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Evaluation of the Efficiency of Community Home Care Service in China

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Abstract

To explore the efficiency of community home care service. Methods: Based on the panel data of 13 provinces (cities) in China from 2018 to 2021, the efficiency of community home care service was analyzed by DEA model, and the Tobit model was used to analyze the influencing factors of efficiency. Conclusion: (1) The overall efficiency of community home care services has been improved, but there is still a lot of room for strengthening. (2) The main factors affecting efficiency include economic development level, income level, education status, medical care level and old age coefficient. Results: Based on the research results, optimization suggestions are put forward to improve the efficiency of community home care service.

Keywords

Community Home Care Service; Data Envelope Analysis; Tobit Regression; Efficiency.

1. Introduction

Data from China Statistical Yearbook (2022) shows that by the end of 2021, the number of population aged 65 and above in China reached 200.56 million, accounting for 14.2%. According to the international classification standard, China has basically entered an aging society, and the demand for elderly care services is huge. According to the statistics of the National Health Commission, China's elderly care shows a "9073" mode, that is, 90% of the elderly population choose community home care, 7% of the elderly population choose community care, and 3% of the elderly population choose to stay in institutions for care. Community home endowment service is our country in 2006 proposed new pension mode, is the family as the core, community to support for the elderly including life care, domestic service, medical care, spiritual comfort services, make up for the defects of the traditional family pension and institutional endowment, but there are still insufficient effective supply, quality efficiency is not high, the problem such as unbalanced allocation of resources[1][2]. There are still elderly groups reporting that the perception is not high and the sense of gain is not strong.

This paper integrates the existing relevant research, on the basis of the analysis of the efficiency of community home care service, analyzes its influencing factors, and puts forward suggestions, in order to further improve the efficiency of community home care service.

2. Literature Data

Wang qiong using China aging scientific research center in 2010 "China's urban and rural elderly population condition tracking survey" of the urban elderly data, the present situation of the elderly family care demand analysis and influence factors, think advocate thrift and for the sake of children and other traditional cultural concept, economic factors such as income and physical function, age, social status, gender, regional factors, are the influence of community home endowment service demand[3]. Through the theoretical research, Wang Yanfang and Feng Zhitao proposed the main factors affecting the demand for home care: first, the individual

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characteristics of the elderly, namely age, gender and educational level; the family characteristics of the elderly, including marital status, living status, economic source and the number of surviving children; third, the physical characteristics of the elderly, including self-care and illness[4]. Xu Tingke et al. used spatial autocorrelation analysis to analyze the spatial distribution pattern of community home care service supply in China, and found that the supply intensity of community home care services increases, but the total amount is still insufficient; the coverage rate of different types of service supply has increased, but the development is unbalanced; the supply of community home care services is clustered and increasingly unbalanced[5].

3. Data and Methods

3.1. Data Source

This study is based on the data of community home care services under the long-term care insurance system implemented in 13 provinces (municipalities) in China in 2018-2021[6], Will focus on the relatively large elderly group in China. This paper takes "community home care" and "social care" "home care" as the keyword search, search time: 2006-2022. The panel data in this paper are from China Statistical Yearbook and China Civil Affairs Statistical Yearbook.

3.2. Study Methods

1) Selection of indicators. Through the relevant literature research[7-11], Three input indexes and two output indexes were selected based on the principles of accessibility and integrity of indexes, correlation with community home care, and reasonable inclusion in DEA model. The number of beds, the number of employees at the end of the year and the number of social workers were used as input variables, and the number of community elderly care services and the average number of residents were used as output indicators. In this paper, there are 2 output indexes and 3 input indexes, and the sample size is 13, which is the product of more than twice the input-output indexes. It can be considered that the DEA evaluation results have strong discriminability.

