Research on the Evaluation of Elderly Care Service Supply Capability from the Perspective of Welfare Pluralism

Rao Dan, PhD
Li Fang, Professor

RaoDan, PhD in Old-age Security and Elderly Care Service, School of Public Administration, Nanjing Agricultural University, Nanjing, China. Li Fang, Professor in Rural Old-age Security and Elderly Service, School of Public Administration, Nanjing Agricultural University, Nanjing, China.Correspondence:RaoDan;215456599@qq.com

Abstract: Based on the welfare pluralism analysis paradigm, an elderly care service supply capability evaluation system with five dimensions, including family, government, market, society and collaboration is constructed. The entropy weight method is used to determine the weight, and the weighted sum method is used to calculate the comprehensive score. The differences in the supply capability of different subjects in 30 provinces (cities) in China in 2018 are analyzed. The study found that there is regional imbalance in the comprehensive supply capacity of elderly care services in China, and the eastern region is higher than the central and western regions: Beijing, Guangdong, Shanghai, Jiangsu, Shandong and other eastern regions have strong supply capability, while Shanxi, Yunnan, Heilongjiang, Xinjiang and Jilin and other central and western regions have weak supply capability. In addition, the supply of elderly care service also presents the different characteristics. Therefore, the paper puts forward some countermeasures and suggestions, such as establishing a balanced development strategy, narrowing the regional gap of elderly care service supply capability, enhancing the supply capability of various subjects, and accelerating the formation of a multi-subject responsibility sharing system for elderly care service.

Key words: elderly care service; supply capability; evaluation system

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INTRODUCTION

Elderly care service is a major social issue related to the national economy and people's livelihood and national long-term security, is the focus of national livelihood security. According to the seventh census data released by the National Bureau of Statistics of China, as of November 1, 2020,

the number of elderly people aged 60 and over in China has reached 264 million, which accounted for 18.7%. There are 190 million people aged 65 and over, accounting for 13.5%. At the same time, according to the latest data from the National Committee on Aging, one out of every six elderly people in China cannot take care of themselves. In 2020, there will be more than 42 million disabled elderly people over 60 in China.

With the continuous expansion of the elderly population and the development of social economy, the increasing demand for elderly care service has led to the expectations of the elderly for the supply of diversified elderly care service. The supply of elderly care service is an important part of alleviating this contradiction which is above-mentioned. Therefore, how to enhance the supply capability of elderly care service is not only an important practical problem to be solved, but also a research topic of widespread concern in the academic community.

It is different from the provision of elderly care service, which emphasizes the implementation of elderly care service resources into service output, the supply capability of elderly care service puts more emphasis on the energy, strength and capability in the supply process. The elder care service supply capability referred to in this article refers to the general term for the capability of the elder care service provider to provide various required products and services for the elder care service demanders. The supplier needs to obtain, allocate and integrate various resources according to the existing institutional conditions and regional environment, and provide services through certain channels and methods.

So, what is the current status of China's current elder care service supply capability? How to scientifically evaluate the supply capability of elderly care service? What are the differences in supply capability between different regions? What should be focused on for improvement? Seeking answers to this series of questions undoubtedly has important practical significance.

With the deepening of aging in China, theoretical and practical workers have done a lot of research on elderly care services. Firstly, in terms of the evaluation content of elderly care service, Lianalyzed regional differences in long-term care services for the elderly in South Korea during the period from 2003 to 2008.[1] The study found that between 2003 and 2007, the concentration of home care and day care services, which had been concentrated in large cities, declined, but this is increasing in 2008 because of Long-term care insurance's introduction in 2008. However, South Korea's home-based care and day-care services are concentrated in big cities, leaving older people in smaller cities with little access to services.Tierney, Melby, and Todd evaluated and compared home-based acute care services and hospital acute care services for older people in Northern Ireland through a quantitative design.[2] Home emergency care services are a safe and cost-effective alternative to traditional hospital services for the elderly, the study found. Such services offer patients choice, shorten hospital stays and costs, and prevent functional decline in the elderly. Provision and capability for emergency care at home should be expanded across Northern Ireland. Wang and Peng evaluated the supply capability of rural social elderly care services in 28 Chinese provinces (autonomous regions and municipalities) based on the data of the National Statistical Yearbook,[3] and found that Shanghai, Beijing and Tianjin ranked better, while Henan, Guizhou and Yunnan were weaker.

Secondly, in the research of evaluation indicators, Xu, Zhang and Wei constructed an evaluation indicator system of smart community elderly care service quality based on intelligence,[4] tangibles, responsiveness, security, reliability, and empathy when evaluating the quality of smart community elderly care service. Shao, Yuan and Lin et al. constructed a relatively systematic analysis framework for the performance evaluation of community and home care service centers through the overall analysis of previous studies and expert interviews.[5] Among them, the index design was divided into six dimensions and 33 specific indicators (such as financial management, hardware facilities, team building, service management, service object and organization building).

