Quantitative Evaluation of Policies for combining Medical and Nursing Care based on the LDA–PMC Model: A Comparative Analysis of Typical Chinese Provinces

Lan Xu1 · Minglu Xi1

Accepted: 3 October 2022
© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract
Improving and optimizing the policy system of combined medical and nursing care (CMNC) is an important driving force in the development of China’s pension industry. Using a latent Dirichlet allocation–policy modeling consistency model, this study analyzes 25 key policies related to CMNC to develop a policy evaluation index system and evaluates the CMNC policies of four provinces in China: Shandong, Sichuan, Jiangsu, and Hubei. It highlights issues facing China’s CMNC policy, including the poor use of policy tools, insufficient publicity, lack of insurance protection for employees, and lack of local policies’ pertinence. Finally, a policy optimization path is proposed.

Keywords Combining medical and nursing care · Policy evaluation · PMC index model · LDA topic model · China

Introduction
According to the official data released by the United Nations, many countries are facing a substantial increase in the population over 60 years of age. This continuous ageing of the population will have a profound impact on society, and the medical care, pension, and social security systems of many countries will face economic and political challenges in the coming decades. According to the results of China’s seventh national population census released in May 2021, its population over 60 years old accounts for 18.7% of the national population and represents 264 million people. This indicates that China has become a moderately to mildly ageing society. Given this demographic background, independent medical
and pension services are far from meeting the health and pension needs of older adults (especially disabled and semi-disabled older adults); hence, it has become imperative to promote the development of a combined medical and nursing care (CMNC) system.

In China, CMNC is regarded as an integration of care and medical resources for older adults. It is a new care model that integrates medical care, rehabilitation, life care, elderly care, and other services to provide smooth and coherent services for older adults (Yue et al., 2020). Similar services are usually called “long-term care” (LTC) or “integrated care” in other countries. CMNC started late in China. The proposal to extend medical services into the field of elderly care was first made in the 12th Five-Year Plan in 2011. With the issuance of “Several Opinions of the State Council on Accelerating the Development of Elderly Care Service Industry” in 2013, China began to promote CMNC more actively as one of the primary tasks for the development of its pension service industry, and issued a series of policies during the following decade. Since 2016, China has successfully set up 90 national pilot cities for CMNC, which has gradually shifted from the top-level design phase to the exploration of practical models phase.

Although the CMNC system in China has received a large amount of economic input and policy support from the government, it still faces many challenges, such as unclear responsibility boundaries for the various departments, a lack of supporting policies in various localities, and difficulties in policy implementation. The policy system still needs to be further improved (Li & Zhang, 2021). This raises the following questions: Are the CMNC policies of different regions comprehensive and appropriate for different development environments? How can the policy be optimized in the future?

To answer these questions, this study uses an LDA–PMC (latent Dirichlet allocation–policy modeling consistency) model to conduct a quantitative analysis of CMNC policies in China. First, we sorted out and classified the policies on CMNC issued by the State and selected “important policies” for text mining to obtain high-frequency words associated with the policy. Second, the LDA model was used to mine the CMNC policies. Next, the high-frequency words and subject classifications were used to develop a policy evaluation index system based on the PMC index model. Last, a comparative analysis was performed of the CMNC policies in four typical provinces in China to identify the advantages and disadvantages of the policies, and to propose targeted suggestions for improvement.

This study makes the following two contributions:

1. It introduces a quantitative analysis method, based on the PMC index model, to the policy evaluation of the CMNC, thus providing a new research method for this field. By combining LDA and PMC, a PMC policy evaluation index system is established based on the results of LDA topic mining to make the policy evaluation results more objective and relevant.

2. Starting at a local level, this study selects the CMNC policies of typical Chinese provinces as the research object, and evaluates the characteristics and shortcom-
ings of the policies in each region through comparative and empirical analyses to provide a basis for CMNC policy optimization in China.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature. Section 3 presents the design of the exponential model of PMC. Section 4 presents an empirical analysis. Section 5 presents the conclusions and policy recommendations. In the last section, the study is summarized and discussed.

**Literature Review**

**Research on the CMNC Policy**

Hande et al. (2021) used an improved objective hermeneutic method to analyze the regulatory policies for provincial LTC volunteers in Canada and explored whether these policies could promote volunteers to improve residents’ quality of life. Estévez-Abe and Ide (2021) documented experiences and lessons from low coronavirus disease 2019 transmission rates in Japanese LTC institutions. Jeon and Kwon (2017) summarized the main challenges of the Korean LTC system in the context of an ageing population. Martens et al. (2021) analyzed the entire process of formulating integrated care policies in Belgium over the past 10 years and the role of stakeholders in combination with the results of stakeholder interviews and a literature review.

Currently, there are few international studies on China’s CMNC policies. The research directions can be roughly divided into two types: the pre-evaluation of policy texts and post-evaluation to analyze the implementation effects. Yue et al. (2020) used a literature review method to construct a three-dimensional analysis framework for policies, and comprehensively examined the application of the policy instruments of CMNC from the dimensions of policy tools, stakeholders, and health-service supply chain. Chen et al. (2020) evaluated stakeholders in home-based CMNC in Shanghai by combining semi-structured interviews and survey methods, and found that distortion in policy implementation and the low degree of specialization of the relevant staff were the key factors affecting policy implementation. The existing studies on CMNC policies have mostly focused on qualitative analysis, such as content analysis or quantitative description of the policy text, while few studies have applied systematic evaluation methods to analyze CMNC policies. Moreover, the objects of these analyses were mostly policies issued at a national level with less focus on local policies.

**Research on Policy Evaluation Methods**

There are many methods to evaluate policies. Chandran et al. (2021) investigated the influence mechanism of selective policy on university research performance in three stages—research, innovation, and value creation—through data envelopment
analysis. Morseletto (2020) comprehensively considered the main sources and treatment of marine garbage and proposed an analytical framework to evaluate the effectiveness of Italy’s current policy on marine garbage management. Peng and Wu (2021) constructed a framework for China’s LTC delivery system using a system dynamics approach to explore the impact of the LTC policy on the burden of family care.

Semi-structured interviews are often used in policy evaluations. Vallance et al. (2021) optimized Canadian policies on alcohol jurisdiction based on interviews with stakeholders in alcohol-related government departments. Cheng et al. (2020), on the other hand, combined interviews and field investigations to evaluate the effectiveness of China’s land use “linkage policy” from the perspectives of participants and researchers.

He and Fu (2021) used a fuzzy qualitative comparative analysis to explore how different factor configurations affect the choice of policy tools for waste management in China. Reuter et al. (2021) combined top-down index analysis with a bottom-up policy evaluation to explore the factors influencing changes in energy demand for home heating and the influence mechanism of the policy on space heating. Azevedo and Leal (2021) proposed a new model for the post-evaluation of local policies to mitigate climate change; this model decomposed the causes of climate change into several sources of change to assess the impact of policies on greenhouse gas emissions more accurately. The Greenhouse Gas and Air Pollution Interactions and Synergies East Asia model was applied by Xu et al. (2021) to evaluate the effectiveness of the Blue Sky Protection Campaign’s policies and analyze and compare policy implementation costs, air pollutant emission reduction, and other data.

The PMC index model is a policy evaluation model proposed by Estrada in 2011 and it has since been used in various fields. Wang et al. (2019) combined neural network technology with the PMC index model and integrated the relationship between policy indicators to achieve a quantitative evaluation of military–civilian integration policy. Liu et al. (2020) used grounded theory to establish a military–civilian science and technology policy evaluation index system based on the PMC index to locate the weak points of the policy. This method has also been applied in China’s pork industry (Li et al., 2021), arable land protection (Kuang et al., 2020), and green development (Dai et al., 2021), thus providing a reference for the adjustment and implementation of new policies through a quantitative evaluation of policies in these fields. A standard PMC index system usually takes the results of high-frequency words obtained from the literature and text mining as references, which are often subjective and may have missing items. This study, therefore, intends to supplement the PMC index system using the LDA topic model.

Methods

Data Processing

In 2006, China proposed for the first time that care service institutions for older adults include nursing, rehabilitation, and medical services to cope with the challenges
associated with an ageing population. Therefore, this study selected policy texts related to the CMNC development that were issued by the State Council and its affiliated institutions from 2006 to the present for the extraction of high-frequency words and theme mining. Relevant policy documents related to CMNC were searched by visiting the policy documents database of the State Council and the official websites of the relevant ministries and commissions, such as the Ministry of Civil Affairs and the Ministry of Finance. Databases for laws and regulations, such as Beida Fabao (http://www.pkulaw.com), were searched using keywords such as “combination of medical and elderly care” and “health and elderly care.” A total of 53 policy documents related to CMNC were collected, of which 28 were “related policies” and 25 were “important policies,” and categorized as “combination of medical and nursing care.” “Important policies” were selected for the text analysis—a sample is shown in Table 1.

The relevant policy content in the 25 selected policy samples was extracted, and the texts were preprocessed by using Jieba (Chinese text segmentation in Python). After word segmentation and stop-word processing, high-frequency words with no significant impact on policy analysis, such as “combination of medical and nursing care,” “medical and nursing care,” and “pension,” were removed manually, and keywords with similar meanings were combined and adjusted. The high-frequency words for CMNC policies are shown in Table 2.

**Policy Text Clustering Based on LDA Topic Model**

The LDA topic model is a text mining technology based on an unsupervised machine learning algorithm that presents the topic classification of text in the form of a probability distribution, and solves the topic clustering of text and document classification problems. In this study, the LDA topic model was used to identify the topic information implied in the text on CMNC policy, and the generated results were used as indicators to supplement the PMC variables of the CMNC policy.

LDA assumes that each document has its own topic distribution, each topic has its own word distribution, and that its prior parameters $\alpha$ and $\beta$ are subject to a Dirichlet distribution. For the $w$-th word in a policy document, it first samples a topic from the topic distribution of the document, and then samples a word from the word distribution corresponding to the topic. Based on LDA, this random generation process is repeated until all the policy files are iterated, and the policy text-topic probability distribution $\theta$ and theme-word probability distribution $\phi$ are obtained. The model structure is illustrated in Fig. 1.

Before topic mining the CMNC policies, we first determined the number of generated topics. Too many topics lead to an excessively scattered distribution of topics and miscellaneous information, while too few topics lead to a failure in determining the details of their content. Therefore, the determination of topic number $K$ has an important influence on the analysis results. In information theory, perplexity can be used to measure the quality of samples predicted by a probability model; it is often used to determine the optimal number of topics (Hong & Wang, 2021). Based on the degree of confusion and the actual situation, this study identifies the optimal number of topics for CMNC policies, as shown in Eq. (1):
| Number | Policy Name                                                                                                                                                                                                 | Release Time         |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 1      | Several Opinions of the State Council on Accelerating the Development of Elderly Care Service Industry                                                                                                    | September 6, 2013   |
| 2      | Several Opinions of the State Council on Promoting the Development of Health Service Industry                                                                                                            | September 28, 2013  |
| 3      | Notice on Accelerating the Construction of Health and Elderly Care Service Projects                                                                                                                        | September 12, 2014  |
| 4      | Notice of the General Office of the State Council on Issuing the Outline for the Planning of the National Medical and Health Service System (2015–2020)                                               | May 06, 2015        |
| 5      | Notice on Advancing the Combining of Medical and Health Services and Elderly Care Services                                                                                                                | November 18, 2015   |
| ...    | ...                                                                                                                                                                                                       | ...                 |
| 24     | Notice on Further Improving Novel Coronavirus Pneumonia Prevention and Control Work in Institutions Combining Medical and Health Service and Elderly Care Service                                               | February 17, 2020   |
| 25     | Notice on Carrying out Actions to Improve the Service Quality of Institutions Combining Medical and Health Service and Elderly Care Service                                                              | December 3, 2020    |
where $M$ is the number of selected policy documents on CMNC, $N_s$ is the number of words appearing in the $s$-th policy document, and $p(w_s)$ is the probability of occurrence of each word in the corpus.

In this study, Python was used to analyze 25 important policy documents on CMNC. The confusion results obtained are shown in Fig. 2. As the number of potential topics increases, the degree of confusion decreases (Huang et al., 2018). It can be seen that the confusion degree in policy text-topic clustering appears as an inflection point when $K=9$, and the confusion degree is the lowest when $K \in [9, 13]$, at which the clustering effect is the best. In this range, different topic numbers $K$ are used to run the model in turn, and five different topic classification results are obtained. When $K=12$, the topic category is the most clearly distinguished; therefore, the optimal topic number was finally determined as 12.

The results of the subject analysis of the CMNC policy documents obtained a total of 12 policy themes. The results are summarized in Table 3. The themes were

![Table 2 Summary of 30 frequently used words in the CMNC policies](image)

| Vocabulary | Frequency | Vocabulary | Frequency |
|------------|-----------|------------|-----------|
| Service    | 168       | Management | 25        |
| Medical Institution | 127       | Mechanism  | 23        |
| Pension Institution | 117       | Resources  | 22        |
| Medical    | 91        | Range      | 22        |
| Nursing    | 72        | Family     | 21        |
| Institution Combining Medical and Health Service and Elderly Care Service | 57 | Capacity | 20 |
| Condition  | 45        | Practice   | 20        |
| Rehabilitation | 43       | information | 19    |
| Pension Service | 34        | Product    | 18        |
| Policy     | 34        | Disability | 18        |
| Community  | 33        | Traditional Chinese Medicine | 18 |
| Cooperation | 32        | Medical Insurance | 16 |
| Professional | 29       | Long-term Care Insurance | 16 |
| Personnel  | 29        | Facility   | 16        |
| Institution | 26        | Local      | 16        |

![Fig. 1 LDA topic model structure](image)

$$perplexity = e^{-\frac{\sum_{s=1}^{M} \log p(w_s)}{\sum_{s=1}^{M} N_s}}$$ (1)
named according to the characteristics of each category and captured the eight most relevant characteristics of the theme.

**Construction of PMC Index System**

The PMC index model assumes that all things are related, and hence, a wide range of relevant variable should be considered in the selection of evaluation indicators; moreover, the weight of each variable should be the same. Based on Estrada’s theoretical model and existing research (Estrada, 2011; Wu et al., 2021; Zhang & Qie, 2017), this study combined the high-frequency words extracted from key CMNC policies, supplemented by the text mining results of policy topics. We, thus, obtained the evaluation index for CMNC policies based on the PMC index model.

Referring to Liu et al. (2020), the evaluation content was divided into four parts: policy concept, policy attribute, policy content, and policy implementation. The keywords “home care,” “institutional service,” “community service,” and the combination of related industries were filed in “policy content” as the first-level indicator, and the second-level indicators were determined by combining the keywords under the theme. The keywords “administrative examination and approval,” “resource allocation,” “insurance guarantee,” “price policy,” “financial input,” “talent construction,” “evaluation mechanism,” and “service supervision” as secondary indicators were filed in “incentives and guarantees.” Fourteen first-level and 60 s-level indicators were obtained. The PMC index system of the CMNC policy is summarized in Table 4.

The supply side policy tools of the first-level indicator \( X_2 \) include personnel training, facility construction, information provision, and other policy tools that can improve the supply of CMNC. Environmental policy tools are more likely to improve the market environment for CMNC, and include service standards, laws, and regulations. Demand-side tools are manifested as the driving force of policies on a combination of endowment and medical resources, and mainly

---

Fig. 2 Text confusion of the policy on CMNC
Table 3  Mining results of the text theme of the policy of CMNC

| