total literacy score
Male	462	69.83±16.67	53.14±15.76	69.11±16.91	64.03±13.81
Female	440	67.73±16.91	50.74±14.99	66.51±16.38	61.66±13.44
	T value	1.876	2.345	2.344	2.607
	P value	0.061	0.019*	0.019*	0.009**
Age					
16-24	296	72.72±16.30	54.35±15.18	72.58±16.58	66.55±13.44
25-30	150	71.73±15.45	54.38±14.10	69.89±15.13	65.33±12.13
31-40	220	67.64±16.17	52.09±15.37	66.41±15.97	62.05±13.12
41-50	152	64.86±17.30	48.13±16.07	62.65±16.37	58.55±13.66
51-60	58	60.61±17.31	45.80±15.46	60.57±16.21	55.66±13.71
61-69	26	58.65±15.52	46.15±13.69	60.79±18.47	55.20±13.04
	F value	11.26***	6.82***	12.35***	14.29***
	P value	0.00	0.00	0.00	0.00
Education					
Primary school or below	56	52.57±17.13	42.08±16.68	52.48±15.77	49.04±13.97
Junior high school	180	61.56±16.14	44.73±14.82	61.36±15.41	55.88±12.69
Senior high school /technical school	274	68.90±15.29	52.13±14.35	68.74±15.43	63.26±12.15
junior college	129	71.99±15.00	55.58±13.65	69.04±16.04	65.54±12.02
undergraduate	256	75.62±15.34	57.33±14.51	74.04±15.98	68.99±12.36
Master or above	7	73.66±16.32	48.26±18.75	73.27±10.81	65.07±13.55
	F value	31.04***	22.62***	25.45***	38.97***
	P value	0.00	0.00	0.00	0.00
Average monthly household income					
<3000	497	68.30±16.93	51.11±15.31	67.79±17.03	62.40±13.84
[3000-6000)	342	69.86±16.39	53.29±15.36	68.41±16.02	63.85±13.32
[6000-9000)	53	66.63±18.94	50.69±15.27	64.33±17.24	60.55±14.31
≥9000	10	69.38±12.04	56.22±16.11	69.35±19.78	64.98±13.42
	F value	0.90	1.72	0.94	1.37
	P value	0.44	0.16	0.42	0.25

Note: \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

although the level of ecological environment and health literacy of residents in Wudang Mountain special Zone is not high, it is much higher than other places in China. As we know, since 2018, the Ministry of Ecology and Environment of China has selected different types of regions as samples to carry out eco-environment and health management pilot projects. In 2019, the Ministry of Ecology and Environment designated Wudang Mountain Special Zone in Shiyan City, Hubei Province

as the second batch of national eco-environment and health management pilot areas. In the pilot areas, the author tries to explore the experience of system construction, policy coordination and environmental health monitoring and assessment with environmental health risk management as the core, so as to promote the coordinated development of environment and health. After being approved as the pilot area, Wudang Mountain Special Zone ensured public health into the

whole process of ecological environmental protection work in all links, combining closely the environmental health management and tourism development of Wudang Mountain, implementing publicity and education widely on environmental and health knowledge for the public, and carrying out environmental protection experience activities regularly. Therefore, we believe that the improvement of residents' environmental and health literacy level in Wudang Mountain Special Zone is inseparable from these efforts. This also proves the success of China's environmental and health management pilot program.

The residents' ecological environment and health literacy level showed significant differences in gender, age, education level and other groups. There is little literacy level difference between male and female, with male slightly higher than female, but no difference in basic concept. This shows that male and female residents in Wudang Mountain Special Zone have basically the same attitude towards environment and health. There were significant differences in the total score and dimensions of environmental and health literacy among residents of different ages, and the higher the age, the lower the score. This shows that young people attach more importance to and pay more attention to environment and health, and are willing to willing to acquire and accept environmental and health knowledge, which is related to young people's relatively higher level of knowledge, broader vision, and more emphasis on personal life quality. The higher the level of education, the higher the score of environmental and health literacy, which is in line with social expectations, as well as relating to the complexity of environmental and health knowledge and the difficulty of learning. There was no difference in the scores of environmental and health literacies among residents with different average monthly income levels, indicating that the relationship between environment and health and residents is not different in regard to the level of wealth of the family. Environment and health are the most basic needs of residents and the most universal welfare.

