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Research on the Quantitative Evaluation and Optimization Path of China's Healthcare Big Data Policy

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Abstract: In order to provide reference for the subsequent policy development and system optimization, this paper design systematic evaluation of the existing Healthcare Big Data policy. The relevant policy documents issued at the central level are collected to analyse the inner logic of the main points, and the PMC model is constructed to evaluate the nine typical policies selected. Results show that all nine policies are at or above the acceptable level, and pass rate is 100%. In detail, all policies have significant advantages in policy areas, policy levels, and policy disclosure indicators, while there are common problems in indicators such as policy timeliness and incentive methods. The PMC indexes of the nine policy documents show a fluctuating downward trend, mainly due to the stage variability of policy points and policy target indicators. The PMC index scores of the highly directional and special policies are low. On this basis, suggestions for optimization of China's Healthcare Big Data policies are proposed.

1. Introduction

Healthcare big data refers to the collection of all information data including medical services, public health, clinical research and other aspects related to life and health. Theoretically, it covers the whole population and the whole process of life cycle. With a spurt of in-depth progress in the new generation of information technology revolutions such as Artificial Intelligence, Internet of Things, and ubiquitous perception in the healthcare field, the way of data capture, collection, analysis and processing have been changed, which challenges the existing medical model. By breaking the information barriers among the systems, achieving disruptive changes in the healthcare industry will inject a strong impetus into deepening the reform of the healthcare system and support the “Healthy China” initiative. Considering with the diversity and particularity of data in the healthcare field, the General Office of the State Council issued the Guiding Opinions on *Promoting and Regulating the Application and Development of Healthcare big data* in 2016, which values healthcare big data as a fundamental strategic resource. Since then, several policies have been introduced to further standardize and guided the application and development of healthcare big data.

At present, the mainstream directions of the study on health care big data in our country are application and practice [1-3], information security and protection [4, 5] and quantitative policies

analysis based on policy tools and other methods [6, 7], but there are relatively few evaluation studies on healthcare big data policy texts. As a policy text evaluation tool emerging in recent years, the PMC model proposed by Ruiz Estrada[8] evaluates internal consistency of policies by selecting as comprehensive indicators as possible and giving the same weight to all indicators.

This paper intends to take the healthcare big data policies issued by the central level as the research object, identifies the characteristics and internal logic of the policies, and builds a PMC model to comprehensively evaluate policies. The synergistic differences, strengths and weakness of policy design are completely discussed, so as to provide reference for the formulation of subsequent policies, to promote the coordination between effective policies and high-quality development of the industry, and increasingly leverage the value of healthcare big data.

2. Construction of PMC model

2.1. Policy Text Screening and Analysis

Taking the healthcare big data policies as the research object, “healthcare big data” and “health informatization” as the keywords, the policy text issued by the State Council and its ministries and commissions since 2009 are searched. And 34 policy texts are retained by deleting duplicate and poorly relevant policy texts. Through importing these policy texts into the software text database, the high-frequency words are obtained.

2.2. Variable Selection and Parameter Determination

Table 1: PMC variable settings

Main-variables	Sub-variables	
X1 Policy tendency	X1.1 Prediction	X1.4 Suggestion
	X1.2 Guidance	X1.5 Description
	X1.3 Support	X1.6 Supervision
X2 Policy timeliness	X2.1 long-term	X2.3 Short-term
	X2.2 Mid-term	
X3 Policy goals	X3.1 Meeting health needs	X3.4 Standardizing data application
	X3.2 Improving the quality and efficiency of services	X3.5 Ensuring information security
	X3.3 Promoting Management Level	X3.6 Driving data sharing
X4 Policy points	X4.1 The construction of health information platform	X4.6 Unified standard system
	X4.2 The intercommunity and sharing of data resources	X4.7 Data security system
	X4.3 In-depth Applications in Healthcare Industry	X4.8 Healthcare education and training
	X4.4 Convenient and benefit services	X4.9 Multi-partners collaboration
	X4.5 Telemedicine	
X5 Policy level	X5.1 National level	X5.3 County and municipal level
	X5.2 Provincial level	
X6 Issuing agency	X6.1 The State Council	X6.3 National Administration of Traditional Chinese Medicine
	X6.2 The National Health Commission	X6.4 Other agencies
X7 Policy area	X7.1 Politics	X7.3 Institution
	X7.2 Economy	X7.4 Technology
X8 Incentive methods	X8.1 Financial support	X8.4 Pilot demonstration
	X8.2 Talent training	X8.5 Legal system guarantee
	X8.3 Public procurement	
X9 Policy evaluation	X9.1 Sufficient basis	X9.3 Reasonable design
	X9.2 Clear Aim	X9.4 Comprehensive plan
X10 Policy disclosure	-	

