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Research on Quantitative Evaluation of China's Health Portrait Policy Based on the Policy Modeling Consistency Index Model

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Abstract. An in-depth investigation into the existing policy landscape for the advancement of health profiling initiatives in China serves the dual purpose of furnishing a solid theoretical foundation for the policy formulation and iterative upgrading of China's health industry, as well as delivering actionable reference and guidance for the high-quality advancement of the domestic health profiling sector. This study takes the national-level health profiling Policy issued by China as the research object and adopts the method of text mining to select the high-frequency words in the policy text, to measure the important measurement tool for internal Consistency and content integrity of the policy - Policy Modeling consistency (PMC). Based on the PMC index model, a corresponding indicator system is constructed to conduct quantitative evaluations of the basic situation and overall nature of policies. The research results show that the average policy performance index of the six health profiling policies in China is 6.46. Among them, the performance of four policies is good, and that of two policies is average. The quality of national-level medical big data policies is generally good, but there is still considerable room for improvement. Overall, China's health profiling policy is basically complete, and its nature and functions are relatively clear. Based on this, this paper conducts specific analysis and improvement suggestions from three aspects: policy content, incentives and constraints, and life cycle.

Keywords: Health portrait; PMC exponential model; Quantitative research; Policy evaluation.

1. Introduction

With the development of smart healthcare and the full implementation of the "Healthy China 2030" Planning Outline [1], public health governance in China has stepped into a pivotal phase of digitalized transformation, where the medical and healthcare sectors, alongside big data technology, have realized in-depth integration with artificial intelligence as the core driving force. In the context of the digital transformation of global public health governance, health profiling technology, by integrating, analyzing, and precisely applying residents' health data, has become an important means to solve core issues such as chronic disease prevention and control, residents' health management, handling of public health emergencies, and medical management [2]. The World Health Organization also explicitly stated in the "Global Digital Health Strategy 2020-2025" that it aims to empower the precision and accessibility of health services through digital technologies, providing an action framework for the digital development of global health [3]. Health profiling is the application of user profiling technology in the medical and health field, that is, by using user profiling technology to provide health profiling services based on individual attributes and differentiated needs. As early as 1998, Pietila A M et al. proposed the concept of health profiling, which became a guideline for health research. Eirola R et al. formed a health profile through qualitative content analysis. Health profiling is of great significance for achieving personalized health management, early screening, and intervention of diseases [4].

Up to now, the majority of existing studies carried out by domestic and international academics within the health profiling technology domain have centered their attention on technology Research and Development (R&D) and practical scenario implementation, lacking systematic analysis of top-level design, and there is a research gap in the policy agenda. Wen Tingxiao et al. systematically sorted out the research context in this field and pointed out that current research mostly focuses on two major

directions: the construction technology of health portraits and their application scenarios. At the level of technology research and development, scholars mainly conduct research around multi-source health data fusion methods, machine learning models for portrait construction, privacy computing technology, and other contents, continuously improving the accuracy and security of health portraits. At the scene application level, existing research has covered multiple fields such as chronic disease management, elderly health care, maternal and child health services, assistance in primary diagnosis and treatment, and public health emergency prevention and control [5].

Based on this, this study takes China as an example and takes the national-level policies of health profiling as the research object, systematically sorting out the policies related to health profiling issued at the national level in China, in order to measure the important measurement tool for internal Consistency and content integrity of policies - Policy Modeling Consistency Based on the PMC index model, a corresponding indicator system is constructed to conduct quantitative evaluations of the basic situation and overall nature of policies. On this basis, this paper puts forward targeted recommendations for policy optimization, with a view to offering a valuable reference for the establishment of a digital governance system within the health and wellness sector.

2. Method

This article uses keywords such as “health profile”, “health data profile”, “personal health profile”, “resident health profile”, and “Medical insurance health profile”, and takes the official websites of government departments such as The General Office of the State Council, the National Health Commission of the People’s Republic of China, the National Administration of Traditional Chinese Medicine, and the National Healthcare Security Administration as the main data sources. Supplemented by databases such as China National Knowledge Infrastructure (CNKI) and pkulaw.cn, the policy documents related to health profiling issued from January 1, 2016, to December 31, 2025, were retrieved.

