

A Study on the Influence Mechanism of Rural Built Environment and Villagers' Health Level: A Case Study of Sunduan Street in Shaoxing City

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Abstract: Healthy rural construction is the only way to carry out "Healthy China Strategy" and "Rural Revitalization Strategy". Studies have shown that common chronic disease risk factors are closely related to life, production mode and environment. Great achievements have been made in rural construction in recent years, but there is still a certain gap between countrysides and cities in terms of infrastructure construction and supporting public service facilities. Clarifying the interactive relationship between the spatial elements of the built environment and the health behaviors of rural residents will be an important basis for future healthy rural construction. From the perspective of residents' temporal and spatial behavior, this paper takes Sunduan Street of Shaoxing City as an example to obtain relevant indicators such as villagers' self-rated health through questionnaires and interviews. Ten villages, including Fanpu Village, Yulin Village and Cuntou Village, are taken as research objects. Based on 1378 valid questionnaires, the interactive relationship between the spatial elements of rural built environment and residents' behaviors was discussed. Through the establishment of the "individual-village level" influence index system, the regression analysis was conducted on the self-rated health results of villagers and the indicators of rural built environment. The research results showed that the characteristics of social activities affecting the villagers' health perception included sports and fitness activities, social interaction activities and cultural and performing arts activities. The coverage of village cultural facilities, road traffic and sports and fitness places are the main built environment factors that affect the occurrence of villagers' health behaviors. Finally, based on the results of quantitative analysis, this study discusses the enlightenment to the construction of healthy villages in order to promote the development of healthy villages.

1. Introduction

Healthy rural construction is the only way to carry out "Healthy China strategy" and "Rural Revitalization Strategy". In 2022, China set a further requirement for solid and steady rural development. This indicates that China's rural revitalization has entered a new stage, and the

construction of rural living environment is no longer limited to ensuring the basic needs of villagers, but to "make rural areas a beautiful home to live and work in peace and contentment". Studies on the global burden of disease show that common chronic disease risk factors are basically closely related to life, production mode and environment[1]. The awareness rate, treatment rate and control rate of chronic diseases in rural areas are lower than those in urban areas, the health needs of rural residents cannot be effectively guaranteed, there is a certain gap between urban and rural health environment and health level, and the construction of healthy countryside has become an urgent problem to be solved by the strategy of "Healthy China". Since the Healthy China Strategy and Rural Revitalization Strategy were put forward, relevant academic and practical research has been a hot topic. From the perspective of healthy China strategy, the "Healthy Community Evaluation Criteria" and the "Health Impact Assessment Theory and Practice Study" issued by the National Health Commission have carried out relevant practice and research in urban construction, community governance, transportation planning and other aspects, but there are few studies at the rural level, and because there has been a great difference between urban and rural development in the long-term. There are differences in production mode, built environment, population characteristics and communicative behavior. Therefore, the experience of Healthy China Strategy in urban communities cannot be directly used to solve the problem of healthy rural areas. From the perspective of Rural Revitalization Strategy, relevant studies focus on architectural design, economic organization, infrastructure construction, etc., while few studies focus on the improvement of villagers' health perception by rural built environment indicators. Under the circumstance that the COVID-19 outbreak in 2020 will inevitably affect the development of agriculture and rural areas, it is obviously an urgent practical requirement to promote the construction of healthy villages.

In terms of research results on healthy human settlements, Lan Wang and other scholars built a quantitative health impact assessment method system for Chinese urban planning schemes on the basis of sorting out existing health impact assessment methods[2]. Through ArcGIS spatial analysis, Chai Yanwei and other scholars found that compared with the objective built environment, residents' physical and mental health conditions were more likely to be affected by community integration factors such as community social network and community satisfaction[3]. Shaohua Tan et al. proposed that the perception of air pollution and water pollution had an impact on the regular physical activity of rural residents[4]. Based on the existing research, this paper distributed questionnaires according to the field survey, and obtained 1397 questionnaire results from 10 villages in Sunduan Steet, Shaoxing City. Through the screening of valid questionnaires, 1378 villagers from 10 villages in Shaoxing City were selected as research objects, and the regression model of individual level and village level was constructed to study the correlation between villagers' health level and rural built environment factors. This study aims to solve the following questions: (1) Which indicators of individual social characteristics of villagers are related to their health perception level? (2) Which village built environment indicators are related to the villagers' health perception level? (3) How to improve the rural health level? The above research questions will provide a more comprehensive perspective to understand the influencing factors of rural health, and help relevant planners to formulate strategies and improve the rural health level from different perspectives. At the same time, the Healthy China Strategy can be further implemented to provide theoretical and practical basis for the construction of healthy villages.

