ISSN 2616-7433 Vol. 5, Issue 13: 102-109, DOI: 10.25236/FSST.2023.051317

Analysis of the Optimization Path of "Internet+Medical" Industry Based on the Current Situation of Medical Resource Allocation

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Abstract: *As a new development direction in the medical industry, "Internet+medicine" can help solve the contradiction between the imbalance of medical resources and the increasing demand for health care in China, and is a medical development model actively guided and supported by the Ministry of Health. In this paper, the research of "Internet+medical" online diagnosis and treatment service is the main research object. Firstly, we use SWOT analysis to analyze the current situation of "Internet+medicine" online medical treatment industry and establish an analysis of the overall industry situation. Second, in order to investigate the regional characteristics of "Internet+medicine" online medical service, we compare the differences of online medical service in different regions based on Dagum Gini coefficient and satisfaction analysis. Through the study, we draw conclusions and make scientific suggestions for the healthy development of "Internet+medicine" online medical services. It is of great practical significance for the promotion of "Internet + medical" online medical treatment mode and the better realization of the vision of "Healthy China".*

Keywords: *Online Diagnosis and Treatment, Health China, SWOT Analysis, Dagum Gini coefficient Big Data*

1. Introduction

"Internet+medicine" is a new medical service model actively supported and encouraged by the state, which is an important part of the strategic goal of "Healthy China". [1] In recent years, the government has introduced various policies such as standardization, encouragement and support to guide the efficient and orderly promotion of medical informatization. Especially in the period of new epidemic, "Internet+medicine" has been further developed, bringing great convenience to people's lives. However, the level of development of each province in China varies greatly, and the medical resources enjoyed by people in each region also differ greatly, and now how to promote the balanced distribution of medical resources has become an urgent problem to be solved.

2. The basic funamental of SWOT analysis model and Dagum Gini coefficient

2.1 The structure of SWOT analysis model

SWOT analysis is a method commonly used to guide the development of enterprises and analyze competitors' situation. By analyzing the internal and external conditions of the company, it enables the company to identify its own strengths, weaknesses, opportunities and threats to match and analyze various factors to provide strategic guidance for the development of the company. S refers to Strengths, W refers to Weaknesses, O refers to Opportunities and T refers to Challenges.

2.2 The structure of the Dagum Gini coefficient

The overall Dagum Gini coefficient is defined as follows:

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$$G=\frac{\sum_{j=1}^{k}\sum_{h=1}^{k}\sum_{i=1}^{n_j}\sum_{r=1}^{n_h}\left|y_{ji}-y_{hr}\right|}{2n^2\overline{y}} \tag{1}$$

Among them, n indicates the number of provinces, k Indicates the number of regional divisions, n_j and n_h denote the number of provinces in region j and region h, respectively. $\overline{y}$ is the national average value of the efficiency of inter-provincial health care services, y_{ji} and y_{hr} are the efficiency of health care services in region j, i provinces and region h, r provinces, respectively.

G_{jj} indicates j intra-regional Gini coefficient, G_{jh} denotes the generalized Gini coefficient between region j and region h whose formulae are Equation (2) and Equation (3), respectively.

$$G_{jj}=\frac{\frac{1}{2\overline{y}_j}(\sum_{i=1}^{n_j}\sum_{r=1}^{n_j}\left|y_{ji-}y_{jr}\right|)}{n_j^2} \tag{2}$$

$$G_{jh}=\frac{\sum_{i=1}^{n_j}\sum_{r=1}^{n_h}(\left|y_{ji}-y_{hr}\right|)}{n_j n_h(\overline{y}_j+\overline{y}_h)} \tag{3}$$

Where $\overline{Y}_j$ is the average of the efficiency of health care services in the j th region.

3. Results

3.1 The analysis of industry dynamics

3.1.1 The strengths analysis

(1)Optimize the consultation process. The "Internet + Medical" online medical platform opens online booking and registration, prints electronic medical records and reports, and other functions, which optimize the consultation process and improve the utilization rate of medical resources through intelligent and digital medical services. Online medical services provide patients with a more convenient and comfortable way to seek medical treatment, and to a certain extent, alleviate the problem of "difficulty in seeing a doctor".