2) The DEA-Tobit model. The data envelope analysis method (data envelopment analysis, DEA) was proposed in 1918 by the famous American mathematician Chanas (Charnes) and Cooper (Cooper)[12]. Mainly include CCR models with assumed constant scale efficiency and BCC models with assumed variable scale efficiency. This paper focuses on how to obtain the maximum output under the constant resource input of community home care services, so the output-oriented BCC model is chosen to measure the efficiency of community home care services. The comprehensive technical efficiency is the product of pure technical efficiency and scale efficiency. In the efficiency value of 0-1, the efficiency value equal to 1 is "DEA valid", and the efficiency value less than 1 is "DEA invalid".

Table 1. Evaluation index of the efficiency of community home care services

Indicator category	Level 1 indicators	Index unit
Investment index	Number of beds	fix
	Number of employees at the end of the year	individual
	Number of social work workers	individual
Output indicators	The number of community elderly care service people	person-time
	Average number of medical visits by residents	Times

Based on the combined efficiency results as the dependent variable, each influencing factor was analyzed with the Tobit model. Tobit model, also known as censored regression model, is applicable to the dependent variable being observed in a limited way, which can make up for

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the parameter estimation deviation and inconsistency in the ordinary least squares regression[13]. In this paper, the efficiency values calculated by DEA are between 0-1, and then the Tobit regression model is used to analyze the factors affecting the efficiency of community home care services.

3.3. Statistical Analysis

The Excel 2021 software was used to establish the database and organize the collected data and related information. DEA analysis was calculated by DEAP 2.1 software, and Tobit model analysis was analyzed using stata 16 software.

4. Results

The relevant data of community home care services in 13 provinces from 2018 to 2021 were imported into DEAP 2.1 software, and the DEA-BBC model was used to obtain the efficiency value of community home care services in 13 provinces (cities).

Table 2. Comprehensive technical efficiency of community home care services in 2018- -2021 in 13 provinces (municipalities) in China

area	2018	2019	2020	2021	mean
Hebei	0.143	1	0.636	0.948	0.682
Jilin	0.671	1	0.384	1	0.764
the Heilongjiang River	0.319	0.564	1	1	0.721
Shanghai	1	1	1	1	1
Jiangsu	0.114	0.637	0.513	0.712	0.494
Zhejiang	0.109	0.709	0.854	1	0.668
Anhui	0.179	0.439	1	0.985	0.651
Jiangxi	0.279	1	1	1	0.820
Shandong	0.217	0.836	0.5	0.608	0.540
Hubei	0.143	1	0.7	1	0.711
Guangdong	0.072	1	0.661	0.531	0.566
Chongqing	1	0.533	0.662	0.647	0.711
Sichuan	0.231	0.978	0.597	1	0.702
mean	0.344	0.823	0.731	0.879	

Comprehensive technical efficiency can measure and evaluate the resource allocation ability and resource utilization ability of community home care services in the region. The efficiency of community home care service did not reach the efficiency of DEA in 2018-2021, and the supply efficiency was 0.344,0.823,0.731 and 0.879 respectively, showing an overall growth trend, but still in a low category. The overall average of the four years from 2018 to 2021 was 0.694, indicating that a 30.6% reduction in community home care service input could reach the same level of output. See Table 2 for details.

From the perspective of different provinces (cities), there are great differences in the supply efficiency of community home care services in different regions. Only the average efficiency of Shanghai in the four years is 1, indicating that the output index of resources input in the area reaches DEA every year. In addition to the reduction in the supply efficiency of community home care services in Guangdong, the comprehensive technical performance in 2021 is only 0.531, and the supply efficiency of most provinces (cities) is gradually improved. The comprehensive technical efficiency of Jiangsu, Anhui, Shandong and Guangdong is all less than 1, and the efficiency value is relatively low, which is considered DEA invalid, and there is room

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for improvement of pure technical efficiency and scale efficiency in different degrees. In the DEA model, the comprehensive technical efficiency is the product of pure technical efficiency and scale efficiency, which shows that the scale efficiency or low pure technical efficiency is the main reason for the low efficiency of community home care.

