

An Empirical Study on the Impact of Uneven Regional Elderly Care Resources in Guangdong on the Development of Institutional Elderly Care from the Intergenerational Perspective of Coupled Coordination

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Abstract: Against the backdrop of an aging population and regional population mobility, the uneven distribution of elderly care resources has become a key issue restricting the high-quality development of institutional elderly care. This paper takes the staff of elderly care institutions in Guangdong Province, planned residents, and young and middle-aged people who have not yet considered institutional selection as the research subjects, uses stratified random sampling to obtain micro-questionnaire data, uses entropy weight method to objectively assign weights, constructs a three-system coupling coordination model of supply-demand-intergenerational cognition, integrates macro-city data and micro-group survey data, and conducts an empirical analysis of the uneven distribution of regional elderly care resources and its impact on institutional elderly care development. Research findings: (1) More than 90 percent of the 21 cities in Guangdong Province are supply-lagging, with only Zhuhai and Shaoguan being demand-lagging. (2) After adding intergenerational cognitive levels, the Pearl River Delta and the eastern, western, and northern parts of Guangdong maintain the characteristic of supply lag and show a gradient order of supply < demand < generational. (3) There are three major contradictions among the regions: a mismatch between supply and demand, a mismatch between generational cognition and supply, and a larger gap in supply-side hard power than that in cognitive soft power. The study proposes differentiated strategies at the levels of government, elderly care institutions, and communities, which can provide empirical references for balancing the allocation of regional elderly care resources and improving the quality and services of institutional elderly care.

Keywords: Uneven distribution of regional elderly care resources; Institutional care; Intergenerational cognition; Coupling coordination model

1. Introduction

With the acceleration of global aging, the elderly care needs of seniors are shifting toward high-quality and dignified services. As a core pillar of the elderly care system, the allocation of institutional care resources and service equity directly affects the accessibility and fairness of elderly care. China has entered a deeply aging society, and addressing population aging has become a national strategy with policies emphasizing improved resource allocation. However, current nursing homes still face low occupancy, uneven resource distribution, and supply-demand mismatch. Guangdong Province shows obvious regional disparities: the Pearl River Delta has rapidly upgraded care needs but an insufficient high-end supply, while eastern, western, and northern Guangdong suffer from inadequate supply and services. Meanwhile, intergenerational cognition influences seniors' admission decisions, and institutional hard power is the key to service quality.

According to current research on the development of institutional elderly care, Mu Guangzong ^[1] points out that supply-demand imbalance is the core dilemma, Wu Min ^[2] stresses the key role of policy

and financial support, and Zhang Fengjian et al. [3] confirm that individual, family, and institutional factors jointly affect the adaptability of elderly care. In terms of regional differences, Li Changgui et al. [4] found obvious spatial differentiation in elderly care services, and Feng Xiaoqian et al. [5] analyzed the supply-demand matching mechanism from a multi-dimensional perspective. With the expansion of intergenerational and mobility research, Ji Jingyao [6] argues that the elderly wish to dominate resource allocation, Song Quancheng and Wang Hongzhi [7] verify that intergenerational mobility reshapes the cognition of elderly care responsibility through logit regression models, and Liu Tao et al. [8] propose that population flow changes the regional aging pattern through scale and structural effects. However, two major deficiencies remain in existing studies: most adopt a single supply-demand dual perspective and ignore the intermediary and regulatory role of intergenerational cognition, and the lack of regional comparison within Guangdong Province makes it hard to put forward practical suggestions for the upgrading and optimization of local elderly care institutions.

Based on this, this paper takes Guangdong Province as the research object and innovatively analyzes the impact of the intergenerational level of supply and demand for elderly care resources on the development of institutional elderly care from an intergenerational perspective. By subdividing the three groups of elderly care institution staff, the planned resident group, and the middle-aged and young group that have not yet considered institutional choices, and sorting out three intergenerational cognitive influence paths, it reveals the coordinated development level of institutional elderly care, which can provide a basis for the government to optimize elderly care facilities and service policies and promote the healthy development of institutional elderly care in China. The selection of Guangdong Province is not only because it is a populous province with significant differences between the Pearl River Delta and the eastern, western, and northern parts of Guangdong, but also because the differences in economic and technological levels within the province provide sample diversity for intergenerational level comparisons within the same province.