(2)Open and transparent information. The most important feature of the Internet is the transparency of information, which is conducive to the establishment of a healthy and safe medical environment. The "Internet+medicine" online medical platform provides professional information of medical personnel and patients' medical evaluation, thus helping other patients to better understand medical personnel and choose a more suitable doctor for consultation. This helps both parties to build trust better and motivates doctors with low ratings to improve their professionalism and provide better medical services.

3.1.2 The disadvantage analysis

(1)Online consultation is difficult to carry out. On the one hand, online diagnosis and treatment cannot make accurate judgment because it cannot directly observe the patient and the physical state the patient is in; on the other hand, there is a time difference between the doctor and the patient, and the communication is not timely, so it is difficult to carry out consultation services.

(2)There are geographical differences in medical resources. While "Internet+medicine" is developing rapidly, there is inevitably the problem of uneven distribution of medical resources. The total medical resources and quality medical services in developed regions have significant advantages, while other regions are developing slowly, and it is difficult to achieve high quality online medical services and levels due to various factors.

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3.1.3 The opportunity analysis

(1)Support of national policies. China continues to implement relevant medical policies, promote the connection between online medical treatment and medical insurance, strengthen the supervision of "Internet + medical" services, urge online medical treatment platforms to strengthen information protection, and promote the healthy development of the online medical treatment industry.

(2)Development and promotion of Internet technology. With the support of cloud computing, AI and other technologies, medical information inquiry, electronic health records and other forms of health care services have accelerated development. Every aspect of online medical services is permeated with the application and development of Internet technology, and blockchain and other technologies also provide a strong impetus for the development of "Internet + medical".

3.1.4 The threat analysis

(1)Information leaks are emerging all the time. Medical information and data involve patients' personal information and property security, and without a sound security maintenance system, information and data are easily leaked and personal privacy information is not protected.

(2)Lack of medical treatment norms. The online medical treatment platform lacks unified rules of medical treatment norms, and the rights and interests of patients cannot be protected. There is no clear legal protection and regulation for online medical treatment, so it is difficult to define and deal with medical disputes once they occur.

3.2 The analysis of regional differences in online consultation services

As the level of development varies greatly from province to province in China, there is an imbalance in the quantity and quality of medical resources provided to local people in each region, and this paper then hypothesizes that geographical variability will be an important factor affecting the usage rate of online consultations. This section uses the Dagum Gini coefficient and satisfaction analysis to compare and analyse the differences in the realisation of online consultations in different regions so that the vision of a healthy China can be better realised.

3.2.1 Regional level classification

As there are many provinces in China, and thus a comparative analysis of each province would be cumbersome and may not yield sharp conclusions, the 31 provinces of China are first divided. By reviewing the literature, this paper uses the clustering results of China's 31 provinces (municipalities and autonomous regions) under a health development perspective[2].

Table 1: Clustering results table

Category	Provincial clustering results
I	Beijing,Shanghai
II	Fujian,Guangdong,Liaoning,Shandong,Jiangsu,Zhejiang,Tianjin
III	Hebei,Henan,Hunan,Jiangxi,Anhui,Hubei,Hainan,Chongqing,Sichuan, Neimenggu,Shaanxi,Jilin,Heilongjiang,Shanxi,Ningxia,Xinjiang,Qinghai, Gansu,Guangxi,Yunnan,Guizhou,Tibet

According to Table.1, this paper divides China's provinces into three categories, treating each category as a type of region, and noting category I, category II and category III as region I, region II and region III respectively.

3.2.2 Metrics of variability

Before comparing the differences in the implementation of online consultation in different regions, we firstly considered whether there were differences in the usage rate of online consultation between different regions, and summarized the usage rate of online consultation in each region into a bar chart, as shown in Figure 1.

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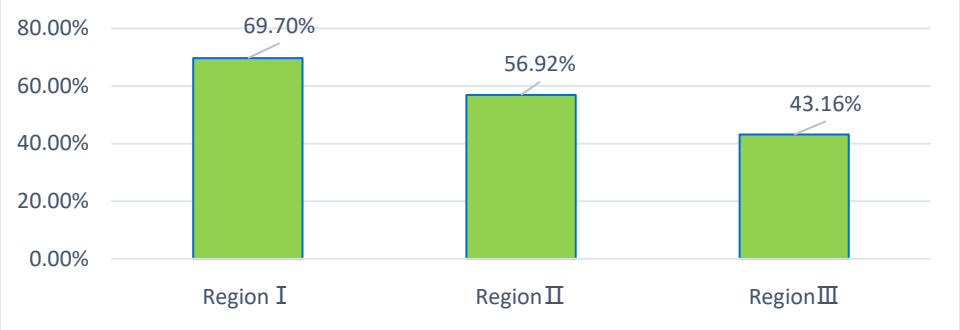

Figure 1: Usage rates by region

The comparison shows that there are significant differences in usage rates between the three regions, which necessitates further analysis for each region.

3.2.3 Regional differences in the efficiency of online health services

The efficiency of healthcare services is an effective indicator of the level of allocation of health resources in a region. In order to better compare the disparity in the level of healthcare services between different regions, this paper uses the efficiency of healthcare services in China's provincial administrative regions and applies the Dagum Gini coefficient to analyse the regional differences in the development of online consultation in China.

(1)Data sources

Many studies have been conducted in China on issues related to the efficiency of healthcare services, and this group cites the healthcare service efficiency index calculated by Lu Lingling in her study on the equality of healthcare resource allocation and service efficiency in China [3] for the provincial administrative regions of China as the data for the next analysis, as shown in Table 2.

Table 2: Our inter-provincial health service efficiency index

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Beijing	0.8608	0.8593	0.8627	0.8495	0.8491	0.8336	0.8258	0.8403	0.8508
Tianjin	0.7491	0.7432	0.7407	0.7094	0.6775	0.6649	0.6578	0.6880	0.6871
Hebei	0.6173	0.6157	0.6430	0.6191	0.6015	0.5802	0.5502	0.5814	0.6115
Liaoning	0.6887	0.6551	0.7034	0.6716	0.6680	0.6406	0.6304	0.6558	0.6578
Shanghai	0.7913	0.7474	0.7146	0.8247	0.8109	0.8007	0.7975	0.8071	0.8155
…	…	…	…	…	…	…	…	…	…

(2) Overall national Dagum Gini coefficient

The Gini coefficient is a common method for analysing regional differences. Equation (1) was used to measure the Gini coefficient for the efficiency of inter-provincial healthcare services in China from 2010 to 2018. The trend of the evolution of the overall health service efficiency in China is shown in Figure 2.

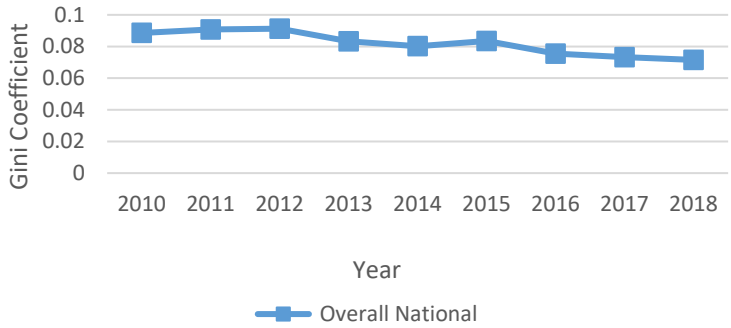

Figure 2: Evolution of the efficiency of national health services

On the whole, the Dagum Gini coefficient is generally on a downward trend, with an average annual decline rate of 2.51%, indicating that the differences in the efficiency of China's overall healthcare services are gradually decreasing, and the differences in healthcare resources between regions are narrowing. In terms of the evolution of the overall disparity, the process is highly volatile, showing a

ISSN 2616-7433 Vol. 5, Issue 13: 102-109, DOI: 10.25236/FSST.2023.051317

repeated "upward - downward" trend, and if the problem of unequal distribution of medical resources between regions is not actively improved, the Gini coefficient may rise again.

