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Obstacle Factors and Spatial Measurement of the Well-Being of the Elderly in China

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Abstract: This paper takes 31 provinces in China as the research object and constructs an evaluation index system for the well-being of the elderly in four aspects (health well-being, income well-being, social well-being and educational well-being) and uses a set-pair analysis model to spatially measure the well-being of the elderly. Then, barrier analysis is used to identify the main factors that lead to the differences in the well-being levels of the elderly in different regions. The results show that: (1) The provinces with higher levels of well-being of the elderly are mainly concentrated in the Beijing–Tianjin–Hebei region, Pearl River Delta region, Yangtze River Delta region and Bohai Sea Rim region. (2) The differences in income well-being levels are the largest among provinces, and the differences in health levels are the smallest among provinces. (3) Analysis of the barriers to elderly well-being shows that the number of beds per 1000 population in health care facilities, elderly dependency ratio, number of higher education schools for adults, number of nursing homes and urban road area per capita are the main factors affecting the differences in the well-being levels of elderly people across provinces. Finally, policy recommendations are made to introduce localized policies for the elderly in China to continuously promote solutions to the problems of the elderly.

Keywords: the well-being of the elderly; set-pair analysis; obstacles; provincial territory

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1. Introduction

The number of people aged 65 and over in the world in 2020 was 723 million, accounting for 9.3% of the world's total population. Among them, China's elderly population was 169 million, accounting for 23.35% of the world's elderly population and 13.5% of China's total population. Population aging is a common problem facing global development in the 21st century. It is a fundamental national condition that the Chinese government needs to deepen its understanding and actively respond continuously. From the perspective of ensuring the interests and sustainable development of the elderly, how to make the elderly obtain opportunities for health, security and participation as much as possible, improve the well-being of the elderly and promote active aging has become the focus of society. From the "Seven-Year Development Programme for China's Aging Work" promulgated in 1994 to the "Thirteenth Five-Year Plan for the Development of the National Aging Cause and the Construction of the Elderly Care System" promulgated in 2017, China has prepared, adjusted and implemented five development plans for aging work one after another in more than two decades. By the evolving national conditions and the continuously increasing financial capacity of the state, these plans have provided top-level design and institutional assurance for the social retirement system in phases to constantly guarantee and improve the essential quality of life of the elderly and promote and enhance their well-being. Currently, the increasing demand for elderly services in the context of rapid aging and the general lack of supply of elderly services are forming a new contradiction,

resulting in an unbalanced allocation of well-being resources and development of elderly services between different regions, urban and rural areas and different elderly groups. Therefore, this study measures the level of well-being of the elderly in different areas of China, analyses the main factors affecting the spatial differences in the well-being of the elderly and puts forward corresponding policy suggestions for further improving the level of well-being of the elderly, promoting the development of the cause of aging and realizing the strategy of active aging.

In the early 1970s, well-being was introduced as an essential human element, which Smith considered the product of a set of influences, referring to a good state of life for people in a given society or region [1]. Smith proposed the geography-of-well-being approach [1] to evaluate the well-being and standard of living of people in different areas and to study the role of relevant policies in improving well-being and the standard of living. The geography-of-well-being approach led to the emergence of the geography of well-being, which focuses on the spatial variation in the well-being and quality of life of residents within a specific region [2,3]. Early geographies of well-being focused on descriptive studies of economic aspects but later moved on to social, political and health inequalities. Well-being studies have mainly focused on the following elements: (1) The definition of the connotation of well-being. Scholars have debated the content of a multidimensional framework for defining the connotation of well-being. Scholars have analyzed it from the perspectives of economic conditions [4], non-economic conditions [5] and sustainable development [6] and clarified that well-being represents the standard of living and quality of life of residents in a specific region and that it reflects not the life of a single individual but social justice in a spatial context; that is, residents obtain well-being from the spatial distribution of factors, linking spatial preferences and well-being indicators. In addition, Wang S.Y. et al. proposed the concept of a "well-being space" [7]. They established the WOSTEEM framework system for the study of the well-being space, pointing out that well-being is unified with the dynamic evolution of time and the unevenness of the spatial scale. (2) Evaluation indicators of well-being. Quantitative evaluation indicators of economic well-being include the GDP index [8], well-being measures of income distribution [9] and sustainable economic well-being index [10]. Regional social indicators are the systematic analysis of social-economic data, demographic data and residential data within a specific spatial scale, revealing the generation mechanism of social-spatial structure and reflecting the "quality of life" and "regional justice". These include the Material Quality of Life Index, the Social Progress Index and the Comprehensive Index of Living Standards [11]. In addition, there are also subjective well-being measures of people's mental and psychological activities, such as life satisfaction and personal happiness [12]. (3) Methods of measuring well-being. Well-being is measured using different spatial and temporal pattern analysis methods, including social surveys, factorial ecological analysis, exploratory spatial data analysis, hierarchical analysis, concentration index, Gini coefficients and other methods [13,14]. (4) Real-world issues in well-being research. These include gender and health well-being, environment and residential well-being, location and economic well-being, culture and local well-being [15] and the level of well-being and social justice of disadvantaged groups such as the elderly and the disabled [16,17]. Among them, research on the well-being of older people is an important aspect, which focuses on the definition of the connotation, evaluation indicators, level measurement and analysis of influencing factors of the well-being of older people [18–22]. Scholars have defined the concept of the well-being of the elderly, which has experienced a comprehensive reflection from a single economic indicator to social, economic, cultural, environmental, health and other multidimensional indicators. Evaluation indicators include quality-of-life indicators, satisfaction and well-being indicators, human development index and environmentally sensitive well-being index. The level of well-being of the elderly is mainly measured by constructing an indicator system. There are two indicator systems: subjective and objective composite well-being levels. The evaluation includes economic indicators such as income and consumption, social indicators such as culture, transport, education and health and environmental indicators

such as atmosphere, water bodies and greenery conditions. It analyzes the influencing factors of the well-being of the elderly, including the role of the social welfare system for the elderly, urban–rural dual structure and social security system at the macro-level [23]; at the micro-level, it mainly studies the individual's gender, age, education level, marital status, living situation, income level, participation in social activities, hobbies, psychological status, social support and other aspects of comprehensive research [24,25].