Thirdly, in terms of research methods, Li and Wei proposed a novel EDAS method with probabilistic linguistic information based on D-S evidence theory for evaluating nursing homes to reduce the effect of some extreme values influencing the decision result.[6] In order to evaluate the performance of home-based care services purchased by the government, some scholarsextended the TODIM method based on the cumulative prospect theory (CPT) to the Pythagorean 2-tuple linguistic sets (P2TLSs) and propose a Pythagorean 2-tuple linguistic CPT-TODIM (P2TL-CPT-TODIM) method for MAGDM.[7] It is not only integrating the advantages of cumulative prospect theory (CPT) into a consideration of the psychological factors of DMs, but also retains the superiority of the classical TODIM in relative dominance. Wu conducts service quality assessments on elderly care institutions to understand the actual situation of elderly care institutions.[8]Investigated the multiple attribute decision making (MADM) problems for evaluating the service quality of elderly institutions with hesitant fuzzy linguistic information. Then he used the hesitant fuzzy linguistic weighted average (HFLWA) operator to develop a procedure to multiple attribute decision making (MADM) problems. To be more objectively and accurately reflect consumers' real evaluation of elderly care service, Li, Wang and Chu et al. innovatively proposed an effective multidimensional attention convolutional neural networks (MACNNs) model to analyze customer comment texts and predict the quality of elderly care service.[9] In MACNN, emoticon features, emotion features and word features can be extracted simultaneously to construct feature space. Then, the attention layer and the convolution layer work together to predict quality of service. In addition, some scholars have evaluated the current development status by using the method of the evaluation of the positive aging index, China's Aging social Development Index and China's health industry development Index.[10-12]

Generally speaking, most of the existing researches on the evaluation of the supply capability of elderly care service are divided into urban and rural areas, starting from different supply models such as families, communities, and elderly care institutions. But there is a lack of comprehensive evaluation research that regards the supply of elderly care services as a whole. Most of the results are based on the survey questionnaire data, dividing different evaluation dimensions around the service content and supply stage, and lacking the evaluation index system from the perspective of the supply subject. However, only by giving full play to their respective potential and effectiveness, diversified and collaborative supply subjects of elderly care services can provide multi-level and diversified elderly care services for such a huge of the elderly people in the new era.

Therefore, based on the theory of welfare pluralism, this article constructs an analysis framework and evaluation indicators from the aspects of family, government, society, market subjects and multiple coordination. We use the entropy weight method and national statistical yearbook data to evaluate the supply capability differences of elderly care services in different provinces and different suppliers. On this basis, targeted countermeasures and suggestions are put forward to provide the basis for relevant departments to formulate policies and provide inspiration for enhancing the comprehensive supply capability of elderly care services.

THEORETICAL BASIS AND ESTABLISHMENT OF THE INDICATOR SYSTEM

Welfare pluralism originated in the mid-1970s. It is a rational reflection on the traditional government from single support to multiple welfare responsibilities under the background of western welfare countries falling into welfare difficulties due to the economic crisis.Under the framework of welfare pluralism analysis, we should first clarify the composition of multiple subjects of social welfare and the supply responsibility relationship of each subject. The "pluralism" of welfare is the result of the continuous development of the dual subject of "government" and "market" in the early western welfare states.[13]While in the early days of China, there was a dual structure between the "government" and "family".

In 1978, Wolfenden, a British scholar, first proposed the inclusion of voluntary organizations in the ranks of participants in welfare pluralism, but did not explicitly specify the specific composition of multiple subjects.[14] Subsequently, Rose, Evers and Olsson advocated the use of the tripartite method,[15-17] the welfare supply body is divided into government, market and family (or organization). On this basis, Evers &Olk (government, market, community and organization), Johnson (government, market, family, and voluntary organizations) and Gilbert (government, voluntary organizations, informal organizations and commercial organizations) further refined the Tripartite Approach and advocated a quadripartite approach to welfare pluralism.[18-20]

Different from western countries, China's social structure has been showing the objective facts of "strong country, weak market and weak society", coupled with the specific emotional factors of Chinese families rooted in thousands of years of traditional culture and proper intergenerational dependence habits, which determines the unique role and important position of families and governments in the multi-subject structure of China's elderly care service supply.However, the core of welfare diversification is to establish a welfare supply mechanism in which multiple subjects participate and coordinate and balance. It is a complementary and win-win cooperative relationship between the main bodies of service supply.It is the responsibility remodeling and function transformation from the actual behavior of the main bodies to the ought-to-be orientation, rather than the logic of passive complementary participation and transfer of supply responsibility under the pressure of weakening family care function and alleviating government responsibility.Therefore, based on the quartet of welfare pluralism theory and embedding it in the specific national conditions of China, this article divides the diversified supply of elderly care service into four main bodies: family, government, market, and society.

As the most direct basic unit to provide elderly care service services, family is still at the core position in the supply of elderly care service services by virtue of irreplaceable kinship and affection satisfaction function, and it also assumes the responsibilities of providing direct services, economic support, service purchase, supervision and feedback, etc.The capability of families to provide elderly care service services mainly includes the capability of their children and their spouses to care for their daily lives,as well as the capability to indirectly translate into purchasing elderly care service services through their own economic level and the capability of their children to provide support.

The government enjoys administrative power and public resources that other subjects cannot have and becomes the "meta-administrator" of the supply of elderly care service. It fulfils the contractual relationship between the State and citizens by providing the most basic service guarantees to satisfy the most basic rights of survival and development of members of society.Therefore, with the roles of guarantor, supporter, guider and constructor, it should bear the responsibilities of system construction, policy specification, support, facility construction and financial support. The government supply capability is mainly reflected in the capability to support the poor, the infrastructure construction capability of public elderly care service institutions and the financial support capability of elderly care services.