Table 3. Pure technical efficiency of community home care services in 2018-2021 in 13 provinces (municipalities) in China

area	2018	2019	2020	2021	mean
Hebei	0.589	1	0.667	1	0.814
Jilin	1	1	0.39	1	0.848
the Heilongjiang River	1	0.609	1	1	0.902
Shanghai	1	1	1	1	1
Jiangsu	1	1	1	1	1
Zhejiang	1	1	1	1	1
Anhui	0.402	0.452	1	1	0.714
Jiangxi	0.469	1	1	1	0.867
Shandong	0.921	0.917	0.537	0.608	0.746
Hubei	0.539	1	0.961	1	0.875
Guangdong	1	1	0.858	0.665	0.881
Chongqing	1	0.558	0.681	0.652	0.723
Sichuan	1	1	0.858	1	0.965
mean	0.84	0.887	0.842	0.917	

Pure technical efficiency reflects the production efficiency of the regional resources invested in a certain technical level, which is affected by management and technical factors. The efficiency value of community home care service in provinces (cities) of China is stable at about 0.872, indicating that the community home care service in provinces (cities) is at a relatively high level in terms of technology and management level, and the efficiency value has reached a considerable position. See Table 3 for details.

From the perspective of provinces (cities), there are four provinces (cities) with pure technical efficiency lower than the average level in 2018 and 2020, and three provinces with the regional average level in 2019 and 2021. The pure technical efficiency value of Shanghai, Jiangsu and Zhejiang is 1, which is DEA effective, indicating that they are relatively advanced in the management and technology of community home care services, and realize the optimization of input and output. The pure technical efficiency of Shandong, Guangdong and Chongqing from 2018 to 2021 showed a downward trend, while Anhui and Jiangxi increased steadily. Although other provinces (cities) did not reach the optimal state, they all improved to varying degrees.

The scale and efficiency of community home care service can reflect whether the regional community home care service supply is in the optimal scale. The efficiency value of community home care services in all provinces (cities) is stable around 0.793, indicating that there is still 20.7% room for improvement. The scale and efficiency of community home care services showed an overall trend from 2018 to 2021. See Table 4 for details.

From the perspective of all provinces (cities), the scale efficiency, comprehensive technical efficiency and pure technical efficiency of all provinces (cities) in 2018-2021 are Shanghai, DEA = 1, indicating that the input and output ratio of home care service in this community has reached the optimal state. Among them, Jilin and Chongqing have high scale efficiency, with the average value stable at about 0.9. In some years, the scale efficiency value is 1, reaching the optimal efficiency level. The scale efficiency value of Jiangsu, Zhejiang and Guangdong is at a

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relatively low level, with the average value lower than 0.70, which indicates that the investment in community home care services should be further expanded to achieve the best scale.

Table 4. Scale and efficiency of community home care services from 2018 to 2021 in 13 provinces (municipalities) in China

area	2018	2019	2020	2021	mean
Hebei	0.243	1	0.953	0.948	0.786
Jilin	0.671	1	0.985	1	0.914
the Heilongjiang River	0.319	0.925	1	1	0.811
Shanghai	1	1	1	1	1
Jiangsu	0.114	0.637	0.513	0.712	0.494
Zhejiang	0.109	0.709	0.854	1	0.668
Anhui	0.445	0.97	1	0.985	0.850
Jiangxi	0.595	1	1	1	0.899
Shandong	0.236	0.912	0.93	0.999	0.769
Hubei	0.265	1	0.729	1	0.749
Guangdong	0.072	1	0.77	0.798	0.660
Chongqing	1	0.955	0.972	0.992	
Sichuan	0.231	0.978	0.696	1	0.726
mean	0.408	0.93	0.877	0.957	0.793

Considering the characteristics of 13 provinces (municipalities) community home endowment service and data availability, this paper selected eight efficiency factors, respectively, health care spending (H1), per capita disposable income (H2), college and above personnel degree H (3), elderly dependency ratio H (4), institutions and facilities H (5), family size H (6), illiterate population proportion H (7), per capita GDPH (8).

