

SPATIAL AND TEMPORAL VARIATION IN THE SUPPLY LEVEL OF ELDERLY SERVICES BY MULTIPLE AGENTS AND ITS INFLUENCING FACTORS

LiLing Shi, ZiXuan Liu*

Business School, Jishou University, Jishou 416000, Hunan, China.

**Corresponding Author: ZiXuan Liu*

Abstract: Aim: Based on the National Statistical Yearbook, this study examines the supply level of elderly services in 31 provinces and urban areas of China and constructs a multidimensional evaluation index system for the level of services provided by the government, families, and social organizations. Methods: We used the entropy method, standard deviation ellipse model, fixed-effects model, and other horizontal and spatial analysis methods to analyse the spatial and temporal patterns of variation in the development level of elderly service supply and the influencing factors of 31 provincial units in China during 2014–2018. Results: We found the overall supply level of elderly services in China to be low, and the development of supply subjects and supply regions in the process of development as unbalanced and inadequate, with significant internal structural differences. Besides, the geographical distribution concentrated in the east and the center. Conclusion: This study explores the spatial and temporal variation of the supply level of multiple actors in China's elderly services and its influencing factors, as well as provides policy reference for the coordinated development of elderly services.

Keywords: Elderly services; Multiple subjects; Supply level; Spatiotemporal disparity; Influencing factors

1 INTRODUCTION

According to the Seventh National Census data, 19.064 million people in China were 65 years, accounting for 13.5% of China's total population. Based on the international standard, China is only 0.5% short of a highly aging country, and the status of the "aging society" is very serious [1]. It is expected that in 2025, 300 million people in China will be >60 years, and by the middle of this century, the number will be close to 500 million, accounting for 35% of China's total population, making China a super-aged country. Per the China Civil Affairs Statistical Yearbook, the current supply level of elderly services does not match the current situation of China's aging population. As of 2019, 29,000 institutions were associated with elderly services in China, with 7.302 million beds, accounting for 3.2% of the total elderly population aged >60 years, which is still far from the 5%7% level in developed countries and cannot fully satisfy the current Chinese elderly demand. Especially in the current stage of high-quality development of elderly services, the problem of unbalanced and inadequate development of elderly services remains prominent. The core problem of the current development of China's elderly service is the incongruity between the people's growing need for diversified and multilevel elderly service and the unbalanced and unsatisfactory development of elderly service supply. It is challenging to build a multilevel and multipillar pension service system by relying on the government financial expenditure alone. Thus, it is necessary to build an elderly service supply system with the joint participation of multiple actors, such as the government, families, and social organizations.

To date, many studies have examined senior care services and suggested that the participation of multiple supply actors exerts a positive impact on increasing the level of senior care services. In particular, Federico's theory of public welfare diversification proposed in 1996 provided new ideas for the supply of elderly care services [2]. Lu proposed that the government [3], as the key supplier of senior care services, occupies a dominant position and should provide adequate financial and policy support for senior care services. Shao stressed the need to give full play to the support role of social organizations to provide useful assistance in building a reasonable elderly service system [4]. Thus far, owing to the differences in research viewpoints, studies on senior care services have been conducted from various aspects such as the supply subject, supply content, and its influencing factors. Yu used the entropy method to analyze the level of local service supply [5]. Valkila comprehensively examined the current situation of elderly service supply in China [6]. Shi proposed that in building a diversified service supply system [7], it is essential to elucidate the rights and responsibilities among multiple subjects, such as the government, families, and social organizations, and cooperatively promote development through the division of labor. Besides, studies have explored the factors influencing the development of elderly service provision, such as Besharov's empirical analysis of the capacity of elderly services in the United States, which reported that government funding and subsidies are crucial factors influencing elderly services [8]. Chen examined from the urban perspective and deduced that the funding of elderly support is the fundamental reason affecting the uneven level of elderly services. Based on the studies mentioned above, it is a general trend for the joint development of multiple actors in elderly care services [9].

Compared with the existing literature, the main contributions of this study are as follows: (i) in the social context of population aging, high-quality elderly service supply pursues balanced layout and nondifferentiated enjoyment and is a

higher supply level, a supply in which multiple supply subjects participate together, emphasizing the significance of the role of families and social organizations in the supply of elderly services. (ii) Constructs an index system for the supply of elderly services by multiple subjects, comprehensively analyzes the efficacy of multiple subjects in the supply of elderly services in time and space, and explores the combination mode of subjects corresponding to the Chinese social environment. (iii) Emphasizes the importance of capital investment. In addition, it considers the capital investment of multiple parties and determines whether the capital investment between multiple entities can increase the level of pension service supply when analyzing the impact on the level of pension service supply. Therefore, based on the panel data of senior care services in 31 provinces and municipalities, this paper uses a combination of horizontal and spatial analysis methods such as entropy value method, SDE standard deviation ellipse model, and fixed effect model to carry out research, trying to precisely analyze the supply level of multiple actors of senior care services and related factors affecting the development. It explores the multiple supply mechanism combining government, family and social organizations in elderly services, and provides policy suggestions for the construction and supply capacity improvement of elderly services in different regions.