Table 1. Total high-frequency vocabulary of the health portrait

No.	Vocabulary	No.	Vocabulary
1	Health	21	Innovation
2	Medical Care	22	Standards
3	Data	23	Hospitals
4	Services	24	Elderly Care
5	Healthcare	25	Resources
6	Applications	26	Support
7	Construction	27	Digitization
8	Development	28	Smart
9	Management	29	Internet
10	Traditional Chinese Medicine	30	Clinical Practice
11	Intelligence	31	Statistics
12	Platforms	32	Residents
13	Informatization	33	Grassroots
14	Institutions	34	Norms
15	Security	35	Clinical Practice
16	Systems	36	Pilot Programs
17	Technologies	37	Artificial Intelligence
18	Sharing	38	Medicine
19	Monitoring	39	Diagnosis and Treatment
20	Digital	-	-

The policies in the past decade are more in line with the current actual situation and demands, and can more effectively guide and support the current and future development of health informatization. According to the following inclusion criteria: (1) Documents that directly stipulate or reflect relevant contents of the health profile of China; (2) Official documents issued by relevant state departments and those that are complete in content and directly reflect the will of the government, such as opinions, notices, and plans. Exclusion criteria: (1) Documents that contain keywords but have no substantive content; (2) News reports, policy interpretations, and other documents; (3) Invalid documents. After searching, six policy texts were finally included in the analysis, specifically: The "Reply to the 7328th Suggestion of the Second Session of the 13th National People's Congress", the "Regarding the 2648th Suggestion of the Second Session of the 13th National Committee of the Chinese People's Political Consultative Conference (Medical and Sports Category 280) The letter of reply to the proposal (No.)", the Notice on Organizing and Carrying out the Application Work for 5G + Medical and Health Application Pilot Projects, the "14th Five-Year Plan for the Informatization of National Health", the Several Opinions on Promoting the Development of Digital Traditional Chinese Medicine, and the Opinions on Promoting and Regulating the Application and Development of Artificial Intelligence + Medical and Health Care. The above-mentioned policies cover core research areas such as digitalization of health care, smart healthcare, digital traditional Chinese medicine, and medical artificial intelligence. They have a complete time span and an authoritative release level, and can comprehensively reflect the policy evolution and top-level design logic in the field of digitalization of health care in China.

In this study, the ROST Content Mining system (ROST Content Mining, RostCM6.0) was used to conduct corresponding word frequency statistics and cluster analysis on the collected policy texts to extract the core contents and key words in the health profile policies. To provide a certain basis for formulating the secondary indicators of the PMC evaluation system and conducting quantitative assessment and analysis of the basic situation and overall nature of the health profiling policy. The statistics of high-frequency words are shown in Table 1.

3. Data Result Analysis

3.1. PMC Exponential Model

The PMC index model is a commonly used policy evaluation tool for quantitative analysis of international policy texts. It was proposed by Mario Arturo Ruiz Estrada in 2011. By establishing an index system of multiple dimensions, it aims to achieve objective quantitative scoring of policy texts. The PMC index model is proposed based on the "Omnia Mobilis" hypothesis. The core function of this system presents a dual attribute: it is firstly designed to assess the internal consistency of individual policy documents, and secondly to examine the strengths and limitations of relevant policies, so as to effectively mirror the overall development status of the entire policy system [6].

3.2. Construction of the PMC Evaluation System

Prior to carrying out the quantitative assessment of policy texts, a prerequisite step is to define and clarify the core indicator system of the PMC evaluation model. The indicators of the evaluation system are usually divided into first-level indicators and second-level indicators. Based on the original model and referring to the policy evaluation PMC index model constructed by GUYi-chun et al. that conforms to the characteristics of China's health and medical big data [7], from the perspective of the entire policy process, combined with the analytical logic in the multi-stream theoretical framework and previous studies, this paper first determines the first-level indicators for the policy of China's health portrait [8]. The establishment of secondary indicators needs to take into account the core content and key words of the policy text and the heterogeneous factors within them [9]. Through the sorting and discussion of the mining content of the policy text, the secondary indicators corresponding to the primary indicators are determined. The integrity of policies and their heterogeneity are studied through the evaluation system of first-level and second-level indicators.