The low level of residents' ecological environment and health literacy is certainly not conducive to environmental and health management. It can be seen that environmental health literacy plays a leading, fundamental and subjective role in the discovery, identification, cognition, appeal of environmental health problems as well as the information, participation, evaluation and promotion of environmental and health management, which is of great significance for promoting ecological environment and health management. The lack of residents' cognition, knowledge reserve and operational skills on environment and health is not conducive to the development of individual environmental protection behaviors, which is bound to affect the enthusiasm, scope and effect of environmental and health management participation. It will be difficult for the environmental and health management to arouse the

attention and support of a wider range of residents, and sequentially the management efficiency will be greatly reduced. At the same time, the low level of residents' environmental and health literacy is not conducive to the formation of healthy behaviors, which will increase individual health risks and further increase the burden of disease in society, hindering risk communication and risk sharing [61].

## Conclusions and Recommendations

Strengthen the education and publicity of environmental and health knowledge. On the basis of regular monitoring of environmental and health literacy, we should promote the popularization of environmental and health knowledge. In the survey, there were still many residents who could correctly understand the basic knowledge that a good environment is the basis of survival and the guarantee of health, which indicated that although the basic concept level of residents' environmental and health literacy was relatively high, it still needed to be strengthened. In accordance with the principles conducive to the acceptance of residents, the government should focus on issues that residents face and are concerned about in daily life, such as air, water, soil, noise and radiation. We should give play to the basic role of school education, and promote environmental and health education coherently and systematically. In terms of environmental and health education, the focus in primary schools should be on the education of the beauty of nature, which guides children to cultivate the instinctive emotion of loving nature, getting close to nature and caring for nature. The middle schools should concentrate on the education of the relationship between man and nature, which guides teenagers to correctly view the ability and value of man, the potential and inability of nature, learn to respect nature and let nature take its course, and "admit the infinity of nature and the limitation of man himself". The colleges should place particular emphasis on environmental and health knowledge and practical education, guiding young people to establish a correct view of nature, ecology and health, as well as improving the action capacities and skill levels related to environment and health. Promote public rational understanding of the relationship between environment and health, improve risk communication efficiency and public event response ability. In terms of the scores of specific questions, the rate of correct answers to basic scientific knowledge such as risk and exposure was low. If the public generally master the basic scientific knowledge that can help correctly judge environmental and health issues, it will help improve the efficiency of risk communication, clarify and avoid rumor spreading, and resolve social problems related to the environment such as not in-my-back-yard syndrome. Take exposure as an example. There is no harm without contact, and the size of the impact is related to the time and

amount of exposure. In addition, risks are always with us, from which no one can escape. We can only try to control risks within a relatively safe range, and a relatively safe state is an acceptable level of risk. Risk is not terrible, but the key is how to understand the risk, and how to prevent the risk to keep the impact on health at an acceptable level. Therefore, it is necessary to strengthen communication on environment and health risks in a way that is easy to understand, accept and participate in, guide rational understanding of risk factors and improve awareness and ability of risk prevention.

Enhance residents' sense of value in participating in environmental and health management. Ecological environment management and health management should be more closely cooperated, the internal connection and mutual influence of ecological environment and population health be paid attention to, and unified, coordinated and integrated governance be adopted. The concept of health first should be firmly established to ensure and the health of the population as a value concept and working principle of environmental construction, pollution prevention and control should be promoted. [67] In population health management, more attention should be paid to the identification and prevention of environmental pathogenic factors, and the prediction and disposal of environmental health risks should be strengthened. We should promote joint supervision, law enforcement and research on environment and health, strengthen information exchange and the sharing of resources, platforms and technologies. It is essential to actively develop social organizations for environment and health [68, 69] in order to guide people to actively participate in the investigation and supervision on the environmental health, decision-making of environmental and health management, the popularization of scientific knowledge of environment and health, scientific research on environmental health, and public interest litigation on environmental health issues. We aim at providing a broad field for people to participate in environmental and health management, improve people's environmental and health literacy in the process. We will strengthen the application of environmental protection practices for residents, value personal participation in garbage sorting, garbage recycling, afforestation, purchase of energy-saving products, and enhance value experience and sense of gain from environmental health. We will also strengthen the conversion of residents' environmental protection practice value, value personal participation in garbage sorting, garbage recycling, afforestation and purchase of energy-saving products, and enhance the experience and sense of acquisition of environmental health value. Therefore, based on the overall improvement of residents' ecological environment and health literacy level, a broad social rational consensus can be formed so that residents can have a higher understanding, greater support and more participation in environmental and health work. This

research was carried out in Wudang Mountain Special Zone, Shiyan City, Hubei Province and maybe use for this zone or some same type of regions.

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### Conflicts of Interest

The authors declare no conflict of interest.

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