2 RESEARCH DESIGN

2.1 Theories and Models

The theory of welfare pluralism began to prevail in the 1980s. It emphasized that the government should coordinate with diverse parties, including voluntary organizations and families, in order to meet the current increasingly complex and individualized needs for elderly care services. To tackle multiple subjects of welfare, Peng divided the structure of these subjects, and proposed that the government lays a solid foundation and the family can be seen as the mainstay, while social organizations and volunteers play a supplementary role to elderly care service supply [10].

(1) Government Dimension

When the government transforms into a comprehensive service-oriented one, it still plays a leading role. This study examines the level of local government's elderly service supply in terms of the supply capacity and level of meso subjects, measured from three aspects, namely capital, material and human resources investment, the research mainly focuses on the supply level of elderly care services by local governments [11-12]. In a densely populated environment, local governments need to improve the supply of elderly care services to meet the growing demand for elderly care.

(2) Family Dimension

Family supply is one of the main providers regarding various elderly care services. Its supply capacity influences what kind of service resources can be provided, which could further determine the level of elderly care services. To realize the diversified development of the supply of elderly care services, it is necessary to give play to the advantages of family supply. This also means that the elderly care services show a diversified and quality performance.

(3) Social Dimension

Since the 1990s, when the "government failure" appeared, the social supply mechanism was pushed to the front, and the social structure has also given a certain degree of autonomy in many fields to release vitality [13]. Social organizations also undertake the responsibility of providing elderly care services by contracting government projects. Zhu found that social organizations, as one of the providers of elderly care services, play a certain role in the supply process. By contracting government projects, social organizations or social workers enter into a partnership with the government on senior care services, with the former providing the government with the corresponding senior care services. This form is conducive to making full use of social resources, and social workers have professional theoretical knowledge and methods to provide specialized services for the elderly, solve their problems, as well as help them better realize their unique functions and values as social beings, and also take up the responsibility of senior care service supply [14]. In addition, volunteer services, being part of the social supply level, play a supplementary role in the supply of services. Volunteers, one of the main bodies of the elderly care service cooperation, participate in the supply of elderly care services together with the government and families.

2.2 Analysis Factors Affecting the Supply of Elderly Services

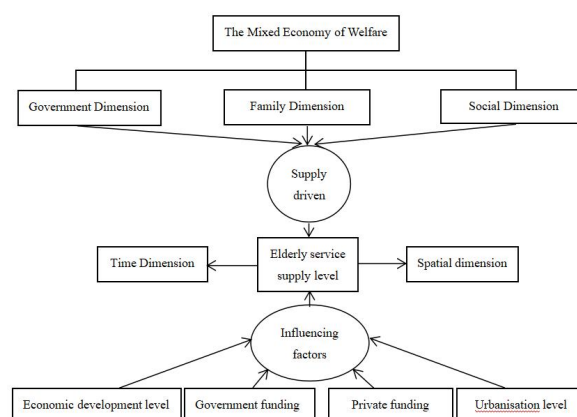


Figure 1 General Framework for the Provision of Elderly Services

The welfare pluralism theory analyzes the differences between the provision of elderly services in several dimensions, but it cannot address what elements are crucial for the elderly service provision system. Thus, we used government financial investment, private financial investment, economic development level, and urbanization level as the influencing indicators and analyzed and summarized the degree of influence between different indicators in different regions. Figure 1 shows the general framework.

2.3 Research Methodology

2.3.1 The entropy method

Senior care services were compared vertically across time in the same region or horizontally across time in different regions, where the measurement of the weights of the selected indicators was the key to assess the level of elderly service provision. In addition, the entropy method was used to determine the index weights—a method of objective assignment—by calculating the extent of information inherent in each index to determine its weight [15]. The higher the variation of the indicator, the lower the entropy value, the more information it contains, the more essential it is for decision-makers, and the greater its weight. By comparing the magnitude of the differences in the original data as the basis for judging the weights, the weights reflected not the personal preference of the evaluator but also the correlation between the data [16-17].