2. Data and Methods

Through a review of the existing literature on healthy villages and communities, it is found that the differences in built environment will affect the villagers' social interaction, cultural activities,

physical fitness and other behaviors, thus affecting the health level of the villagers. Therefore, this paper proposes a research framework as shown in Figure 1, which takes the health level of villagers as the dependent variable of this study, the indicators related to the built environment of the rural layer as the independent variable, and the variables of individual social characteristics in the individual layer as the control variable. When selecting the independent variables of the regression model, the independent variables that have an impact on self-rated health were first obtained according to the analysis of variance, and then the corresponding health impact indicators were selected from the village level and the individual level for regression analysis.

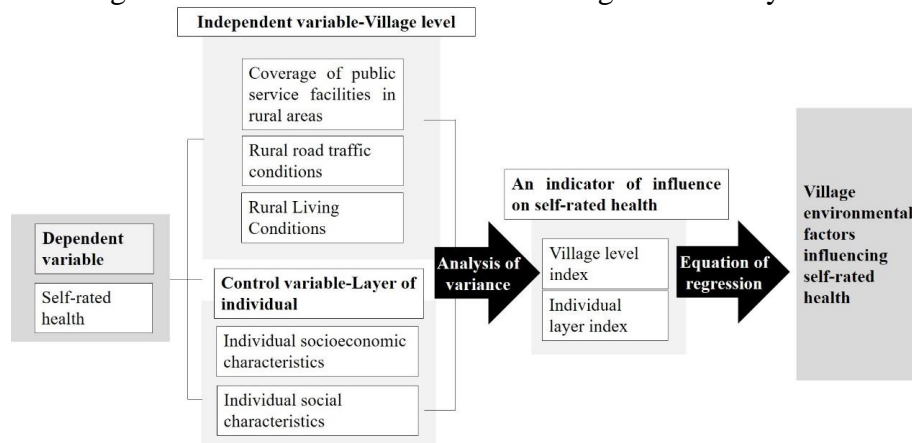


Figure 1: Research framework. Source: Illustrated by the author.

2.1. Data Sources

In this paper, objective evaluation indexes were obtained through field investigation of 10 villages in Sunduan Street, Shaoxing City, village planning and village records, and self-rated health scores and subjective evaluation indexes were obtained through questionnaires and interviews with villagers. This study selected 10 villages as the research object: Fanpu Village, Huangfuzhuang Village, Anqiaotou Village, Yulin Village, Cuntou Village, Xiaoku Village, Zhangjia Village, Qianshuangpeng Village, Houshuangpeng village and ZhenZhudian Village. The sample size of the questionnaire was 1397. This paper links data at the individual level with data at the village level, removes incomplete response samples, and finally obtains 1378 valid samples from 10 villages.

2.2. Study on Variable Selection

2.2.1. Health Conditions

Self-rated health can truly reflect individual health status and effectively predict mortality and other objective health indicators [5]. In the field of health city research, more and more studies are conducted on self-rated health [6]. Likert Scale is a commonly used measure of self-rated health. Foreign scholars Laaksonen et al. explored the impact of social and economic conditions on Helsinki residents' health perception through self-rated health [7]. Dunn used self-rated health to explore the impact of housing conditions on residents' self-rated perception [8]. In this study, the self-rated health of villagers was measured by the following questions: "How do you feel about your healthy level?", the questionnaire results were divided into five levels: "very poor =1, relatively poor =2, average =3, fairly good =4, very good =5", and 1-5 respectively represented the self-rated health from low to high (Table 1).

