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# Correlation Analysis of Health Factors of Elderly People in Traditional Miao Dwellings in Western Hunan

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**Abstract:** Under the macro context of severe global aging, the typical villages and dwellings of the Miao ethnic group in western Hunan were selected, and the daily life and health status of the local elderly were evaluated through behavioral observation, interviews, and questionnaires (e.g., physiological, psychological, and residential environments). In addition, the health status and relevant evaluation factors of the respondents were correlated and then analyzed using SPSS software. As indicated by the results of this study, the local elderly used all the spaces and functions of the existing dwellings and were satisfied with the spaces except for the toilet. In addition, their physiological functions had declined, and their daily behaviors were affected by a wide variety of physical diseases. From a psychological perspective, more than 60% of the elderly had significant feelings of loneliness and frustration. As indicated by the correlation results, the health status of the elderly in traditional Miao dwellings in western Hunan was positively correlated with family, income, daily acts, dwellings, and infrastructure, and negatively correlated with age. They showed linear correlations with all impact factors: Health = 157.44 − 5.242 ∗ Gender − 1.611 ∗ Age − 0.606 ∗ Education level − 0.411 ∗ Family + 0.001 ∗ Income − 7.191 ∗ Daily acts + 13.621 ∗ Dwelling + 4.682 ∗ Infrastructure + 17.198 ∗ Natural. Based on the results of study, targeted improvement strategies were proposed for the elderly in traditional Miao dwellings in western Hunan from four aspects—infrastructure, traditional dwellings, mental health, and policy support—to improve the health status of the elderly in traditional Chinese villages and towns.

**Keywords:** Miao nationality in western Hunan; traditional dwellings; health of the elderly; SPSS; correlation analysis

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## 1. Introduction

Population aging has been confirmed as a common problem worldwide, and one of the main challenges facing China. Currently, China is subjected to population aging on a large scale, with great depth and speed. China has a total population of 1411.78 million people, of which 260 million are aged 60 years or above, accounting for a proportion of 18.70%, and 190 million are aged 65 years or above, taking up 13.50%, as indicated by the statistical results of China's seventh census [1]. As China's population has aged, it has become increasingly difficult to provide a suitable living environment for the elderly in China, coupled with a marked urban-rural disparity. To be specific, people aged 60 and 65 years and above in rural areas account for 23.81% and 17.72%, being 7.99% and 6.61% higher than in urban areas, respectively. The aging issue is even more serious in the Xiangxi Tujia and Miao Autonomous Prefecture of Hunan Province, China, and the issue of the living environment and health of the elderly should arouse more attention and interest in research. Physical health problems (e.g., respiratory infections and strokes) [2,3] and mental health problems, including depression [4] that arises from the living environment (e.g., the living environment) of the elderly, are of particular concern. Furthermore, since

the emergence of COVID-19 in 2019, human health has become the focus of global concern, especially the health status of the elderly [5–8]. Accordingly, a correlation study on the sustainability of the health status of the elderly is warranted.

With people's concern for health, a growing number of scholars are engaged in research on the health of the elderly. More studies have been conducted on habitat, environment, and health factors. A review of the literature has suggested that most research on health factors has placed a focus on their relation to thermal comfort, living conditions, psychological conditions, and external conditions in different areas [9–18]. Rakhshani et al. [19] investigated the correlation between the design and architectural factors of nursing homes and residents' mental health through Pearson correlation coefficients and multiple regression analysis. On that basis, correlation coefficients between the study variables and the mental health of the elderly were yielded. As indicated by the regression analysis, design and architectural factors accounted for 40.2% of the mental health of the elderly. Jiao et al. [20] investigated the typical transition spaces of 42 buildings in 17 elderly care facilities in Shanghai and their effects on the thermal adaptation of the elderly through questionnaires and physical measurements. The thermal satisfaction and self-assessed health status of the elderly suggested that the ideal model for designing transition spaces in elderly care facilities is to use semi-open exterior corridors with increasing temperature/humidity from outdoor transition space to an indoor decrease in temperature/humidity. Li et al. [21] used a multinomial logistic regression model to analyze the effects of education level, health status, and income level on the residential preferences of the elderly in China. The results show that from a spatial perspective, the residential preference for "living together" tends to be increased from the northeast to the southwest. Individual factors (e.g., education level, health status, and income level) significantly affect housing preferences. Major differences exist in residential preferences in different regions and different cities, such that the development of elderly care services should be adapted to local conditions. Shi [22] employed the growth of housing wealth driven by the prefecture-level housing market as an exogenous change in wealth at the household level in China. The findings suggested a causal relationship between wealth and individual health-related outcomes. Because the growth in housing wealth has reduced health activities and healthcare utilization, it has had a complex impact on health status. Wu [23] investigated the effect of switching household fuel from solid to non-solid fuels on the health of the elderly along several dimensions, and their results suggested that fuel switching improved the self-measured health of the elderly but had no significant effect on the ability or independence of the elderly to perform daily activities; fuel switching enhanced the self-measured health of educated elderly people but had no significant effect on uneducated elderly people; fuel switching improved the self-measured health of older women but did not affect older man. Chen et al. [24] conducted a study on the infrastructure of basic living places for the elderly in the community. The results showed that adding elevators, installing bathing facilities, supplying gas or natural gas, and changing squatting toilets to sitting toilets had a positive impact on the health of the elderly. The degree of impact on self-measured health was elevator > type of bathroom > kitchen gas supply > bathing facilities, while the degree of impact on activities of daily living was bathing facilities > type of bathroom > elevator > kitchen gas supply, in that order.

Through combing and analyzing the relevant literature, it was found that most of the studies on the elderly have focused on the period of the COVID-19 pandemic, and on urban housing and community architecture for the elderly [25–30]. There are relatively few studies on the elderly living in traditional dwellings in extensive rural areas, and the elderly living in traditional Miao dwellings in western Hunan are very different from those living in urban areas in terms of their production habits, daily behavioral activities, and the layout of village architecture and ethnic cultural beliefs [31]. Compared with modern lifestyles and standards, traditional dwellings in western Hunan meet the special physiology of the elderly in terms of planar functions, indoor thermal environments, accessibility facilities, etc., while the lack of the companionship of relatives leads to difficulties in meeting their

psychological needs. Thus, given the specific policy and economic status of the western Hunan region, the culture and customs of the local ethnic groups, and the needs of the residents themselves, this study primarily aimed to clarify the relevant factors affecting the health status of the elderly in traditional Miao dwellings in western Hunan, to quantify and visualize the relationship between health and its influencing factors, and then to propose targeted improvement suggestions based on the quantitative results.

## 2. Materials and Methods

### *2.1. Study Content*

#### 2.1.1. Study Area

The Xiangxi Tujia and Miao Autonomous Prefecture has been reported as the main distribution area of the Miao ethnic group in China. Among the five batches of "Chinese Traditional Villages" announced, the number of traditional villages in Xiangxi Tujia and Miao Autonomous Prefecture has reached 172 [32]. To be specific, there are a considerable number of Miao traditional dwellings with a long history and different forms. The Miao traditional villages that have kept their traditional architecture and culture intact were selected as the main focus of this study. Four typical Miao traditional villages were selected as the study area, comprising Zhushan Village, Zhaogang Village, Laojiazhai Village, and Liangdeng Village in Phoenix County (Figure 1). These four villages are typical Miao villages, and far from the towns, because of the rugged mountain roads, the drive to the nearest county town is basically over an hour. All of them are inhabited by Miao people, and the young laborers in the villages basically go out to work, while only the elderly stay in the villages, preserving the most traditional and primitive Miao way of life. Accordingly, this can represent the traditional customs and living environment of the Miao people in western Hunan while indicating the current situation of the Miao people.