Step 1: The original data must be standardized to eliminate the impact on the measurement results owing to the data order of magnitude. The specific formula is as follows:

$$\text{Positive indicators: } x'_{ij} = \frac{x_{ij} - \min\{x_{1j}, \dots, x_{nj}\}}{\max\{x_{1j}, \dots, x_{nj}\} - \min\{x_{1j}, \dots, x_{nj}\}} x_{ij}$$

$$\text{Reverse indicator: } x'_{ij} = \frac{\max\{x_{1j}, \dots, x_{nj}\} - x_{ij}}{\max\{x_{1j}, \dots, x_{nj}\} - \min\{x_{1j}, \dots, x_{nj}\}}$$

where i denotes the sample area; j denotes the relevant indicators in the evaluation index system of China's elderly service development. The specific standardized calculation method of each indicator is as follows:

$$\text{The } j\text{th indicator is standardized for year } t = \frac{x_{j(t)} - x_{\min(0)}}{x_{\max(0)} - x_{\min(0)}}$$

Step 2:

$$\text{Calculate the weight of the } i\text{th sample value of the indicator under the } j\text{th indicator: } p_{ij} = \frac{x_{ij}}{\sum_{i=1}^n x_{ij}}, i = 1, \dots, n, j = 1, \dots, m$$

Step 3:

$$\text{Calculate the entropy value of the } i\text{th indicator: } e_j = -k \sum_{i=1}^n p_{ij} \ln(p_{ij}), j = 1, \dots, m \quad k > 0, k = \frac{1}{\ln(n)}, e_j \geq 0$$

Step 4:

Calculate the coefficient of variation. The larger the value of the coefficient of variation, the greater the degree of influence of the indicator on the results, and the better the indicator: $d_j = 1 - e_j, j = 1, \dots, m$

Step 5:

$$\text{Calculate the weights of each indicator; Table 1 details the weights: } w_j = \frac{d_j}{\sum_{j=1}^m d_j}, j = 1, \dots, m$$

2.3.2 Standard deviation elliptic model

The standard deviation ellipse model was used to reveal the multifaceted characteristics of the spatial distribution of elderly service supply in China. The principal feature of the standard deviation ellipse model is to visualize the direction and distribution of a dataset, and the generated results can output a set of ellipses on the map, reflecting its geographical distribution characteristics. To determine the range and spatial distribution pattern of senior care service supply levels during 2014-2018, the standard deviation ellipse tool in ArcGIS 10.1 software was used to perform standard deviation ellipse analysis for each year of senior care service supply distribution. Then, the basic parameters needed to depict the map, such as the long axis and short axis, were calculated to quantitatively depict the development of the spatial supply level of elderly services at the governmental level, household level, social organization, and volunteer level in the 5 years during 2014-2018. Next, we studied the trend of spatial diffusion of multiple supply agents in the level of elderly service supply [18].

The main parameters were calculated as follows:

$$\text{Mean center: } \bar{X}_w = \frac{\sum_{i=1}^n w_i x_i}{\sum_{i=1}^n w_i}; \bar{Y}_w = \frac{\sum_{i=1}^n w_i y_i}{\sum_{i=1}^n w_i}$$

$$\text{Azimuth angle: } \tan \theta = \frac{\left(\sum_{i=1}^n w_i^2 \tilde{x}_i^2 - \sum_{i=1}^n w_i^2 \tilde{y}_i^2 \right) + \sqrt{\left(\sum_{i=1}^n w_i^2 \tilde{x}_i^2 - \sum_{i=1}^n w_i^2 \tilde{y}_i^2 \right)^2 + 4 \sum_{i=1}^n w_i^2 \tilde{x}_i^2 \tilde{y}_i^2}}{2 \sum_{i=1}^n w_i^2 \tilde{x}_i \tilde{y}_i}$$

$$\text{x-axis standard deviation: } \sigma_x = \sqrt{\frac{\sum_{i=1}^n (w_i \tilde{x}_i \cos \theta - w_i \tilde{y}_i \sin \theta)^2}{\sum_{i=1}^n w_i^2}}$$

$$\text{y-axis standard deviation: } \sigma_y = \sqrt{\frac{\sum_{i=1}^n (w_i \tilde{x}_i \cos \theta - w_i \tilde{y}_i \cos \theta)^2}{\sum_{i=1}^n w_i^2}}$$

2.3.3 Fixed-effects model

To determine the influence of the participation of multiple agents on the level of elderly service supply, a fixed-effects model was established according to the panel data of 31 provinces in China. The supply level (esl) obtained from the previous calculation was used as the explanatory variable, government financial input (gov), private financial input (pri), and economic development level (gdp) as explanatory variables, and urbanization rate (urb) as control variables. In addition, μ_i was used as an unobservable individual effect, γ_t as a time effect, and ε_{it} as an error term. A fixed-effects model was constructed as follows. Furthermore, STATA software was used for analysis.

$$\text{esl}_{it} = \alpha + \beta_1 \text{gov}_{it} + \beta_2 \text{pri}_{it} + \beta_3 \text{gdp}_{it} + \beta_4 \text{urb}_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (1)$$

2.4 Indicator Selection and Data Sources

A data sample of 31 provinces nationwide during 2014–2018 was selected for the study, and all indicator data and their raw data were obtained from the China Statistical Yearbook, China Civil Affairs' Statistical Yearbook—Statistics of China Social Service, and China Social Statistical Yearbook, and the missing data were filled according to the average value taken in all other objects.