(3)Intra-regional variation in the efficiency of health services

G_{jj} refers to the Gini coefficient within region j. The intra-regional differences in the efficiency of health services in the three regions and their trends are shown in Figure 3 using equation (2).

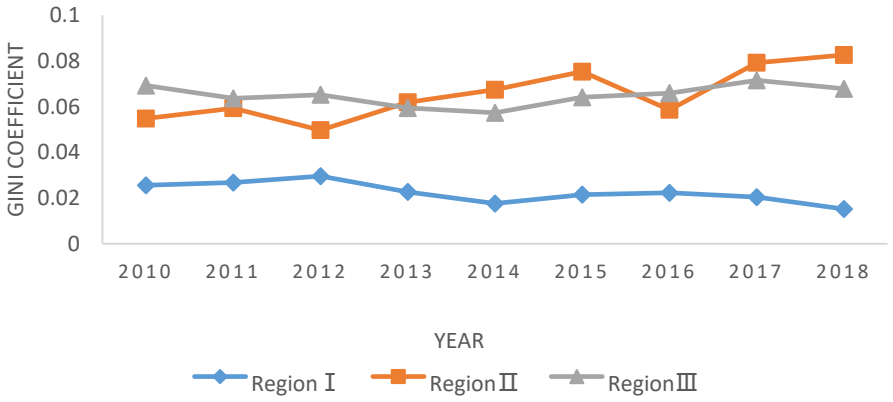

Figure 3: Intra-regional variation in the efficiency of health services

Overall, the intra-regional variation in Region I is small, which the panelists attribute to the fact that Region I contains only two provinces and cities that are comparable in terms of economic and medical development. The intra-regional variation in both Region II and Region III is greater and is roughly in the range. In terms of the evolution of intra-regional differences, Region I has a tendency to become smaller, although the intra-regional differences themselves are smaller; Region II has a more volatile evolution with increasing differences; and Region III has a smoother evolution without much fluctuation.

(4) Inter-regional differences in the efficiency of health services

G_{jh} denotes the generalised Gini coefficient between region j and region h. The inter-regional differences in the efficiency of health care services in the three regions and their evolutionary trends using equation (3) are shown in Figure 4.

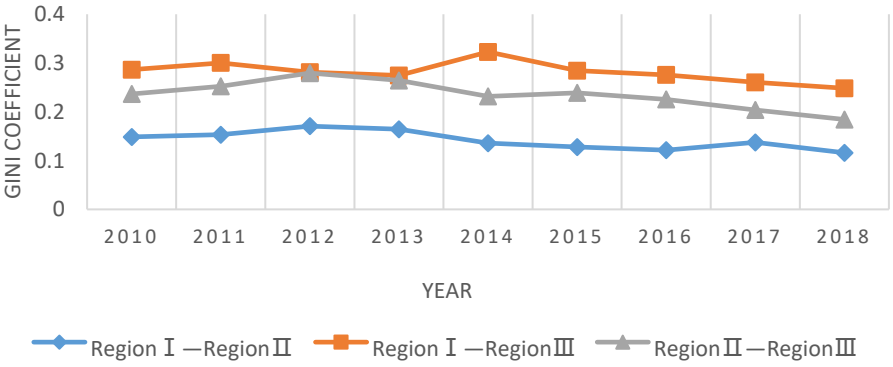

Figure 4: Inter-regional differences in the efficiency of health services

From an overall perspective, the difference in the efficiency of health care services between Region I-Region II is the smallest, and the difference between Region I-Region III is the largest. The evolution of the differences between regions shows that the differences in the efficiency of health care services between all three regions are gradually decreasing.

3.2.4 Differences in satisfaction by region

(1)Establishing user satisfaction evaluation indicators

In this research, in view of the characteristics and user groups of online medical consultation platforms, we refer to the index division of online medical consultation satisfaction evaluation[in Wang

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Fucheng's article "Research on the factors influencing the quality of online health community services and the willingness to continue to use[4] and Lv Antong's article "Research on the factors influencing the satisfaction of Internet medical consultation users from the perspective of information ecology[5],and initially determined seven indexes for the research (trust,usefulness,ease of use,interactivity, privacy protection, perceived reputation, access to medical resources, and willingness to continue to use) and designed 22 related questions. The summary is shown in Table 3.