2. Research Design

2.1. Survey Scheme design

In view of the characteristic that regional elderly care resources in Guangdong are concentrated in the Pearl River Delta and dispersed in eastern, western, and northern Guangdong, a combined strategy of stratified sampling and random sampling was adopted for microdata to ensure rational sample coverage. The specific operation methods are as follows:

2.1.1. Questionnaire Design and stratified random sampling

This study designs three questionnaires for elderly care staff, potential seniors, and young-middle-aged groups, covering population mobility, unbalanced elderly care resources, and intergenerational interaction. With unified basic modules and differentiated contents, they respectively investigate supply operation, demand willingness, and intergenerational care behaviors.

A stratified random sampling method was adopted for microdata, with the PRD, eastern Guangdong, western Guangdong, and northern Guangdong as regional strata to survey three groups in Guangdong Province. A total of 89 questionnaires were collected in the pre-survey. After optimization, the formal survey was conducted, with 892 questionnaires distributed and 772 valid ones recovered, yielding an effective response rate of 86.5%, and the data passed reliability and validity tests.

Table 1: Sampling Stratification and Sample Size Allocation.

Region	Group classification	Resident population /10,000 people	Overall weight/%	Number of questionnaires distributed / pieces
Pearl River Delta Region	Elderly care workers	7051	56.1	168
	Planned occupancy groups			168
	Young and middle-aged groups			109
Eastern, western, and northern Guangdong	Elderly care workers	5511	43.9	132
	Planned occupancy groups			132
	Young and middle-aged groups			85

The sample is reasonably distributed by region: 436 valid questionnaires were collected in the Pearl

River Delta (150 from institutional staff, 170 from potential residents, and 116 from young and middle-aged groups), and 336 in eastern, western, and northern Guangdong (126 from institutional staff, 131 from potential residents, and 79 from young and middle-aged groups). The sample structure is consistent with the population distribution of Guangdong Province and has good representativeness. The detailed distribution is shown in Table 1.

2.1.2. Macro data sources

This study takes 21 cities in Guangdong as samples and 2024 as the study period. Supply-demand data are from the Guangdong Statistical Yearbook 2025 and civil affairs quarterly reports, while intergenerational cognition data are from questionnaires. A three-level indicator system with 12 indicators is established, as shown in Table 2.

Table 2: Guangdong Province's Supply-Demand-Intergenerational Cognition Index System for Elderly Care Institutions.

Indicator Layer	Related Metrics	Symbols	Metric weights	Properties of Indicators
Supply level of elderly care institutions (U ₁)	Elderly care facilities per 10,000 population (units)	C ₁	0.290565	+
	Physicians per 1,000 population (person/thousand)	C ₂	0.136629	+
	Per capita local public budget revenue (yuan)	C ₃	0.416307	+
	Pension investment fit(yuan/person)	C ₄	0.156500	+
Demand level for elderly care institutions (U ₂)	Estimated proportion of people aged 60 and above in 2024(%)	C ₅	0.147996	+
	Proportion of young and middle-aged people (%)	C ₆	0.148658	-
	Per capita disposable income(yuan)	C ₇	0.509913	+
	Participation rate (%)	C ₈	0.193433	+
Intergenerational cognitive difference level (U ₃)	Consensus on service quality assessment	C ₉	0.8099	+
	Consensus on spending on elderly care	C ₁₀	0.0150	+
	Consensus on pension options	C ₁₁	0.1297	+
	Regional gap perception consensus	C ₁₂	0.0454	+

2.2. Research Methods

2.2.1. Test of Reliability and Validity

(1) Reliability test

To test the consistency, stability, and reliability of the measurement results in the three questionnaires, a coefficient was adopted. Generally, a coefficient above 0.7 is considered an acceptable reliability (Considine et al. [9]), and the larger the coefficient, the greater the credibility of the measurement.