Table 1 Indicator System for the Supply of Multiple Actors in Elderly Care

Type of supply	Supply indicator	Unit
Government-level supply	Social security and employment expenditure	hundred million
	Capital investment	
	Expenditure of the basic pension insurance fund for urban employees	hundred million
	Expenditure of the basic pension insurance fund for urban and rural residents	hundred million
	Basic Medical Insurance Fund expenditure	hundred million
	Material input	
	Number of health care facilities	Piece
	Number of beds in health care facilities per 1,000 population	Piece
	Number of elder care service institutions	Piece
	Number of residential care beds per 1,000 elderly population	Piece
	Number of community service agencies and facilities	Piece
	Number of beds in community services and facilities at the end of the year	Piece
	Manpower input	
	Total cumulative number of Social Worker and AssiWstant Social orker passes	person
Household-level supply	Cumulative number of certified elderly care workers	person
	Number of employees in elderly services at the end of the year	person
	Number of employees at the end of the year in community services and facilities	person
	Average family household size	Person/home
	Disposable income per inhabitant by region	yuan
	Per capita consumption expenditure by region	yuan

	Number of social organization units	Piece
Social organisations and Voluntary Service Provision	Number of employees of social organisations at the end of the year	person
	Number of volunteers serving	person
	Volunteer Service Hours	person

3 RESULTS

3.1 The Time Dynamic Evolution of the Diversified Supply of Elderly Services in China

Based on the panel data of 31 provinces and municipalities in China during 2014–2018, the entropy method was used to measure the level of elderly service supply in China during 2014–2018 using MATLAB software, shown in Tables 2 and 3.

Table 2 Indicator Weights for the Level of Provision of Elderly Services

Tier 1 indicators	Secondary indicators	Tertiary indicators	entropy	coefficient of variation	weight
China Old Age Services Diversity Supply Levels	Government-level supply (0.701915)	Social security and employment expenditure	0.997577	0.002423	0.050779
		Expenditure of the basic pension insurance fund for urban employees	0.99737	0.00263	0.055129
		Expenditure of the basic pension insurance fund for urban and rural residents	0.997057	0.002943	0.061679
		Basic Medical Insurance Fund expenditure	0.997074	0.002926	0.061334
		Number of health care facilities	0.996039	0.003961	0.083023
		Number of beds in health care facilities per 1,000 population	0.997551	0.002449	0.051332
		Number of elder care service institutions	0.99931	0.00069	0.014457
		Number of residential care beds per 1,000 elderly population	0.998275	0.001725	0.036149
		Number of community service agencies and facilities	0.999287	0.000713	0.014944
		Number of beds in community services and facilities at the end of the year	0.995823	0.004177	0.087541
		Total cumulative number of Social Worker and AssiWstant Social orker passes	0.998236	0.001764	0.036971
		Cumulative number of certified elderly care workers	0.997409	0.002591	0.054305
		Number of employees in elderly services at the end of the year	0.998008	0.001992	0.041759
		Number of employees at the end of the year in community services and facilities	0.997494	0.002506	0.052513
	Household-level supply(0.127079)	Average family household size	0.998014	0.001986	0.041633
		Disposable income per inhabitant by region	0.99789	0.00211	0.044223
		Per capita consumption expenditure by region	0.998033	0.001967	0.041223
	Social organisations and Voluntary Service Provision(0.171005)	Number of social organization units	0.997827	0.002173	0.045543
		Number of employees of social organisations at the end of the year	0.997556	0.002444	0.051223
		Number of volunteers serving	0.997503	0.002497	0.052343
		Volunteer Service Hours	0.998955	0.001045	0.021896

Table 3 Data Ratios for Each Indicator of Elderly Service Provision, 2014-2018.