The high-frequency words, related literature[9, 10] and the internal logic relationship of policy provide a reference for main-variables and sub-variables. Based on the related research on PMC, 10 main-variables and 44 sub-variables are selected in this evaluation system, as shown in Table 1.

2.3. Measure the PMC index

According to the PMC calculation method, the calculation is divided into four steps: First of all, assign values to the policy texts based on each sub-variable index X_{ij}, where i represents the main-variable and j represents the sub-variable. Referring to formula (1) (2), the binary method is adopted, for example, if the policy is predictive-- reflecting the prospect and long-term planning of healthcare big data, the value is marked 1; otherwise, it is 0. Then, calculate the value of the main-variable according to formula (3). The main-variable is actually the arithmetic mean, which is the ratio of the sum of the values of the sub-variables to the number of sub-variables, and n is the number of sub-variables. Thirdly, the PMC value corresponding to each policy is calculated by adding all main-variables of the policy text. Finally, each policy is rated according to the scores. The specific formula is as follows:

$$X\sim N[0,1] \tag{1}$$

$$X=\{XR: [0,1]\} \tag{2}$$

$$X_i = \left[\sum_{j=1}^{n} \frac{X_{ij}}{T(X_{ij})}\right], i = 1,2,3 \dots \dots \propto \tag{3}$$

$$PMC=\sum_{i=1}^{9}(Xi\ \left[\ \sum_{J=1}^{n} \frac{Xij}{T(Xij)}\ \right]\ ) \tag{4}$$

According to the four rating criteria of the PMC model, the scores are divided as follows: 9-10 points for excellent policies, 7-8.99 points for good policies, 5-6.99 points for acceptable policies, and less than 5 points for failing policy.

3. Empirical analysis

3.1 Policy sample selection

Further selection is made from the 34 policy documents initially screened. After abandoning the policy documents with poor relevance, such as the key tasks of the medical and health system reform in a certain year, nine documents which are representative and authoritative are selected for empirical analysis, as shown in Table 2.

Through in-depth analysis of the selected policy texts, it is found that there is a state of connectedness between the key points, as shown in Figure 1Figure 1: Internal logical relationship diagram of policy points. The development of healthcare big data, which is orderly operated under the guarantee of security system, is based on infrastructure construction and get power from human resources. Its aim is to deepen the service application and meet the public health demand. These points are inextricably linked and cannot be dispensed with without one.

Since the 12th Five-Year Plan, on the premise of data resource exchange and sharing among medical institutions, the construction of population health information platform has been attached great importance by governments at all levels. Both medical big data including electronic medical records, hospital information systems and other channels, and health big data such as physical examination reporting systems and wearable devices constitutes healthcare big data. It requires standardizing data standards to ensure data security and improving data quality. On this basis, some aspects such as telemedicine, convenient and beneficial services, disease prevention and control can

be promoted orderly, moving toward personalized and accurate direction. The applications are coordinated and organically unified with service. The realization of personalized services cannot be achieved without the industrial application of healthcare big data, aim of which is to provide people with better health services and meet their diverse needs. Each link entails human input, and the sustainable development can finally be achieved by training and multi-partners collaboration.