Table 1: Assignment rules for each research variable.

Hierarchy of variables	Indicators		Method of measurement
Dependent variable	Self-rated health		Very poor =1, relatively poor =2, fair =3, fairly good =4, very good =5
Individual layer control variables	Gender		Male =1, female =2
	Age		18-29 years old =1, 30-44 years old =2, 45-59 years old = 3,60 years old and above =4
	Job		Village cadre =1, student =2, enterprise or factory worker =3, farming =4, self-employed =5
	Average monthly earnings		Less than 1000 RMB = 1,1000-3000 RMB= 2,3000-5000 RMB= 3,5000-8000 RMB = 4, more than 8000RMB =5
	Family demography		1 person =1, 2 person =2, 3-4 person =3, 5-6 person =4, more than 6 person =5
Individual layer control variables	Leisure and Entertainment Activities	Frequency	Less than 1 activity in a week =1 1-2 activities in a week =2 3-4 activities in a week =3 5-6 activities in a week =4
		Intensity	Activity duration less than 15 minutes =1, 15-30 minutes =2, 30-60 minutes =3, and more than 60 minutes =4
	Physical fitness activities	Frequency	Less than 1 activity in a week =1, 1-2 activities in a week =2, 3-4 activities in a week =3, 5-6 activities in a week =4
		Intensity	Activity duration less than 15 minutes =1, 15-30 minutes =2, 30-60 minutes =3, and more than 60 minutes =4
	Social interaction Activities	Frequency	Less than 1 activity in a week =1, 1-2 activities in a week =2, 3-4 activities in a week =3, 5-6 activities in a week =4
		Intensity	Activity duration less than 15 minutes =1, 15-30 minutes =2, 30-60 minutes =3, and more than 60 minutes =4
	Cultural and Performance Activities	Frequency	Less than 1 activity in a week =1, 1-2 activities in a week =2, 3-4 activities in a week =3, 5-6 activities in a week =4
		Intensity	Activity duration less than 15 minutes =1, 15-30 minutes =2, 30-60 minutes =3, and more than 60 minutes =4
Independent variable of rural layer	Rural built environment	Road Traffic Conditions	Road hardening: presence of water =1, not all hardening =2, all hardening =3 Penetration rate of road lighting facilities: lighting coverage of main roads in the village < 100%= 1,100 %=2 Road route density: "Total length of village roads/village area" (KM/KM) Road density < 1.5=1, road density between 1.5 and 3.0= 2, road density > 3.0=3
		Public service facilities	Commercial service facility coverage: "Village population/Number of commercial facilities" 500 or more people/place = 1,300 -500 people/place = 2,300 people/place =3 Educational service facility coverage: "Village population/Number of educational facilities" 1000 people or more/place = 1,1000 people or less/place =2, no facilities =0 Health-care facility coverage: "village population/number of health-care facilities" 1000 people or more/place = 1,1000 people or less/place =2, no facilities =0 Sports venue coverage: "Village population/Number of sports venues" 500 or more people/place = 1,300 -500 people/place = 2,300 people/place =3 Coverage of cultural facilities: "Village population/Number of cultural facilities" 1000 people or more/place = 1,500-1000 people/place = Less than 2,500 people/place =3
		Living Conditions	Building density: "Building base area/village construction land area" Building density < 25%=3, building density 25%-35%=2, building density > 35%=1 Yard space Rate: "Yard area/residential area" Yard space rate < 25%=1, yard space rate 25%-50%=2, yard space rate > 25%=3

2.2.2. Measure of Health Behavior Indicators at the Individual Level

According to the social ecology model, human health is influenced by individual factors such as "age, gender and income", environmental factors such as "built environment and social environment", and social networks such as "family and community"[9]. Domestic scholar Jie Yang et al. discussed the influence mechanism of community built environment and social network on residents' self-rated health[3]. Individual social activities and economic characteristics not only affect individual health outcomes, but also can be used as mediating factors or moderating factors to affect rural residents' health. Therefore, gender, age, monthly income, family size and occupation are selected as individual socioeconomic characteristics in this paper. The frequency and intensity of villagers' leisure and entertainment activities, sports and fitness activities, social interaction activities and cultural and performing arts activities were selected to reflect individual social activities. The scoring rules are shown in Table 1. The higher the score, the higher the frequency and intensity of the activity.