Table 3: Satisfaction indicators

Level 1 Indicators		Secondary indicators	
TD	Trustworthiness	TD1	Online treatment is professional and credible
		TD2	No additional health risks involved in online treatment
U	Usefulness	U1	Can improve the efficiency of the consultation
		U2	Can improve the effectiveness of the consultation
		U3	Will listen and act on suggestions
EU	Usability	EU1	Easy access to information
		EU2	Familiar with the operation method
		EU3	Willing to learn to use
I	Interactivity	I1	Promote two-way communication between doctors and patients
		I2	Collect user opinions
PP	Privacy Protection	PP1	Consent will be sought for the use of personal information
		PP2	Personal information mechanism has been established
CR	Cognitive reputation	CR1	Services provided by a famous hospital
		CR2	Consider the reputation of the platform
		CR3	Trust doctors with high likes and high ratings
		CR4	The advice of friends can influence the choice
		CR5	Media campaigns can influence choices
CU	Willingness to continue using	CU1	Think the platform has many users
		CU2	Online treatment is a good way forward
		CU3	More new users will join
		CU4	Willing to recommend
		CU5	Will be used when needed

(2)Satisfaction index measurement of online medical platform users

The questionnaire was scored on a five-point Likert scale, with "strongly agree" assigned a score of 5,"agree" assigned a score of 4,"neutral" assigned a score of 3, "disagree" assigned a score of 2,and "strongly disagree" assigned a score of 1. "Disagree" was assigned a score of 2, and "Strongly Disagree" was assigned a score of 1. The higher the score, the more the respondents agree with the statement and the more they are satisfied with the question.

Referring to the level division of 31 provinces in China using cluster analysis in the first part, we calculate the satisfaction of platform usage in each tier of provinces separately, and the comparison reveals that there are large differences in the level of online medical services between different regions.

1) Calculation of satisfaction scores for each level of indicators

The calculation and analysis of user satisfaction generally starts with the calculation of the average of satisfaction for each level 1 indicator, i.e. the percentage average of the five levels, which ultimately results in a score for each indicator, with the formula:

$$S_I = \sum P_J q_{ij} \left(i = 1,2,3 \cdots n, j = 1,2, \cdots 5 \right) \tag{4}$$

Where, S_I indicates the score of the I th satisfaction indicator; n is the number of level 1 indicators affecting satisfaction (seven in this paper); P_J refers to the score corresponding to a satisfaction level of J (e.g. $P_1 = 1$, $P_5 = 5$); q_{ij} refers to the percentage mean of respondents' satisfaction with the choice of the j th indicator for the ith indicator.

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The satisfaction indicators of each of the three layers of provinces were substituted into the above formula to calculate the satisfaction assessment indicator scores for each layer,as shown in Table.4.

Table 4: Area I level indicator satisfaction score

Factors	Percentage of user satisfaction (%)					Score
	1	2	3	4	5	
Trustworthiness	4.24	10.92	21.08	36.53	27.23	3.7159
Usefulness	4.69	6.41	19.51	36.06	33.33	3.8693
Usability	2.69	3.11	9.35	43.92	40.93	4.1729
Interactivity	5.76	5.77	15.39	42.31	30.77	3.8656
Privacy Protection	5.69	12.15	14.14	37.93	30.09	3.7458
Cognitive reputation	3.49	9.98	14.46	39.92	32.15	3.8726
Willingness to continue using	2.03	4.08	14.38	42.08	37.43	4.0880

Similarly, the index satisfaction scores of Region II and Region III can be calculated. The scores of trust, usefulness, ease of use, interactivity, privacy protection, perceived reputation, and willingness to continue using for Region II are: 3.1401,3.458,3.59113,3.4138,3.3621,3.38096 and 3.60388.The indicator satisfaction scores for Region III were 3.0757,3.44334,3.45832,3.304,3.2317,3.32962,and 3.17166,respectively.