The market, as the most active venue for the diversified supply of elderly care service, is essentially a spontaneous behavior determined by the supply-demand relationship and the main task is to solve the contradiction between supply and demand. As the pioneer, practitioner and innovator of elderly care service supply, the market should consolidate infrastructure construction with the help of the government, provide diversified and multi-level product selection, service types and service grades according to the health status and income levels of different elderly people. Such as the capability of provide beds in elderly care institutions which registered by enterprises, the interval gradient of fee levels and the innovative capabilities of related elderly care service products.

As an important support for the supply of elderly care services, social subjects play the role of intermediary and bridge in other subjects with their advantages of strong flexibility and high service efficiency, acts as the intermediary and coordinator,[21] and undertaking the integration function of revitalizing social elderly care service resources and the responsibility of ethical practice based on social value. The social supply capability includes the proportion of elderly care service expenditure to lottery welfare fund, the infrastructure construction capability of the elderly care institutions registered by social organizations, the number of volunteers and the service time status, the participation degree of social organizations and the community mutual-aid facilities for the elderly.

In addition to complementing each other's responsibilities, each entity needs to cooperate in the specific practice of providing elderly care service. Therefore, based on the above four subjects of family, government, market and society, this paper adds an analysis dimension of collaborative supply. That is to say, collaborative supply is the resultant force of continuous promotion and deepening development in view of the need for multi-agent participation, mutual cooperation and collaborative cooperation in the supply of elderly care services. Such as the capability of government-enterprise cooperation in elderly care service projects, the capability to integrate medical care and daily care, the development level of smart elderly care, and the capability to increase the number of elderly care nurses.

Based on the above-mentioned division of elderly care services and the proper positioning of each subject, combined with the principles of systematicness, effectiveness, and operability for index selection, and the availability of data,this paper constructs an evaluation system of the supply capability of elderly care services including five dimensions of family, government, market, society and coordination, covering 25 specific indicators (as shown in Table 1).

Table 1
Comprehensive Evaluation Index System of Elderly Care Service Supply Capability

Target Layer	Criterion Layer	Index Layer	Calculation formula	Weight
Elderly Care Service Supply Capability (A)	Family Supply Capability (B_1)	C_1 Average per household resident population (person/household)	Number of permanent population/ Number of households	0.0431
		C_2 The proportion of spouses aged 60 and over (%)	Number of spouses aged 60 and above / population aged 60 and above × 100 %	0.0439
		C_3 Per capita basic pension level (yuan/year)	Basic Pension Fund Expenditure / Actual Recipients of Basic Pension Insurance	0.0409
		C_4 Per capita disposable income of residents (yuan)	Total disposable income / resident population of household sector	0.0380
	Government Supply Capability(B_2)	C_5 Expenditure level of assistance and support for the extremely poor in rural areas (yuan/person year)	Expenditure on assistance and support for the extremely poor in rural areas/The number of people in rural poverty who are assisted and supported	0.0379
		C_6 Expenditure level of assistance and support for the extremely poor in city areas (yuan/person year)	Expenditure on assistance and support for the extremely poor in city areas/The number of people in city poverty who are assisted and supported	0.0380
		C_7 The percentage of beds in elderly care institutions registered by government (%)	The number of beds in elderly care institutions registered by government/The total number of beds in elderly care service institutions×100%	0.0438
		C_8 The proportion of elderly welfare expenditure in fiscal expenditure (%)	(Elderly care service subsidy + senior age subsidy + nursing subsidy)/financial expenditure×100%	0.0426
	Market Supply Capability(B_3)	C_9 The percentage of beds in elderly care institutions registered by enterprises (%)	The number of beds in elderly care institutions registered by enterprises /The total number of beds in elderly care service institutions×100%	0.0396
		C_{10} The proportion of pension agency with a charge range of less than ￥5,000 (%)	The number of pension agency with a charge range of less than ￥5,000/The total number of pension agency×100%	0.0489
		C_{11} The proportion of pension agency with a charge range of ￥5,000-10,000(%)	The number of pension agency with a charge range of ￥5,000-10,000/The total number of pension agency×100%	0.0396
		C_{12} The proportion of pension agency with a charge range of more than ￥10,000(%)	The number of pension agency with a charge range of more than ￥10,000/The total number of pension agency×100%	0.0382
		C_{13} The patio of the number of valid patents related to elderly care services to the total number of patent	The number of valid patents related to elderly care services /The total number of patent applications×100%	0.0414