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum_{i=1}^k \sigma_{Y_i}^2}{\sigma_X^2} \right) \tag{1}$$

Here, k represents the total number of items on the scale; $\sigma_{Y_i}^2$ is the variance of the score for the i-th item; and σ_X^2 is the variance of the total score of the scale.

(2) Validity test

In this study, the KMO test was used to determine whether the data were suitable for factor analysis. The KMO value is usually required to be greater than 0.6, and the P-value of the Bartlett's sphericity

test must be significant before proceeding with the next analysis (Kaiser et al. [10]).

$$KMO = \frac{\sum \sum_{i \neq j} r_{ij}^2}{\sum \sum_{i \neq j} r_{ij}^2 + \sum \sum_{i \neq j} p_{ij}^2} \quad (2)$$

Among them, r_{ij} : the simple correlation coefficient between variables i and j ; p_{ij} : the partial correlation coefficient between variables i and j .

2.2.2. Entropy weighting method

The entropy weight method objectively weights indicators of the coupling coordination model according to data discreteness: indicators with greater inter-city variation carry more information, lower entropy, and higher weights.

Firstly, to eliminate the influence of different indicator scales, the original data is standardized. For positive and negative indicators, the following formulas are used, respectively:

$$x'_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \quad (3)$$

$$x'_{ij} = \frac{\max(x_j) - x_{ij}}{\max(x_j) - \min(x_j)} \quad (4)$$

Then, calculate the entropy value e_j of the j -th indicator, and the formula is as follows:

$$e_j = -k \sum_{i=1}^n P_{ij} \ln(P_{ij}) \quad (5)$$

Among them, $P_{ij} = \frac{x'_{ij}}{\sum_{i=1}^n x'_{ij}}$ represents the proportion of the i -th sample in the j -th indicator; the constant $k = \frac{1}{\ln(n)}$, ensuring that $0 \leq e_j \leq 1$.

Finally, the difference coefficient of the indicator is calculated as $d_j = 1 - e_j$. The larger the difference coefficient, the greater the influence of this indicator on the evaluation result. The weight calculation formula for the j -th indicator is:

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

Among them, $m = 4$ represents the total number of indicators.

2.2.3. Coupling Coordination Model

This study uses the coupling coordination model to analyze the impact of supply-demand imbalance in elderly care resources on institutional elderly care.

Firstly, the comprehensive evaluation index T is calculated, and the formula is as follows:

$$T = \alpha U_1 + \beta U_2 + \gamma U_3 \quad (7)$$

Among them, α , and γ are the undetermined coefficients of each subsystem. This study treats the three systems equally, so $\alpha = \beta = \gamma = \frac{1}{3}$ is adopted. When only analyzing the supply and demand systems, the same method is adopted.

Then, the coupling degree C ranges from 0 to 1; a higher value indicates stronger interaction. Formulas for two and three systems are as follows:

$$C = 2 \times \frac{\sqrt{U_1 \times U_2}}{U_1 + U_2} \quad (8)$$

$$C=3 \times \frac{\sqrt[3]{U_1 \times U_2 \times U_3}}{U_1 + U_2 + U_3} \quad (9)$$

Coupling coordination degree D ranges from 0 to 1. Higher values represent better coordination. See formula below.

$$D = \sqrt{C \times T} \quad (10)$$

Referring to Wang et al. (2021)^[11], this study classifies coordination levels by D value, as shown in Table 3.

Table 3: Classification Criteria for Coordination Levels and Coordinated Development.

Intervals	C	D	Categories
[0, 0.1)	Extreme dysregulation		Recessionary class
[0.1, 0.2)	Severe dysregulation		
[0.2, 0.3)	Moderate dysregulation		
[0.3, 0.4)	Mild dysregulation		
[0.4, 0.5)	On the verge of dysregulation		
[0.5, 0.6)	Barely coordinated		Development class
[0.6, 0.7)	Primary coordination		
[0.7, 0.8)	Intermediate Coordination		
[0.8, 0.9)	Good coordination		
[0.9, 1]	High-quality coordination		

3. Analysis of Empirical Results

3.1. Test results of reliability and validity

Table 4 shows the reliability and validity test results of the three groups, in which all Cronbach's α coefficients and KMO statistics reach qualified levels, Bartlett's sphericity test is significantly valid for each group, and variables have reasonable common factor structures suitable for factor analysis, demonstrating that the questionnaire data of the three groups have favorable reliability and validity and can be applied to subsequent research analysis.