Table 2: Nine typical policy samples

Number	Title of Policy Document	Policy type
P1	Guidelines of the National Health and Family Planning Commission and the National Administration of Traditional Chinese Medicine on Accelerating the Construction of Population Health Informatization	comprehensive policy
P2	Notice of the State Council on the Issuance of Action Plan for Promoting the Development of Big Data	
P3	Guideline of The General Office of the State Council on promoting and standardizing the application and development of healthcare big data	
P4	Notice of the National Planning and Family Planning Commission on the Issuance of the 13th Five-Year National Population Health Informatization Development Plan	
P5	Opinions of the General Office of the State Council on Promoting the Development of "Internet + Medical Health"	
P6	Notice of the National Health Commission on further promoting the informatization construction of medical institutions with electronic medical records as the core	special policy
P7	Opinions of the National Health Commission on Accelerating the Popularization of Electronic Health Cards	
P8	Opinions of the National Health Commission on Strengthening the Construction of National Health Information Standardization System	
P9	Notice of Notice of the National Health Commission, National Healthcare Security Administration and National Administration of Traditional Chinese Medicine on Further promoting the "Internet + Medical Health" and "Five One" Services initiatives	

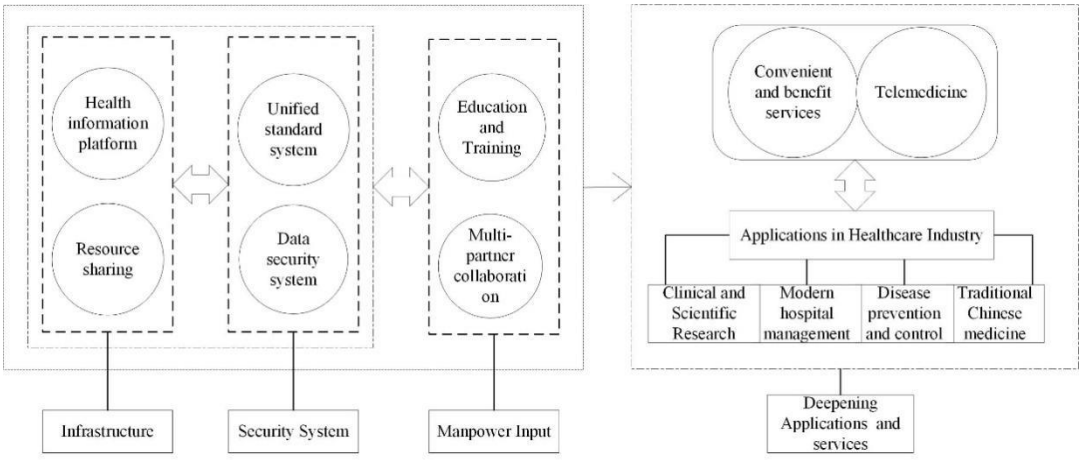

Figure 1: Internal logical relationship diagram of policy points

3.2 Results of policy sample evaluation

According to the PMC model of healthcare big data, mark assignment are carried out on nine policy samples to obtain the PMC index as shown in Table 3. On the whole, the pass rate of the policy samples is 100%, including good and acceptable levels. The good policies are P1, P2, P3, P4 and P5, and the rank of the policy samples is P4>P3>P1>P5>P2>P7>P8>P6>P9.

Table 3: PMC scores and ratings

	P1	P2	P3	P4	P5	P6	P7	P8	P9	The mean
X1	0.67	0.83	0.67	1.00	0.67	0.67	0.67	0.67	0.33	0.69
X2	0.67	1.00	0.67	0.67	0.67	0.33	0.33	0.33	0.33	0.56
X3	0.83	0.67	0.83	0.83	0.83	1.00	0.83	0.50	0.50	0.76
X4	0.78	0.44	1.00	1.00	1.00	0.56	0.67	0.78	0.67	0.77
X5	1.00	0.33	1.00	1.00	1.00	1.00	1.00	0.67	1.00	0.89
X6	0.50	0.25	0.25	0.25	0.25	0.25	0.25	0.50	0.75	0.36
X7	0.50	1.00	0.75	1.00	0.75	0.50	1.00	1.00	0.75	0.81
X8	0.80	0.80	1.00	1.00	0.20	0.20	0.40	0.60	0.40	0.60
X9	1.00	0.75	1.00	1.00	0.75	0.75	0.75	0.75	0.50	0.81
X10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PMC index	7.74	7.08	8.17	8.75	7.12	6.26	6.90	6.79	6.23	7.23
Policy rating	good	good	good	good	good	acceptable	acceptable	acceptable	acceptable	good

3.2.1 Analysis of the mean

PMC model includes as many comprehensive indicators as possible to examine the consistence of policies. By observing the mean of the main-variables of all policies, we can quickly grasp the overall merits and demerits. We analyze in order of average score from lowest to highest.