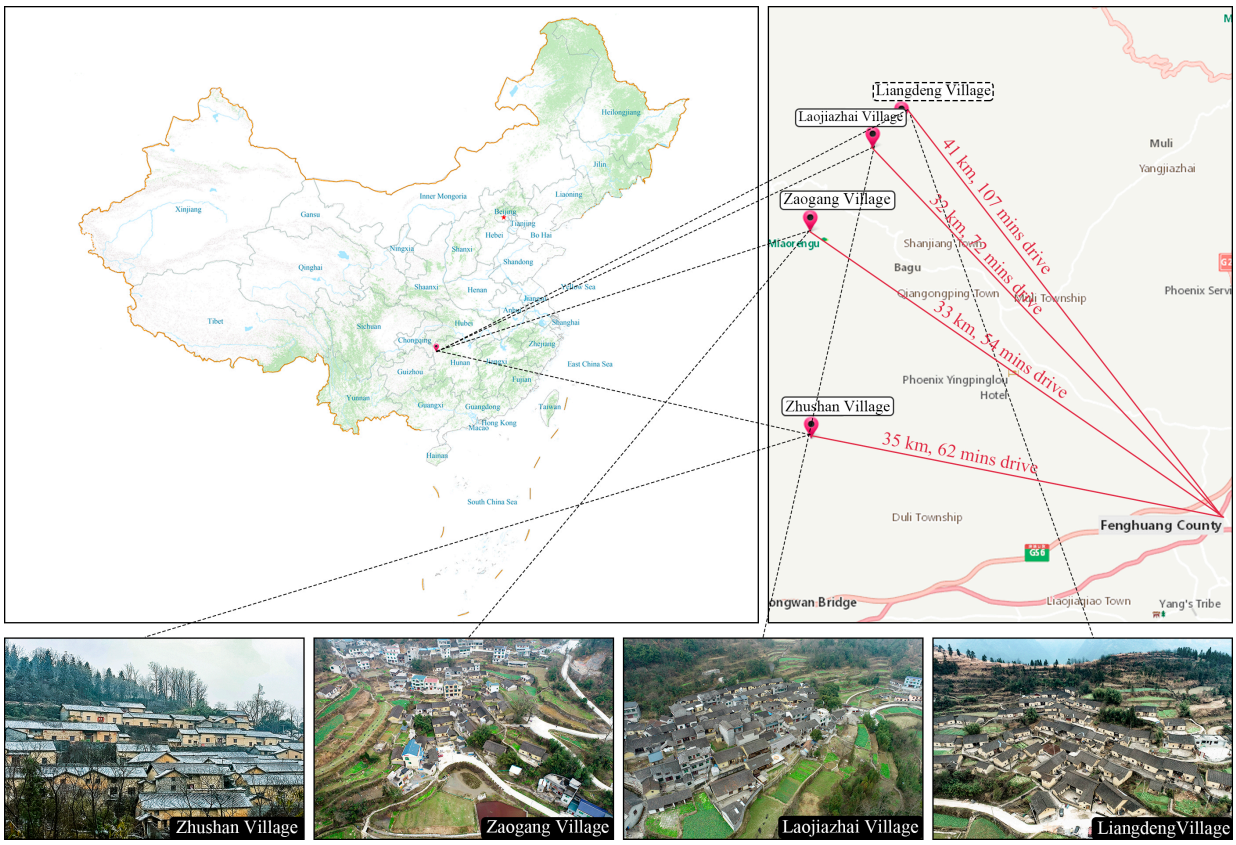



**Figure 1.** Study area.

### 2.1.2. Study Object

Traditional Miao dwellings with unique regional characteristics were created based on their unique geographical location, traditional construction skills, strong ethnic culture, and the mysterious ethnic cult of the Miao nationality in western Hunan (Figure 2). Compared with modern architecture and the traditional dwellings of other ethnic groups, the traditional dwellings of the Miao nationality in western Hunan exhibit more simple layouts and functions. Based on Liu's research [31] on the dwellings of western Hunan, the planar shape of traditional Miao dwellings in western Hunan fell into three categories (i.e., "I" shape, "L" shape, and "U" shape), with some families in better economic conditions adopting the "L" or "U" layouts (Table 1). The main house is a three-room house enclosed by four roof frames, with the middle room set back a column to form a 'swallowed mouth'. In this study, the three typical house plans of "I", "L", and "U" were studied in the field, and the dimensions were determined through team mapping. Most of the dwellings are two stories tall, with an area of about 100 square meters, with the first floor as living space and the second floor as storage space.

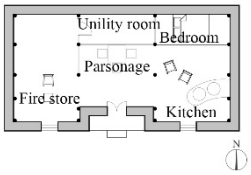
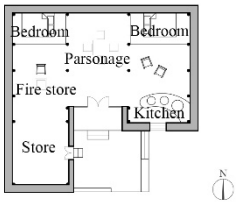
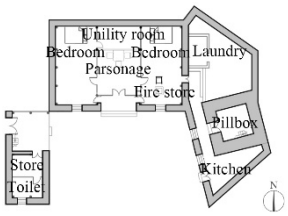



**Figure 2.** Miao Traditional Dwellings in Western Hunan.

### 2.1.3. Study Sample

During the field survey of four villages in the study area—Zhushan, Zhaogang, Laojiazhai, and Liangdeng in Phoenix County, Xiangxi Tujia and Miao Autonomous Prefecture—we observed the daily production and living habits conducted by the native residents, interviewed their physiological and psychological states, and administered questionnaires on health status and related factors. A total of 97 elderly people aged 60 years and above in the four villages were accepted and participated in our study. In this way, a total of 97 research data samples were available in this study.

**Table 1.** Typical traditional dwelling plan types of the Miao nationality in western Hunan.

| Type of Plane | Photo | Plan View |
| --- | --- | --- |
| "I" shaped plane |  |  |
| "L" shaped plane |  |  |
| "U" shaped plane |  |  |

## 2.2. Research Methodology

We used SPSS software to correlate the health status and factors of the elderly in traditional Miao dwellings in western Hunan. Moreover, the reliability and validity of the sample data were tested by their reliability and validity in SPSS. Reliability is capable of examining the consistency of all options of a scale. This study was based on using SPSS reliability analysis to analyze the inherent reliability of the assessment factors of the health factors in the questionnaire. The reliability was evaluated using Cronbach's alpha coefficient. Cronbach's alpha coefficient ranged from 0.000 to 1.000, with higher values suggesting higher reliability and lower values suggesting lower reliability. When Cronbach's alpha coefficient exceeded 0.600, the data became reliable. The validity is used to specifically examine the energy efficiency of each item and whether each item plays an important role in the scale. This study examines the structural validity of the health factors in the questionnaire based on the SPSS reduced-factor numerator. The validity was evaluated by analyzing the results of the KMO test and the Bartlett sphere test, and X2 achieved a *p* value. The questionnaire data exhibited structural validity at the coefficient of the KMO test and the Bartlett sphere test greater than 0.500 and the *p* value of X2 less than 0.050.

