

Study on Air Quality Perception of Residents in Valley Cities

Wen Liu, Hai-Li Zhao* and Ya-Li Zhang

School of geography and environmental science, northwest normal university, lanzhou

E-mail:1186362339@qq.com

E-mail: zhl.grase@163.com

E-mail:1907665262@qq.com

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Abstract. As the direct sensor of air quality, the public's perception of air quality is an important basis for the government to make air pollution control decisions. Taking Lanzhou residents as research objects, 521 questionnaires were sent to four urban districts to obtain relevant data on environmental perception and to study their perceptions of changes in air quality, aiming to provide decision-making for effective policy and pollution control measures. In order to achieve the purpose of improving air quality. The results show that: (1) There is a significant correlation between residents' age and air quality concern, change perception, impact perception and environmental participation. The overall perception of residents aged 36-55 is the most obvious; (2) the length of residence and air The perception of quality change is significantly correlated with the perception of impact. The longer the residence time, the more obvious the perception. (3) The degree of education of residents is significantly related to the attention of air quality, perception of change, and perception of influence. The higher the education, the more obvious the perception. (4) Residents' occupations are significantly related to air quality attention, change perception, impact perception and environmental participation. The perceptions of teachers and medical staff are most obvious. Combined with the perception survey, it proposes reasonable measures to provide reference for reducing the impact of air quality changes on residents and creating a good urban environment.

1. Introduction

The current urban air pollution problem has become an important obstacle to urban development. Protecting and improving the quality of urban air environment is an important part of the sustainable development of urban social economy [1]. According to a report released by the World Health Organization (WHO) in 2016, more than 90% of the world's population lives in areas with severe air pollution, and nearly 3 million deaths each year are related to outdoor air pollution. The National Environmental Analysis of the People's Republic of China, released in January 2013, shows that the deterioration of China's air quality has resulted in higher social costs. For example, based on disease cost estimates, the annual economic losses caused by air pollution are roughly equivalent to the GDP of the year. 1.2%, and based on the willingness to pay, the economic loss is as high as 3.8% of GDP in that year, and the equivalent of GDP is 500,000 yuan. The loss of 1% is about 500 billion. It can be seen that air pollution has seriously affected Residents' health, economic and social development, and government governance of air pollution are imminent [2].

So far, the research on residents' perception has focused on the subjective perception of the living environment and ecological environment and its changes and the perception of tourists' perception of the tourism environment. In the former study, foreign scholars generally select a pollutant such as (NO₂) as a measure of air pollution, and use questionnaires to explore the relationship between subjective well-being and environmental pollution[3-4]. From the perspective of health, the influencing factors of environmental perception[5-6] prove that there is a negative correlation between air pollution and residents' happiness. Domestic scholars' environmental perception research focuses on the environmental perception of farmers in ecologically fragile areas[7-8], using big data[9] to discuss the impact of air quality and residents' emotions; in the study of tourism environment perception, advocate the concept of sustainable development From the perspective of

tourists, explore the influencing factors of perception[10], provide reference suggestions for development of scenic spots[11], explore tourists' perception of tourism[12], improve environmental awareness and promote ecological harmony [13-14] .

In summary, it is advisable to evaluate the air quality condition from a perceptual perspective. However, current research rarely pays attention to the relationship between air quality and residents' environmental perception. Based on this, taking Lanzhou City as an example, through questionnaire survey, the local residents' perception of air quality is discussed from the aspects of air quality attention, impact perception, change perception and participation in environmental protection activities, with a view to environmental monitoring in Lanzhou City. Provide theoretical support with environmental governance.

2. Research Area

Lanzhou City is located in the central part of Gansu Province (36°03'N, 103°40'E). Its administrative scope includes five districts and three counties. The urban area is mainly concentrated in the valley basin. The terrain is long and narrow, the terrain is high in the west and low in the east. The Yellow River runs through the city from west to east, forming a gorge and basin.

3. Data Sources and Research Methods

3.1. Data Source

Through the questionnaire survey of residents in Chengguan District, Qilihe District, Xigu District and Anning District of Lanzhou City, relevant research data were obtained. In order to ensure that the data has a certain representativeness, a typical sampling was taken, a total of 590 questionnaires were submitted, and 560 questionnaires were retrieved. After eliminating the incomplete information samples, a total of 521 questionnaires were used, and the questionnaire efficiency reached 93.03%, meeting the research needs (Table 1).