2) Ranking of factors affecting user satisfaction - grey correlation analysis

In order to study the degree of influence of each level of indicators on user satisfaction, we used the method of gray correlation analysis to calculate the gray correlation coefficients between a total of seven influencing factors of trust, usefulness, ease of use, interactivity, privacy protection, perceived reputation, and willingness to continue using the platform and satisfaction with the platform, and the specific results are shown in Table 5.

Table 5: Region I ranking of impact factors

Factors	Relevancy	Ranking	Weights
Willingness to continue using	0.733	1	0.1501
Usefulnes	0.715	2	0.1464
Trustworthiness	0.706	3	0.1446
Interactivity	0.702	4	0.1437
Cognitive reputation	0.691	5	0.1414
Usability	0.686	6	0.1405
Privacy Protection	0.651	7	0.1333

Similarly, we can calculate the ranking of the influence factors of region II and region III.

3) Calculation and analysis of overall satisfaction

After the satisfaction of each first-level indicator is calculated, the combined user satisfaction is calculated by using the addition rule based on the user satisfaction of each first-level indicator with the formula:

$$S = \sum U_I S_I \tag{5}$$

Where, S indicates the overall satisfaction score; U_I is the weighting factor, indicating the degree of influence of each influencing factor on the overall; S_I indicates the satisfaction score of the I th indicator.

The results of the overall satisfaction of platform users were obtained after collation as follows:

$$S_1 = 3.9061 \quad S_2 = 3.4203 \quad S_3 = 3.2869 \tag{6}$$

Referring to our satisfaction index (CCSI) measurement system, the critical value is determined as follows: $S_{Low} = 2.3$, $S_{High} = 3.7$. $0 \le S \le 2.3$ for low satisfaction, $2.3 \le S \le 3.7$ for medium

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satisfaction, $3.7 \le S \le 5$ for high satisfaction. Based on the results of the calculations, the following conclusions can be drawn:

① The overall satisfaction level of region I is high reaching a high satisfaction level; regions II and III are at a medium satisfaction level;

② The satisfaction levels of regions I, II and III show a decreasing trend, which indicates that there are indeed differences in the development of online medical treatment among different regions.

③ Since the division of regions is based on the level of economic development and the level of public health services in each province and city, this indicates that online consultation services are better developed in regions with high levels of economic development and more resources for public health services.

4. Conclusions

In recent years, the development of "Internet+medicine" online medical services has gained strong momentum. In this paper, we learn from SWOT analysis that the existence of threats such as information leakage and lack of treatment standards, as well as opportunities such as policy introduction and Internet technology development, require online medical services to combine their own advantages and disadvantages, and seek better development with the strategic plan of "Health China".

There are certain geographical differences in health care services in China. In this paper, the inter-provincial geographical division and the Dagum Gini coefficient are used to realize the measurement of the difference in the efficiency of medical and health services between geographical regions in China. For the trend of variation, the overall variation in China shows a slow decreasing trend, among which, the intra-regional variation of region and region III changes more slowly from year to year, and the intra-regional variation of region II changes more; for the intra-regional variation, the intra-regional variation of region I is small, and the intra-regional variation of region II and region III is large and presents a comparable degree of variation; for the inter-regional variation, the difference between region I and region II The difference between regions is the largest, and the difference between regions I and III is the smallest, and the satisfaction level of online treatment is high in region I and medium in regions II and III.

References

[1] Li Guoyu, Yao Qiang, Liu Xiaojun, et al. Research on medical insurance payment policy for "Internet+" medical services in China[J]. Health Economic Research, 2023, 40(05):43-46.
[2] Lei H. C., Xiao L. H. A clustering study of 31 provinces (cities and autonomous regions) in China: Based on the perspective of health development [J]. Health Economics Research, 2012(05):30-34.
[3] Lu Lingling. Research on the equality of medical and health resources allocation and service efficiency in China [D]. Hefei University of Technology, 2021.
[4] Wang F. Cheng. Study on the factors influencing the quality of online health community services and the willingness to continue using them [D]. Jilin University, 2022.
[5] Lv Antong. Research on the factors influencing the satisfaction of Internet medical consultation users from the perspective of information ecology [D]. Zheng Institute of Aviation Industry Management, 2022.