## 2.3. Survey

### 2.3.1. Behavioral Observation

Observation and data collection can provide more insights into the social interactions of the elderly within a designated ancient town, and observation is an effective way to collect information on the elderly's activities and record them for later analysis [33]. As the daily productive life behavior of the elderly is closely related to their perceptions of the traditional residential environment, this study investigated the daily productive life activities of the elderly in traditional Miao villages in western Hunan. Specifically, the research team conducted a three-week field survey in several Miao traditional villages in Fenghuang County, Xiangxi Tujia and Miao Autonomous Prefecture, systematically

mapping the local traditional dwellings, as well as making detailed observations of the daily production and living behaviors of the local residents and recording their use of various functional spaces inside.

#### 2.3.2. Interviews

The research interviews in this study were conducted using subjective interviews rather than strictly question-based interviews (Table 2). A preliminary understanding of the living environment of the elderly in the ancient villages of the Miao nationality in western Hunan can be gained by collating and analyzing the results of the interactions and interviews with local indigenous residents.

**Table 2.** Interview content of the elderly in the traditional dwellings of the Miao nationality in western Hunan.

| Basic Features | Comment | | Question |
|---|---|---|---|
| Physiological characteristics | Daily productive life behavior | | Work, farming, housework, childcare |
| | Action capability | | Free movement, crutches, immobility |
| | Physical underlying disease | | Cervical spondylosis, lumbar spondylosis, arthropathy, arthrolithiasis, other diseases, no such diseases |
| | Daily social activities | | 10 min, 30 min, an hour, more than two hours |
| | Daily exercise | | 10 min, 20 min, 30 min, more than one hour |
| | Physical sensory ability | Sight | Good vision, nearsightedness or farsightedness, color blindness or color deficiency, blindness |
| | | Hearing | Good hearing, poor hearing, phantom hearing and tinnitus, deafness |
| | | Taste | Good sense of taste, loss of taste, taste disorder, no sense of taste |
| | | Smell | Good sense of smell, declining sense of smell, dysmorphic sense of smell, no sense of smell |
| | | Tactile | Good sense of touch, declining sense of touch, dysesthesia, no sense of touch |
| Psychological characteristics | Loneliness | | Weak loneliness, average loneliness, strong loneliness |
| | Security | | Weak sense of security, fair sense of security, strong sense of security |
| | Belongingness | | Weak sense of belonging, fair sense of belonging, strong sense of belonging |
| | Frustration | | Weak sense of frustration, fair sense of frustration, strong sense of frustration |
| dwelling environment | Courtyard space | | Satisfactory, more satisfactory, fair, unsatisfactory, poor |
| | Window and door dimensions | | Satisfactory, more satisfactory, fair, unsatisfactory, poor |
| | Fire room | | Satisfactory, more satisfactory, fair, unsatisfactory, poor |
| | Parsonage | | Satisfactory, more satisfactory, fair, unsatisfactory, poor |
| | Storage space | | Satisfactory, more satisfactory, fair, unsatisfactory, poor |
| | Bedroom | | Satisfactory, more satisfactory, fair, unsatisfactory, poor |
| | Kitchen | | Satisfactory, more satisfactory, fair, unsatisfactory, poor |
| | Toilet | | Satisfactory, more satisfactory, fair, unsatisfactory, poor |

1. Physiological characteristics

In this study, 97 elderly people from four traditional Miao villages, namely Zhushan, Laojiazhai, Zaogang and Liangdeng in Fenghuang County, Xiangxi Prefecture, were interviewed about their physiological characteristics, physical status, and sensory functions, including productive life activities, underlying physical illnesses, daily social activities, and sensory abilities such as vision, taste, hearing, and touch.

2. Psychological characteristics

As China's economy develops and urbanization progresses, more and more villages and towns are becoming hollowed out. Most of the young people who used to work as farmers in the countryside choose to work and settle in the cities, while the elderly choose to stay in the traditional villages for various reasons (e.g., physical mobility problems, inability to adapt to modern living patterns, and nostalgia for their homeland). This situation is even more evident in the traditional villages of the Miao nationality in western Hunan, where the elderly in the Miao traditional villages of Phoenix County have largely stayed in their native villages. For the above-described reasons, the research team spent three weeks living in four Miao traditional villages in Fenghuang County, Xiangxi Province (i.e., Zhushan Village, Laojiazhai Village, Zaogang Village, and Liangdeng Village) to conduct in-depth interviews and collect records on the psychological characteristics of 97 (more than half of those aged 60 and older in these villages) indigenous elderly people, including four aspects (i.e., loneliness, security, belonging, and frustration), all of which can have a certain effect on their use of traditional dwellings and the layout of the dwelling space.

3. Interviews of the residential environment

Based on Zhang et al.'s study on the elderly [34], in-depth interviews on the living environment of the elderly in Miao ancient villages in western Hunan (e.g., the territorial renewal of the inhabited traditional dwellings) were conducted according to the native resident elderly. Through the field survey and the compilation of mapping data, the functional spaces of the traditional dwellings were categorized into the following parts: entrance, courtyard, swallowing mouth, hall, fire pit, bedroom, and storage room. Interviews were also conducted with the elderly living in them on their subjective assessment of the safety, use, comfort, privacy, and culture of these spaces.

#### 2.3.3. Questionnaire Surveys

In this study, the health status questionnaire for the elderly of the Miao nationality living in traditional dwellings in western Hunan was modified on the SF-36 scale, and a systematic structured questionnaire was administered to respondents in nine areas (i.e., physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, mental health, and reported health transition), where the converted scores served as the overall indicators of health assessment [35,36]. A structured questionnaire was built with 28 assessment factors in five categories (i.e., basic conditions, daily behavior, traditional dwellings, infrastructure, and natural environment) by classifying existing research based on the characteristics of the ethnic group and the specificity of the region (Table 3). The 23 assessment factors under daily behavior, traditional dwelling, infrastructure, and natural environment were divided into five assessment levels [1–5]. Based on the subjective statements of the respondents, their assessment factors were quantitatively converted by the following equation. Furthermore, the correlation between the respective assessment factor and health assessment was investigated using SPSS software.

$$\text{Quantitative conversion scores} = \frac{\text{Actual scores} - \text{Minimum possible score in this area}}{\text{Highest possible score in this area} - \text{Minimum possible score in this area}} \times 100 \quad (1)$$

**Table 3.** Health assessment factors for the elderly in the traditional dwellings of the Miao nationality in western Hunan.

| Dimension | Assessment Factor |
| --- | --- |
| Basic information | Gender |
| | Age |
| | Education level |
| | Number of permanent household members |
| | Annual per capita income |
| Daily acts | Productive life work |
| | Caring for the family |
| | Cooking and eating habits |
| | Sports and exercise |
| | Social activities |
| | Interests and hobbies |
| Traditional Dwellings | Building construction time |
| | Building area |
| | Building material |
| | Building thermal performance |
| | Indoor temperature and humidity |
| | Indoor light and ventilation |
| | Indoor air quality |
| Infrastructure | Traffic conditions |
| | Electricity conditions |
| | Water conditions |
| | Drainage and sewage |
| | Medical conditions |
| | Education conditions |
| Natural environment | Village siting |
| | Air quality |
| | Climate comfort |
| | Noise pollution |

## 3. Results

### *3.1. Behavioral Observation Result*

Figure 3 shows the behavior of the elderly in the traditional dwellings of the Miao nationality in western Hunan, with a, b, and c being traditional dwellings of the "I", "L", and "U" shapes, respectively. The daily productive activities of the middle-aged and elderly, mainly rest and sleep, cook and eat, sacrifice, social and communication, exercising and activities, recreation, farm work and housework, and toilet and bath, are spread throughout the rooms, suggesting that the elderly in the traditional dwellings of the Miao nationality in western Hunan use all the space and functions of the existing dwellings. Statistics show that rest and sleep are the most time-consuming behavioral patterns, accounting for 42% of daily life time; cook and eat are the next most time-consuming, accounting for 12% of daily life time; farm work and housework chores account for 8%; and social and communication, exercise and activities, and recreation together account for 35%.