Table 4: Results of the Three-Group Reliability and Validity Test.

Population types	Cronbach's α	Overall KMO values	p value
Planned occupancy group	0.885	0.890	0.000
Middle-aged and young people	0.956	0.924	0.000
The group of elderly care workers	0.881	0.861	0.000

3.2. Analyze the development level of institutional elderly care in the Pearl River Delta and eastern, western, and northern Guangdong based on coupling coordination

3.2.1. Theoretical Framework

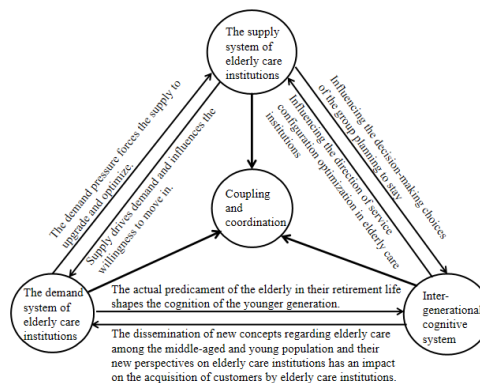


Figure 1: Supply-Demand-Intergenerational Cognition Relationship.

From the clockwise direction of demand-supply-intergenerational cognition-demand: The demand system serves as the core driver of institutional elderly care development. Elderly care pressure forces the supply side to adapt its service content, facility allocation, and operation models. The improved supply system guides demand, influences elderly residents' willingness to move in, and shapes young and middle-aged people's perceptions, gradually shifting the traditional sole reliance on family care. The intergenerational perception system further affects the elderly's decision-making, improves customer acquisition efficiency, and completes the closed-loop transmission. The above interactive logic framework is shown in Figure 1.

Viewed from a counterclockwise perspective, Practical elderly care difficulties directly shape the perceptions of young and middle-aged groups, making them realize the necessity and value of institutional care. Intergenerational cognition provides directions for the optimization of the supply system, aligning resource allocation with mutually recognized care needs. The upgraded supply system improves service quality and supply-demand matching, accurately responds to needs, and strengthens positive perceptions, thus forming a virtuous cycle in which demand drives cognition, cognition guides supply, and supply meets demand, promoting coordination among the three systems and the high-quality development of institutional elderly care.

3.2.2. Establishment of the supply and Demand System for elderly care institutions in Guangdong Province

The coupling degree C, index T, and coordination degree D of 21 cities in Guangdong Province are shown in Table 5.

Table 5: Index Related to the Coupling and Coordination of Supply and Demand Systems of Elderly Care Institutions in Guangdong Province.

Region	city	f(U ₁) supply	f(U ₂) demand	Two systems C	Two systems T	Two systems D	Coordination level	Supply and demand characteristics
PearlRiver Delta	GZ	0.468	0.599	0.992	0.5335	0.7277	Primary/moderate coordination	Supply lag type
	JM	0.278	0.473	0.966	0.3751	0.6019		Demand lag type
	ZH	0.579	0.577	1	0.5784	0.7605	Barely coordinated	Supply lag type
	FS	0.249	0.51	0.939	0.3796	0.5971		
	SZ	0.587	0.714	0.995	0.6506	0.8046		
	ZQ	0.272	0.368	0.989	0.3198	0.5622		
	HZ	0.286	0.355	0.994	0.3208	0.5647		
	ZS	0.226	0.457	0.941	0.3414	0.5669		
Eastern Guangdong	DG	0.184	0.448	0.909	0.316	0.536	On the verge of dysregulation	Supply lag type
	SW	0.189	0.278	0.982	0.2332	0.4785		
	JY	0.099	0.274	0.883	0.1863	0.4056		
	ST	0.091	0.357	0.803	0.2239	0.424		
Western Guangdong	CZ	0.076	0.369	0.752	0.2221	0.4086	Barely coordinated	Supply lag type
	ZJ	0.199	0.321	0.972	0.2604	0.5031		
	YJ	0.343	0.382	0.999	0.3624	0.6015		
Northern Guangdong	MM	0.151	0.335	0.926	0.2433	0.4746	On the verge of dysregulation	Demand lag type
	SG	0.475	0.408	0.997	0.4411	0.6632	Primary/moderate coordination	
	MZ	0.396	0.453	0.998	0.4251	0.6513		
	HY	0.295	0.362	0.995	0.3285	0.5716	Barely coordinated	
QY	0.244	0.407	0.968	0.3251	0.561			
	YF	0.209	0.371	0.961	0.2899	0.5277		