	applications (%)		
	C_{14} The proportion of elderly care service expenditure to lottery welfare fund (%)	Elderly care service Expenditure / Welfare Lottery Benefit × 100 %	0.0424
	C_{15} The percentage of beds in elderly care institutions registered by social organizations (%)	The number of beds in elderly care institutions registered by social organizations /The total number of beds in elderly care service institutions×100%	0.0421
Social Supply Capability(B_4)	C_{16} The number of volunteers in elderly care service institutions (person times)	statistical data	0.0387
	C_{17} The time of volunteers in elderly care service institutions (hour)	statistical data	0.0379
	C_{18} The proportion of social organizations related to the elderly in the total social organizations (%)	(The number of elderly associations + The number of elderly foundations + The number of elderly rights protection coordination organizations + The number of other elderly social organizations) / The total number of social organizations × 100%	0.0348
	C_{19} The number of community mutual-aid facilities for the elderly (units)	statistical data	0.0346
	C_{20} The proportion of cumulative investment in PPP (Public-Private Partnership) pension projects to total investment (%)	Cumulative investment in PPP pension projects / total investment in PPP projects × 100 %	0.0370
	C_{21} The number of rehabilitation and medical outpatients in elderly care service institutions (person times)	statistical data	0.0383
Cooperative Supply Capability(B_5)	C_{22} The proportion of the number of semi-self-care and non-self-care in the total number of elderly care service institutions (%)	The number of semi-self-care and non-self-care/ The number of semi-self-care, non-self-care and self-care) × 100 %	0.0415
	C_{23} The number of beds per thousand elderly population (pieces/1,000 persons)	The number of beds for the elderly / elderly population aged 60 and above × 1000	0.0398
	C_{24} The cumulative number of demonstration units in the pilot application of smart health and elderly care applications (units)	The number of smart health and elderly care demonstration enterprises + the number of demonstration streets (townships) + the number of demonstration bases	0.0393

	C_{25} Each thousand elderly people have a cumulative number of qualified elderly care nurses (units/thousand people)	Accumulated number of qualified elderly care nurses/aged population of 60 years old and above×1000	0.0378

DATA SOURCES AND EVALUATION METHODS

Data Sources

The original data involved in the indicator system constructed in this article are mainly derived from the 2019 China Social Statistics Yearbook, China Population and Employment Statistics Yearbook, China Finance Yearbook, China Labor Statistics Yearbook, China Health Statistics Yearbook, "China County Statistical Yearbook", "Statistical Yearbook of Provinces" and relevant government department websites, etc. Due to the lack of some indicators in the Tibet Autonomous Region and the extreme values of individual indicators, the Tibet Autonomous Region was deleted from the comparison between provinces. Therefore, the regions participating in the inter-provincial comparison include 30 provinces (autonomous regions or municipalities) except Hong Kong, Macau, Taiwan and Tibet.

Evaluation Methods

In order to avoid the subjective limitations and random assumptions of the subjective weighting method, and to solve the problem of information overlap between multi-index variables, this paper uses the entropy weight method to objectively weight each evaluation index. At the same time, on this basis, we use weighted summation method to measure and evaluate the supply capability of elderly care services in various regions. Usually, the larger the entropy value, the less the information carried by the index, the smaller its role in comprehensive evaluation, and the smaller the index weight. On the contrary, the smaller the entropy value of the index is, the more information it contains, and the greater its role in the comprehensive evaluation is, namely, the greater the weight is.

(1) Standardizing treatment of the data

In order to ensure the reliability and objectivity of the results, the original index data should be standardized first. Data standardization mainly includes index forward and dimensionless processing to solve the problem of data with different properties and data comparability. Since the indicators in this paper do not involve negative indicators, the forward process of indicators is no longer covered. In order to reduce the influence of extreme values on the comprehensive evaluation results, the standardization method is used to dimensionless the original data:In the comprehensive evaluation of multi-dimensional index system, assuming that there are m units to be evaluated and n indicators to be evaluated. These can form the original data decision matrix of A_j (1≤j≤n): $x = (x_{ij})m \times n$ .The standardization process of positive indicators is as follows:

When the index is positive:

$$x'_{ij} = \frac{x_{ij} - \bar{x}}{s_j} \quad (1)$$

Among them, x_{ij} is the original value of the i-th sample and j index, x'_{ij} is the standardized index value, $\bar{x}$ and s_j are respectively for the mean and standard deviation of the j-th index.

In addition, since the entropy weight method involves the operation steps of taking logarithm, in order to make the data operation meaningful and reasonably solve the non-negative problem of data, it is necessary to translate the dimensionless data as a whole.That is:

$$Z_{ij} = x'_{ij} + \alpha \quad (2)$$

Among them, Z_{ij} is the value after translation, α is the translation amplitude. The closer the value of α is to min (x'_{ij}) the more significant the evaluation result will be.

After the coordinate translation, the data are normalized, and the index value proportion p_{ij} of the i evaluation unit of the j index is calculated, so as to obtain the standardized matrix:$P = (p_{ij})_{m*n}$

$$p_{ij} = \frac{Z_{ij}}{\sum_{i=1}^{n} Z_{ij}} \quad (3)$$

(2) Determination of weights by entropy method

The entropy weight method is used to determine the weight of the evaluation index. Firstly, the entropy weight of each index is calculated by information entropy, and then the unreasonable weight of each index is corrected. This method is based on the amount of information transmitted to decision makers to determine the weight, eliminate the subjective impact of human factors (entropy weight results see Table 1).