### *3.2. Interviews Results*

#### 3.2.1. Physiological Characteristics Interview Results

Figure 4 presents the results of the interviews on the physiological characteristics of the elderly in the traditional dwellings of the Miao nationality in western Hunan. For daily productive life behavior, the elderly who were engaged in work, farming, housework, and childcare accounted for 21.7%, 66%, 53.6%, and 13.6% of the total number of interviews, respectively. The analysis of the interviews indicated that most of the local elderly were subjected to physical ailments (e.g., curvature of the spine, shoulder pain, and gout in the joints), and 34% of them reported that they should rely on crutches to get around, closely correlated with their productive lifestyle behavior due to the constant farming

work, coupled with the lack of infrastructure and accessibility facilities in the traditional dwellings. However, because of the relative isolation from transport and their daily work habits, local seniors spent more time on social activities and exercise, with over half of them spending more than an hour on social activities and over 30 min on exercise. For physical senses, the elderly had a more pronounced decline in visual and auditory functions, and over half of them considered that the decline in their visual and auditory senses affected their productive life activities. Furthermore, the elderly are exposed to smoke from cooking in fire pits and stoves for long periods, thus causing a significant loss of vision, visual fatigue, and eye diseases (e.g., glaucoma). Their sense of taste and smell are relatively good. Over 90% of the interviewees stated that these senses were still functioning normally and did not cause any inconvenience to their lives, probably due to their long-term stability. The sense of touch of the elderly interviewed was good, because they have lived in traditional dwellings for a long time without much contact with external electrical equipment, such that they have become more sensitive to the senses of cold and heat.

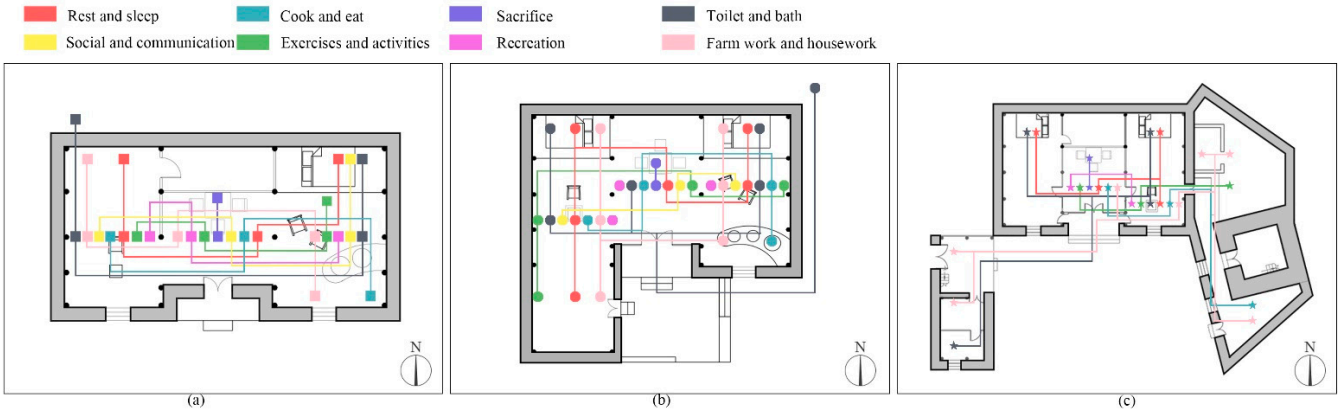



**Figure 3.** Daily activities of the elderly in the traditional dwellings of the Miao nationality in western Hunan: (**a**) I-shaped flat dwelling; (**b**) L-shaped flat dwelling; (**c**) U-shaped flat dwelling.

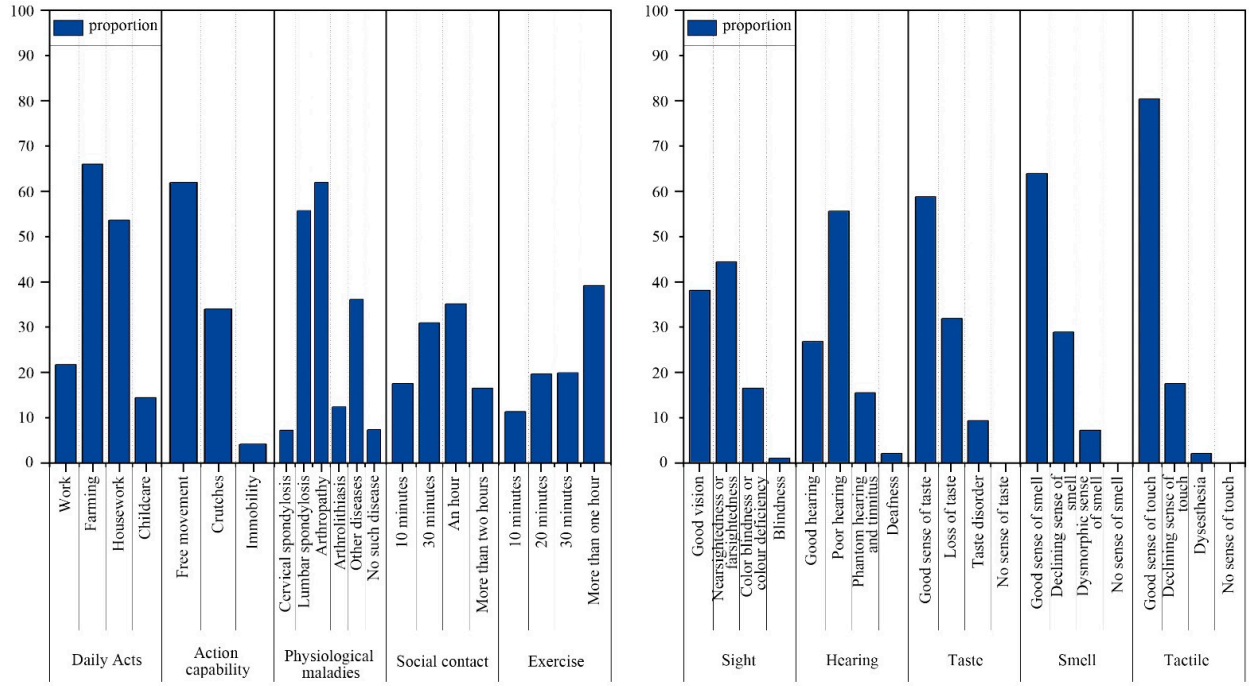



**Figure 4.** Physiological characteristics of the elderly in the traditional dwellings of the Miao nationality in western Hunan: (**left**) daily productive life behavior; (**right**) physical sensory abilities.