Table 1. Basic information of resident samples

Attributes	Characteristic	proportion%
Sex	male	43.2
	Female	56.8
age	Under 18 years old	4
	18~35	55.1
	36~55	33.4
	56~69	5
	Over 70 years old	2.5
	Time of residence	
Educational level	Under 3 years	17.9
	3~5	16.3
	5~10	17.1
	over 10 years	48.8
	illiteracy	0.4
	primary school	3.1
	junior high school	6.9
Caree	High school or secondary school	18.6
	College/Bachelor	53.7
	Master degree and above	17.3

Attributes	Characteristic	proportion%
	Worker	12.1
	teacher	11.7
	student	15.4
	Self-employed persons	9.4
	Medical staff	14.4
	Farmer	1.3
	State-owned enterprises, employees of public institutions	23
	other	12.7

3.2. Research Methods

The Homogeneity of variance test is a method for checking whether the population variances of different samples are the same in mathematical statistics[15], which is an important prerequisite for analysis of variance [16]. To measure the relationship between resident attributes and perception, by constructing the following mathematical model (Table 2).

$$P_{mj} = \frac{1}{n} \sum_{i=1}^n P_{mij}$$

Where: P_{mj} is the assignment of the m perception of the i resident of the j variable, n is the number of residents of the j variable, and P_{mij} is the m perception index of the resident of the j variable.

Table 2. Measurement indexes and values of air quality perception

	measure	Assignment
Air quality attention	Q1.How concerned about air quality?	more concerned with =3, generally =2, attention = 1
Air quality impact perception	Q2.How much does it affect your health? Q3.How much does it affect the appearance of the city?	more affected = 3 is generally = 2, does not affect = 1
Air quality change perception	Q4.What is the air quality situation in Lanzhou in recent years?	better = 3, generally = 2, worse = 1
Environmental activity participation	Q5.Reporting polluted air behavior to relevant units?	more likely to be =3, generally =2, impossible=1

4. Results and Analysis

4.1. Analysis of Residents' Air Quality Concerns

Investigate residents' attention to air quality by asking questions such as “How concerned about air quality?”, the proportion of which is 85.99%, and the degree of concern is high, which is related to the frequent dust and haze weather in Lanzhou in recent years; Mobile media, television and other media have also increased the attention of residents to a certain extent (Table 3)..

Residents of different ages, education levels, and occupations have significant differences in air quality concerns. The focus is mainly on middle-aged people aged 36-55. Middle-aged is a crucial period of life, and is in the dangerous period of life and high-risk life[17]. Middle-aged people between the ages of 40 and 50 are the backbone of society and continue to withstand high-intensity work and mental stress for a long time. With the increase of age, the functions of various organ systems in the middle-aged human body begin to decline slowly, and the disease resistance is also reduced. The incidence of chronic respiratory diseases such as chronic bronchitis increases with age,

and the climate and spring and winter seasons in Lanzhou are prone to occur. The smog and dust storms seriously threaten the health of residents, and residents pay attention to health care; the survey of residents below the primary school level is mostly older people over 70 years old, paying attention to health, so the proportion of attention is high. The junior and senior high school students are mostly students in the school, and the learning tasks are heavy, so the proportion of attention is small. The special (this) and master's degree or above have high requirements on the environment, high attention to health, and therefore high attention; teachers, Medical staff and employees of enterprises and institutions are highly concerned. Teachers generally suffer from diseases related to air changes such as pharyngitis and bronchitis; medical staff are overloaded for a long time, combined with the special nature of hospital work, and more emphasis on health; The air quality of enterprises and employees during the commute to work during the nine-to-five commute period has changed greatly, so the degree of attention is high.

Table 3. Levene statistics and F value table of residents' air quality perception

		Age	Time of residence	Educational level	Career
Q1	Levene statistic	2.453(0.045)****	0.407(0.748)	3.788(0.002)****	2.256(0.017)****
	F	3.959(0.004)****	1.551(0.201)	5.170(0.000)****	4.916(0.000)****
Q2	Levene statistic	6.230(0.000)**	2.228(0.084)**	6.440(0.000)	1.911(0.056)****
	F	7.156(0.000)**	2.708(0.045)**	3.317(0.006)	3.139(0.002)****
	Kruskal-Wallis statistic	(0.000)**			
Q3	Levene statistic	0.741(0.565)*****	0.756(0.519)	2.692(0.021)****	2.424(0.014)
	F	4.366(0.002)*****	1.430(0.233)	4.332(0.001)****	1.850(0.066)
Q4	Levene statistic	1.324(0.260)****	1.185(0.315)**	1.159(0.329)****	2.756(0.005)**
	F	4.928(0.001)****	4.653(0.003)**	5.596(0.000)****	1.704(0.095)**
	Kruskal-Wallis statistic				(0.019)**
Q5	Levene statistic	0.574(0.682)*****	0.868(0.458)	2.068(0.068)	0.811(0.593)****
	F	5.197(0.000)*****	2.201(0.087)	2.166(0.057)	3.163(0.002)****

P value in parentheses, ***** is significant at 0.001 level, **** is significant at 0.005 level, ***0.01 is significant at level, ** is significant at 0.05 level