The average of X6 is 0.36, which is the lowest main-variable, because there are only three joint documents among different departments. NHC, which is the backbone of policy-making in healthcare big data, issues two-thirds of the nine policies. The mean of X2 ranks 0.56. P2 sets three plans with different deadlines, while remaining eight texts lack long-term plans and even four of them just carry out short-term plans, which are not clear about medium and long-term plans. The X8 average is 0.6. Most policies, which rely on talent training, under the law and other ways, have not yet achieved the diversification of incentives to driven healthcare big data. The average of X1 reaches 0.69. All policy samples contain suggestions. However, nearly half texts are weak in describing the current situation and strengthening supervision, which may lead to deviation in the implementation.

In terms of X3, the average ranks 0.76. All policies have the same pursuit in meeting health needs, improving the quality and efficiency of services, and ensuring information security. On account of the logically rigorous policies, X4 are consistent with X3, so the average of policy goals is almost the same as that of the policy points, with score of 0.77. Most policies mention the intercommunity and sharing of data resources, the construction of health information platform, convenient and benefit services and unified standard system and so on. But at the same time, half of the policies are not comprehensive, showing different shortcomings in platform construction, telemedicine and other aspects.

The average score of X9, X7, X5 and X10 is higher than 0.8, reflecting high policy consistency. The application and development of healthcare big data requires multiple and multi-party cooperation. The vast majority of policies cover political, economic, institutional and other areas, and refer to national, provincial and county-level policy levels, which are transparent to give full play to policy advantages. Therefore, the policy evaluation (X9) is not so bad on the whole.

In addition, obvious difference can be seen in Figure 2, the scores of comprehensive policies are significantly higher than those of special policies, except for the three indicators of policy level, issuing agency and policy area, with an overall difference of 1.22. That is because the comprehensive policy covers a wider range of policy content and has obvious advantages in this comprehensive evaluation system. On the contrary, the PMC index of special policies reach low scores, especially in terms of X1, X3, X4 and X8. So special policies need to be improved in these areas.

In short, among all main-variables, policy level, policy area and policy disclosure have advantages.

When formulating policies, the country has considered the particularity and complexity of policies in general. However, the low scores of issuing agencies, policy timeliness and incentive methods also have deficiencies, which should be paid more attention in the future policy-making.

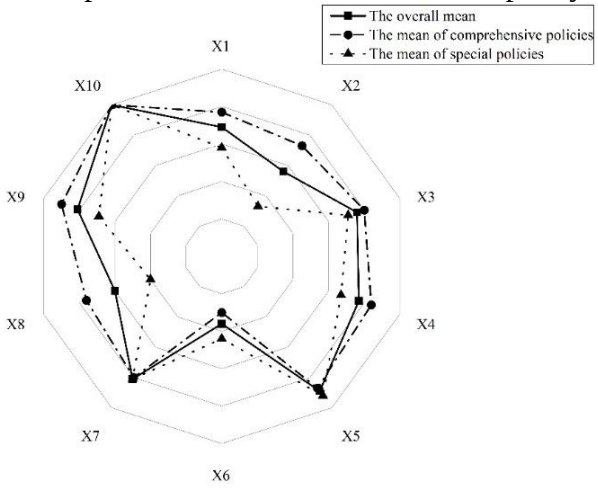

Figure 2: Radar maps of different types of policies

3.2.2 Specific policy analysis

Due to the limitation of research space, this paper only makes further analysis on the highest score policy and the lowest score policy.

As a result of the policy diffusion and innovation, P4 is the continuation and development of P3. It learns from the merits of P3 and considers more comprehensively. For that reason, its score is 8.75, ranking first among all samples. Four main-variables of policy tendency, policy level, policy area, policy evaluation and policy disclosure reach full marks, especially in the policy tendency, P4 makes up for the deficiencies appearing in P3 by strengthening supervision and management. But the PMC index score of P4 still does not reach the excellent policy level. In the future, policy makers can start with the issuing agency, policy timeliness and incentive methods to formulate increasingly stable and consistent policies.