According to the results, (1) Institutional elderly care in Guangdong is generally supply-lagging, with only Zhuhai and Shaoguan being demand-lagging. Supply-demand imbalance is the core constraint. (2) Regional gaps are prominent. The PRD has a far higher coordination level than eastern, western, and northern Guangdong, with non-PRD cities suffering low coordination and insufficient supply. (3) The provincial supply-demand system has high coupling, low coordination, and large regional gaps. High coupling but low overall supply level.

3.2.3. Construction of the supply-demand-Intergenerational system for elderly care institutions in Guangdong Province based on supply-demand Theory

The coupling degree C of the three systems is shown in Table 6.

Table 6: Sub-regional Scores of Intergenerational Cognitive System-Related Indicators in the Pearl River Delta and Eastern, Western, and Northern Guangdong.

Region	C_9	C_{10}	C_{11}	C_{12}
Pearl River Delta	0.908806	0.991935	0.627392	0.989678
East-West-North Guangdong	0.640394	0.946098	0.721123	0.911482

Results show higher consensus on elderly care modes in eastern, western, and northern Guangdong, with less generational conflict and greater acceptance of institutional care, reflecting strong development potential. The three-system coupling coordination results are shown in Table 7.

Table 7: Coupling Coordination Model of Supply-Demand-Intergenerational Cognition.

Region	U_1	U_2	U_3	C	T	D	Coordination level	System characteristics
Pearl River Delta	0.3477	0.5001	0.8772	0.929	0.575	0.731	Intermediate Coordination	Supply lag type
East-West-North Guangdong	0.231	0.359	0.668	0.909	0.419	0.617	Primary coordination	

Results show that both the PRD and eastern, western, and northern Guangdong follow a supply-lagging pattern of supply < demand < intergenerational cognition, where high cognition boosts institutional care but inadequate supply remains the main barrier. The PRD's moderate coordination level (0.731) is notably higher than eastern, western, and northern Guangdong's primary coordination level (0.6174), driven by regional differences in supply, demand, and cognition.

4. Conclusions

This study investigates the uneven distribution of elderly care resources across Guangdong Province and its impact on institutional care, surveying staff, potential residents, and young and middle-aged groups. To ensure representative sampling, it combines stratified and random sampling between the Pearl River Delta and eastern, western, and northern Guangdong, with reliable questionnaire data. A macro-micro framework is established using entropy weight and a three-system coupling coordination model. Results reveal three key mismatches: supply–demand, intergenerational cognition–supply, and a wider gap in hard infrastructure than soft cognitive capacity. Elderly care institutions in both regions are supply-lagged ($U_3 > U_2 > U_1$), with significantly higher coordination in the Pearl River Delta. This study makes up for the problems of a single research perspective and insufficient regional comparison. Through quantitative analysis, it reveals the internal logic of resource allocation affecting service efficiency and intergenerational cognition acting on move-in decision-making, which can optimize the layout of regional elderly care resources and improve institutional elderly care. Services provide empirical support and have practical significance for promoting a high regional balance of elderly care services. There are also limitations in the study: only using cross-sectional data makes it difficult to reflect dynamic changes; The type and scale of institutions are not subdivided, and the universality of the conclusions needs to be further verified. In the future, time series data can be introduced to carry out multi-period comparative analysis to provide a more sufficient basis for institutional elderly care and regional collaborative governance.

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