Region	2014	2015	2016	2017	2018	Average
Beijing	0.208866	0.223024	0.258638	0.287139	0.303398	0.256213

Tianjin	0.091934	0.112248	0.126216	0.138207	0.153217	0.1243644
Hebei	0.296868	0.371267	0.385393	0.407245	0.453859	0.3829264
Shanxi	0.149401	0.167833	0.193794	0.220279	0.23784	0.1938294
Inner Mongolia	0.150451	0.200337	0.213602	0.236299	0.258575	0.2118528
Liaoning	0.229187	0.25332	0.275727	0.298513	0.330554	0.2774602
Jilin	0.106439	0.122949	0.147642	0.152687	0.180361	0.1420156
Heilongjiang	0.145529	0.183708	0.195343	0.221538	0.24042	0.1973076
Shanghai	0.201124	0.230523	0.270462	0.30003	0.322471	0.264922
Jiangsu	0.420576	0.47816	0.515927	0.568913	0.641378	0.5249908
Zhejiang	0.316658	0.38648	0.434585	0.489032	0.571578	0.4396666
Anhui	0.185021	0.24937	0.263635	0.268782	0.33283	0.2599276
Fujian	0.146749	0.188879	0.200665	0.227697	0.245109	0.2018198
Jiangxi	0.148691	0.174051	0.188788	0.223054	0.243494	0.1956156
Shandong	0.394158	0.49284	0.53907	0.633835	0.655476	0.5430758
Henan	0.26146	0.351181	0.365759	0.414689	0.456401	0.369898
Hubei	0.217927	0.259296	0.284933	0.319992	0.369497	0.290329
Hunan	0.25782	0.316554	0.302878	0.371005	0.416619	0.3329752
Guangdong	0.362009	0.430229	0.494584	0.595882	0.710947	0.5187302
Guangxi	0.16294	0.210294	0.230306	0.250711	0.26994	0.2248382
Hainan	0.062945	0.079001	0.089526	0.092548	0.100892	0.0849824
Chongqing	0.154901	0.204062	0.222223	0.246957	0.26731	0.2190906
Sichuan	0.32514	0.413605	0.465542	0.516879	0.533855	0.4510042
Guizhou	0.145979	0.191444	0.206946	0.238277	0.268484	0.210226
Yunnan	0.143485	0.179159	0.197969	0.224024	0.240468	0.197021
Xizang	0.057238	0.095673	0.066944	0.07581	0.0736	0.073853
Shaanxi	0.166091	0.203652	0.229774	0.259345	0.316275	0.2350274
Gansu	0.133281	0.168144	0.185691	0.199231	0.232357	0.1837408
Qinghai	0.080929	0.1027	0.110288	0.119725	0.123577	0.1074438
Ningxia	0.064936	0.085291	0.104397	0.106805	0.112007	0.0946872
Xinjiang	0.131554	0.151352	0.180373	0.187119	0.185869	0.1672534
Average	0.190977	0.234729871	0.256374839	0.286846742	0.317698645	0.256213

A comparative analysis of the data on the supply of multiple actors in China's elderly services and the weights of their indicators during 2014–2018 revealed that the weights calculated for government-level supply, family-level supply, and social organization and voluntary service supply were 0.7019, 0.1270, and 0.1710. Among the secondary indicators of “government-level supply,” the number of beds in community service institutions and facilities at the end of the year and the number of healthcare institutions had weights 0.0875 and 0.0830, respectively, which were relatively more crucial. In the secondary indicator of “supply of social organizations and voluntary services,” the weight of the number of volunteer services accounted for 0.05234, indicating that the number of volunteer services is a crucial element in the supply of social organizations and voluntary services.

Regarding vertical comparison, during 2014–2018, the value of China's elderly service supply level revealed a steady upward trend, with the average value increasing from 0.1909 in 2014 to 0.3176 in 2018, with an average annual growth rate of 10.1%, suggesting that China's elderly service supply level improved significantly in the past 5 years. Regarding horizontal comparison, Shandong Province, Jiangsu Province, and Guangdong Province ranked the top three in terms of the comprehensive level of elderly services, with the average values of 0.54, 0.52, and 0.51 during 2014–2018, respectively.

3.2 Spatial Dynamic Distribution of Multiple Supplies of Elderly Services in China

We calculated the basic parameters of the map ellipse by applying the standard deviation ellipse analysis of the ArcGIS 10.7 software to the supply of elderly services at the government level, family level, and social organization and voluntary service levels in each province during 2014–2018 and quantitatively describes the overall characteristics of the spatial distribution of the elderly service supply level of the three types of supply entities of the government, households, and social organizations, as well as generate an ellipse surface containing the characteristics of the spatial distribution of the three types of supply dimensions for each year according to the SDE parameters. This ellipsoid

surface revealed the spatial diffusion trend of service supply points of the three types of supply subjects, as shown in Figure 2–4.