2.2.3. Village Level Health Dimension Indicator Measure

The indicators of rural built environment factors affect the health of villagers, including public service facilities, road traffic conditions, landscape greening conditions and so on. By studying the natural environment, communication environment, travel environment and living environment of villagers, Qingyuan and other scholars found that the spatial form of villages, street traffic capacity and the degree of connectivity of buildings affect the health perception of villagers[10]. Based on the existing studies, three components of rural road traffic, rural public service facilities coverage and living conditions were selected to reflect the health level of rural built environment. Road traffic conditions are expressed in terms of road hardening rate, road lighting and road density. The coverage of rural public service facilities is represented by cultural facilities, commercial facilities, educational facilities and sports facilities. Residential status is expressed by building density and courtyard space rate. The scoring rules are shown in Table 1. The higher the score, the healthier the village.

2.3. Analytical Method

The main objective of this paper is to explore the impact of rural environmental elements on villagers' health perception. According to the research framework, this study first used ANOVA to explore the relationship between the built-up environmental indicators of rural layer and the social characteristics of individual layer and rural health, and summarized the indicators with significant differences. Then, this study constructed a Logistic statistical regression model, in which the dependent variable was the self-rated health score of villagers, the independent variable was the components of the built environment of the village, and the control variable was the social characteristic index of the individual level. VIF values in the model are all less than 5, so there is no multicollinearity problem.

3. Results

3.1. Association between Individual Level Control Variables and Rural Health

The valid samples of this study were 1378 villagers from 10 villages, including 621 males and 757 females. The average age of the sample was about 50 years old. Individual socioeconomic characteristics reflect the occupation, income, and family structure of different villagers, which are important factors affecting the health level of individuals[11]. At the same time, the characteristics

of individual social activities, such as fitness and social communication, also affect the physical health of villagers to a certain extent. Therefore, the characteristics of villagers' social economy and social activities may play a mediating or moderating role in the impact of rural built environment on villagers' self-rated health [12]. This study first used ANOVA to test the relationship between different social characteristics of villagers and self-rated health. The included variables of villagers' social characteristics include gender, age, occupation, family size, monthly average income, frequency and intensity of fitness activities, leisure and entertainment activities, cultural performing arts activities and social interaction activities.

3.1.1. Social and Economic Characteristics: Age, Occupation and Monthly Income were Related to Villagers' Health Perception

In terms of individual socioeconomic characteristics, we obtained the following analysis results (Table 2): First, there were significant differences in the self-rated health level of villagers at different ages ($F=9.904$, $p=0.000$). The older the villagers were, the lower the self-rated health score was. This is consistent with the existing sociological conclusion that with the growth of age, the villagers' physical functions decline, and thus their self-rated health scores are low. Second, there are significant differences in the self-rated health level of villagers with different occupations ($F=3.976$, $p=0.001$). The self-rated health level of village cadres, enterprises or factory workers is higher, and the self-rated health level of villagers mainly working in agriculture is the lowest. It is speculated that the reasons may be that the workers in the system have higher job stability, relatively perfect social insurance, and regular physical examination service every year. These factors all contribute to improving the villagers' perception of health level. Relevant studies also show that the higher the occupation class of residents, the more likely they are to have access to insurance, sick leave and preventive medical services, so their actual health level is higher [13]. Third, there is a significant difference between villagers' average monthly income and self-rated health ($F=11.011$, $p=0.000$). With the increase of villagers' average monthly income, their self-rated health level also increases. The possible reason is that with the increase of villagers' income, their living standards have also been improved, and they may purchase additional critical disease insurance or medical disease screening services to improve their perception of health level. In addition, gender and family population did not have significant differences in self-rated health, so they were not included in the subsequent regression analysis model.