Throughout previous studies, scholars have provided different criteria and methods for measuring well-being, but there is still room for strengthening the measurement of the well-being space, as well as research that explicitly refines, differentiates and systematically analyzes its indicators. There is also a paucity of literature exploring the well-being space for older people. In particular, there is a lack of research to determine the level of well-being of older people, measure the disparity between the well-being of older people in different regions and use this as a basis for formulating pathways to improve well-being. In recent years, there has been a pressing need for the Chinese government to scientifically assess the level of well-being of older people in different regions, verify the applicability of existing policies and provide a factual basis for the introduction of new policies in the future. To achieve this goal, it is urgent to build a scientific spatial assessment index system for well-being and to use scientific methods to measure the level of well-being so as to analyze more accurately the level of well-being of older people in each province and to introduce relevant policies for the elderly in accordance with local conditions and to continuously promote a step-by-step solution to the elderly problem.

2. Research Methodology and Data Sources

2.1. Constructing the Indicator System

The well-being of the elderly is the development of an environment that provides solutions to the problems of life for older people. Considering that the object of well-being evaluation is older people, it is necessary to reflect all aspects of the well-being of the elderly comprehensively, highlight the characteristics of each indicator and take into account the interrelationship between the indicators, as well as the possibility of obtaining data. This study is based on the framework of "health, security and participation", the three pillars of "active aging" put forward by the World Health Organization in recent years. Combined with the related dimensions of health, income, safety, freedom and social relations put forward by scholars on well-being [26], the evaluation index system of the well-being level of the elderly is constructed from four aspects: health well-being, income well-being, social well-being and educational well-being. As an independent internal goal of the well-being of the elderly, health well-being reflects the treatment and rehabilitation of diseases caused by aging, which is specifically characterized by the total cost per capita and the allocation of medical institutions in public health services. Income well-being represents the security basis of the life of the elderly, and the economic basis of the quality of life of the elderly can be analyzed from the income and expenditure structure of residents. Social well-being reflects the degree of participation of the elderly in socio-economic, cultural and spiritual activities in terms of the proportion of the elderly population, the allocation of pension institutions, cultural resources and transportation conditions. Educational well-being evaluates the extent to which the elderly continue to contribute to the society by using their knowledge, skills and experience in terms of educational funds, educational institutions and educational level. Social well-being and educational well-being represent the ability of older people to participate in social life. This study selects 31 provincial administrative units in China (excluding Hong Kong, Macao and Taiwan), whose total population, number of older people and share of older people in the total population are shown in Figure 1. We use data from each provincial area in 2018 for empirical analysis. The relevant data are from 2019 China Statistical Yearbook, China Social Statistical Yearbook, China Health Statistical Yearbook, provincial statistical yearbooks and pension information network. Among them, due to the lack of indicators of the income level and education level of the elderly, we use average employee wage, an important parameter in pension payment, to

replace the income level indicators of the elderly. Considering that the general level of education of the elderly over 65 is relatively low due to the constraints of the overall social environment, we use the illiteracy rate and average years of schooling to replace the lack of education of the elderly in each province. In this paper, the entropy value method is used to assign the weight of the evaluation indicators (Table 1).