3.2.1. Construction of primary indicators

The multi-stream theory commonly used in policy evaluation can comprehensively cover the policy communities and political events involved in the policy process. When combined with the PMC index model, it can first construct accurate first-level indicators. The multi-stream framework is a theory widely used in public policy proposed by political scientist John Kingdon. It helps explain how certain issues become the top priorities on the policy agenda and how policies are formulated, especially in a complex and unpredictable political environment. It holds that policy plans determine the nature and timeliness of policies, government actions determine the level of policies, and the community composed of the government, the public, and stakeholders determines the recipients and content of policies. This series of viewpoints has important reference value for the construction of the policy evaluation system [10]. The PMC policy modeling method usually requires the establishment of nine first-level indicators to form a matrix. Therefore, this study selected nine first-level indicators that can represent the key dimensions of policy evaluation, including "policy nature", "policy timeliness", "policy content", "policy object", "policy objective", "incentive and safeguard measures", "policy function", "data lifecycle", and "policy effectiveness level".

3.2.2. Construction of secondary indicators

The secondary indicators are based on the collected policy texts (Table 1), combined with the high-frequency word list analyzed by Rost.cm6. After manual screening, words such as "above" and "related" that have little impact on the results or low correlation are eliminated. The secondary goals for "policy content" and "policy objectives" in the primary indicators are set. The policy content summarizes the focus of health profiling work. The high-frequency words "application", "construction", "standardization", "standard", and "monitoring" are the key areas of concern. The corresponding secondary indicators are set as "application infrastructure construction" and "industry governance", and the high-frequency words are "traditional Chinese medicine", "innovation", "artificial intelligence", "Internet", and "elderly care". Corresponding to the secondary indicators "Innovative Development of Traditional Chinese Medicine", "Application of Artificial Intelligence", "Internet Healthcare", and "Medical and Elderly Care Services"; Policy objectives refer to the ultimate goals that policy implementation aims to achieve. High-frequency terms such as "resources", "sharing", "grassroots", and "residents" are the key focuses, and the corresponding secondary indicators are set as "resource sharing", "data integration", and "convenience and benefits for the people". By consulting the literature, the secondary indicators of the remaining first-level indicators were established.

The PMC index evaluation system for policies in the field of Chinese health profiling constructed in this study adopts the 0-1 binary assignment method and is built from three levels: first-level variables, second-level variables, and core evaluation criteria. It includes a total of 9 first-level variables and 48 second-level variables, as detailed below: The first-level variables include X1 policy nature, X2 policy timeliness, X3 policy content, X4 policy targets, X5 policy objectives, X6 incentives and safeguard measures, X7 policy functions, X8 data lifecycle, and X9 policy effectiveness levels.

In terms of policy nature (X1), the secondary variables include X11 forward-looking (medium and long-term development vision and planning), X12 suggestive (directional incentive measures), X13 descriptive (industry status quo and problem description), X14 guiding (development direction and core tasks), and X15 regulatory (industry supervision and risk prevention and control). In terms of policy timeliness (X2), the secondary variables include X21 long-term planning (implementation period≥5 years), X22 short-term deployment (1–3 year phased tasks), and X23 pilot trials (demonstration pilot and pioneering trial arrangements). In terms of policy content (X3), the secondary variables include X31 application infrastructure construction, X32 industry governance, X33 Internet healthcare, X34 hierarchical medical treatment, X35 artificial intelligence application, X36 knowledge base construction, X37 digital development of traditional Chinese medicine, X38 public health prevention and control, and X39 medical and elderly care services. Covering the construction requirements of the entire digital scene in health care, in terms of policy targets (X4),