3.1.2. Characteristics of Social Activities: Physical Fitness, Social Interaction and Cultural and Performing Arts Activities are Related to Villagers' Health Perception

In terms of the characteristics of individual social activities, the following analysis results were obtained (Table 2): First, there were significant differences between the frequency and intensity of physical fitness and villagers' self-rated health ($F_1=15.532$, $p_1=0.000$, $F_2=12.867$, $p_2=0.000$). The higher the frequency and intensity of physical fitness, the higher the self-rated health level. This conclusion accords with common sense. Second, there were significant differences between the frequency and intensity of social interaction activities and villagers' self-rated health ($F_1=13.204$, $p_1=0.000$, $F_2=7.341$, $p_2=0.000$). The higher the frequency and intensity of social interaction activities, the higher the self-rated health level. The reason may be that villagers' active social communication helps release psychological pressure and improve their perception of health level. Third, there is a significant difference between the frequency of cultural performing arts activities and the villagers' self-rated health ($F=8.366$, $p=0.000$). The higher the frequency of cultural performing arts activities, the higher the villagers' self-rated health level. The reason may be that cultural performing arts activities improve the villagers' spiritual pursuit, and then affect their health

perception. In addition, the frequency and intensity of recreational activities and the intensity of cultural and performing arts activities did not have significant differences on self-rated health, so they were not included in the subsequent regression analysis model.

Table 2: ANOVA results of self-rated health of villagers with different social characteristics.

Independent variable	F	ANOVA (significance)
Gender	1.923	.166
Age	9.904	.000
Job	3.976	.001
Family demography	6.816	.046
Average monthly earnings	11.011	.000
Frequency of physical fitness activities	15.532	.000
Intensity of physical fitness activities	12.867	.000
Frequency of leisure and recreational activities	5.266	.853
Intensity of leisure and entertainment activities	6.575	.588
Frequency of social interaction	13.204	.000
Intensity of social interaction	7.341	.000
Frequency of cultural and performing arts activities	8.366	.000
Intensity of cultural and performing arts activities	9.042	.334

Note: If the significance of ANOVA is < 0.05 , it indicates that there are significant differences in social characteristics and self-rated health among different villagers.

3.2. Correlation between Rural Level Independent Variables and Villagers' Self-Rated Health

The correlation between objectively measured environmental indicators and self-rated health has been widely confirmed. Based on field research and village data review, this paper selected 10 village environmental indicators and villagers' self-rated health for ANOVA, and the results are shown in Table3.

3.2.1. In Terms of Public Service Facilities, the Coverage of Cultural, Commercial, Educational and Sports Facilities has a Significant Impact on Villagers' Health Perception

The following results can be obtained from the correlation between the coverage of village public service facilities and the villagers' health perception. First, there is a significant difference between the coverage of village cultural facilities and the villagers' self-rated health ($F=17.129$, $p=0.000$), which may be caused by the improvement of the number of historical and cultural resources and the coverage of cultural facilities further promote the villagers' cultural and performing arts activities. And then the effect on villagers' health perception; Second, there was a significant difference between the coverage rate of commercial facilities and the self-rated health of villagers ($F=6.898$, $p=0.001$). The reason may be that the coverage rate of commercial facilities was related to the convenience of the villagers' life services. The more perfect the life service facilities, the more beneficial to improve the villagers' health perception. Third, there was a significant difference between the coverage rate of educational facilities and the self-rated health of villagers ($F=3.205$, $p=0.041$). The reason may be that the better the educational facilities are, the more beneficial it is to retain the middle-aged and young people, and thus affect the health perception of villagers. Fourthly, there is no significant difference between the coverage of medical facilities and the self-rated health of villagers ($F=0.084$, $p=0.772$), which is contrary to the results of previous studies. After discussion, this study believes that the reason for this result is that similar villages share the situation of rural health centers and are jointly affected by the radiation of Sunduan Street

People's Hospital. Therefore, the index of medical facility coverage is not included in the regression equation; Fifth, there is a significant difference between the coverage rate of sports venues and villagers' self-rated health ($F=2.369$, $p=0.002$), which is consistent with common sense. The higher the coverage rate of sports facilities, the more beneficial it is for villagers to carry out sports and fitness activities and improve their health perception.