The specific steps are as follows:

According to the definition of entropy, calculate the entropy of item j:

$$e_j = -\frac{1}{\ln n}\sum_{i=1}^{n} p_{ij} \ln(p_{ij}) \quad (4)$$

Calculate the difference coefficient for indicator j:

$$g_j = 1 - e_j \quad (5)$$

Determine the weight of indicator j:

$$w_j = \frac{g_j}{\sum_{j=1}^{m} g_j} \quad (6)$$

(3) Determination of comprehensive evaluation scores by weighted summation method

In this study, the linear weighted model with strong operability is used to calculate the comprehensive evaluation scores of the supply capability of elderly care services of multiple subjects such as families, governments, markets and society, so as to conduct comparative analysis and comprehensive evaluation. The specific formula is:

$$F_i = \sum_{j=1}^{m} w_j p_{ij} \quad (7)$$

RESULTS AND ANALYSIS

Comprehensive Supply Capability

According to the evaluation index system constructed above, using cross-sectional data from 30 provinces across the country in 2018. The entropy weight method is used to determine the index weight, and the weighted summation method is used to calculate the supply capability evaluation scores of families, governments, markets, society and collaborative subjects. Finally, the comprehensive evaluation score of multi-subject elderly care service supply capability is obtained (table 2). The results show that the top rankings are Beijing (0.0399), Guangdong (0.0371), Shanghai (0.0362), Jiangsu (0.0360) and Shandong (0.0357), and the top nine provinces are all located in the eastern coastal areas of China. The weaker comprehensive supply capability is Shanxi (0.0315), Yunnan (0.0314), Heilongjiang (0.0308), Xinjiang (0.0307) and Jilin (0.0300). In terms of different regions, the overall supply capability of elderly care service in the eastern region is higher than that in the central and western regions.

Table 2
The Scores and Rankings of Comprehensive Evaluation on Elderly Care Service Supply Capability in 2018

Region	Comprehensive supply capability	Rank	Family supply capability	Rank	Government supply capability	Rank	Market supply capability	Rank	Social supply capability	Rank	Cooperative supply capability	Rank
Beijing	0.0399	1	0.0069	2	0.0066	1	0.0080	2	0.0096	1	0.0087	4
Guangdong	0.0371	2	0.0058	9	0.0053	16	0.0087	1	0.0081	8	0.0093	2
Shanghai	0.0362	3	0.0070	1	0.0058	9	0.0070	11	0.0080	9	0.0084	8
Jiangsu	0.0360	4	0.0061	4	0.0053	17	0.0070	9	0.0089	4	0.0087	5
Shandong	0.0357	5	0.0055	15	0.0045	29	0.0067	18	0.0092	2	0.0098	1
Tianjin	0.0353	6	0.0065	3	0.0059	6	0.0069	14	0.0086	5	0.0074	17
Zhejiang	0.0351	7	0.0055	14	0.0050	25	0.0071	7	0.0085	6	0.0089	3
Hebei	0.0348	8	0.0060	5	0.0046	28	0.0069	12	0.0091	3	0.0082	10
Fujian	0.0340	9	0.0054	16	0.0051	20	0.0073	5	0.0082	7	0.0080	12
Sichuan	0.0335	10	0.0048	29	0.0056	13	0.0073	6	0.0076	15	0.0083	9
Ningxia	0.0335	11	0.0057	10	0.0057	10	0.0068	15	0.0069	27	0.0084	6
Guizhou	0.0333	12	0.0053	20	0.0061	3	0.0070	8	0.0078	11	0.0070	26
Neimenggu	0.0330	13	0.0051	23	0.0056	12	0.0066	23	0.0073	19	0.0084	7
Hunan	0.0329	14	0.0056	12	0.0056	11	0.0067	20	0.0077	14	0.0074	20
Hubei	0.0328	15	0.0053	19	0.0060	5	0.0068	16	0.0070	25	0.0076	14
Qinghai	0.0326	16	0.0052	21	0.0058	8	0.0070	10	0.0072	21	0.0074	18
Hainan	0.0326	17	0.0058	7	0.0050	26	0.0079	3	0.0070	26	0.0069	29
Guangxi	0.0326	18	0.0054	17	0.0052	19	0.0066	21	0.0073	17	0.0080	11
Henan	0.0324	19	0.0058	8	0.0049	27	0.0065	24	0.0073	18	0.0080	13
Anhui	0.0324	20	0.0058	6	0.0045	30	0.0067	19	0.0079	10	0.0075	16
Jiangxi	0.0324	21	0.0055	13	0.0059	7	0.0068	17	0.0070	24	0.0072	23
Shanxi	0.0320	22	0.0053	18	0.0056	14	0.0065	25	0.0072	20	0.0074	19
Liaoning	0.0320	23	0.0051	26	0.0052	18	0.0064	28	0.0077	13	0.0076	15
Gansu	0.0319	24	0.0051	25	0.0061	2	0.0063	29	0.0071	22	0.0072	22
Chongqing	0.0317	25	0.0050	27	0.0054	15	0.0073	4	0.0068	28	0.0072	21

Shanxi	0.0315	26	0.0056	11	0.0050	22	0.0061	30	0.0078	12	0.0069	27
Yunnan	0.0314	27	0.0052	22	0.0061	4	0.0066	22	0.0067	30	0.0068	30
Heilongjiang	0.0308	28	0.0049	28	0.0050	21	0.0065	27	0.0073	16	0.0071	24
Xinjiang	0.0307	29	0.0051	24	0.0050	23	0.0069	13	0.0067	29	0.0070	25
Jilin	0.0300	30	0.0046	30	0.0050	24	0.0065	26	0.0070	23	0.0069	28

Family Supply Capability

In terms of family supply capability (see Table 2 and Table 3), from the evaluation score ranking, the top rankings are Shanghai (0.070), Beijing (0.0069), Tianjin (0.0065), Jiangsu (0.0061) and Hebei (0.0060). On the contrary, Liaoning (0.0051), Chongqing (0.0050), Heilongjiang (0.0049), Sichuan (0.0048) and Jilin (0.0046) have weaker rankings.