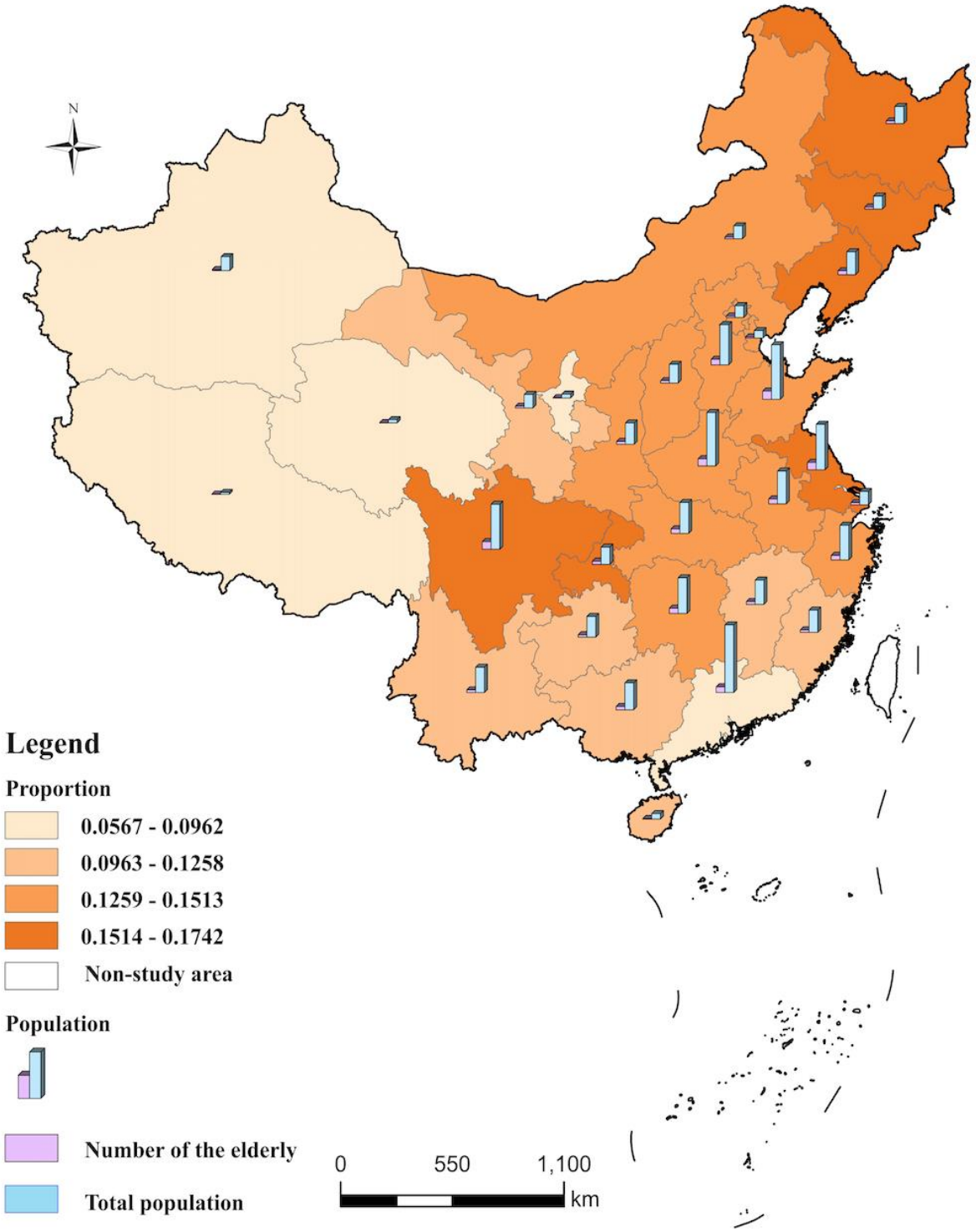

Figure 1. Spatial distribution of the elderly in 31 provinces in China.

Table 1. Indicator system for evaluating the level of well-being of the elderly.

Target Level	Guideline Level	Indicator Abbreviation	Indicators	Nature of Indicator	Weighting
Well-Being of the elderly	Health well-being	H1	Total health expenditure per capita (CNY)	Positive	0.0322
		H2	Density of public health institutions (per 10,000 square kilometers)	Positive	0.0565
		H3	Number of beds per 1000 population in health care facilities (in beds)	Positive	0.0611
		H4	Number of health technicians per 1000 population (unit)	Positive	0.0351
	Income well-being	G1	Gross regional product per capita (CNY)	Positive	0.0699
		G2	Per capita disposable income of urban and rural residents (CNY)	Positive	0.0634
		G3	Local revenue within the general budget (CNY billion)	Positive	0.0543
		G4	Average employee wage (CNY)	Positive	0.0598
		G5	Per capita consumption expenditure (CNY/person)	Positive	0.0532
		G6	Engel coefficient (%)	Negative	0.0367
	Social well-being	S1	Elderly dependency ratio (%)	Positive	0.053
		S2	Number of nursing homes (unit)	Positive	0.0799
		S3	Number of residential care beds per 1000 elderly people (unit)	Positive	0.039
		S4	Public library collections (million volumes)	Positive	0.0707
		S5	Urban road area per capita (m^2)	Positive	0.0374
		S6	Number of buses per 10,000 people (vehicles per 10,000 people)	Positive	0.0428
	Educational well-being	E1	Education expenses (CNY million)	Positive	0.0481
		E2	Average years of schooling (years)	Positive	0.0215
		E3	Illiteracy rate (%)	Negative	0.0191
		E4	Number of higher education schools for adults (unit)	Positive	0.0662

Note: The entropy method is an objective weighting method. Using the information carried by the entropy value for weight calculation, the tool of information entropy is used to calculate the weight of each indicator in combination with the degree of variation of each indicator, providing a basis for the comprehensive evaluation of multiple indicators. In addition, there are 2 missing values in the original data: the total public library collections in Tibet and the number of adult higher education schools in Guangxi. For the total public library collections in Tibet, we used the time-series data of previous years and used linear interpolation to impute the data for 2018. For the number of adult higher education schools in Guangxi, we used the moving average method to impute the data for 2018.

2.2. Measurement Model

In this study, the set-pair analysis model is used to measure the well-being level of the elderly in 31 provinces in China. Set-pair analysis regards the associated set A and set B as set pair H, and set pair H has N characteristics. The common feature of the two sets is S, the opposite part is P, and the remaining parts are uncertain [27]. The values of the connection degree μ between set A and set B are as follows:

$$\mu(W) = \frac{S}{N} + \frac{F}{N}i + \frac{P}{N}j = a + bi + cj \quad (1)$$

In the above equation, a denotes the degree of identity between set A and set B on question W, b denotes the degree of difference between the two sets, and c denotes the degree of opposition between the two sets while satisfying $a + b + c = 1$. i denotes the coefficient of difference between the two sets, and j denotes the coefficient of opposition between the two sets. i takes the value of $[-1,1]$, and j is fixed to -1. According to the above setting, set A denotes the system of indicators of well-being of the elderly in 31 provinces in China, and set B denotes the evaluation standard of indicators of the well-being of the elderly. According to the above settings, set A represents the system of indicators of the well-being of the elderly in 31 provinces in China, and set B represents the evaluation criteria of indicators of the well-being of the elderly. Set A and set B construct set pair H{A, B} and measure the proportion of their same, different and contrasting relationships. It will transform the perceptual evaluation of the well-being level of the elderly in 31 provinces of China into a comparative analysis of set A and set B. In addition, the problem of the well-being level of the elderly in the 31 Chinese provinces is set as $Q = \{M, N, O, W\}$, evaluation scheme as $M = \{m_r\}$ $(r = 1,2, \ldots ,m)$, evaluation indicator as $N = \{n_k\}$ $(k = 1,2, \ldots ,n)$ and evaluation

object as $O = \{o_t\}$ (t = 1,2, ... ,p), and the indicator weights are $W = \{w_k\}$ (k = 1,2, ... ,n). The relevant data are compared in the same space, based on which the optimal evaluation indicators are selected to construct the optimal solution set $U = \{u_1,u_2, \ldots ,u_n\}$, and the low indicators are selected to construct the inferior solution set $V = \{v_1,v_2, \ldots \ v_n\}$ [28]. The degree of association of set pair $\{F_m, U\}$ between $[U, V]$ is:

$$\begin{cases} \mu(f_m, U) = a_m + b_m i + c_m j \\ a_m = \sum w_p a_{pk} \\ c_m = \sum w_p c_{pk} \end{cases} \qquad p = (1,\ 2,\ ...,\ n) \tag{2}$$

In the formula, a_{pk} and c_{pk} are the same degree and opposite degree of evaluation index d_{pk} and set $[v_p, u_p]$, respectively, and w_p is the weight of item p [29].