3.2.2. In Terms of Road Traffic, Road Hardening Rate, Road Hardening Condition and Road Route Density all had a Significant Impact on Villagers' Health Perception

In terms of road traffic, road hardening rate, road lighting and road density had significant effects on villagers' self-rated health ($F_1=17.680$, $p_1=0.000$, $F_2=21.219$, $p_2=0.000$, $F_3=16.448$, $p=0.000$). The reason may be that the road hardening rate and route density both affect the daily travel of villagers. The better the road traffic condition, the higher the travel frequency of villagers, the better the related supporting facilities and services they enjoy, and the better the health perception. Road lighting affects the frequency of traveling at night and the feeling of safety of traveling at night, and then affects the health perception of villagers.

3.2.3. In Terms of Living Conditions: Building Density and Courtyard Space had no significant Impact on Villagers' Health Perception

Residential building density and courtyard space ratio have no significant impact on villagers' self-rated health ($F_1=7.074$, $p_1=0.161$, $F_2=2.049$, $p_2=0.129$). The reason may be that the ten villages in this study have little difference in building density and courtyard space ratio, and are different from the urban environment with high floor area ratio. The countryside itself takes the open and natural ecological environment as the living background, and the research objects are the water villages in the South of the Yangtze River. The public space perception is at a relatively high level, so the residential building density and the ratio of courtyard space have no obvious influence on the villagers' health perception.

Table 3: ANOVA results of village built environment components on villagers' self-rated health.

Independent variable	F	ANOVA (significance)
Public service facilities		
Coverage of cultural facilities	17.129	0.000
Coverage of commercial facilities	6.898	0.001
Coverage of educational facilities	3.205	0.041
Coverage of medical facilities	0.084	0.772
Coverage of sports venues	2.369	0.002
Road Traffic Conditions		
Road hardening rate	17.680	0.000
Road Lighting Condition	21.219	0.000
Road route density	16.448	0.000
Living Conditions		
Residential building density	7.074	0.161
Proportion of courtyard space	2.049	0.129

Note: If the significance of ANOVA is < 0.05 , it indicates that there are significant differences in social characteristics and self-rated health among different villagers.

3.3. Logistic Model Regression Analysis of Rural Health Related Factors

Most of the existing studies focus on the relationship between urban built environment and

residents' health, while few focus on the impact of rural environment on villagers' self-rated health. Improving rural health is of great significance to the strategy of "Healthy China". Based on the results of the above analysis of variance, this study selects 11 indicators that have a significant impact on villagers' self-rated health for regression analysis, and the results are as follows (Table 4). In Model 1, eight indicators related to the built environment of villages and health perception were included. In order to avoid collinearity problems in the model, the original indicators "road hardening rate", "road lighting" and "road density" were combined into one indicator, "road traffic", and included in the regression model. On the basis of model 1, Model 2 selected the indicators of rural built environment with significant differences and added the indicators of individual socio-economic characteristics. On the basis of model 1, Model 3 selected the indicators of rural built environment with significant differences and added the indicators of individual social activities. Model 4 Based on the above model, the indicators that have significant influence on self-rated health were selected for regression analysis.

Table 4: Regression model results of the impact of village environment on villagers' self-rated health.