Table 3
Comparison of the Scores and Rankings of Family Supply Capability

The rank of family supply capability	Region	The rank of average per household resident population	The rank of proportion of spouses aged 60 and over	The rank of per capita basic pension level	The rank of per capita disposable income of residents
1	Shanghai	30	3	1	1
2	Beijing	27	2	2	2
3	Tianjin	23	1	3	4
4	Jiangsu	14	5	12	5
5	Hebei	11	4	6	17
26	Liaoning	29	10	24	8
27	Chongqing	21	15	29	11
28	Heilongjiang	26	6	26	19
29	Sichuan	20	23	28	21
30	Jilin	24	18	30	18

In areas with strong family supply capability, spouses become the main providers of family elderly care services, and the overall economic support capability is stronger than the living care ability. Due to the widespread reform of elderly care service concept and intergenerational separation in Beijing, Shanghai and Tianjin, the average resident population per household is relatively small, which weakens the family support capability to a certain extent. At the same time, the social and economic development in these areas is high and the medical and health technology is advanced, which improves the cure rate of the elderly, prolongs the life span of the elderly and their spouses, and makes spouses become the main responsible person for family care services. In addition, the high per capita pension and disposable income of residents in the region provide good economic support for the elderly to purchase socialized elderly care services. The weak family supply capability in Sichuan, Chongqing and Northeast China is due to the two-way decline of service support and economic

support capability. As a big province of labor outflow, the average per household resident population in these five provinces is small due to large-scale population outflow, which makes the human supply of family care is insufficient. At the same time, affected by factors such as the number of local participants in social pension insurance and the average social wage, migrant workers return home when they are old, which increases the expenditure of the local pension, and also increasing the pressure on pension insurance funds to pay. These reasons all lead to weak family economic supply capability.

Government Supply Capability

In terms of government supply capability (see table 2 and table 4), Beijing (0.0066), Gansu (0.0061), Guizhou (0.0061), Yunnan (0.0061) and Hubei (0.0060) ranked the top scorers, while Hainan (0.0050), Henan (0.0049), Hebei (0.0046), Shandong (0.0045) and Anhui (0.0045) ranked the low scorers. From the geographical division, in addition to Beijing, Gansu, Guizhou, Yunnan and other western regions of government supply capability is strong, and Henan, Hebei, Shandong and other central and eastern regions of government supply capability is weak.

Table 4
Comparison of the Scores and Rankings of Government Supply Capability

The rank of government supply capability	Region	The rank of expenditure level of assistance and support for the extremely poor in rural areas	The rank of expenditure level of assistance and support for the extremely poor in city areas	The rank of percentage of beds in elderly care institutions registered by government	The rank of proportion of elderly welfare expenditure in fiscal expenditure
1	Beijing	1	2	24	23
2	Gansu	23	20	6	1
3	Guizhou	7	15	5	3
4	Yunnan	16	8	7	2
5	Hubei	9	9	4	13
26	Hainan	13	19	14	24
27	Henan	27	27	13	22
28	Hebei	22	13	23	29

In areas where the government's supply capability is strong, the government has given full play to its role as a guarantee and financial support. As the capital of China, Beijing has the highest level of assistance and support for the extremely poor in urban and rural areas ranks among the top in the country. The governments of Gansu, Guizhou, Yunnan and Hubei have performed well in preparing beds and financial support for elderly care service institutions. In addition, due to the insufficient development of marketization and socialization of the supply of elderly care service in the western region, it is more dependent on the government-led supply model of elderly care service. Therefore, the governments in the western region are required to put more emphasis on ensuring the basic level of supply responsibility. The central and eastern regions, such as Hainan, Shandong, and Hebei, have gradually moved towards the development model of multi-subject supply, and the participation and cooperation of market and social supply subjects have achieved initial results. Therefore, to a certain extent, the effect of government supply capability has been weakened.

Market Supply Capability

In terms of market supply capability (see Table 2 and Table 5), due to the mature elderly care service market in the eastern developed areas, it has a strong attraction for the investment of related enterprises, so the market supply capability is strong in Guangdong (0.0087), Beijing (0.0080), Hainan (0.0079), Chongqing (0.0073) and Fujian (0.0073), and the ability is weak in the eastern three provinces (Jilin 0.0065, Heilongjiang 0.0065, Liaoning 0.0064), Gansu (0.0063) and Shanxi (0.0061).