When d_{pk} has a positive effect on the evaluation results:

$$\begin{cases} a_{pk} = \frac{d_{pk}}{u_p + v_p} \\ c_{pk} = \frac{u_p v_p}{d_{pk}(u_p + v_p)} \end{cases} \tag{3}$$

When d_{pk} has a negative impact on the evaluation results:

$$\begin{cases} a_{pk} = \frac{u_p v_p}{d_{pk}(u_p + v_p)} \\ c_{pk} = \frac{d_{pk}}{u_p + v_p} \end{cases} \tag{4}$$

The relative closeness degree r_m between the scheme f_m and the optimal scheme set U can be defined as:

$$r_m = \frac{a_m}{a_m + c_m} \tag{5}$$

In this study, the value of r_m index reflects the level of well-being of the elderly in various provinces of China, that is, the greater the r_m value, the higher the level of well-being of the elderly in the province, and vice versa.

3. Measurement and Analysis of the Well-being Level of the Elderly in Various Provinces of China

3.1. Measurement Result

Based on the set-pair analysis measurement model, the health well-being (B1), income well-being (B2), social well-being (B3), education well-being (B4) and overall (B) levels of the elderly in each province and region in China in 2018 were calculated and ranked according to the overall level. The results are shown in Figure 2.

Among the 31 provinces, Beijing, Shanghai, Jiangsu and Zhejiang have the highest level of well-being for the elderly. In contrast, Ningxia, Qinghai, Hainan and Tibet have the lowest level of well-being for the elderly. In terms of differences in the four aspects of well-being, the three provinces with the highest level of health well-being are Beijing, Shanghai and Shandong; the three provinces with the highest level of income well-being are Shanghai, Beijing and Guangdong; the three provinces with the highest level of social well-being are Jiangsu, Shandong and Zhejiang; and the three provinces with the highest level of educational well-being are Guangdong, Beijing and Sichuan. The provinces with the lowest level of well-being in the four aspects: Tibet, Anhui and Hainan are the provinces with the lowest level of health well-being, and they are among the lowest in the country in terms of the density of public health institutions, the total health expenditure per capita and the number of beds per 1000 population in health care facilities. Among them, the density of public health institutions in Tibet is equivalent to 30% of the national average, the total health expenditure per capita in Anhui is only 70% of the national average, and the number of beds per 1000 population in health care facilities in Hainan is only 80% of the national average. The three provinces with the lowest level of income well-being are Gansu, Heilongjiang and Shanxi (in this order). Their gross regional product per capita,

local revenue within the general budget, per capita disposable income of urban and rural residents, average employee wage and per capita consumption expenditure are all at a lower level in the country. In contrast, the Engel coefficient as a proportion of total personal consumption expenditure is higher. The three provinces with the lowest level of social well-being are Tibet, Hainan and Qinghai, which are in a relatively poor state in terms of the number of nursing homes, the number of residential care beds per 1000 elderly people and the public library collections, with the number of nursing homes and the public library collections in Tibet and Qinghai being only about 1/10 of the national average, the number of residential care beds per 1000 elderly people in Hainan and Tibet being 1/3 of the national average and the urban road area per capita and the number of buses per 10,000 people in Tibet being 60–70% of the national average. Ningxia, Tibet and Qinghai are the provinces with the lowest level of educational well-being, mainly manifested in the low education expenses and the small number of higher education schools for adults, as well as the illiteracy rate of more than 10%. The calculated standard deviation of the well-being level shows that income well-being > social well-being > educational well-being > health well-being; that is, the level of income well-being varies most among provinces, while the gap of health well-being is the smallest among provinces.