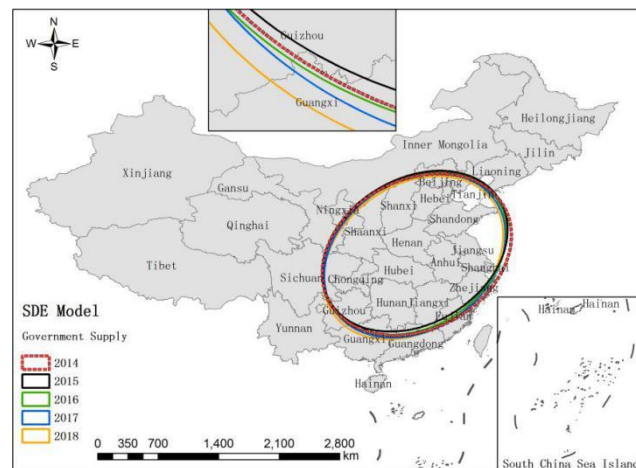


Figure 2 Ellipse Analysis of Standard Deviation of Government Supply Levels, 2014-2018
Source: Standard Map Service System (<http://bzdt.ch.mnr.gov.cn>)

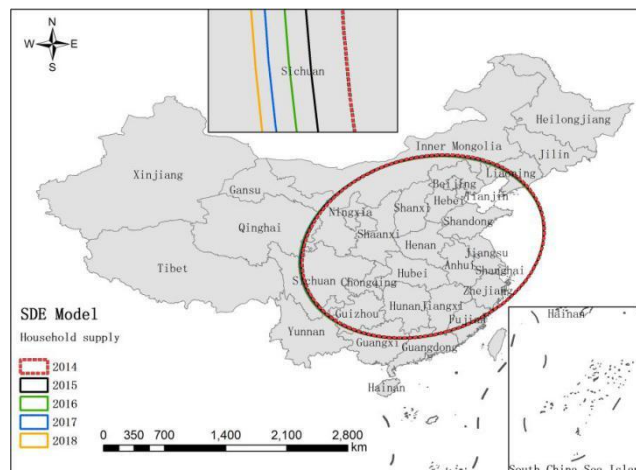


Figure 3 Ellipse Analysis of Standard Deviation of Household Supply Levels, 2014-2018
Source: Standard Map Service System (<http://bzdt.ch.mnr.gov.cn>)

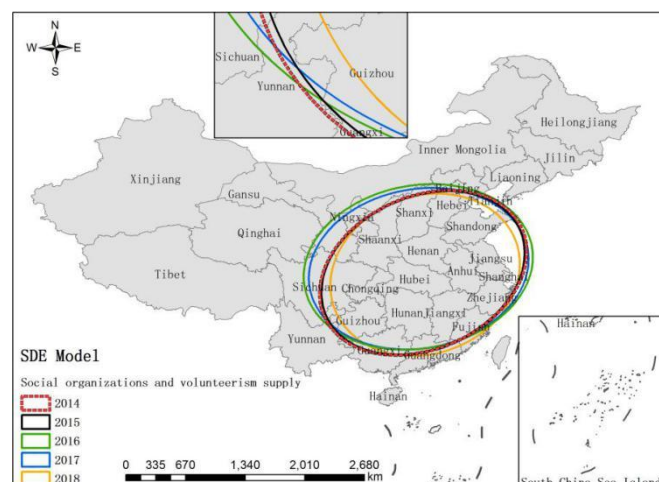


Figure 4 Ellipse Analysis of the Standard Deviation of Tissue Supply Levels, 2014-2018
Source: Standard Map Service System (<http://bzdt.ch.mnr.gov.cn>)

The development pattern of government-supplied and organization-supplied elderly service level showed the characteristics of circle spreading. The circles primarily concentrated in the eastern and central regions and gradually spread outward with this as the core. The primary reason is that the eastern and central regions actively promote the restructuring of the senior care industry and employment structure to quicken the transformation of the economic development mode so that the spatial levels of government supply and organizational supply exhibit the characteristics

of “diffusion.” Figures 2 and 4 show that the level of government-supplied and organization-supplied elderly services is higher in the eastern and central parts of the development. In contrast, the development of the family-supplied senior care service level was the opposite, exhibiting the characteristics of tightening the circle. The spatial “clustering” trend indicated that the household-level supply level of elderly services primarily concentrated in a few developed provinces owing to large economic differences between provinces and faster economic structure optimization and upgrading in economically developed and geographically advantageous areas. Nevertheless, this reflects that the current supply of elderly services in China is largely concentrated in the east and central regions. The supply level of elderly services in the western region warrants further strengthening, and there is an urgent need to augment the regional economic strength and drive the high-quality economic development of counties in the western region so that the supply level can be enhanced through the diffusion of economic capacity.

3.3 Factors Influencing the Supply Level of Elderly Services in China

The supply level obtained using the previous calculation was set as the explained variable (Y). The various influencing factors affecting the level were set as explanatory variables, such as government financial input, private financial input, economic development level, and urbanization rate; Table 4 shows the variables and their definitions.