Taking the comprehensive technical efficiency of 13 provinces (cities) in China as the dependent variable, the influencing factors of the efficiency of community home care service were analyzed. The following table.

Table 5. Results of the Tobit regression analysis

variable	coefficient	standard deviation	t price	P price
H1	-0.244	0.073	-3.33	0.002
H2	0.544	0.177	3.07	0.004
H3	-0.481	0.159	-3.02	0.004
H4	0.163	0.035	4.66	0.000
H5	0.268	0.156	1.72	0.092
H6	0.030	0.082	0.37	0.715
H7	0.134	0.036	3.73	0.001
H8	-0.268	0.128	-2.09	0.042

(1) There was a negative correlation between health care expenditure and the efficiency of community home care services, with the regression coefficient of-0.244, P <0.05. Diseases are the biggest adverse factors affecting the life of the elderly in their later years. The main diseases of the elderly are mainly chronic diseases, especially cardiovascular and cerebrovascular diseases and diabetes. The result is with Wang Peili, Li Enping[14]The results are generally consistent. The factors influencing the medical burden of Chinese residents, with the improvement of residents' income and health awareness, people have the ability to obtain

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advanced medical resources and health infrastructure, which may lead to congestion of medical resources or rising prices. This is a mismatch between health resources and the growing demand for medical services. The worse the health status of the elderly, the weaker the self-care ability, and the high demand for health care services. However, the lower return on investment compared with the young, and the high cost, they need to bear a high burden of medical care. The rise of health care price has a more significant inhibitory effect on the health care expenditure of urban residents[15].

(2) per capita disposable income and community home endowment service efficiency is highly positively correlated, coefficient of 0.544, P <0.05. Increase per capita disposable income per unit, community home endowment service efficiency will increase 0.544 units, from another aspect also reflects the per capita disposable income is an important reason to improve the efficiency of community home endowment service. There was a positive correlation between the elderly dependency ratio and the efficiency of community home care services, with a regression coefficient of 0.163, P <0.05. This suggests that the elderly dependency ratio has a positive effect on promoting the community home care. This is associated with Zhu Yixi, Feng Yuying[16]The results are generally consistent. This paper introduces the explanatory variable of elderly population dependency ratio, measured as the number of elderly population required to burden per 100 working-age population. As can be seen in the table, for limited public health resources, the higher proportion of the elderly population means the higher demand for community home endowment service, so as to promote the security department to further expand the regional community home endowment service investment scale, and improve the corresponding management level, accelerate the continuous optimization of community home endowment service efficiency.

(3) There is a negative relationship between the degree of service staff or above and the efficiency of community home care service, and the regression coefficient was-0.481, P <0.05. This is not consistent with the usual cognition, which may be because the proportion of the elderly in the community cannot form an effective ratio with the professional elderly service providers, so the promotion of community elderly service services is under great pressure. Moreover, most of the community workers lack a formal establishment, and the salary level is generally low, but they undertake quite heavy grass-roots work, and the recruitment work is also difficult to promote. College students tend to hospitals and other medical institutions, selectively avoid the community elderly care service industry, and lack of professional talents to the society. The positive relationship between the proportion of illiterate population and the efficiency of community home care service, and the regression coefficient was 0.134, P <0.05. This result is similar with Lu Xuanru and Zhang Xiaoyi[17]The results are generally consistent. Generally speaking, the elderly with higher education have more extensive social support and medical resources, more open thinking, strong ability to adapt to the society, have higher requirements for their own success and quality of life in their later years, and thus have a low demand for community home care services. In contrast, the elderly with low education level are at a disadvantage, so the improvement effect of community home care services will be more significant.