secondary variables include X41 government agencies, X42 medical institutions, X43 third-party institutions, and X44 the general public, covering all relevant entities in the policy chain. In terms of policy objectives (X5), the secondary variables include X51 resource sharing, X52 interconnection and interoperability, X53 data integration, X54 industrial promotion, and X55 convenience and benefit for the people, clearly defining the core development direction of the policy. In terms of incentive and safeguard measures (X6), the secondary variables include X61 talent development, X62 fiscal incentives, X63 business environment optimization, X64 technical support, X65 data security, and X66 standard norms, covering all-around guarantees for policy implementation. In terms of policy functions (X7), the secondary variables include X71 supervision and restraint, X72 normative guidance, X73 service optimization, X74 innovation-driven, and X75 industrial support, clearly defining the core functional positioning of the policy. In terms of the entire data lifecycle (X8), the secondary variables include X81 data generation and collection, X82 data organization and storage, X83 data sharing and circulation, X84 data mining and utilization, and X85 data supervision and evaluation, covering the requirements of the entire process management of medical data. In terms of the policy effectiveness level (X9), the secondary variables include X91 laws and regulations, X92 administrative regulations, X93 departmental rules, X94 normative documents, and X95 industry standards and norms, corresponding to the legal binding force level of the policy.

3.3. PMC Index Calculation

Based on the PMC evaluation system of the first-level and second-level indicators determined above, the calculation of the PMC index can be divided into the following four steps: (1) Place the first-level and second-level variables into the multi-input-output table; (2) According to the value selection method of Formula (1), assign values to each secondary variable one by one. If the policy text meets the evaluation criteria, assign the corresponding secondary indicator as 1; otherwise, assign it as 0. (3) Calculate the value of each variable, which should be between 0 and 1. (4) Calculate the PMC index according to Formula (2). The grade classification criteria are set based on previous studies as follows: 0 to 4.99 is poor, 5 to 6.99 is good, 7 to 7.99 is excellent, and 8 to 9 is perfect [7]. In the formula, i denotes the primary-level variable, j stands for the secondary-level variable, while nj refers to the total number of secondary-level variables included in the system. The PMC indices of the six health profiling policies in China are shown in Table 2.

$$X_i = \sum_{j=1}^{n_j} \frac{X_{ij}}{n_j} i = 1,2,\ldots,9 \tag{1}$$

$$\begin{aligned} PMC = {} & \sum_{j=1}^{5} \frac{X_{1j}}{5} + \sum_{j=1}^{3} \frac{X_{2j}}{3} + \sum_{j=1}^{9} \frac{X_{3j}}{9} + \sum_{j=1}^{4} \frac{X_{4j}}{4} + \sum_{j=1}^{5} \frac{X_{5j}}{5} \\ & + \sum_{j=1}^{6} \frac{X_{6j}}{6} + \sum_{j=1}^{5} \frac{X_{7j}}{5} + \sum_{j=1}^{5} \frac{X_{8j}}{5} + \sum_{j=1}^{5} \frac{X_{9j}}{5} \end{aligned} \tag{2}$$

Table 2. PMC Index Results of 6 Health Portrait Policies in China

	P1	P2	P3	P4	P5	P6	Mean
X1	1.00	1.00	1.00	0.60	0.60	0.60	0.80
X2	0.67	0.67	0.67	0.67	1.00	1.00	0.78
X3	1.00	0.56	1.00	0.22	0.30	0.45	0.59
X4	1.00	1.00	1.00	0.75	0.75	1.00	0.92
X5	1.00	1.00	1.00	0.60	0.80	1.00	0.90
X6	0.83	0.67	0.83	0.17	0.50	0.83	0.64
X7	1.00	1.00	1.00	0.60	0.60	0.80	0.83
X8	1.00	1.00	1.00	0.20	0.40	0.60	0.70
X9	0.40	0.40	0.40	0.20	0.20	0.20	0.30
PMC	7.90	7.30	7.90	4.01	5.15	6.48	6.46
Rankings	1	3	1	6	5	4	-
Rating	Good	Good	Good	Passed	Passed	Good	-

3.4. PMC Surface Drawing

Drawing the PMC surface graph is to visually display the scores of each policy under study on various variables. When drawing the surface graph of a single policy, the scores of each first-level variable in the policy sample are converted into matrix form for drawing. The higher the rating index of the Z-axis data in the figure, the better the policy rating result [11]. The surface drawing of the six policies is shown in Figure 1.