(1) Government financial input. Presently, senior care services are still classified as quasi-public goods by nature, and when the supply of senior care services occurs on public property, the “free-rider problem” arises inevitably. The government not only needs to fulfill the needs of the elderly but also must sustain the stability of senior care services through financial regulation. Thus, the central special investment fund for the elderly is used as an indicator of the government’s investment in elderly services, reflecting the government’s influence on the development level of elderly services and is expressed as gov.

(2) Private funding input. With the rising power of private organizations and capital, the government’s function in the process of senior care service supply is fading, ushering in new funding channels and development channels for senior care service supply. The investment in fixed assets of private organizations in senior care institutions and facilities as one of the indicators affecting the supply level is expressed as pri.

(3) Level of economic development. Taking regional GDP as a key indicator reflecting the regional economic development level, regions with a relatively high economic development level can provide relatively adequate environmental guarantee for the development of local elderly service industry. Thus, we determined whether there is an influence of the high level of regional GDP on the level of elderly service supply and expressed it as gdp.

(4) Urbanization rate. As a critical indicator reflecting the urbanization process, it can be used as a control variable in the analysis of the model of factors influencing the elderly services and is used to analyze its crucial role in influencing the supply level, denoted by urb.

Table 4 Indicators Related to Factors Influencing the Level of Provision of Elderly Services

Factor	Variables Code	Variable name	Unit
Government funding	gov	Central special pension investment funds invested	ten thousand yuan
Private funding	pri	Input of CSO fixed assets in aged care institutions and facilities	ten thousand yuan
Economic development level	gdp	Regional GDP	hundred million
controlled variable	urb	Urbanisation rate	%

Table 5 Regression Results of the Model of Total Supply of Elderly Services

Total supply model		
	FE	RE
gov	1.7644*(2.9926)	6.9663*** (3.5215)
pri	1.5523*(1.3971)	3.1951** (1.4207)
gdp	5.7512*** (3.5943)	3.8556 (1.0641)
urb	130.72*** (5.9964)	-13.4002 (-0.9345)
constant term	-580.61*** (-7.5974)	-227.4518*** (-5.4656)
Hausman Test	48.5	
	Selecting a fixed effects model	
R ²	0.8853	0.3316

Note: ***, **, * represent significance levels of 1%, 5% and 10% respectively, and standard error terms are in parentheses

After the Hausman test, the fixed utility model was chosen for the elderly service supply model. The analysis results in Table 5 show that government financial investment, private capital investment, and economic development level exert significant effects on the level of elderly service supply.

The coefficients of the effects of government financial input and private organization input on the level of elderly service provision were positive and both passed the significance test with the effect coefficients of 1.7644 and 1.5523, implying that every 1% increase in government capital investment and private capital investment would bring 1.7644 and 1.5523 percentage points of increment to the level of elderly service supply. This indicates that both government funding and private capital exert a significant promotion effect on the development of elderly services at this stage. The impact of government fund investment on the level of pension service supply was higher than that of private capital investment, but the percentages were not much different. It reflects from the side that China's pension service supply model is no longer the government's responsibility. The diversified main body supply of elderly care services could provide them with higher-quality elderly care services and enhance the efficiency of the supply of elderly care services. The analysis of the indicators of economic development level showed that it has a significant positive contribution to the supply level of elderly services, especially in the relatively economically developed eastern regions, where the economic strength are relatively high and have the opportunity and ability to seek senior care services from the market to fulfill different levels of senior care needs. Conversely, economically developed regions can create a good market environment for the supply of senior care services, letting more social organizations and enterprises participate in the supply of senior care services, thereby markedly improving the supply level of senior care services. By studying the relevant indicators that affect the overall level of elderly service supply in China, we explored what factors affect the level of elderly service supply in different regions. Table 6 shows the model regression results.

Table 6 Regression Results from a Model of the Level of Provision of Elderly Services in East, Central and West China

	Eastern Region		Central Region		Western Region	
	FE	RE	FE	RE	FE	RE
gov	2.9126* (3.6463)	7.6164*(3.4 641)	0.4964 (0.3487)	4.0446*(3.4618)	0.8134 (0.4461)	6.5431 (1.9942)
pri	2.6640* (1.6431)	3.8412(3.46 44)	2.6654* (2.0197)	5.5971*** (4.763 1)	-3.9164 (-1.9442)	2.4154 (1.8731)
gdp	-5.6461 (-1.6231)	8.3141(0.57 61)	2.9488**(2.2016)	6.7694*** (3.142 5)	-50.101* (-3.4618)	2.7121 (0.3147)
urb	195.45*** (7.6115)	-28.4312 -0.6698	8.8814 (0.1971)	117.41*** (7.891 5)	400.41*** (6.5401)	58.46* (2.4642)
constant term	-531.14*** (-3.4641)	-250.44* (-3.1615)	-139.72** (-3.4094)	-631.121*** (-9. 9824)	-884.448*** (-11.433)	-500.1644*** (-4. 1641)
Hausman Test	20.61 Selecting a fixed effects model		29.42 Selecting a fixed effects model		11.65 Selecting a fixed effects model	
R ²	0.8634	0.4465	0.9346	0.3394	0.8811	0.4654