(4) There was a positive correlation between the number of institutions and facilities and the efficiency of community home care services, with the regression coefficient of 0.268 and P> 0.05, and the positive correlation was not statistically significant. According to the general cognition, the more the number of community home care institutions and facilities means that the more adequate service personnel, so as to improve the satisfaction of the elderly in receiving services, which should intuitively improve the efficiency. However, the regression results of this study showed that there was no significant relationship between the number of institutions and facilities. The possible explanation is that the content of basic community home care service facilities is single. Most community home care centers only have some basic

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entertainment facilities for the elderly, and lack the introduction of large-scale number of intelligent living equipment and medical equipment[18]. There was a positive correlation between family size and the efficiency of community home care services, with a regression coefficient of 0.030 and P> 0.05, and the positive correlation was not statistically significant. This is done together with Yao Zhaoyu, Chen Risheng, and Jiang Haojun[19]The results are generally consistent. For families with a large number of family members and more complex types, the elderly have more interactions with family members, and can obtain material support, life care and spiritual comfort from within the family. Therefore, the demand for home care services outside the family will be reduced.

(5) Per capita GDP is negatively associated with the efficiency of community home care services. The regression coefficient was-0.268, P <0.05. Huang Dandan, Wu Shaotang and Liang Xiaohui found that the higher the economic level was not, the better the fairness in the allocation of public health resources[20], Dai Jing, Luo Shuting, Li Wei[21]In the study on pension willingness, the impact of per capita GDP on residents' pension willingness was significantly negatively correlated, and the per capita disposable income and the presence of pension insurance had a greater impact on it. The increase of residents 'income level does not mean that residents will choose community home care. It may be affected by other pension concepts and programs such as "buying a house", "raising children" and commercial insurance will affect residents' willingness to participate, so it will not have a direct impact on the efficiency of community home care services. Provinces (cities) with good economic development have greater financial input and policy inclination, residents choose more, have a strong awareness of self-health care, and the efficiency of community home care services is lower than the areas with the weak level of economic development.

5. Discussions and Suggestions

Analysis on the efficiency of community home care service in 13 provinces (municipalities) in China in 2018-2021 based on DEA-Tobit model. The results show that: (1) the overall efficiency of community home care services is general, and there is a large gap among provinces (cities). There is only one province (city) with comprehensive technical efficiency, pure technical efficiency and scale efficiency reaching DEA efficiency, accounting for 7.7%, and the comprehensive technical efficiency of the three provinces (cities) is lower than the national average level. The average scale efficiency is better than the pure technical efficiency, and the comprehensive technical efficiency is mainly affected by the pure technical efficiency, indicating that the provinces with ineffective DEA should focus on strengthening internal management, scientific planning and development.(2) There is a significant positive correlation between per capita disposable income, elderly dependency ratio, proportion of illiterate population and the efficiency of community home care services; medical care expenditure, college or above education, and per capita GDP have a significant negative correlation with the efficiency of community home care services.

Based on the above conclusions, this paper puts forward the following suggestions to improve the efficiency of community home care services: First, it is necessary to accurately identify the diversified needs of the elderly group from a theoretical perspective. To promote the quality and diversified development of elderly care services, and then improve the consumption willingness of all the elderly, stimulate the market vitality, and form a "positive" cycle[22]; At the same time, we will improve the payment guarantee for the elderly, accelerate the implementation of long-term care insurance, and create economic conditions for the elderly to consume community home care services. Second, we will promote smart elderly care services and strengthen the construction of talents for elderly care services. Establish personal files for the elderly in the community, install remote electronic control system for the elderly in their

home to realize dynamic monitoring; and strengthen publicity and education, promote the research and development of intelligent equipment for the elderly, cultivate their ability to obtain information, and promote the research and development of intelligent equipment for the elderly. In view of the problems existing in community home care staff, attention should be paid to vocational education and the combination of academic education, vocational training and practice, and the salary and professional reputation of elderly care staff should be improved.

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