4.2. Analysis of Perceived Air Quality Change Perception

There are significant differences in residents' perceptions of change in different age groups, different residence times, and different levels of education. The analysis found that the proportion of improvement in perception increased in a stepwise manner. Residents aged 18 to 35 perceived the deterioration of air quality. Most of the migrant workers in the middle of the country believed that Lanzhou had low vegetation coverage and often suffered from dusty weather. The health status of residents over the age of 36 has declined, they are sensitive to air pollution, and they have experienced the transformation of "Lanzhou Blue", so they have a good attitude. Overall, residents' perceived air quality improved better than deterioration, indicating that Lanzhou air quality improvement has been recognized by residents; air quality improvement perception ratio and perception index increased simultaneously, and the deterioration rate decreased in turn. Residents with a residence time of less than 5 years have a small proportion of improvement in perception, and a higher proportion of improvement perceptions over 5 years (Table 7). Looking at the Lanzhou

Environmental Bulletin data, it is found that the number of fine days in Lanzhou has increased year by year in the past 10 years, so the longer the residence time, the greater the proportion of improvement; in general, the higher the education level, the higher the sensitivity of residents to the environment. During the investigation, it was found that most of the junior high school education level was below the local residents, and they were entering the middle-aged and old ages. They lived for a long time and witnessed the change of air quality in Lanzhou City. The ratio of perceived improvement was high. Undergraduate and master's degree or above, on the air The quality of attention is high, the higher the environmental requirements, the greater the concern for health, so the air quality is evaluated strictly, and the deterioration rate is obvious; the perceived deterioration is mainly 23% of the teachers and 25.3% of the medical staff. Air quality perception is related to the profession in which it is engaged. The improvement of perception is mainly the employees of public institutions, enterprises and institutions pay attention to the greening of the unit environment, and the working environment is continuously improved. Therefore, the proportion of employees in enterprises and institutions is higher.

4.3. Persistence Analysis of Residents' Air Quality Impact

Residents under the age of 35 have high pressure to study and work with low environmental concerns, so they believe that air quality has a low impact on health. For residents aged 36-55, they pay attention to health, and therefore think that air quality has a great impact on health. Residents of all ages believe that air pollution has an impact on the appearance of the city, indicating that the Lanzhou Municipal Government has implemented the vehicle limit number for the creation of a civilized city. The three-pack policy has played a role in the front; the impact on the health of residents with different living times is analyzed. It is indicated that residents with different residence times have significant differences in impact perception. The analysis found that the longer the residents lived, the stronger the dependence on the local environment, the more worried about self-health; the analysis of the perception of the health effects of different occupational residents found that the perceptions of different occupations were different, mainly focusing on teachers, medical staff and Enterprises and employees, they both pay attention to physical health and the city appearance.

4.4. Analysis of the Participation of Residents in Environmental Protection Activities

Through the issue of “reporting the possibility of polluting air behavior to relevant units”, the participation of residents in social responsibility and environmental protection activities is measured. Students actively participate in social services, but social service activities are less sustainable, so the participation rate is lower; age growth, mature thinking, strong sense of social responsibility, and increased participation. The analysis found that the environmental protection participation of the employees of state-owned enterprises is high, and the initiative of the company to assume environmental responsibility helps to increase awareness of the environmental protection cause. Under the impetus of the low-carbon economy concept, the awareness of environmental awareness has prompted its active participation, so participation is high. The participation rate is large.

5. Conclusions and Recommendations

5.1. Conclusion

1. The age of residents and the perceived variables are significantly related to attention, cognition, change perception, risk perception and environmental participation. Especially in the middle-aged population between the ages of 36 and 55, the function of the body and organ system began to slowly decay, and began to focus on health and seek physical health.

2. The residence time is significantly correlated with the change perception and influence perception in the variable. The longer the living time, the more obvious the perception.

3. Residents' cultural level is significantly correlated with the degree of attention, perceived perception, and perceived perception in perceived variables.

4. Career and perceptual variables are significantly related to attention, cognition, change perception, impact perception and environmental participation. Teachers' occupational diseases, the working environment of medical staff and the working hours of enterprises and employees require them to pay attention to changes in air quality, so the change perception is obvious.

5.2. Suggestions

Local governments play a leading role in the prevention and control of air pollution. Pollutant emissions from production activities are the main source of air pollution, and the public is an indispensable link in air pollution control[18]. Solving the problem of air pollution requires the joint efforts of the government, enterprises and the people. The Lanzhou Municipal Government has first defined its responsibilities, formulated a strict environmental comprehensive remediation plan, and monitored the air quality in real time to improve the monitoring accuracy. For industries with high consumption and serious pollution, increase the fines, implement the principle of “who pollutes who is governed”, and actively encourage foreign-invested enterprises with high-tech and high value-added clean production to settle in Lanzhou. Enterprises must constantly innovate technology, adjust the industrial structure, and ensure strict implementation of relevant environmental protection laws. For the people, they should consciously assume the necessary social responsibilities, change their consumption concepts and models, actively participate in environmental protection, implement the environmental concept of “green priority, low carbon priority” and advocate a green and low-carbon lifestyle.

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