



# Quantitative Analysis of the Policy of Centralized Drug Procurement Based on PMC Index Model

Duan Xiaoxiang, Wang Shuling\*

(School of Business Administration, Shenyang Pharmaceutical University, Shenyang 110016, China)

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## Abstract

**Objective** To quantitatively analyze the policy of centralized drug procurement centralized drug procurement in order to provide reference for the subsequent policy formulation and improvement. **Methods** Text mining method was used to process 15 centralized drugs procurement policies issued at the national level during 2015–2022, and a PMC index evaluation model of centralized drug procurement policies was established. Then, 15 centralized drug procurement policies were quantitatively analyzed from the overall and comparative perspective through an evaluation model. **Results and Conclusion** The average PMC index of 15 centralized drug procurement policies was 6.95, which was acceptable on the whole. Among them, eight were excellent and seven were acceptable. As to the first-order variables, the centralized drugs procurement policy still lacks incentives and constraints. The comparative results show that there are differences in the content and structure of policies, but they are strongly related to each other. Chinese centralized drug procurement policy has been basically formed, which is closely related to medical insurance and medical policies. However, it is still necessary to pay attention to the structure of the policy to ensure the elaboration of the policy content.

**Keywords:** centralized drug procurement; PMC index; policy; quantitative analysis

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Centralized drugs procurement means that government departments negotiate with drug manufacturers by means of quantity and quotation from enterprises based on the basic principle of quantity for price<sup>[1]</sup>, so as to achieve the goal of cutting drug prices to a reasonable level and further promoting the reform of the medical and health system. Centralized drug procurement is an important way for the central government to realize the reform of the supply side of medical services. On February 28, 2015, the General Office of the State Council

issued the “Guiding Opinions on Improving the Centralized Drug Procurement in Public Hospitals”, which proposed for the first time that the principle of linking quantity and price should be followed in the centralized drug procurement. It started the prelude of the centralized drug procurement in China. Then, with the continuous development of the consistency evaluation of generic drugs, our country carries out the pilot work of “4 + 7” with centralized drug procurement. Due to the remarkable effect of the pilot, the policy was expanded to cover the whole country. Therefore, China’s centralized drug procurement started formally.

At present, most studies focus on the development path of China’s centralized drug

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\* Corresponding author: Wang Shuling, professor. Major research area: Pharmaceutical management regulations, human resources and drug circulation management, etc. Tel: 13998302138, E-mail: Lingyi50@163.com.



procurement policy from the perspective of the implementation effect of the policy [2-5], which pay insufficient attention to the policy itself. Only Song Jia and other scholars made a specific analysis of the overall situation of centralized drug procurement policy based on the two dimensions of policy tools and stakeholders [6], and few scholars took the policy itself as the research object. From the perspective of the analysis of policy text, this paper makes quantitative research on the policy of centralized drug procurement. Therefore, the centralized drug procurement policy promulgated at the national level since 2015 was selected, based on the perspective of content analysis. Combined with existing studies, an index quantitative analysis system of centralized drug procurement policy was built, and policy modeling consistency (PMC) index model was applied for the quantitative analysis of centralized drug procurement policy to provide reference for the subsequent policy formulation and improvement.

## 1 Sample and method

### 1.1 Sample source

The sample of this paper is the policy documents

closely related to centralized drug procurement issued by state departments (including the Central Committee of the Communist Party of China and various ministries and commissions under the State Council, etc.) during 2015–2022. The professional policy databases of Peking University, Law Star and other professional policy databases were searched with keywords such as “drug procurement” and “purchase with quantity”. On this basis, the official websites of the State Council and the National Healthcare Security Administration were visited to inquire the policy documents issued.

The following factors should be considered: (1) The research samples in this paper should include laws, regulations, departmental rules and other normative documents, which are generally binding on centralized drug procurement, while the content such as policy interpretation, announcement, approval and replies are not included; (2) The study sample should be closely related to centralized drug procurement. If the specific policy of centralized drug procurement can be included, and some provisions are closely related to centralized drug procurement, it will not be included. According to the above process and standards, 15 effective policy texts were finally sorted out. See Table 1 for detail.

**Table 1 Centralized drug procurement policies from 2015 to 2022**

Serial	Policy name	Issuing agency	Time of publication
P1	A Guideline on Improving the Centralized Drug Procurement in Public Hospitals	General Office of the State Council	2015-02-28
P2	A Circular on the Implementation of Guidelines on Improving Public Hospitals' Centralized Drug Procurement Work	The National Health and Family Planning Commission	2015-06-19
P3	A Circular on Doing A Good Job in the Centralized Drug Procurement Under State Negotiation	The National Health and Family Planning Commission and other seven ministries and commissions	2016-05-20
P4	Several Opinions on Further Reforming and Improving the Policy of Drug Production, Circulation and Use	General Office of the State Council	2017-02-09
P5	A Circular on Strengthening Drug Supervision during the Pilot Period of Centralized Drug Procurement and Use	National Medical Products Administration (NMPA)	2018-12-31
P6	Circular on the Issuance of Pilot Programs for the Centralized Purchase and Use of Drugs Organized by the State	General Office of the State Council	2019-01-17

(to be continued)



Continued Table 1

Serial	Policy name	Issuing agency	Time of publication
P7	Notice on the State Organization of Centralized Drug Procurement of Selected Drugs Clinical Equipment and Use	The General Office of the National Health Commission	2019-01-25
P8	Opinions on Supporting Measures for State Organization of Centralized Drug Purchase and Use of Pilot Medical Insurance	National Healthcare Security Administration	2019-03-05
P9	Opinions on the Implementation of the State-Organized Pilot Program for Centralized Drug Purchase and Use to Expand Regional Scope	The National Medical Insurance Administration and nine other ministries and commissions	2019-09-30
P10	Circular on Several Policies and Measures to Further Deepen the Reform of the Medical and Health System with the Centralized Purchase and Use of Drugs as a Breakthrough	The Leading Group of the State Council for Deepening the reform of the medical and health system	2019-11-29
P11	Advice on Doing A Good Job in Current Drug Price Management	National Healthcare Security Administration	2019-12-10
P12	Notice on Further Improving the Provision and Use of Selected Drugs in the Centralized Drug Procurement Organized by the State	General Office of the National Health Commission	2019-12-19
P13	Circular on Launching the Second Batch of Work on Centralized Procurement and Use of State-Organized Drugs	The National Medical Insurance Administration and five other ministries and commissions	2020-01-16
P14	Opinions on Promoting the Regular and Institutionalized Implementation of Centralized Drug Procurement	General Office of the State Council	2021-01-28
P15	Notice on the Continuation of the Work after the Expiration of the Agreement on Centralized Drug Procurement Organized by the State	Office of the National Healthcare Security Administration	2021-11-05

1.2 Methods

PMC index model, namely policy consistency index model, is a quantitative method of policy evaluation and analysis. The research sample should include a good range of variables in policy modeling, and no relevant variables should be ignored. Therefore, various variables should be taken into account as much as possible when constructing an index model based on actual policy content [7, 8]. The PMC index model can set up a multidimensional evaluation system to analyze the internal heterogeneity and the quality level of a certain policy by combining the existing studies [9], which can realize the visualization effect of the quantitative results of each dimension of the policy through the PMC curved

surface. In this paper, combining the characteristics of centralized drug procurement policy and the needs of model construction, the analysis process of PMC index model is divided into the following five steps. First, it is the mining of policy text. The second is the classification and assignment of variables. Third, it is the establishment of multi-input-output table. Fourth, it is the calculation of PMC index. The fifth is the drawing of PMC surface graph.

2 Construction of PMC index model

2.1 Mining of policy texts

In this paper, ROSTCM 6.0 software was used to process the above policy texts and form a semantic



network analysis graph to explore the core themes and characteristics of centralized drug procurement policy and provide a basis for the confirmation of primary and secondary variables. See Fig. 1 for details. Keywords in the policy are distributed in the form of nodes on the semantic network analysis graph, and the lines between nodes indicate that there is some semantic connection between adjacent keywords. As shown in Fig. 1, “drug” “concentration” and “procurement” are in the core position, belonging to the core concept of centralized drug procurement policy, that form a close connection with other words.

Keywords such as “national” “medical insurance” “selected” and “use” are in the sub-core position and belong to the focus of centralized drug procurement policy. They extend outward from the core concept and are manifested in the process of centralized drug procurement and the use of drugs. The keywords “improvement” “implementation” “mechanism” and “management” are in the peripheral position, belonging to the focus in the implementation process of centralized drug procurement policy, including the establishment and improvement of the management system at each stage.

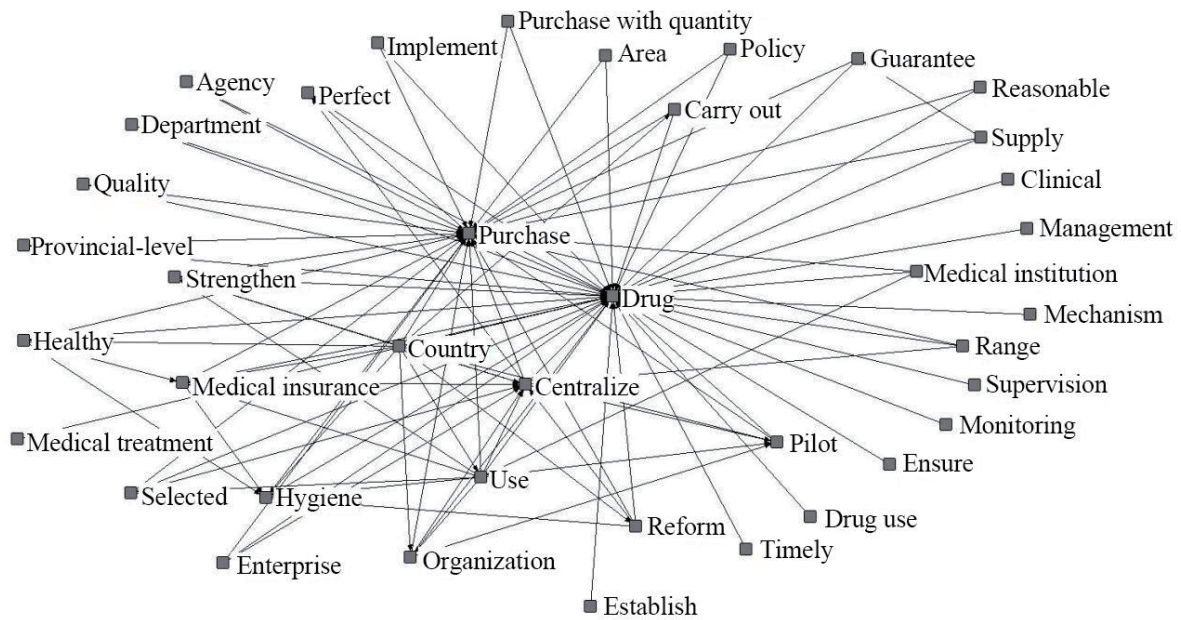


Fig. 1 Semantic network analysis diagram based on centralized drug procurement policy issued from 2015 to 2022

2.2 Classification and assignment of variables

2.2.1 Classification of variables

Based on relevant studies, the evaluation index system of centralized drug procurement policy was established in this paper according to Fig. 1 and combined with the characteristics of the policy. A

total of 10 first-level variables and 46 second-level variables were set, as shown in Table 2. Among them, policy disclosure ( $X_{10}$ ) refers to whether the policy belongs to the public policy, and the centralized drug procurement policies involved in this paper can be obtained from the official websites and belong to the public policy, so secondary variables are not set.



**Table 2 Variable classification of centralized drug procurement policy**

First-level variable	Second-level variable	Source of the variable
Policy timeliness ( $X_1$ )	$X_{1,1}$ Long term (more than 5 years); $X_{1,2}$ Metaphase (3–5 years); $X_{1,3}$ Short term (less than 3 years)	Based on literature [9] modification
Publishing authority ( $X_2$ )	$X_{2,1}$ The State Council; $X_{2,2}$ The National Health Commission; $X_{2,3}$ The National Healthcare Security Administration; $X_{2,4}$ Others	Based on literature [10] modification
Policy instrument ( $X_3$ )	$X_{3,1}$ Command and regulation; $X_{3,2}$ Incentive; $X_{3,3}$ Capacity building; $X_{3,4}$ System change; $X_{3,5}$ Information and persuasion	Based on literature [6] modification
Policy nature ( $X_4$ )	$X_{4,1}$ Forecast; $X_{4,2}$ Regulation; $X_{4,3}$ Recommendations; $X_{4,4}$ Trials; $X_{4,5}$ Guidance	Based on literature [11] modification
Incentive constraint ( $X_5$ )	$X_{5,1}$ Performance appraisal; $X_{5,2}$ System guarantee; $X_{5,3}$ Personnel training; $X_{5,4}$ Financial subsidies; $X_{5,5}$ Evaluation of the first; $X_{5,6}$ Professional title evaluation	Based on literature [10] modification
Policy content ( $X_6$ )	$X_{6,1}$ Consistency evaluation; $X_{6,2}$ Drug purchase; $X_{6,3}$ Drug payment settlement; $X_{6,4}$ Drug distribution; $X_{6,5}$ Information construction; $X_{6,6}$ Drug use; $X_{6,7}$ Comprehensive evaluation; $X_{6,8}$ Medical insurance payment; $X_{6,9}$ Medical service; $X_{6,10}$ Drug price; $X_{6,11}$ Supervision and monitoring	Modified based on text mining
Policy evaluation ( $X_7$ )	$X_{7,1}$ Sufficient basis; $X_{7,2}$ Clear objectives; $X_{7,3}$ Scientific plan; $X_{7,4}$ Detailed content; $X_{7,5}$ Clear powers and responsibilities; $X_{7,6}$ Coordinated promotion	Based on literature [9] modification
Policy perspective ( $X_8$ )	$X_{8,1}$ Micro; $X_{8,2}$ Macro	Based on literature [12] modification
Policy receptor ( $X_9$ )	$X_{9,1}$ Government departments; $X_{9,2}$ Pharmaceutical manufacturers; $X_{9,3}$ Pharmaceutical distribution enterprises; $X_{9,4}$ Medical institutions; $X_{9,5}$ Others	Based on literature [6] modification

2.2.2 Assignment of variables

values to second-level variables <sup>[13]</sup>, see Table 3 for specific standards.

In this paper, binary rules are adopted to assign

**Table 3 Assignment criteria for secondary variables**

First-level variable	Second-level variable	Assignment criteria
Policy prescription ( $X_1$ )	$X_{1,1}$ Long term	Whether the prescription of the centralized drug procurement policy is greater than 5 years, if yes, 1, and if no, 0
	$X_{1,2}$ Metaphase	Whether the prescription of the centralized drug procurement policy is between 3 and 5 years is 1 if it is in conformity and 0 if it is not
	$X_{1,3}$ Short term	Whether the prescription of the centralized drug procurement policy is less than 3 years is 1 if it meets, 0 if it does not

(to be continued)



**Continued Table 3**

First-level variable	Second-level variable	Assignment criteria
Issuing authority ( $X_2$ )	$X_{2,1}$ The State Council	If the issuing agency of the centralized drug procurement policy includes the State Council, the number that meets is 1, and the number that does not is 0
	$X_{2,2}$ National Health Commission	If the issuing agency of the centralized drug procurement policy includes the National Health Commission, the conformity is 1, and the inconsistency is 0
	$X_{2,3}$ National Healthcare Security Administration	If the issuing agency of the centralized drug procurement policy includes the National Healthcare Security Administration, the number that meets is 1, and the number that does not is 0
	$X_{2,4}$ Others	If the issuing agency of the centralized drug procurement policy includes others, 1 is consistent and 0 is inconsistent
Policy instrument ( $X_3$ )	$X_{3,1}$ Command and regulation type	Whether the centralized drug procurement policy includes command and regulation policy tools, if yes is 1, if no is 0
	$X_{3,2}$ Incentive type	Whether the centralized drug procurement policy contains incentive policy tools, if yes is 1, if no is 0
	$X_{3,3}$ Capacity building type	Whether the centralized drug procurement policy includes capacity building policy tools, if yes is 1, if no is 0
	$X_{3,4}$ System transformational	Whether the centralized drug procurement policy contains system transformational policy tools is in conformity with 1 and not in conformity with 0
	$X_{3,5}$ Information and persuasion type	Whether the centralized drug procurement policy contains information and persuasive policy tools, if yes is 1, if no is 0
policy nature ( $X_4$ )	$X_{4,1}$ Forecast	Whether the centralized drug procurement policy has the nature of prediction is in conformity with 1, but not in conformity with 0
	$X_{4,2}$ Regulation	Whether the centralized drug procurement policy has the nature of supervision is in conformity with 1, and in inconsistency with 0
	$X_{4,3}$ Suggestions	If the centralized drug procurement policy has the nature of a recommendation, yes is 1, no is 0
	$X_{4,4}$ Test	Whether the centralized drug procurement policy has the nature of an experiment is in conformity with 1, and not in conformity with 0
	$X_{4,5}$ Guidance	If the centralized drug procurement policy has the nature of guidance, the conformity is 1, and the inconsistency is 0
Incentive constraint ( $X_5$ )	$X_{5,1}$ Performance review	Whether the incentive method of the centralized drug procurement policy includes performance assessment is in conformity with 1, but not in conformity with 0
	$X_{5,2}$ System guarantee	Whether the incentive mode of the centralized drug procurement policy includes the system guarantee is 1 if it meets, and 0 if it does not
	$X_{5,3}$ Personnel training	Whether the incentive method of the centralized drug procurement policy includes personnel training is 1 if it meets, and 0 if it does not
	$X_{5,4}$ Financial subsidies	Whether the incentive method of the centralized drug procurement policy includes financial subsidies is 1 if it meets, and 0 if it does not
	$X_{5,5}$ Evaluate the best and the best first	Whether the incentive method of the centralized drug procurement policy includes the evaluation of the best and the first, the conformity is 1, and the inconsistency is 0
	$X_{5,6}$ Professional title evaluation	Whether the incentive method of the centralized drug procurement policy includes professional title evaluation is consistent with 1 and inconsistent with 0

(to be continued)



**Continued Table 3**

First-level variable	Second-level variable	Assignment criteria
Policy content ( $X_6$ )	$X_{6:1}$ Consistency evaluation	Whether the content of the centralized drug procurement policy includes consistency evaluation? Yes is 1, no is 0
	$X_{6:2}$ Drug procurement	If the content of the centralized drug procurement policy includes drug purchase, the conformity is 1, and the inconsistency is 0
	$X_{6:3}$ Drug payment settlement	Whether the contents of the centralized drug procurement policy include drug payment settlement, if yes is 1, if no is 0
	$X_{6:4}$ Drug distribution	If the content of the centralized drug procurement policy includes drug distribution, the conformity is 1, and the inconsistency is 0
	$X_{6:5}$ Information construction	If the content of the centralized drug procurement policy includes information construction, the conformity is 1, and the inconsistency is 0
	$X_{6:6}$ Drug use	If the content of the centralized drug procurement policy includes drug use, the conformity is 1, and the inconsistency is 0
	$X_{6:7}$ Comprehensive evaluation	Whether the content of the centralized drug procurement policy includes comprehensive evaluation, the conformity is 1, and the inconsistency is 0
	$X_{6:8}$ Medical insurance payment	Whether the content of the centralized drug procurement policy includes medical insurance payment is 1 if it meets, 0 if it does not
	$X_{6:9}$ Medical service	If the content of the centralized drug procurement policy includes medical service, the conformity is 1, and the inconsistency is 0
	$X_{6:10}$ Drug price	Whether the contents of the centralized drug procurement policy include drug price, if yes is 1, if no is 0
	$X_{6:11}$ Supervision and monitoring	If the content of the centralized drug procurement policy includes regulatory monitoring, the conformity is 1, and the inconsistency is 0
Policy evaluation ( $X_7$ )	$X_{7:1}$ Well-founded	If the basis of the centralized drug procurement policy is sufficient, the conformity is 1, and the inconsistency is 0
	$X_{7:2}$ Clear objectives	If the objective of the centralized drug procurement policy is clear, the conformity is 1 and the inconsistency is 0
	$X_{7:3}$ Program science	Whether the scheme of the centralized drug procurement policy is scientific or not is 1, while 0 is not
	$X_{7:4}$ Detailed and accurate	Whether the content of the centralized drug procurement policy is detailed or not is 1 if yes and 0 if no
	$X_{7:5}$ Rights and responsibilities are clear	If the rights and responsibilities of the centralized drug procurement policy are clear, the conformity is 1, and the inconsistency is 0
	$X_{7:6}$ Coordinated promotion	Whether the centralized drug procurement policy is promoted in coordination with other policies, the conformity is 1, and the inconsistency is 0
Policy perspective ( $X_8$ )	$X_{8:1}$ Micro	Whether the perspective of the centralized drug procurement policy includes micro-level, if it is in conformity, it is 1 and if it is not, it is 0
	$X_{8:2}$ Macro	If the perspective of the centralized drug procurement policy includes macro, the conformity is 1, and the inconsistency is 0

(to be continued)



**Continued Table 3**

First-level variable	Second-level variable	Assignment criteria
Policy receptor ( $X_9$ )	$X_{9,1}$ Government departments	If the acceptor of the centralized drug procurement policy includes government departments, yes is 1, no is 0
	$X_{9,2}$ Drug manufacturers	If the acceptor of the centralized drug procurement policy includes drug manufacturers, the conformity is 1, and the inconsistency is 0
	$X_{9,3}$ Drug circulation enterprises	If the acceptor of the centralized drug procurement policy includes drug circulation enterprises, the conformity is 1, and the inconsistency is 0
	$X_{9,4}$ Medical institutions	If the acceptor of the centralized drug procurement policy includes medical institutions, yes is 1 and no is 0
	$X_{9,5}$ Others	If the acceptor of the centralized drug procurement policy includes others, yes is 1 and no is 0
Policy disclosure ( $X_{10}$ )		Whether the centralized drug procurement policy is open or not, if it is true, it is 1 and if it is not, it is 0

**2.3 Establishment of multi-input-output table**

Combined with the above quantitative system, this paper established the multi-input-output table in line with the centralized drug procurement policy, as shown in Table 4. Multi-input-output table is

a data analysis framework that can be used to analyze research samples by constructing a multi-dimensional variable quantitative system<sup>[14]</sup>. Each first-level variable has the same weight as the second-level variable, and there is no difference in order of precedence<sup>[13]</sup>.

**Table 4 Multi-input-output table of centralized drug procurement policy**

First-level variable	Second-level variable
$X_1$	$X_{1,1}, X_{1,2}, X_{1,3}$
$X_2$	$X_{2,1}, X_{2,2}, X_{2,3}, X_{2,4}$
$X_3$	$X_{3,1}, X_{3,2}, X_{3,3}, X_{3,4}, X_{3,5}$
$X_4$	$X_{4,1}, X_{4,2}, X_{4,3}, X_{4,4}, X_{4,5}, X_{4,6}$
$X_5$	$X_{5,1}, X_{5,2}, X_{5,3}, X_{5,4}, X_{5,5}$
$X_6$	$X_{6,1}, X_{6,2}, X_{6,3}, X_{6,4}, X_{6,5}, X_{6,6}, X_{6,7}, X_{6,8}, X_{6,9}, X_{6,10}, X_{6,11}$
$X_7$	$X_{7,1}, X_{7,2}, X_{7,3}, X_{7,4}, X_{7,5}, X_{7,6}$
$X_8$	$X_{8,1}, X_{8,2}$
$X_9$	$X_{9,1}, X_{9,2}, X_{9,3}, X_{9,4}, X_{9,5}$
$X_{10}$	

**2.4 Calculation of PMC index**

This paper determines the PMC index value of each policy by assigning a value to the secondary

variables. The binary assignment rules are shown in formulas (1) and (2), where  $i$  represents the first-level variables and  $j$  represents the second-level variables. Referring to the relevant literature<sup>[7]</sup>, the first-level



variables are calculated to get the PCM index value based on formulas (3) and (4).

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

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

$$X_i \left( \frac{\sum_{j=1}^n X_{ij}}{T(X_{ij})} \right) \tag{3}$$

$$PMC = [X_1(\sum_{i=1}^3 \frac{X_{1i}}{3}) + X_2(\sum_{j=1}^4 \frac{X_{2j}}{4}) + \dots + X_9(\sum_{r=1}^5 \frac{X_{9r}}{5}) + X_{10}] \tag{4}$$

Combined with the evaluation criteria [7], in this paper, policy levels are divided according to the PMC index value of each policy, as shown in Table 5.

**Table 5 The corresponding relationship between PMC index and different policies**

PMC index	0-4.99	5-6.99	7-8.99	9-10
Policy hierarchy	Bad	Acceptable	Good	Excellent

### 2.5 PMC surface drawing

PMC surface drawing can display the calculated results of PMC index model in three dimensions, so as to realize visualization. As the policy text screened in this paper comes from the policy database and the official government websites, it belongs to public information. Therefore, the policy disclosure ( $X_{10}$ ) in the construction of PMC curved surface diagram is deleted. In this paper, the PMC surface map is drawn by constructing matrix of first-order variables, and  $3 \times 3$  matrix [15].

$$PMC \text{ surface matrix} = \begin{bmatrix} X_1 & X_2 & X_3 \\ X_4 & X_5 & X_6 \\ X_7 & X_8 & X_9 \end{bmatrix} \tag{5}$$

### 3 Empirical analysis

#### 3.1 Overall analysis of PMC index results

Based on the index evaluation system, a specific analysis of the overall situation of 15 centralized drug procurement policies is made, as shown in Table 6 and Fig. 2. The average PMC index of centralized drug procurement policy is 6.95, which is acceptable on the whole. It shows that China attaches importance gradually to the work of centralized drug procurement and related policies have been continuously improved. After the “4 + 7” quantity procurement has been promoted nationwide, China has initially explored the rules and management system of centralized drug procurement which suits our situation. Among them, there are 8 excellent policies, and the PMC index value of policy 6 is the highest, which is 7.96. There are 7 acceptable policies, and policy 15 has the lowest PMC index value of 5.75.

**Table 6 PMC Index results of 15 policies**

First-order variables	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$	$X_9$	$X_{10}$	PMC index	Ranking	Policy hierarchy
P1	0.33	0.25	0.60	1.00	0.50	0.73	0.83	1.00	1.00	1.00	7.24	6	Good
P2	0.33	0.25	0.80	1.00	0.50	0.73	1.00	1.00	1.00	1.00	7.61	4	Good
P3	0.33	0.25	0.60	1.00	0.17	0.64	0.83	1.00	1.00	1.00	6.82	9	Acceptable
P4	0.33	0.25	1.00	0.80	1.00	0.91	1.00	0.50	1.00	1.00	7.79	2	Good
P5	0.33	0.25	0.60	1.00	0	0.18	0.83	1.00	1.00	1.00	6.19	13	Acceptable
P6	0.33	0.25	0.80	1.00	0.67	0.91	1.00	1.00	1.00	1.00	7.96	1	Good

(to be continued)



Continued Table 6

First-order variables	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$	$X_9$	$X_{10}$	PMC index	Ranking	Policy hierarchy
P7	0.33	0.25	0.80	1.00	1.00	0.36	0.83	1.00	0.60	1.00	7.17	8	Good
P8	0.33	0.25	0.80	1.00	0.33	0.45	0.83	1.00	0.60	1.00	6.59	10	Acceptable
P9	0.33	0.75	0.80	0.80	0.67	0.91	1.00	0.50	1.00	1.00	7.76	3	Good
P10	0.33	0.25	0.80	0.80	0.50	1.00	1.00	0.50	1.00	1.00	7.18	7	Good
P11	0.33	0.25	0.60	1.00	0	0.45	1.00	0.83	0.80	1.00	6.26	12	Acceptable
P12	0.33	0.25	1.00	0.80	1.00	0.27	0.83	0.50	0.40	1.00	6.38	11	Acceptable
P13	0.33	0.75	0.60	0.80	0	0.27	0.83	0.50	1.00	1.00	6.08	14	Acceptable
P14	0.33	0.25	0.80	1.00	0.33	0.82	1.00	1.00	1.00	1.00	7.53	5	Good
P15	0.33	0.25	0.60	0.80	0	0.64	0.83	0.50	0.80	1.00	5.75	15	Acceptable
Mean	0.33	0.32	0.75	0.91	0.44	0.62	0.91	0.79	0.88	1.00	6.95		

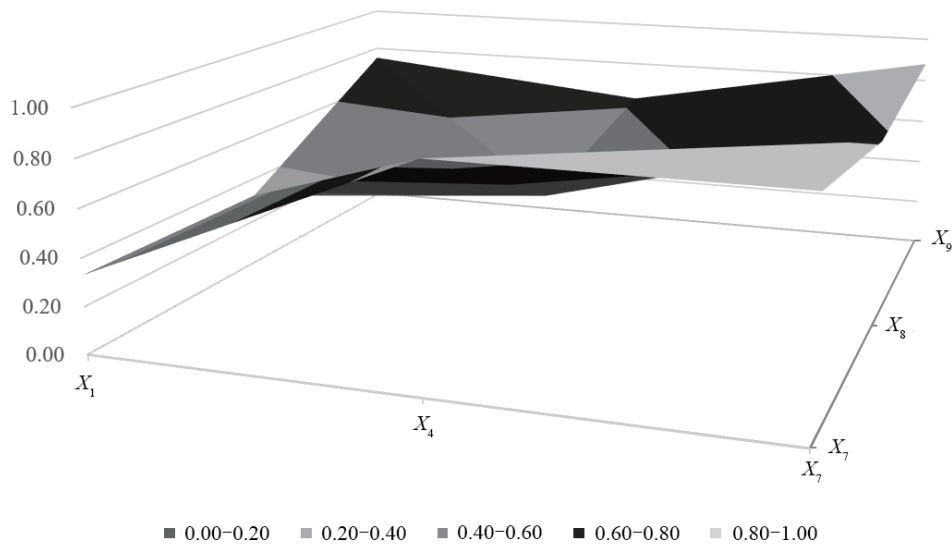


Fig. 2 PMC curved surface of 15 centralized drug procurement policies

In terms of first-order variables, the average PMC index of policy prescription ( $X_1$ ) is 0.33, while that of policy nature ( $X_4$ ) is 0.91. Most of the policy texts belong to medium and long-term planning, which reflects the centralized drug procurement policy is relatively comprehensive in content and involves a wide range of aspects. Combined with the refining and improvement of supporting policies, it is more targeted

in guiding centralized drug procurement work. The average PMC index of the issuing agency ( $X_2$ ) is 0.32, while the average PMC index of the policy receptor ( $X_9$ ) is 0.88. Most of the policy texts are issued separately by the Ministries and commissions of the State Council, but the specific content involved multiple departments, such as medical insurance payment, etc. The average PMC index of policy

instrument ( $X_3$ ) is 0.75, while the policy perspective ( $X_8$ ) is 0.79, and the incentive constraint ( $X_5$ ) is 0.44. The 15 policy texts involve policy instruments including mandatory requirements, the construction of gathering platform and policy publicity. But the formulation of policy texts focuses on the macro perspective, the relevant incentive measures are not further detailed, which means that 73.33% (11/15) of the policy texts have no specific measures to encourage medical institutions to use purchased drugs. Instead, appropriate conditions are created to improve the use of centralized purchased drugs by providing physicians with relevant training and constraints of rules and regulations. The average PMC index of policy content ( $X_6$ ) is 0.62. Most of the policy texts cover a wide range of content, but some of the policy texts are deficient in comprehensive evaluation and medical services. Therefore, only 46.67% (7/15) of the policy texts involve comprehensive evaluation, but the content is scattered. The average PMC index of policy evaluation ( $X_7$ ) is 0.91, among which, the PMC index value of 7 policy texts reach 1.00, indicating that the

formulation of centralized drug procurement policy has achieved the requirements of sufficient basis, clear objectives, scientific programs, detailed content, clear responsibilities and coordinated promotion.

### 3.2 Comparative analysis of policy 9 and policy 12

Both policy 9 and policy 12 are policy documents issued by the government after centralized drug procurement has been formally started in our country. And policy 9 belongs to excellent policy while policy 12 belongs to acceptable policy. Therefore, this paper demonstrates the difference between the policies by analyzing of the two policy documents comparatively. As shown in Fig. 3, the two policies are consistent in three aspects: Policy timeliness ( $X_1$ ), policy nature ( $X_4$ ) and policy perspective ( $X_8$ ). Meanwhile, their differences are large in six aspects: Issuing institution ( $X_2$ ), policy tool ( $X_3$ ), incentive constraint ( $X_5$ ), policy content ( $X_6$ ), policy evaluation ( $X_7$ ) and policy receptor ( $X_9$ ). In this paper, the PMC curves of the two policies are further illustrated, as shown in Fig. 4 and Fig. 5.

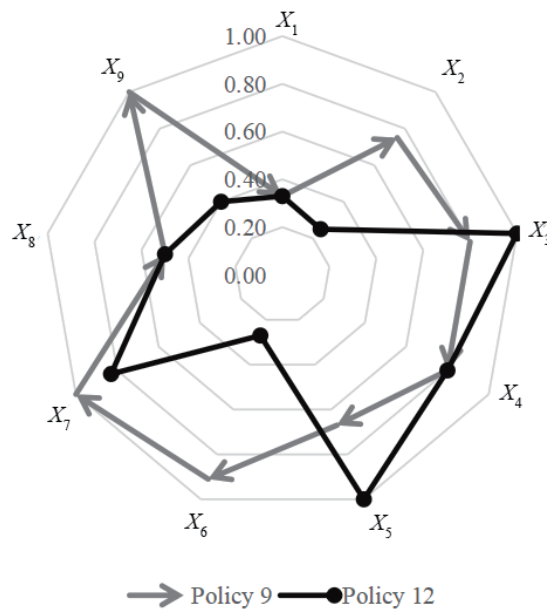


Fig. 3 Comparison and analysis of first-order variables between policy 9 and policy 12

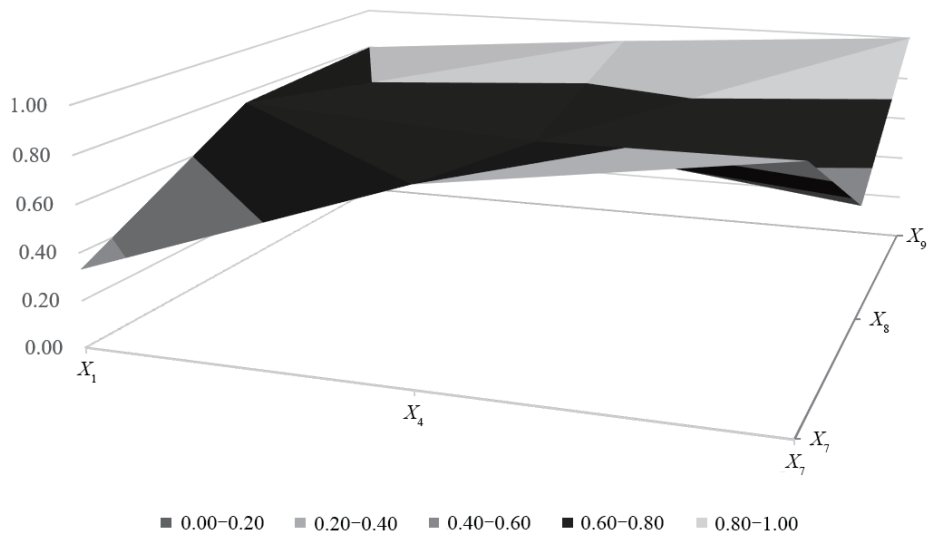


Fig. 4 PMC surface diagram of policy 9

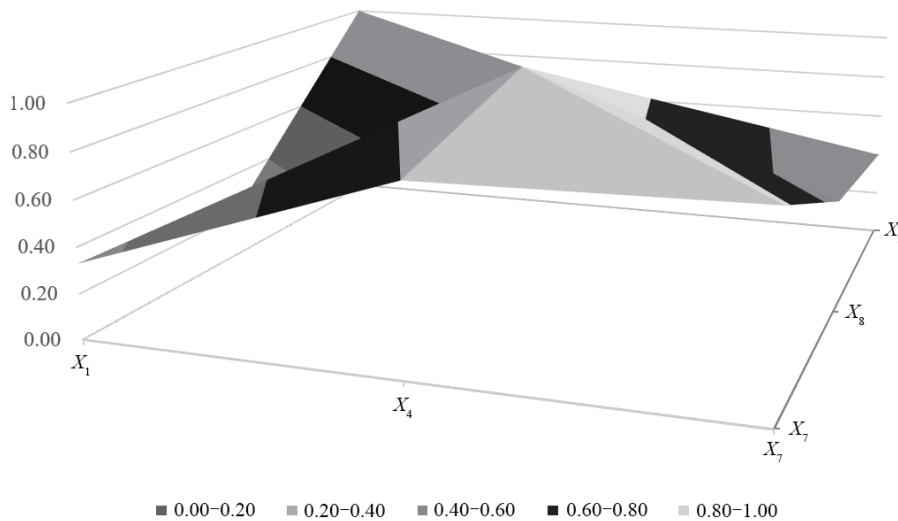


Fig. 5 PMC surface diagram of policy 12

On the whole, the PMC index value of policy 9 is higher than that of policy 12, that is, policy 9 is better than policy 12. When it comes to specific variables, the score of policy 12 is higher than that of policy 9 in the aspects of policy tools ( $X_3$ ) and incentives and constraints ( $X_5$ ). The specific performance of policy 12 is the implementation rules for the further expansion of drug purchase and use in pilot areas, and the overall content focuses on the allocation and use of selected drugs. Compared with policy 9, the incentive measures in the use of centralized purchased drugs are

more specific and perfect, and the use of policy tools is more comprehensive. The score of policy 9 is higher than that of policy 12 in four aspects, namely, issuing agency ( $X_2$ ), policy content ( $X_6$ ), policy evaluation ( $X_7$ ) and policy acceptor ( $X_9$ ), which show that policy 12 is an implementation plan to further expand the scope of drug purchase and use in pilot areas. The various stages of drug purchase, distribution and use require the participation of government departments for guidance and supervision. The policy content is relatively comprehensive, covering drug procurement,



use and incentive measures. In the aspect of policy coordination, it focuses on centralized drug procurement, improving drug use structure in medical institutions, cutting drug prices to a reasonable level, so as to promote the coordinated reform of medical insurance, medical treatment and medicine. In short, although there are differences in the content and structure of the two policies, there is a strong correlation between them.

## 4 Discussion and suggestions

### 4.1 Further refine the incentive and restraint measures in the policy

In terms of incentives and constraints, the formulation of centralized drug procurement policy focuses on the macro perspective, and the relevant incentive measures are not further detailed. In addition, there is a practice of using administrative force to interfere with doctors' medication in the policy, such as increasing the use of selected drugs in the performance assessment of medical staff, which has a negative impact on the normal work of medical staff. In order to optimize incentives, policy formulation should focus on the micro perspective. First of all, the bid-winning drugs and non-bid-winning drugs should be included in the performance assessment for medical staff, and the drug selection results should be evaluated by measuring the economic burden and actual therapeutic effect of drugs in patients, so as to ensure the rational use of the purchased drugs and non-selected drugs. Secondly, the initiative and sense of participation of medical staff in the daily management of the hospital should be enhanced. For example, the training of medical staff should pay attention to their development needs, and the feedback of doctors on the use of purchased drugs should be collected <sup>[16]</sup>.

### 4.2 Effectively link policy evaluation at all stages

In terms of comprehensive evaluation, centralized drug procurement policies involve evaluation of

various aspects, including drug selection, purchasing, use and clinical effect. Therefore, it involves multiple departments, while some policies are scattered and not specific in terms of comprehensive evaluation. The author suggests that a comprehensive evaluation policy should be set up specifically to standardize centralized drug procurement, and the content should be revised according to the results of centralized drug procurement in different rounds. In addition, it can be considered that the government departments should connect the purchasing platform with the hospital management platform to link the management and evaluation at various stages and improve the information feedback channels to ensure the accuracy of data. The real-time monitoring function of data is promoted to improve the overall management efficiency <sup>[17]</sup>.

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