3.2.2. Psychological Characteristics Interview Results

Figure 5 illustrates the results of the interviews on the psychological characteristics of the elderly in the traditional dwellings of the Miao nationality in western Hunan. As indicated by the results, 38% of the elderly considered themselves to be very lonely, 47% considered themselves to be relatively lonely, and 14% considered themselves to be less lonely, which was closely associated with the number of permanent family members of the elderly. The reason for the above result is that most of their children have gone out to work, such that there has been a smaller number of permanent family members and a corresponding increase in loneliness. 51% of the elderly considered themselves to have a strong sense of security, 41% considered themselves to have an average sense of security, and 8% considered themselves to have a weak sense of security. Furthermore, 74% of the elderly considered themselves to have a strong sense of belonging, 22% considered themselves to have an average sense of belonging, and 4% considered themselves to have a weak sense of belonging, while their sense of security and belonging were correlated with their traditional culture and living customs. The local elderly have lived in traditional dwellings and villages for a long time, and their long-term productive life activities have given them a strong sense of security and belonging to their homeland. 30% of elderly considered themselves to be highly frustrated, 34% considered themselves to be moderately frustrated, and 36% considered themselves to be weakly frustrated. The elderly's frustration primarily originated from their children, their fear of being a burden to their children due to their health condition, or their frustration that they will hinder their children's development.

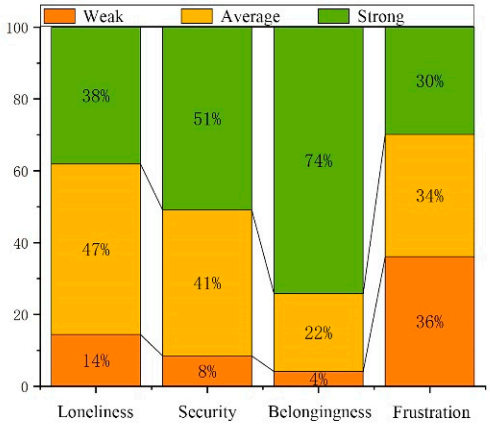



**Figure 5.** Psychological characteristics of the elderly in the traditional dwellings of the Miao nationality in western Hunan.

3.2.3. Residential Environment Interview Results

Figure 6 presents the results of interviews with elderly in the traditional dwellings of the Miao nationality in western Hunan about their living environment. Most people were satisfied with their living environment, with overall satisfaction levels of 100% for the courtyard space, door and window sizes, fire pit and hall, and 46%, 34%, and 36% for the storage space, bedroom, and kitchen, respectively. Furthermore, the overall satisfaction levels reached over 60%. However, 58% of the 97 elderly people interviewed felt that the toilets were poor, and 18% were dissatisfied with them. As revealed by the interviews, the elderly was generally satisfied with the environment they currently live in, whereas they were largely dissatisfied with the toilet space. The reason for this result is that most traditional dwellings do not have a separate toilet space, thus reducing convenience for the elderly. In addition, some of the elderly felt that the ground was only compacted with triple clay and lacked sufficient levelling, that the interior space lacked separation and was less private, and the staircase steps were poorly proportioned and affected travel. As indicated by the interviews, when suggestions were proposed for renovating the traditional

dwellings of Miao nationality in western Hunan to address their dissatisfaction with the existing living environment, they were most concerned about the cost.

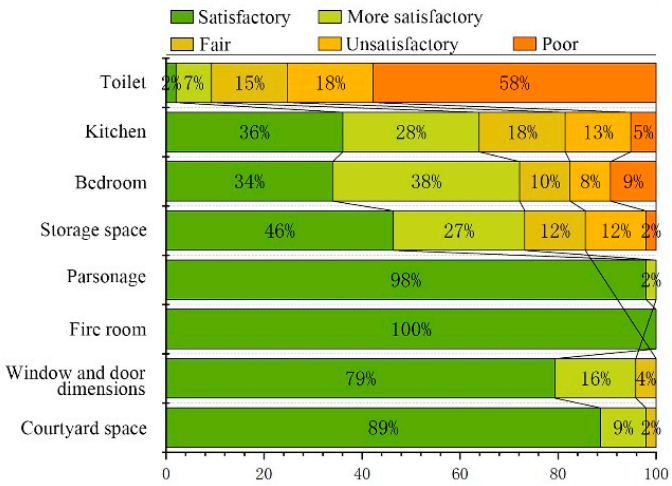



**Figure 6.** Results of interviews about the residential environment of the elderly in the traditional dwellings of the Miao nationality in western Hunan.

### *3.3. Questionnaire Results*

#### 3.3.1. Sample Characteristics

A total of 97 valid questionnaires out of the 110 questionnaires distributed were collected, with an efficiency rate of 88.2%. The number of respondents from Liangdeng, Zaogang, Laojiazhai, and Zhushan villages reached 20, 21, 27, and 29, respectively, as indicated by the 97 validly collected questionnaires. Respondents received and answered the questionnaire anonymously, and we ensured that the data and privacy of its content were protected and limited to the use of this study for academic research and not for other purposes. The content of the questionnaire follows the Declaration of Helsinki and is formally approved in terms of ethics and morality. To be specific, 51 (52.6%) were female respondents, and 46 (47.4%) were male respondents; 56 (57.7%) were aged 60–69 years, 31 (32.0%) were aged 70–79 years, and 10 (10.3%) were aged 80 years or above. The respondents' scores on the SF-36 Health Assessment Scale suggested that 41 (42.3%) scored below 60, 26 (26.8%) scored 60–69, 20 (20.6%) scored 70–79, and 10 (10.3%) scored 80 or above (Figure 7).

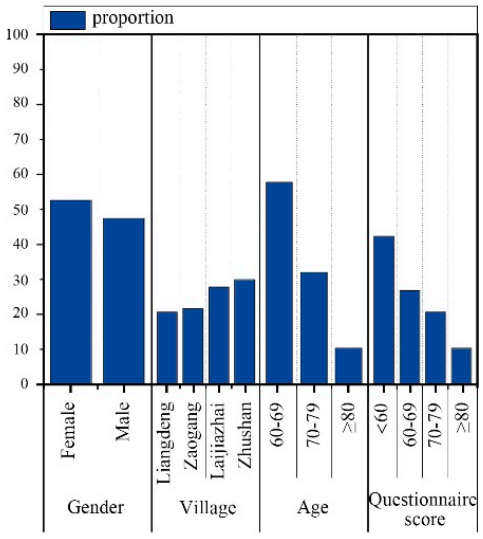



**Figure 7.** Sample characteristics.

3.3.2. Reliability and Validity Test

As indicated by the SPSS analysis (Table 4), the Cronbach's alpha coefficient for daily behavior in this study's questionnaire reached 0.716; the Cronbach's alpha coefficient for the traditional dwellings was 0.704; the Cronbach's alpha coefficient for infrastructure reached 0.684; the Cronbach's alpha coefficient for the natural environment was 0.660. The above results revealed that the questionnaire of this study exhibited good reliability, such that the correlation analysis of the questionnaire can be reliable.

**Table 4.** Reliability test results.

| Dimension | Cronbach's Alpha Coefficient | Number of Terms |
|---|---|---|
| Daily acts | 0.716 | 6 |
| Traditional Dwellings | 0.704 | 7 |
| Infrastructure | 0.684 | 6 |
| Natural environment | 0.660 | 4 |

As indicated by the SPSS analysis (Table 5), the KMO test values for daily behavior in this study's questionnaire reached 0.736, for traditional dwellings 0.675, for infrastructure 0.766, and for the natural environment 0.607, and their corresponding *p*-values were all less than 0.050. The correlation coefficients and unit matrices were significantly different, suggesting that there was a correlation between the survey data. Thus, the questionnaire exhibited structural validity.

**Table 5.** Validity test results.

| Dimension | KMO Test and the Bartlett Sphere Test | *p* Value |
|---|---|---|
| Daily acts | 0.736 | 0.000 |
| Traditional Dwellings | 0.675 | 0.000 |
| Infrastructure | 0.766 | 0.000 |
| Natural environment | 0.607 | 0.000 |

3.3.3. Correlation Analysis

Based on the statistical results of the SF-36 questionnaire, the converted score values served as the total indicators of health assessment and as the dependent variables. The five assessment factors (i.e., age, gender, education level, number of permanent household members, and annual per capita income under the basic situation) were taken as independent variables, and the other 23 assessment factors were grouped into four independent variables (i.e., daily behavior, traditional dwellings, infrastructure, and natural environment). The correlation analysis of the health status of the elderly in the traditional dwellings of the Miao nationality in western Hunan was conducted using SPSS. Pearson's correlation is between −1 and +1, with values greater than 0 suggesting a positive correlation and the opposite suggesting a negative correlation. The correlation was enhanced with the increase in the absolute value, where * denotes a significant correlation at the 0.05 level (two-tailed) and ** represents a significant correlation at the 0.01 level (two-tailed). As indicated by the results of the SPSS correlation analysis (Table 6), the health status of the elderly living in the traditional dwellings of the Miao nationality in western Hunan was not correlated with gender, education level, and natural environment. The Pearson values corresponding to the number of permanent household members, daily behavior, traditional dwellings, and infrastructure reached 0.250, 0.213, 0.209, and 0.228, respectively, suggesting a positive correlation at the 0.05 level. The Pearson value corresponding to income reached 0.278, showing a positive correlation at the 0.01 level. The Pearson value corresponding to age was −0.847, suggesting a negative correlation at the 0.01 level. The Pearson value for income was 0.278, showing a positive correlation of 0.01, and the Pearson value for age

was −0.847, showing a negative correlation of 0.01. As revealed by the above data, among the four dimensions (i.e., daily behavior, traditional dwelling, infrastructure, and natural environment), the correlation between natural environment and health status was poor, whereas the correlation between daily behavior, traditional dwelling, and infrastructure and health status was strong. Furthermore, indoor lighting, and ventilation and indoor air quality under the traditional dwelling dimension, as well as electricity and water conditions under the infrastructure dimension, can be the four assessment factors that are more significantly correlated with health status.

**Table 6.** Correlation analysis results.

| | | Gender | Age | Education Level | Family | Annual Income | Daily Acts | Dwelling | Infrastructure | Natural | Health |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gender | Pearson's correlation | 1 | 0.008 | −0.026 | 0.037 | −0.006 | −0.159 | −0.085 | 0.061 | 0.206 * | −0.163 |
| | P (two-tailed) | | 0.937 | 0.804 | 0.720 | 0.952 | 0.119 | 0.406 | 0.553 | 0.043 | 0.111 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Age | Pearson's correlation | 0.008 | 1 | −0.166 | −0.315 * | −0.246 * | −0.301 ** | −0.110 | −0.237 * | −0.127 | −0.847 ** |
| | P (two-tailed) | 0.937 | | 0.104 | 0.002 | 0.015 | 0.003 | 0.283 | 0.019 | 0.215 | 0.000 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Education level | Pearson's correlation | −0.026 | −0.166 | 1 | 0.036 | 0.226 * | −0.055 | −0.132 | 0.131 | 0.110 | 0.139 |
| | P (two-tailed) | 0.804 | 0.104 | | 0.728 | 0.026 | 0.595 | 0.197 | 0.201 | 0.285 | 0.175 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Family | Pearson's correlation | 0.037 | −0.315 ** | 0.036 | 1 | 0.016 | 0.206 * | 0.224 * | 0.161 | 0.048 | 0.250 * |
| | P (two-tailed) | 0.720 | 0.002 | 0.728 | | 0.874 | 0.043 | 0.028 | 0.116 | 0.643 | 0.013 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Income | Pearson's correlation | −0.006 | −0.246 * | 0.226 * | 0.016 | 1 | 0.052 | 0.100 | 0.199 | −0.025 | 0.278 ** |
| | P (two-tailed) | 0.952 | 0.015 | 0.026 | 0.874 | | 0.615 | 0.331 | 0.051 | 0.806 | 0.006 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Daily acts | Pearson's correlation | −0.159 | −0.301 ** | −0.055 | 0.206 * | 0.052 | 1 | 0.059 | −0.165 | −0.048 | 0.213 * |
| | P (two-tailed) | 0.119 | 0.003 | 0.595 | 0.043 | 0.615 | | 0.566 | 0.107 | 0.643 | 0.036 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Dwelling | Pearson's correlation | −0.085 | −0.110 | −0.132 | 0.224 * | 0.100 | 0.059 | 1 | −0.060 | −0.005 | 0.209 * |
| | P (two-tailed) | 0.406 | 0.283 | 0.197 | 0.028 | 0.331 | 0.566 | | 0.557 | 0.963 | 0.040 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Infrastructure | Pearson's correlation | 0.061 | −0.237 * | 0.131 | 0.161 | 0.199 | −0.165 | −0.161 | 1 | 0.032 | 0.228 * |
| | P (two-tailed) | 0.553 | 0.019 | 0.201 | 0.116 | 0.051 | 0.107 | 0.557 | | 0.752 | 0.025 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Natural | Pearson's correlation | 0.206 * | −0.127 | 0.110 | 0.048 | −0.025 | −0.048 | −0.005 | 0.032 | 1 | 0.180 |
| | P (two-tailed) | 0.043 | 0.215 | 0.285 | 0.643 | 0.806 | 0.643 | 0.963 | 0.752 | | 0.078 |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| Health | Pearson's correlation | −0.163 | −0.847 ** | 0.139 | 0.250 * | 0.278 ** | 0.213 * | 0.209 * | 0.228 * | 0.180 | 1 |
| | P (two-tailed) | 0.111 | 0.000 | 0.175 | 0.013 | 0.006 | 0.036 | 0.040 | 0.025 | 0.078 | |
| | N | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |

Note: * and ** indicate significant correlation at 0.05 and 0.01 levels.

### 3.3.4. Regression Model Establishment

The nine independent variables of gender, age, education level, number of permanent household residents, income, daily behavior, traditional dwellings, infrastructure, and natural environment were investigated using SPSS together with the dependent variable of health status in a linear regression. A Durbin–Watson value of 1.608 was achieved, with Durbin–Watson values from 0 to 4 and closer to 2, as indicated by the results of the Durbin–Watson test (Table 7). The above results suggested that there was no autocorrelation. In addition, as indicated by the coefficient of determination ($R^2$), 77.5% of the elderly's health status can be explained by the developed regression model when using the same independent variables. Furthermore, the F-test was performed on the model (Table 8), and the results suggested that the model *p*-value was 0.000, less than 0.001, suggesting that the model passed the F-test, and the model showed a linear relationship. Moreover, the statistical significance of the model developed in this study revealed that the inclusion of independent variables can be conducive to predicting the dependent variable compared with the null model, or the model outperformed the null model, suggesting that at least one of the nine independent variables in this study can theoretically affect the health status. Figures 8 and 9 present the histograms and Normal P-P plot of regression standardized from the validation analysis of the model. As indicated by the histogram results, the curves were normally distributed, and the distribution of the points in the normal P-P plot was close to the diagonal, suggesting that the data tended to be normally distributed. The above finding confirmed that the regression model can take on statistical significance.

**Table 7.** D-W test results.

| Model | R | $R^2$ | Adjusted $R^2$ | Error in Standard Estimate | Durbin–Watson |
|---|---|---|---|---|---|
| 1 | 0.880 [a] | 0.775 | 0.752 | 7.22511 | 1.608 |

[a]. Predictor variables: (Constant), Natural, Infrastructure, Dwelling, Daily acts, Income, Family, Education level, Age, Gender.

**Table 8.** F test results.

| Model | | Sum of Squares | Degree of Freedom | Mean Square | F | P |
|---|---|---|---|---|---|---|
| 1 | Regression | 15,662.785 | 9 | 1740.309 | 33.338 | 0.000 [a] |
| | Residual | 4541.594 | 87 | 52.202 | | |
| | Sum | 20,204.379 | 96 | | | |

[a]. Predictor variables: (Constant), Natural, Infrastructure, Dwelling, Daily acts, Income, Family, Education level, Age, Gender.

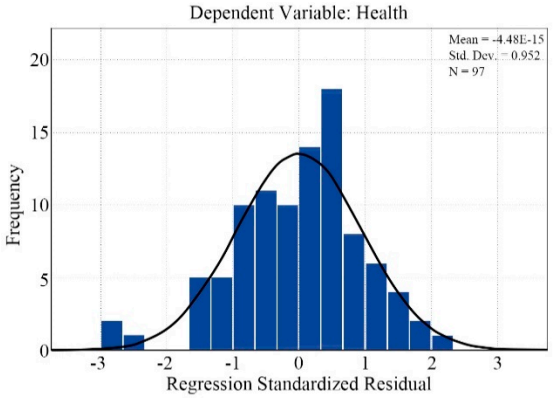



**Figure 8.** Histogram.

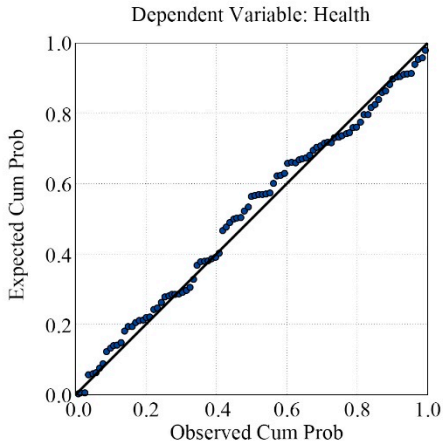



**Figure 9.** Normal P-P plots of regression standardized residuals.

In brief, the model for this study laid a foundation for the generation of linear regression equations. Nine independent variables were employed in this study (i.e., gender, age, education level, number of permanent household residents, income, daily behavior, traditional dwellings, infrastructure, and natural environment). Accordingly, the multiple linear regression analysis was conducted in this study to verify the linear relationship between the above nine independent variables and health status (Table 9). The mathematical model of the multiple linear regression equation is expressed as $E(y) = \beta_0 + \beta_1 \times x_1 + \beta_2 \times x_2 + \ldots + \beta_p \times x_p$, where y denotes the dependent variable, x represents the independent variable,

and β expresses the coefficient. The above-described equation can explain the change in the dependent variable y caused by the change in the independent variable x. $x_p$ (i = 1, 2, . . . , p) represents the independent variable, and p expresses the number of independent variables. $\beta_0$ is the constant term of this equation, and $\beta_p$ (i = 1, 2, . . . , p) is the regression coefficient. As indicated by the results of the linear regression analysis (table), $\beta_0$ reached 157.444, $\beta_1$ was −5.242, $x_1$ represents Gender, $\beta_2$ was −1.611, $x_2$ was Age, $\beta_3$ was −0.606, $x_3$ expresses Education level, $\beta_4$ was −0.411, $x_4$ denotes Family, $\beta_5$ was 0.001, $x_5$ represents Income, $\beta_6$ was −7.191, $x_6$ expresses Daily acts, $\beta_7$ reached 13.621, $x_7$ represents Dwelling, $\beta_8$ reached 4.682, $x_8$ denotes Infrastructure, $\beta_9$ is 17.198, $x_9$ expresses Natural. Thus, the linear regression equation for this study was set in the following.

$$\text{Health} = 157.44 - 5.242 * \text{Gender} - 1.611 * \text{Age} - 0.606 * \text{Education level} - 0.411 * \text{Family} + 0.001 * \text{Income} - 7.191 * \text{Daily acts} + 13.621 * \text{Dwelling} + 4.682 * \text{Infrastructure} + 17.198 * \text{Natural} \quad (2)$$

**Table 9.** Regression analysis results.

| Model | | Unstandardized Coefficient | | Standardized Coefficient | t | P |
|---|---|---|---|---|---|---|
| | | B | Standard Error | β | | |
| 1 | Constant | 157.444 | 14.773 | | 10.658 | 0.000 |
| | Gender | −5.242 | 1.534 | −0.181 | −3.416 | 0.001 |
| | Age | −1.611 | 0.117 | −0.826 | −13.805 | 0.000 |
| | Education level | −0.606 | 1.380 | −0.024 | −0.439 | 0.662 |
| | Family | −0.411 | 0.949 | −0.024 | −0.434 | 0.666 |
| | Income | 0.001 | 0.001 | 0.069 | 1.253 | 0.214 |
| | Daily acts | −7.191 | 6.763 | −0.061 | −1.063 | 0.291 |
| | Dwelling | 13.621 | 7.063 | 0.104 | 1.928 | 0.057 |
| | Infrastructure | 4.682 | 8.990 | 0.029 | 0.521 | 0.604 |
| | Natural | 17.198 | 7.960 | 0.114 | 2.160 | 0.033 |

## 4. Discussion

The Chinese dwelling tradition is to have several generations of family members living together in one dwelling [37]. With the development of modern society, young people have more contact with the outside world and have a difference in their housing preference, preferring to live alone. Thus, since young people have long-term employment, many elderly people stay in traditional dwellings.

The results of the interviews and communication as well as the analysis of the data show that there is a correlation between the health status and psychological status of the elderly. The psychological condition of the elderly is closely related to the family and the surrounding environment. The elderly may feel lonely because their children go out to work all the time, and they may feel depressed because they cannot help their children or even become a burden to them. Their sense of security and belonging is based on their familiarity with the village and the people and environment around them. The positive correlation between family size and health status also confirms the importance of family peer relationships for health, as family members can communicate with them, improve their mental state, and help them seek medical care when they are not feeling well.

For the current living environment, the local elderly show overall satisfaction, but express stronger dissatisfaction with their toilet space. Some of them will buy special stools or modify wooden stools and place them on top of the squatting pit, replacing the traditional squatting toilet with a sitting toilet. This is on the one hand related to the fact that their physical functions do not support them to squat for a long time, on the other hand, the elderly show high satisfaction with the sitting toilet, which helps to improve their sense of well-being in life [38].

In this study, the correlation between the health and evaluation factors of the elderly in Miao traditional dwellings in western Hunan was analyzed. As indicated by the results, the health status of the elderly can be dependent on many factors. To be specific, undoubtedly health status has a significant negative correlation with age at the 0.01 level. The education level of the sample was not correlated with health status, which was due to the overall selection of the study sample of the elderly aged 60 years and above in the remote, mountainous traditional dwellings of the Xiangxi Miao ethnic group, whose education level was generally low Furthermore, income showed a significant correlation with health, mainly because income showed a significant negative correlation with age, while age showed a significant negative correlation with health. The result of the field survey suggested that the local elderly could only earn income through manual work, agricultural products, and selling specialties, all of which were highly correlated with age. However, the health status of the elderly showed a positive correlation with income due to the negative correlation between income and age, and the positive correlation between daily behavior, traditional housing, and infrastructure and health status suggested that good daily behavior, traditional housing, and infrastructure can contribute to health.

We found that the daily behaviors of the Hmong elderly living in traditional dwellings in western Hunan are very different from those in urban dwellings and nursing homes. The elderly in traditional dwellings in the western Hunan province spend a lot of time and energy on daily farming activities, and most of them suffer from physical diseases such as spinal curvature, shoulder pain, and joint gout due to years of agricultural activities. In contrast, the elderly in urban homes and nursing homes not only do not need to do heavy agricultural work every day, but also have more comprehensive medical facilities, building accessibility, and other facilities for the elderly. In addition, we found that the mental health status of the elderly in traditional Miao dwellings in western Hunan differs significantly from that of the elderly in urban dwellings and nursing homes in that they show a stronger sense of loneliness and frustration, mainly due to the fact that their family members often go out to work for a living and cannot be with them. Moreover, the social activities of the Miao elderly in traditional dwellings in western Hunan are more primitive, and they basically do not use modern social tools, let alone enrich their time with modern entertainment products. At the same time, our survey of Miao elderly people living in traditional dwellings in western Hunan found that when it was suggested that they renovate traditional Miao dwellings in western Hunan to address their dissatisfaction with the existing living environment, their main concern was the cost.

Through the study, we found that the living environment and daily behaviors of this particular group of the elderly in traditional Miao dwellings in western Hunan are very different from those in urban residences and nursing homes, which leads to different physical and psychological needs, and thus affects their respective health [39–45]. However, the health of the elderly has been recognized as an important and urgent issue. China currently has a large elderly population, and the current elderly policy does not apply to the Miao elderly in traditional villages in the western Hunan Province, whose physical health, mental health, and living environment are what we need to pay attention to. We need to explore a sustainable development model for the health of the elderly in traditional Chinese villages based on reasonable data analysis and argumentation.

## 5. Problems and Recommendations

With China's socio-economic development and urbanization, the ancient villages and towns of the country are becoming increasingly 'hollowed out'. In this study, the participants in the interviews and questionnaires were all aged 60 years and above, and as they aged, their physical functions and mobility deteriorated, often suffering from cervical spondylosis, arthritis, ventilation, and other physical ailments. In addition, most elderly people have two or fewer permanent residents in their families, and their children and offspring are often unable to accompany them, such that they are prone to psychological problems such as depression, anxiety, and confusion. Furthermore, there are the problems

caused by buildings (e.g., the thermal performance of traditional residential homes, the indoor lighting environment, indoor air quality, and so forth). The external environment is characterized by inadequate infrastructure (e.g., medical conditions, water, electricity, and light resources). All of these have a direct impact on the health of the elderly.

Given the research in this study, the following recommendations regarding the health status of the elderly in the traditional dwellings of the Miao nationality in western Hunan are proposed, in view of the special geographical environment, customs, and culture of the Miao nationality:

- Infrastructure:

An emphasis on infrastructure development in traditional villages and towns such as transport, water, and electricity resources can improve the quality of life of the residents. In addition, there is a need to provide strong support and assistance to traditional Miao villages and towns in western Hunan for medical and educational resources, so as to ensure that the elderly have access to good medical services and that their offspring can receive a good education.

- Traditional dwellings:

First, the thermal performance of traditional dwellings should be enhanced to enhance indoor thermal comfort. Second, artificial lighting should be added to enhance the indoor lighting environment to meet the needs of the elderly for a well-li environment. Smoke extraction equipment should be added, as fire pits are an integral part of the architectural culture of the Miao people in western Hunan, such that smoke extraction should be artificially assisted to improve indoor air quality. Lastly, modern toilets should be built to provide convenience for the elderly.

- Mental Health:

Social services should be strengthened in traditional villages and towns. The elderly often show a strong sense of loneliness due to long periods of solitude and unaccompanied diversion, so it is necessary to strengthen psychological care.

- Policy support:

The introduction of more targeted support policies for ethnic minority and poverty-stricken areas will create a virtuous circle of sustainable development by improving the incomes and accessibility of local people and increasing the number of jobs to retain young people in local employment.

## 6. Conclusions

This study was based on the use of fieldwork data to analyze and study the health status of the elderly in the traditional dwellings of the Miao nationality in western Hunan. Behavioral observations, interviews, and questionnaires were conducted with the indigenous elderly residents of four typical Miao traditional villages (i.e., Zhushan Village, Zaogang Village, Liangdeng Village, and Laojiazhai Village) to analyze the health status of the elderly in the traditional villages.

The results of the study showed that the elderly in traditional Miao dwellings in western Hunan used basically all the spaces of the current dwellings and expressed overall satisfaction with the current dwelling spaces except for the toilets, which did not require spatial updating. In addition, the elderly in the area suffered from physical illnesses and discomfort due to years of physical farming, and have a significant lack of psychological security. Through the correlation study of their health, we concluded that the health status of the local elderly showed a multivariate linear relationship with gender, age, education level, number of permanent household residents, income, daily behavior, traditional residence, infrastructure, and natural environment.

At the same time, we found that the health status and factors of the elderly in traditional Miao dwellings in western Hunan were different from those of their urban counterparts, mainly due to differences in production and living habits over the years, plus

differences in living environment, ethnic beliefs, and other aspects from other elderly people. When we conducted the follow-up study, the existence of a large number of group differences also made us understand that we must build on this unique body and not apply the urban approach, which is not in line with the health rules and logic of the elderly in the Miao traditional dwellings in the western Hunan region. Based on the results of the study, we proposed targeted strategies to improve the quality of life and health status of the elderly in traditional Miao dwellings in the western Hunan region, while inheriting the local Miao customs and architectural culture, with the intention of improving the overall health status and well-being of the local elderly.

This study also has some limitations. In this study, the health status of the elderly in the traditional dwellings of the Miao nationality in western Hunan was investigated through detailed observations, interviews, and questionnaires based on the subjective judgments of the interviewees. However, the effect of coupled multi-factorial factors on health status was not considered in this study, and long-term testing data on the indoor physical environment to support the residents' subjective conclusions were not obtained. The recommendations for improvement, including those made in this study, should be verified in practice, which should be studied in depth in the future, to make a sustained improvement in the health of the elderly in the traditional dwellings of the Miao nationality in western Hunan. Based on the research in this paper, we demonstrated that the health of the elderly in traditional Miao dwellings in the western Hunan province shows a positive correlation with their dwellings, and we hope that in future research, we can continue to deepen the research into the interior space of the dwellings and discuss in depth the influence of each interior space and internal factors of the buildings such as the air quality and thermal environment on the health of occupants.

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