	Model 1		Model 2		Model 3		Model 4	
	VIF	significance	VIF	significance	VIF	significance	VIF	significance
Village built environment index								
Cultural facilities coverage	1.773	0.027	1.539	0.004	1.546	0.016	1.204	0.001
Commercial facilities coverage	1.863	0.044	1.390	0.023	1.386	0.383		
Educational facility coverage	1.792	0.110						
Sports venues coverage	1.238	0.010	1.106	0.000	1.113	0.040	1.089	0.047
Road traffic conditions	1.610	0.000	1.287	0.000	1.287	0.000	1.292	0.000
Individual socioeconomic characteristics								
Age			1.027	0.076				
Job			1.038	0.003			1.039	0.003
Average monthly earnings			1.035	0.000			1.050	0.000
Individual social characteristics								
Frequency and intensity of physical fitness					1.400	0.009	1.025	0.001
Frequency and intensity of social interaction					1.403	0.261		
Frequency of cultural and performing arts activities					1.027	0.000	1.043	0.000
Model goodness test								
R-squared	0.040		0.065		0.052		0.082	
Durbin-Watson	1.811		1.834		1.827		1.845	

Note: If VIF value is less than 5, it indicates that there is no collinearity problem in the model; if significance < 0.05, it indicates that the independent variable is significantly correlated with the dependent variable; if R-square approaches 1, it indicates that the model has a good fitting effect; if Durbin-Watson is around 2, it indicates that there is no serial correlation in the equation, and the regression equation is valid

According to the results of regression model 1, when the control variables were not included, the coverage of cultural facilities, commercial facilities, sports venues and road traffic conditions were significantly correlated with the self-rated health of villagers. When only individual socioeconomic features are included, as in Model 2, the significant impact of commercial facility coverage and cultural facility coverage on villagers' self-rated health decreases, and the impact factor (coefficient decreases); When only individual social characteristics were included, as in Model 3, business facility coverage no longer had a significant impact on self-rated health. When all control variables were included, the significant effect of sports venue coverage on self-rated health decreased, and the impact factor (coefficient became smaller). The above research results show that improving the

coverage of rural cultural facilities, road traffic conditions and sports venues is more conducive to improving the health perception of rural villagers.

4. Conclusions

There are some similarities and differences between this study and the research on the impact of urban health environment. In the correlation study between social characteristics and health perception of urban residents, age, occupation, disposable income and social communication status of urban residents have a correlation effect on the health perception of urban residents. The correlation effect between social and economic characteristics of villagers and health perception in this study is consistent with the above research. In addition, this study also found that the characteristics of social activities affecting the villagers' health perception include sports and fitness activities, social interaction activities and cultural and performing arts activities. In the correlation study of factors affecting urban health environment, relevant studies have found that the health perception of urban residents is affected by urban commercial facilities, educational facilities, sports facilities, road traffic and other factors. The characteristics of rural built environment corresponding to this study are consistent with the above research. However, they are slightly different in terms of greening and cultural facilities. The reason for the difference lies in the different environment and residents' behaviors between villages and cities. To sum up, the primary environmental factors affecting the health perception of villagers are the coverage of cultural facilities, road traffic and fitness places, and the second environmental factors affecting the health perception of villagers are the coverage of commercial facilities and educational facilities. Therefore, the above indicators can be used as the focus of promoting healthy villages.

In terms of improving the cultural environment, villagers' daily activities mainly include going to temple fairs and watching artistic performances. Therefore, it is suggested that villages with historical and cultural heritages should carry out cultural activities in combination with the cultural heritages, and strengthen the construction of cultural facilities to improve the frequency and quality of villagers' cultural activities. In terms of road environment improvement, attention should be paid to improving the daily travel conditions of villagers, such as realizing road hardening and road lighting in the whole village, and improving the road network density within the construction land to improve the accessibility of the village. In terms of fitness environment, the construction of each village should be combined with the idle space in the village to carry out the layout of sports and fitness facilities, optimize the coverage of sports and fitness places, and improve the frequency of villagers' sports activities.

The limitation of this paper is that firstly, the research object is the water villages in Jiangnan of China, and the research conclusions may be different in the cold areas of northern China. Secondly, the environmental perception of villagers was not included into the model as a control variable in this study to analyze its impact on villagers' health perception. Future studies can be further carried out based on qualitative analysis of villagers' perception.

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