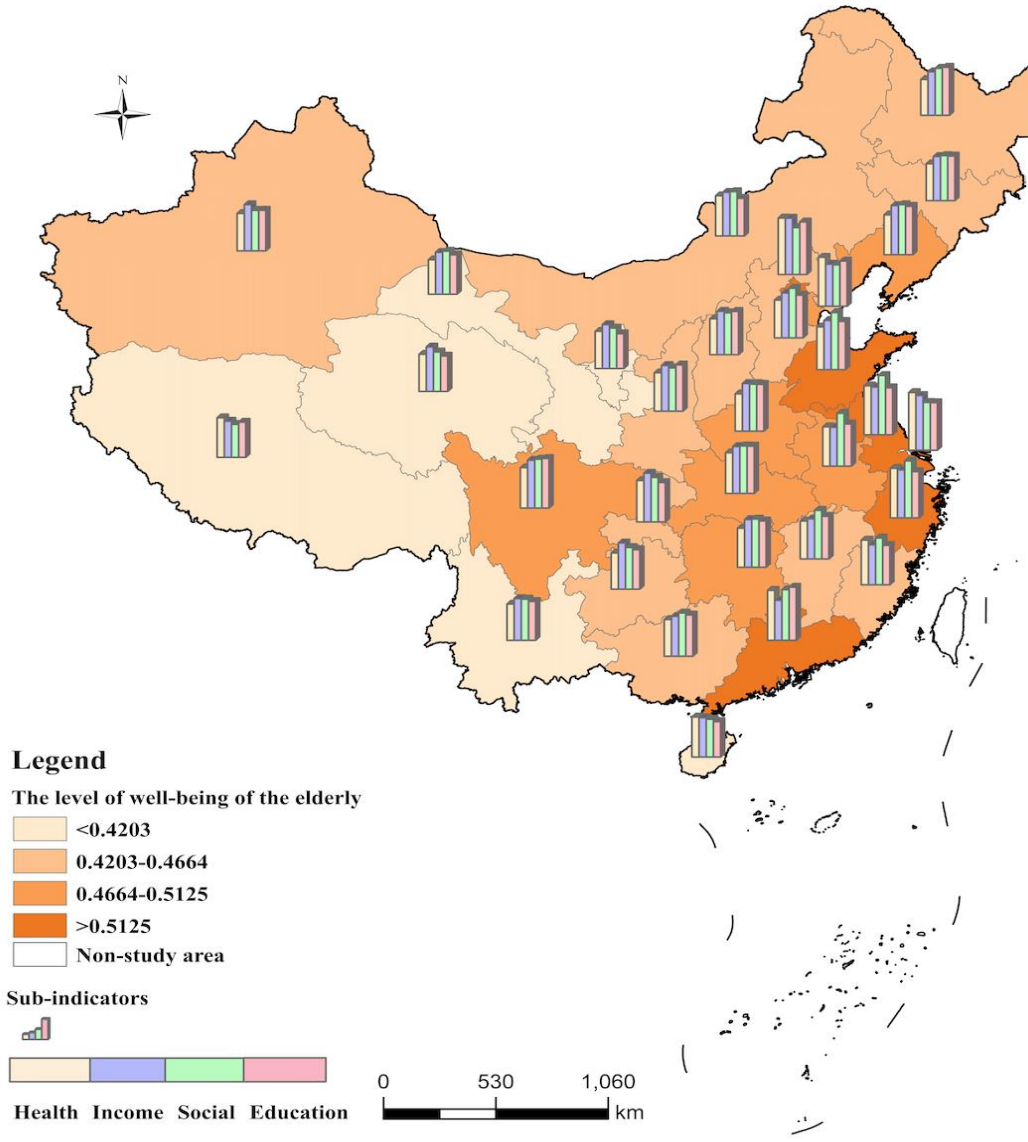

Figure 2. Results of measuring the well-being level of the elderly in 31 provinces of China.

To reveal more clearly the disparities in the well-being of older people between provinces, the mean value of the overall well-being level M = 0.4664 and the standard deviation Std = 0.0461 are set as the benchmarks for classifying the well-being levels of older people in 31 provinces in China (Table 2). The Beijing–Tianjin–Hebei region, Pearl River Delta region, Yangtze River Delta region and Bohai Rim region have higher levels of well-being in China.

Table 2. Classification criteria for the level of well-being of older people in China's provinces.

Classification Number	Classification Criteria	Classification Results	Grade	Province
1	$0 \leq R < (M - Std)$	$0 \leq R < 0.4203$	Lower	Gansu, Yunnan, Ningxia, Qinghai, Hainan, Tibet
2	$(M - Std) \leq R < M$	$0.4203 \leq R < 0.4664$	Moderate	Fujian, Hebei, Chongqing, Heilongjiang, Shaanxi, Jiangxi, Jilin, Inner Mongolia, Xinjiang, Shanxi, Guizhou, Guangxi
3	$M \leq R < (M + Std)$	$0.4664 \leq R < 0.5125$	Higher	Liaoning, Sichuan, Hubei, Hunan, Tianjin, Anhui, Henan
4	$(M + Std) \leq R \leq 1$	$0.5125 \leq R \leq 1$	Highest	Beijing, Shanghai, Jiangsu, Zhejiang, Shandong, Guangdong

Note: The abbreviations in Table 2 stand for: R for the value of the level of well-being of older people in each province, M for the mean value of the overall well-being level and Std for the standard deviation.

According to the evaluation results of the overall well-being level, the provinces with lower well-being levels for the elderly are Gansu, Yunnan, Ningxia, Qinghai, Hainan and Tibet. In terms of evaluation indicators, the density of public health institutions, gross regional product per capita, local revenue within the general budget, per capita disposable income of urban and rural residents, per capita consumption expenditure, number of nursing homes, public library collections and number of higher education schools for adults are among the lowest in the country in these six provinces. It is noteworthy that although the level of well-being of the elderly is generally low in these six provinces, among the income well-being indicators, the average employee wage in Qinghai and Ningxia is higher than the national average, and the Engel coefficient is lower than the national average. Therefore, the wage income and living standards of workers in Qinghai and Ningxia are better than those in the other four provinces, which also directly affects their levels of income well-being in old age. Among these six provinces, the total health expenditure per capita in Qinghai, Tibet, Ningxia and Hainan is higher than the national average, indicating that they have developed health care investment faster; the urban road area per capita in Gansu, Ningxia and Hainan and the number of buses per 10,000 people in Qinghai, Ningxia and Yunnan are all higher than the national average, indicating that they have certain advantages in terms of transportation conditions for the development of social well-being. However, on the whole, the problems of poor medical and health conditions, living needs of residents and housing and cultural conditions are common in these six provinces, indicating that the convenience of daily life services for the local elderly is poor. Local governments should fully consider the needs of public welfare services for the elderly, pay attention to their physical health, economic income levels, social support environments and educational attainment and reasonably allocate public service resources such as healthcare, education and transportation to build a comfortable environment for the elderly in their daily lives.

$(M - Std) \leq R < M$, with 12 provinces such as Fujian and Hebei having an intermediate level of elderly well-being; that is, nearly half of the provinces in China have an intermediate level of elderly well-being. Since the promulgation of the "decision of the CPC Central Committee and the State Council on strengthening work for the elderly" and the "opinions on speeding up the socialization of Social Welfare" jointly issued by many ministries and commissions in 2000, governments in various parts of China have increased their