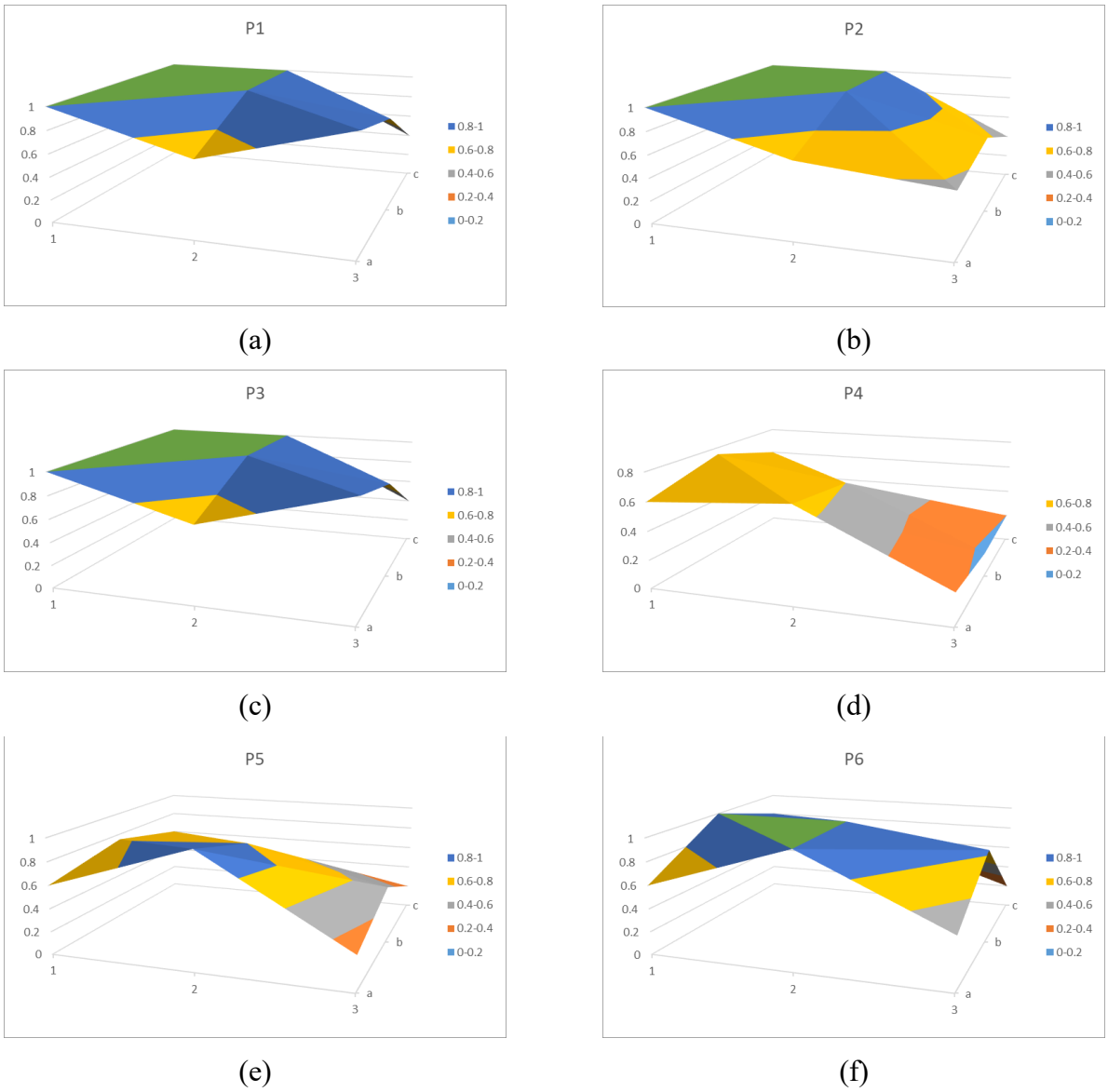

Fig. 1 3D PMC index surface plots for 6 health and medical digital policies Picture credit: Original