According to the internal logical relationship of the policies (Figure 1), the last four policy samples respectively involve the promotion in different professional policy points, with weakness in the points of infrastructure and guarantee. In addition, influenced by the main-variables such as the issuing agency, policy timeliness and incentive methods, the scores of policy evaluation are not very high, and then the PMC index shows low scores to varying degrees. Especially, the PMC index of P9 is 6.23. As the latest but lowest score policy, P9 is a specific policy intended to the “Internet + medical health” and “five ones” service actions. The high score of the joint document helps the policy to be at a good level, but it fails to make up the weakness existing in other indicators. With the achievements and long-term goals not mentioned, the policy tendency is single, lacking multiple tendencies. In terms of policy goals, the policy lacks emphasis on meeting health needs, promoting management level and standardizing data application. Correspondingly, policy points are not comprehensive enough, and there are few words about standard system and data security system. The incentive methods mostly adopt talent training and pilot demonstration, which shows the insufficient basis, the partial planning in the policy evaluation. Policies should be optimized for the above variables to improve the coordination of the whole policy system.

4. Conclusions

It is inevitable that the application of healthcare big data complies with the development trend of science and technology. Its value will bring profound changes to the healthcare field, which will constantly meet the diverse health needs. This paper makes a quantitative evaluation of the policies based on the PMC model. Seeing from the evaluation results, the main conclusions are as follows: Existing policies are relatively reasonable, which can basically meet the requirements of the national strategic planning for the development of healthcare big data. But common problems exist in variables of most policies such as issuing agency, policy timeliness, incentive methods, and policy tendency, which have become weaknesses that needed to be valued. At the same time, as times pass, the policy orientation is stronger, the score of PMC index becomes increasingly low and a sign of fluctuating decline can be seen, which mainly caused by the phased differences in policy points, policy goals and other indicators.

The conclusions drawn make the following recommendations for subsequent policy top-level design: Firstly, the development of healthcare big data requires the coordination of multiple departments, so we should avoid the singleness of issuing agency and adopt more joint documents to expand the scope of policy influence. Secondly, we should improve incentives and mobilize the enthusiasm of all parties. We need to comprehensively use a variety of incentive methods, adhere to the combination of funds, talent training and legal system guarantee. In addition, based on the consistent standards, encourage provinces and cities pilot demonstration, by exploring the innovative demonstration bases which is centered on local characteristics. Thirdly, policy adjustments should strike a balance between fundamental and key policies. We should improve the construction of unified standard system and data security system while highlighting special policies and focusing on segmented fields such as the reform of public hospitals.

References

[1] Qin P, Xie L, Chen Q, et al. Research on the Implementation Path of Hierarchical Diagnosis and Treatment Based on Health Care Big Data [J]. Chinese Hospital Management, 2021, 41(06): 75-8.

[2] Shi X, Zhao J, Wang L, et al. Review of Precision Medical Application Based on Big Data Analysis Technology [J]. Chinese Hospital Management, 2021, 41(05): 26-31.

[3] Zhang M. Studying on The Power, Mechanism and Regulation of Implementing PPP Model in Big Data of Urban Healthcare [J]. Chinese Health Service Management, 2021, 38(01): 3-5+17.

[4] Sun Z, Liu X, Tian Z. Discussing the Security Protection of Health Care Big Data [J]. Chinese Health Service Management, 2021, 38(07): 518-20+25.

[5] Gu H, Jia C, Wu D, et al. Researches on the Personal Privacy under the Background of Health Care Big Data application [J]. Chinese Health Service Management, 2021, 38(02): 117-20.

[6] Shen H, Zhao J, Ma H, et al. Policy Text Analysis on Health Care Big Data in China-From the Perspective of Policy Tools [J]. Health Economics Research, 2021.

[7] Yu Q, Jing S, Tai Y, et al. Multidimensional Analysis of the Healthcare Big Data Policy Documents in China [J]. Chinese General Practice, 2019.

[8] Estrada M. The Policy Modeling Research Consistency Index (PMC-Index) [J]. Social Science Electronic Publishing, 2010.

[9] Jia T, Ma G, He G, et al. Policy reviewing and quantitative evaluation on China's integrated treatment and convalesce-Analysis based on PMC index model [J]. Soft Science of Health, 2021, 35(08): 38-42.

[10] Yu X, Zheng J, Tan H, et al. Research on quantitative evaluation of China's health poverty alleviation policies based on PMC index model [J]. Modern Preventive Medicine, 2021.