Table 5
Comparison of the Scores and Rankings of Market Supply Capability

The rank of market supply capability	Region	The rank of percentage of beds in elderly care institutions registered by enterprises	The rank of proportion of pension agency with a charge range of less than ￥5,000	The rank of proportion of pension agency with a charge range of ￥5,000-10,000	The rank of proportion of pension agency with a charge range of more than￥10,000
1	Guangdong	1	45.32%	42.45%	12.23%
2	Beijing	6	50.64%	35.90%	13.46%
3	Hainan	3	79.73%	12.16%	8.11%
4	Chongqing	2	90.63%	8.33%	1.04%
5	Fujian	23	77.19%	19.30%	3.51%
26	Jilin	19	97.50%	2.00%	0.50%
27	Heilongjiang	16	97.87%	2.13%	0.00%
28	Liaoning	18	95.29%	3.53%	1.18%
29	Gansu	13	100.00%	0.00%	0.00%
30	Shanxi	26	94.19%	5.81%	0.00%

In areas with strong market supply capability such as Guangdong, Beijing and Fujian, there are more beds in elderly care institutions registered by enterprises and the private pension institutions have more diversified fees, which can meet the multi-level needs of different consumer groups. At the same time, there are a large number of patents related to elderly care service, and the product innovation ability is strong, which can provide diversified service products. However, in the three northeastern provinces (Jilin, Heilongjiang, Liaoning), Gansu and Shanxi, since the proportion of pension institutions registered by enterprises is small. Moreover, its fees and services are still mainly aimed to the basic services for middle and low-income groups, while the market product innovation ability is poor, the multi-level and diversified characteristics of market service supply is obviously insufficient. It is noteworthy that the market supply capability of Hainan and the three northeastern provinces shows a trend of polarization. This may be affected by the increasingly popular way of elderly care service, what we called "migratory-bird-style". Due to factors such as increasingly severe population aging and severe weather conditions in the three provinces of Northeast China, the scale of net population migration has continued to expand. While Hainan has become the preferred place for the elderly to move in for living because of its good air quality and superior natural environment. Generally speaking, the elderly who choose this off-site pension method often have strong consumption ability. The consumption habits and preferences of these elderly people have an important impact on the overall

consumption structure and price level of the places where they moved to, thus promoting the supply level of Hainan's elderly care service market.

Social Supply Capability

In terms of social supply capability (see Table 2 and Table 6), according to scores and rankings, Beijing (0.0096), Shandong (0.0092), Hebei (0.0091), Jiangsu (0.0089) and Tianjin (0.0086) have strong supply capability. All of the top ten are located in the eastern region. However, Hainan (0.0070), Ningxia (0.0069), Chongqing (0.0068), Xinjiang (0.0067) and Yunnan (0.0067) have weaker social supply capabilities.

Table 6
Comparison of the Scores and Rankings of Social Supply Capability

The rank of social supply capability	Region	The rank of proportion of elderly care service expenditure to lottery welfare fund	The rank of percentage of beds in elderly care institutions registered by social organizations	The rank of number of volunteers in elderly care service institutions	The rank of time of volunteers in elderly care service institutions
1	Beijing	3	8	15	1
2	Shandong	9	4	4	4
3	Hebei	5	7	17	16
4	Jiangsu	13	15	1	2
5	Tianjin	26	3	19	20
26	Hainan	14	19	29	29
27	Ningxia	19	20	26	25
28	Chongqing	30	21	16	15
29	Xinjiang	29	17	23	22
30	Yunnan	23	24	27	27

The areas with strong social supply capability are mainly concentrated in the eastern coastal areas, and the weak areas are mainly distributed in the underdeveloped areas in the central and western regions. The reasons are: (1) Influenced by the level of economic development and regional management capabilities, the development environment, the maturity and participation of social organizations, the amount of welfare lottery public welfare funds and the construction of pension infrastructure in the central and western regions are insufficient. (2) The central and western regions are more deeply influenced by the traditional concept of elderly care service, and the elderly are more inclined to the family elderly care service, while the recognition and acceptance of the elderly care service provided by the society need to be improved. (3) At the same time, the existing social prejudices are difficult to eliminate, the income level of employees and volunteers who engaged in social organizations is low, and it is difficult to obtain their due social status and respect, resulting in a high labor turnover rate in social organizations, which further hinders the development of social supply capability in the central and western regions.

Cooperative Supply Capability

In terms of collaborative supply capability (see Table 2 and Table 7), Shandong (0.0098), Guangdong (0.0093), Zhejiang (0.0089), Beijing (0.0087) and Jiangsu (0.0087) ranked the top, while Guizhou (0.0070), Shanxi (0.0069), Jilin (0.0069), Hainan (0.0069) and Yunnan (0.0068) ranked the bottom with the low scores.

Table 7
Comparison of the Scores and Rankings of Cooperative Supply Capability

The rank of cooperative supply capability	Region	The rank of proportion of cumulative investment in PPP (Public-Private Partnership) pension projects to total investment	The rank of rehabilitation and medical outpatients in elderly care service institutions	The rank of proportion of the number of semi-self-care and non-self-care in the total number of elderly care service institutions	The rank of beds per thousand elderly population
1	Shandong	1	4	15	14
2	Guangdong	25	1	5	7
3	Zhejiang	23	6	17	2
4	Beijing	26	2	2	6
5	Jiangsu	4	3	12	3
26	Guizhou	9	21	29	10
27	Shanxi	27	27	24	26
28	Jilin	22	20	25	22
29	Hainan	28	16	7	30
30	Yunnan	24	26	14	29

The eastern coastal areas such as Beijing, Zhejiang and Guangdong have better cooperative supply capability. The reason is that the eastern coastal area, as a high-tech enterprise gathering place and the place where labor flows into, has the technical conditions for the development of intelligent pension and the human resources basis for increasing the number of elderly care nurses. In addition, in the face of the weakening of family care functions, the developed eastern regions should increase cooperation among various elderly care service providers, and further strengthen the combination of medical departments and elderly care service institutions, so as to alleviate the contradiction between supply and demand of elderly care service for the old people with disabilities, and to solve the lack of family care in elderly families and other issues.

There are many reasons for the weaker cooperative supply capability in the central and western regions:(1) Due to the lagging construction of databases and information platforms, the promotion of smart pension pilot is still in its infancy. Each supplier cannot enjoy the unimpeded service information. (2) There is insufficient cooperation between medical institutions and elderly care services. The number of rehabilitation and medical outpatients in elderly care service institutions is not high. The policy convergence of the combination of medical care and pension is not consistent, resulting in insufficient development of elderly care service institutions with medical service functions. Since the low supply capability of the combination of medical and elderly care services, the proportion of the elderly who choose to live in pension institutions for semi-self-

care and non-self-care is low. (3) The investment support of multiple subjects has shortcomings. The government's financial support for elderly care services still has room for improvement. Because of the poor market investment environment of social capital, the supervision and management mechanism of market investment is not sound, which increases the risk of capital investment. In order to avoid investment risks, the investment and financing of social capital and related enterprises are insufficient.

CONCLUSIONS AND DISCUSSION

Conclusions

From the perspective of multiple subjects, this paper constructs an evaluation system of elderly care service supply capability from five dimensions: family, government, market, society and coordination. The study finds that:

The comprehensive supply capability of China 's elderly care services is higher in the eastern region than in the central and western regions. The eastern regions such as Beijing, Guangdong, Shanghai, Jiangsu and Shandong have stronger comprehensive supply capability, and the central and western regions such as Shanxi, Yunnan, Heilongjiang, Xinjiang and Jilin have weaker comprehensive supply capability. The supply subjects of elderly care services show different characteristics: The areas with strong family supply capability have good economic support level, while the areas with weak family supply capability show a two-way downward trend of service guarantee and economic support. The effective play of government supply capability is increasingly prominent in the western region with low marketization and socialization, while it is still insufficient in the central region due to lake of the expenditure level of assistance and financial support for the extreme poverty. Market supply capability is not fully stimulated due to weak product innovation and multi-level supply gradients not yet formed. Social supply capability is under-developed thanks to many restrictions on the proportion of elderly care service expenditure to lottery welfare fund and the participation of social forces. Areas with weaker coordinated supply capabilities have problems such as insufficient financing, poor integration of medical and elderly care policies, and inadequate human resources construction of the elderly care nurses.

Policy Implications

To improve the supply capability of multi-subject elderly care services, this paper highlights the following implications.

(1) According to the level of regional social and economic development and the degree of population aging, establish a balanced development strategy for the supply of elderly care service. Reasonably optimize the fiscal special budget and transfer payment system, play the comparative advantage of central and western regions to enhance the attraction of investment and construction. Encourage cross-regional cooperation between the east and the central and western regions to form a long-term and stable relationship of assistance and to further narrow the regional gap in the supply of elderly care service.

(2) Strengthen the supply capacity of each subject, clarify the role positioning and coordination relationship among multiple supply subjects, [22] and accelerate the formation of a multi-subject responsibility sharing system for elderly care services.

First of all, focus on improving the family's financial support and service support capabilities, and it is recommended that family members care for each other and take care of each other in a timely manner. At the same time, it is suggested that the elderly and elderly families maintain good living habits and healthy lifestyles (such as strengthening exercise, reducing the intake of alcohol and cigarettes, etc.) to improve their own physical health.

Second, the government should continue to consolidate its inherent responsibilities to ensure that the bottom line of elderly services is fair. Further increase the support for the elderly and areas in poor, and improve the infrastructure construction for the provision of elderly care services (such as the ageing renovation of public places,

the maintenance of elderly fitness equipment, and the management of smoke-free environments, etc.)

Thirdly, we should further stimulate the vitality of market supply to meet the personalized and quality demand for elderly care service. It is recommended that intensify the innovation of products related to elderly care services, form a more attractive innovation incentive mechanism and increase the number and vitality of market products for elderly care services.

Finally, actively promote the extensive participation of social forces, strengthen multi-subject cooperation to give full play to the supply force, and gradually promote the transformation of the supply of elderly care service from a single subject dependence to a shared responsibility of multiple subjects.

Limitations and Future Research Directions

However, due to the limited data access and spatiotemporal restrictions, the index system design of this study cannot cover all aspects of the supply capability of elderly care services, and it needs to be continuously improved in the future. In addition, this paper we use the cross-sectional data of 2018, which can only represent the current situation of elderly care service supply capability. It is our future research direction that use the continuous data for many years to track the status quo for a long time and analyze the temporal and spatial differences of elderly care service supply capability.

Conflicts of Interest Disclosure Statement

The authors declare no conflict of interest in the authorship or publication of this work.

Author Declaration

The authors declare no sponsored financial sources by any organization related to tobacco production for the undertaken study.

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