investment in the work for the elderly and the development of social welfare undertakings year by year, and the level of social welfare for the elderly has been continuously improved. Hebei and Jiangxi in the central region and Shaanxi in the northwest region have seen significant improvements in welfare levels compared to other provinces, especially in social well-being, income well-being and health well-being. Chongqing and Fujian are more potent than other provinces in terms of income well-being and social well-being. Still, in terms of educational well-being, these two provinces are below the national average in terms of education expenses, average years of schooling and number of higher education schools for adults. Jilin and Heilongjiang in the northeast region stand out for their low levels of income well-being, which is an essential component of older people's well-being, and the level of residents' income and expenditure directly affects income well-being. Increasing income and expenditure levels is the essential support for the well-being of older people. The income of the elderly is mainly composed of pension, child support or their continued labor income, while the expenditure of the elderly is mainly composed of food and health care products. The level of expenditure of the elderly is positively related to the level of income, which determines the well-being of the elderly. Therefore, the income and expenditure of residents in these two provinces directly affect their level of well-being in old age. Shanxi, Guizhou and Guangxi are in a similar situation. In addition to improving their economic strength and increasing residents' income, they need to strengthen the environment in terms of social services and make up for the shortcomings in terms of the number of nursing homes, the number of residential care beds per 1000 elderly people, the public library collections and the number of buses per 10,000 people in terms of resource allocation. In Inner Mongolia and Xinjiang, health well-being, social well-being and education well-being are all at the lower end of the national scale, except for income well-being, which is at the middle of the national scale. In terms of health well-being, these two provinces share the common feature of having a much lower density of public health institutions than the national average, while the non-equalization of the spatial distribution of health care resources is a prominent problem. In terms of social well-being, both provinces still suffer from a severe shortfall in the number of nursing homes and low public library collections. In particular, there is a significant shortfall in the number of nursing homes, with 403 and 216 nursing homes in Inner Mongolia and Xinjiang, respectively, while the average number of nursing homes in each province is 805. In terms of educational well-being, both provinces are at the lower end of the national scale in terms of education expenses and the number of higher education schools for adults, with Inner Mongolia being particularly prominent. These 12 provinces have a certain foundation for the development of welfare for the elderly, but the problems are also concentrated and prominent, which is a typical "problem zone" that needs key breakthroughs and rapid promotion.

$M \leq R < (M + Std)$, with seven provincial areas, including Liaoning and Sichuan, having higher levels of elderly well-being. The average elderly dependency ratio in these provinces is 18.15, which is 2.46 percentage points higher than the national average of 15.69. These provinces are also the main areas where China's elderly population is concentrated. To meet the needs associated with the growing elderly population, these seven provinces have seen significant improvements in the economic, health, education and cultural conditions of the elderly. Tianjin, Hubei and Sichuan are provinces with a large population and developed economy; the population determines the demand for public services, and the financial resources of local governments determine the supply of public services. The average employee wage, total health expenditure per capita and education expenses in these provinces are higher than those of any other provincial area in China, reflecting that the higher level of public service investment construction has enormously contributed to the improvement of the well-being of the elderly. At the same time, it should be noted that while all seven provinces have high levels of well-being among the elderly, there are significant differences among them. In Anhui and Tianjin, the number of beds per 1000 population in health care facilities and the number of health technicians per

1000 population are relatively low among the seven provinces. The construction of health institutions still needs to be strengthened. Henan, Hunan and Liaoning do not reach the average of the seven provinces in terms of indicators related to income and well-being, such as gross regional product per capita, average employee wage and per capita consumption expenditure, and they should focus more on increasing income, promoting consumption and continuously raising the level of regional well-being. The number of nursing homes and the number of residential care beds per 1000 elderly people in Tianjin are relatively low compared to other provinces and cities, coupled with the fact that quality nursing resources in urban areas with convenient transportation and their full-service facilities are even more strained, which objectively affects the supply of welfare nursing services. Anhui, Sichuan and Henan, where the average years of schooling are lower than in several other provinces, still have more room to improve the quality of their elderly welfare provision and service capacity, despite the fact that their elderly well-being levels are among the higher-ranking provinces. These three provinces should pay more attention to the elderly's internal factors, such as education level, intellectual resources and spiritual and cultural life.

$(M + Std) \leq R \leq 1$. The six provinces of Beijing, Shanghai, Jiangsu, Zhejiang, Shandong and Guangdong have the highest level of well-being among the elderly. Beijing is the political and cultural center, Shanghai is the economic and financial center, and Jiangsu, Zhejiang and Guangdong are the economic centers of the Yangtze River Economic Belt and the Pearl River Delta, respectively. Shandong is a solid northern economic province. The economic, educational, health and social development levels of these six provinces are far higher than those of other provinces in terms of gross regional product per capita, average employee wage, per capita disposable income of urban and rural residents, education expenses and other financial funds related to welfare level but also in the number of nursing homes, number of residential care beds per 1000 elderly people and public library collections. As well as the urban road area per capita, the number of buses per 10,000 people and other social public service provisions are in a dominant position. Due to their superior economic and social development, these provinces can attract a greater concentration of human resources, creating the conditions for better welfare provision, which is an essential factor in the high level of well-being of the elderly.

3.2. Analysis of Influencing Factors

To analyze the factors influencing the spatial differences in the level of well-being of the elderly in 31 provinces in China, we introduced the barrier degree [30] calculation method, which is formulated as follows.

$$M_j = V_j \times U_j / \sum_{j=1}^{n} V_j U_j \times 100\% \quad (6)$$

In the above equation, M_j is the degree of barrier, V_j is the degree of deviation from the indicator (the gap between each indicator and the overall target for the level of well-being of the elderly), and U_j is the degree of factor contribution (the degree of influence of each indicator on the overall target).

The calculation results of Equation (6) show the obstacle factors to the level of well-being of the elderly in China by the province in 2018 (Table 3).

Table 3 shows that among the factors affecting the well-being of the elderly, H3 (number of beds per 1000 population in health care facilities), S1 (elderly dependency ratio), E4 (number of higher education schools for adults, S2 (number of nursing homes) and S5 (urban road area per capita) are five indicators with high frequency. The first obstacle factors affecting the well-being of the elderly in each province are E4 (number of higher education schools for adults), S1 (elderly dependency ratio) and H3 (number of beds per 1000 population in health care facilities). The first obstacle to the level of well-being of the elderly varies from province to province, and corresponding measures should be taken

according to their different obstacle factors to accurately improve the level of well-being of the elderly.