Note: ***, **, * represent significance levels of 1%, 5% and 10% respectively, and standard error terms are in parentheses

After the Hausman test, the fixed-effects model was chosen for the east, central, and west regions; however, the factors affecting the level of elderly service provision were not consistent across regions. Among them, government capital investment, private capital investment, and economic development level exerted significant positive effects on the level of elderly service supply in the eastern region, and the positive effect of government support was significant, which is consistent with the results of the analysis at the level of national elderly service supply. Nevertheless, the results presented in the central and western regions were different. The degree of influence of government investment and private capital on the enhancement of the supply level of elderly services in the western region was not significant, perhaps, because the development of the elderly service industry in the western region was relatively slow and local elderly service-related enterprises could not yet open up the market situation. It might also be because the current government support is deficient, and enterprises related to elderly care services are unable to obtain high-quality development.

4 CONCLUSIONS

(1) Whether at the government level, family level, or social organization level, the supply level of elderly services has been increasing rapidly for years; however, the internal structure of the supply differs significantly between regions. The supply level in the eastern and central regions is greatly higher than that in the western region, indicating a lack of total supply and effective regional supply on the elderly services.

(2) The structural imbalance in China is even more serious. The current supply of elderly services still relies predominantly on the government, and the share of supply from families and social organizations remains far from adequate, which is not consistent with the current elderly needs and the construction goals of the national policy. Second, in the measurement of the supply level of elderly services in 31 provinces and municipalities in China, the unreasonable resource allocation was found to cause a large gap in the resource distribution of the supply level of

elderly services in China's regions, with the western region lagging far behind the east and central regions, which is not consistent with the policy of high-quality development of elderly services in China.

(3) The empirical analysis establishes that, overall, government financial investment and the level of economic development exert a significant impact on enhancing the level of elderly service supply, which can better improve the structure of elderly service supply and narrow the gap of elderly service supply due to regional economic disparity. Analyzed regionally, regions with higher levels of economic development, such as the east, have a relatively larger scale of government and private organization funding, so the eastern region shows a positive impact on the latter two factors. For the central region, the level of regional economic development has the most significant degree of influence on its supply level, while the western region, because of the relative lack of government funding and the inability of private organizations and funding to fully support the construction of the elderly service system, results in the indicator not being significant on the supply level.

5 DISCUSSION

This study constructs a long-term cooperation mechanism for multiple supply bodies of elderly services. Reasonable institutional arrangements are the key to establishing good collaboration between multiple supply entities and ensuring cooperation and coordination. First, to build a clear responsibility mechanism, the creation of government-led, social organizations, and volunteers, families, and multiple subjects to participate in the operating mechanism, clearly define the boundaries of services and the content of responsibilities between each subject, so as to ensure the effective operation of the supply. The second is to enhance communication and establish a high-quality development of the elderly service supply system through responsibility-sharing and equal dialogue. Furthermore, upgrade the incentive mechanism to promote the common development of the main body of elderly service supply. The current supply system comprises other elements besides the government, and while increasing incentives to the government, there exists a need to strengthen incentives to social organizations and volunteers. The government, as the planner, standard setter, and supervisor of senior care services, must stimulate its own innovation in all aspects of senior care service content determination, feasibility assessment, and supervision. For social organizations and volunteers, a long-term incentive mechanism can be established to provide them with financial support and financial compensation to encourage their contribution to senior care services. Finally, enhance the supervision and assessment mechanism to guarantee the long-term cooperative operation of the diversified supply of the elderly service system; this warrants strengthening the social supervision of subjects of senior care service supply, particularly the mutual supervision among subjects. It is feasible to conduct surveys and assessments of the elderly from time to time, assess the actual situation of senior care services supplied by multiple entities based on the feedback information of the elderly, and conduct a quantitative assessment of the supply content, so as to urge each supply entity to continuously improve itself and create a strong synergy for the development of senior care services to accomplish the fundamental goal of high-quality development of senior care services.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in China Statistical Yearbook. The link to the China Statistical Yearbook is: <http://www.stats.gov.cn/tjsj/ndsj/>. And this work selects China Statistical Yearbook data from 2014 to 2018.

INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study.

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