3.5. PMC Index Score Results

In the comparison of various policies, the average value has been added as a reference value for specific analysis. Based on the analysis results of the scores of various policies (Table 2) and the average scores of the first-level indicators (Table 2), the average score of China's health profile policies is at a good level (6.46), among which the average scores of the variables policy object X4 (0.92), policy goal X5 (0.90), policy function X7 (0.83), and policy nature X1 (0.80) are relatively high. This indicates that the targets of China's health profiling policy involve a relatively wide range of government agencies, medical institutions, third-party institutions, and the general public. Policies also include prediction, suggestion, description, guidance, and supervision, playing a role in supervision and restraint, standardization and guidance, and service optimization. Among all the policy texts included in the PMC evaluation system, the two highest overall scores were recorded for

the following documents: the Implementation Opinions on Promoting and Regulating the Application and Development of Artificial Intelligence + Medical and Health Care (7.90), and the Notice on Issuing the 14th Five-Year Plan for National Health Informatization (7.90). The content of the plan is relatively comprehensive and reasonable. The lowest average score indicates that the country's implementation efforts are insufficient. In future policy-making, it can be considered to enhance the enforcement efforts of departments.

Based on the current analysis results, the PMC index scores of the six national-level health profiling policies in China included in this study range from 4.00 to 7.99, all at the qualified level, with an average score of 6.46. Among them, the scores of four policies were at a good level, and the scores of the remaining two policies were at a qualified level. Overall, the policy demonstrates clear policy goals, relatively comprehensive and reasonable policy content, and target groups, which can guide the implementation of health profiling work. However, some individual dimensions still need effective improvement and enhancement.

Overall, the top-level design policy system in the fields of digitalization of health care and medical big data in China is relatively complete. It has clear policy goals and comprehensive and reasonable policy contents, which can anchor the medium and long-term development direction for the whole industry, while delivering systematic guiding frameworks and standardized specifications for the high-quality and sustainable advancement of the sector. However, policies for special pilot projects and responses to suggestions and proposals share common problems such as incomplete coverage of dimensions, insufficient safeguard measures, and low levels of effectiveness. The quality of different types of policies shows a stratified differentiation feature, which requires effective improvement and enhancement.

4. Conclusion

Through the analysis of China's health policies, it can be found that the current health profiling policies in China perform well in many aspects, and the policy system has a relatively clear development orientation and a complete top-level design. The vast majority of policies have clearly defined their development directions, core goals, and applicable subjects. However, incentive and safeguard measures, as well as the level of policy effectiveness, are the core shortcomings of the current policy system. There are widespread problems, such as insufficient application of supply-oriented policy tools, the absence of high-level legislation, and an incomplete industry standard system. Meanwhile, most special policies still have considerable room for optimization in terms of the full life cycle management of data and the integrity of policy functions. Based on the research conclusions, this study puts forward three policy optimization suggestions: First, strengthen the top-down and bottom-up synergy of the policy system, promote the close connection between top-level strategic planning and special pilot policies, and enhance the systematicness and implementability of policies; Second, the structural system of policy instruments should be continuously optimized and adjusted, with the implementation scope and application intensity of supply-driven policy instruments further expanded, such as fiscal incentives and talent subsidies, to fully motivate the enthusiasm of policy recipients. Third, establish a policy full life cycle management mechanism, dynamically adjust policy content based on implementation results, and ensure the effectiveness and sustainability of policies. However, this article still has certain limitations, such as an insufficient in-depth depiction of a certain policy. In the future, further supplementary research can be conducted by combining field investigations and case studies, with the aim of enriching the specific practice of China's health policies.

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