Table 3. Obstacles to the well-being of the elderly by the province in China in 2018.

Provincial Area	First Barrier Degree		Second Barrier Degree		Third Barrier Degree		Fourth Barrier Degree	
	Factors	Obstacles	Factors	Obstacles	Factors	Obstacles	Factors	Obstacles
Beijing	G4	14.355%	G3	13.246%	H4	12.756%	G5	10.868%
Tianjin	G1	8.500%	G5	7.054%	G4	6.664%	H2	6.608%
Shanghai	G2	13.782%	G4	13.206%	G5	12.214%	H2	11.668%
Chongqing	H3	5.440%	E3	3.458%	H2	3.426%	G1	3.290%
Hebei	H2	6.263%	S6	4.463%	S2	4.337%	E1	4.326%
Shanxi	G6	4.554%	S1	4.033%	E2	3.730%	H2	3.700%
Liaoning	E4	6.859%	S2	6.049%	H3	5.660%	S4	4.253%
Jilin	E4	5.054%	G6	4.274%	S2	4.272%	H3	3.607%
Heilongjiang	E4	7.220%	H3	4.504%	S2	4.311%	S6	4.081%
Jiangsu	S4	9.791%	G3	9.255%	S2	8.000%	G1	7.973%
Zhejiang	S4	9.022%	G2	8.391%	S3	7.805%	G3	7.016%
Anhui	S2	7.446%	S5	4.883%	S3	4.508%	E1	3.633%
Fujian	G1	5.693%	S6	4.890%	S1	4.531%	G2	4.513%
Jiangxi	S2	8.298%	S1	4.047%	S5	3.932%	E3	3.425%
Shandong	H2	7.182%	S2	7.079%	G3	6.892%	E1	6.863%
Henan	E1	6.103%	H2	5.934%	S2	4.661%	G6	4.120%
Hubei	E4	5.054%	H3	4.544%	S3	4.172%	S4	3.968%
Hunan	H3	5.221%	S6	5.026%	E4	4.332%	E1	4.081%
Guangdong	G3	13.083%	E1	11.510%	S4	10.033%	G5	5.577%
Hainan	S1	5.250%	E2	3.730%	E3	3.443%	S5	3.251%
Sichuan	E4	5.776%	H3	5.600%	E1	5.383%	G3	4.055%
Guizhou	H3	4.882%	S3	3.769%	G6	3.625%	E1	3.232%
Yunnan	S1	4.356%	E1	3.487%	G6	3.460%	S6	3.396%
Shaanxi	H4	6.214%	E4	5.054%	H3	4.384%	G6	3.958%
Gansu	S3	3.773%	H3	3.587%	S5	3.544%	S1	3.121%
Qinghai	S1	5.656%	S6	4.431%	H3	4.225%	H4	4.091%
Inner Mongolia	S3	7.904%	S5	4.830%	S1	4.554%	H4	4.168%
Guangxi	S5	3.945%	S1	3.674%	E3	3.530%	E1	3.043%
Tibet	G4	9.347%	S1	6.753%	H1	3.393%	S5	2.028%
Ningxia	S5	4.881%	H4	4.709%	S1	4.619%	G6	4.400%
Xinjiang	S1	5.762%	H3	5.620%	S6	4.346%	S5	4.189%

Note: Factor abbreviations are consistent with indicator abbreviations in Table 1.

In terms of health well-being, H2 (density of public health institutions) is the first obstacle factor affecting the well-being of the elderly in Hebei and Shandong, indicating that these two provinces have an advantage in the allocation of health care resources, and the accessibility and convenience of public health services for the elderly are significant; H3 (number of beds per 1000 population in health care facilities) is the first obstacle factor affecting the well-being of the elderly in Chongqing, Hunan and Guizhou. As there is a difference in the size of public health institutions, the number of institutional beds effectively compensates for the amount of occupancy per capita. The bed equipment in health service institutions in these provinces is more adequately equipped, effectively increasing the level of convenience for older people to reach public health institutions to enjoy medical and health services; H4 (number of health technicians per 1000 population) is the first obstacle factor affecting the level of well-being of older people in Shaanxi, which in recent years has increased the number of relevant professionals. Shaanxi has increased the number of schools and training institutions in recent years, providing better primary conditions for training health technicians and continuously increasing the number of health technicians to provide the necessary human resources for the improvement of the health and well-being of the elderly. In terms of income well-being, G1 (gross regional product per capita) is the number one obstacle factor affecting the well-being of older people in Tianjin and Fujian. The economic development of these two provinces is good, and the living standard of the elderly is better than that of other provinces. G2 (per capita disposable income of urban and rural residents) and G3 (local revenue within the general budget) are the main factors affecting the well-being of older people in Shanghai and Guangdong. G4 (average employee wage) is the main factor affecting the well-being of older people in

Beijing and Tibet. These two provinces have high wage levels for locally employed people due to favorable state policies, while the level of essential pension insurance contributions and the level of retiree wages are both closely related to the average local social salary. In terms of social well-being, S1 (elderly dependency ratio) is the number one barrier to the level of well-being of the elderly in Hainan, Yunnan, Qinghai and Xinjiang. In these provinces and territories, due to the low elderly dependency ratio, the number of individuals of working age participating in basic old-age insurance can be fully guaranteed and basic pensions are more adequate, while the number of pensioners is smaller and the social burden is more minor. S2 (number of nursing homes) and S3 (number of residential care beds per 1000 elderly people) are the main factors affecting the level of well-being of the elderly in Anhui, Jiangxi and Gansu and Inner Mongolia. S4 (public library collections) is the main factor affecting the well-being of older people in Jiangsu and Zhejiang. S5 (urban road area per capita) is the main factor affecting the level of well-being of the elderly in Guangxi and Ningxia. This indicator represents the level of urban road construction in the region and reflects the convenience and accessibility of transport conditions. Investment in road networks should be increased to improve road access and meet the needs of urban transport development, thereby improving the convenience and efficiency of travel for the elderly. In terms of educational well-being, E1 (education expenses) is the number one barrier to the level of well-being of the elderly in Henan. E4 (number of higher education schools for adults) is the main factor affecting the well-being of older people in Liaoning, Jilin, Heilongjiang, Hubei and Sichuan. Higher education schools for adults are an essential vehicle to undertake the development of elderly education. They aim to lower the threshold of higher education, give older people the opportunity to study again and promote the social culture of learning without stopping, which is vital for improving older people themselves and the social atmosphere. In the future, the number of adult higher education schools, universities for the elderly and community classes should be increased to provide better learning conditions and environments for the elderly and to meet their cultural needs for improving their humanistic qualities and promoting physical and mental health education.

4. Conclusions and Recommendations

4.1. Conclusions

Promoting the well-being of the elderly is a long and arduous process, and China's aging career is still in a stage of exploration and development. Along with the guidance and support of relevant favorable policies for the cause of elderly services in recent years, the level of well-being of the elderly is improving significantly. However, regional differences and uneven development will still persist. Nationally, the provinces with higher levels of elderly well-being are mainly concentrated in the Beijing–Tianjin–Hebei region, Pearl River Delta region, Yangtze River Delta region and Bohai Sea Rim region. The analysis of obstacle factors shows that H3 (number of beds per 1000 population in health care facilities), S1 (elderly dependency ratio), E4 (number of higher education schools for adults), S2 (number of nursing homes) and S5 (urban road area per capita) are the main factors affecting the well-being of the elderly in different provinces of China.

4.2. Recommendations

In response to the above research conclusions, this paper puts forward the following suggestions:

The Chinese government should optimize the effective allocation of health resources and improve the coverage and equitable accessibility of health services. Health services for the elderly are unevenly allocated between different regions, urban and rural areas and between critical medical and health institutions and primary health services, resulting in an imbalance in the supply and demand of health resources and a wide gap in the coverage and accessibility of health services. The uneven distribution of existing health resources has become a bottleneck limiting the level of well-being of older people in China. Therefore,

government departments need to make comprehensive adjustments according to the supply and demand of health resources between different regions and promote a rational distribution of resources, paying particular attention to some western and intermediate areas where parity is currently low, to promote a balanced supply and demand. At the same time, based on increasing investment in health and hygiene institutions, technicians, beds and medical equipment in rural areas, existing urban health resources should be guided in an orderly manner to radiate to surrounding rural areas, narrowing the gap in the allocation of health service resources between urban and rural areas and realizing the sharing of medical resources between urban and rural areas. In addition, it is also necessary to focus on the accessibility of service coverage in primary health care institutions and effectively improve the equity of health and well-being of the elderly from three aspects: geographical accessibility, economic accessibility and resource accessibility.

The Chinese government should pay attention to social support for the elderly and improve the quality assurance of social services. Social support for the elderly is an essential factor in meeting the needs of the elderly population and directly affecting their level of well-being. It depends on the quantity and quality of social services provided. The primary social environment conditions such as the elderly dependency ratio and the number of nursing homes in various provinces, as well as urban public transport conditions, are the key points of social support for older people. As the population ages and the phenomenon of smaller families and empty nesters continue to increase, institutional care is becoming more mainstream, especially in the case of "combined medical care". The number of nursing homes and the number of beds per 1000 population in health care facilities directly determine the scale of institutional care. These figures establish the social basis for the level of well-being of older people everywhere. While medical and nursing care institutions are being built around the world, strengthening the standardization of the construction and management of nursing care institutions is an important step in improving the quality of services provided by nursing care institutions and protecting the rights and interests of the elderly. We should deepen the reform of public pension institutions with private construction, cooperative operation and service outsourcing, support community nursing homes, build rural happiness homes, promote Internet + 's home-based pension service, expand the pension service model and enrich pension service products. At the same time, in order to meet the needs of the elderly in terms of culture and entertainment, education and medical care, the elderly need to get out of their living space. Public transport has become the first choice for the elderly. In view of the low share of road area per capita in cities, we should increase the land for the construction of parking lots and road transport facilities for the elderly, enhance the aging-friendly degree of urban transport infrastructure and provide practical convenience for the elderly to travel. In addition, attention should be paid to the issue of aging-friendly public transport, providing green lanes or specialized transport aids for older people who have difficulty traveling and setting up full-time professionals to provide relevant services and guarantees, to achieve equal access to public transport for all ages.

The Chinese government should improve the investment mechanism for elderly education, perfect the elderly education service system and actively play the leading, coordinating role of local governments at all levels to formulate planning, supervise the implementation and continuously invest in education for the elderly. At the same time, we should stimulate all sectors of society to actively participate in elderly education, explore and improve the mechanism for local governments to purchase public service products for elderly education, drive the healthy interaction and rapid development of related industries, break down the barriers of the industry, pool quality resources, collaborate horizontally and link up vertically, cultivate a number of senior universities, senior schools and senior classes with good effect so as to build a four-level education service system covering the city, district, street (township) and community (village), continuously increase investment to improve schooling conditions and create a social and cultural atmosphere for the elderly to learn. It is also necessary to clarify that the current focus of elderly education in China is

on the grassroots and rural areas, and it strives to form a supply-side structure of elderly education oriented to the needs of grassroots elderly education, continuously increase quality elderly education resources, optimize the layout of elderly education and promote the coordinating development of the elderly society with grassroots elderly education. At the same time, elderly education should be tailored to local conditions, using different models in different regions. Local humanities, history and culture, health care and wellness can become unique resources for local elderly education, attracting more elderly people to receive elderly education and thus creating a unique regional brand of elderly education. Education for the elderly also needs to consider the characteristics of the audience, promote the deep opening of all kinds of educational institutions, set up characteristic courses for the elderly at different levels and pursue the fairness and universality of education. The Internet and other new technologies can be actively used to shorten the distance, open up channels and strengthen social interaction to provide better-quality, more convenient and more appropriate education for older people at home.

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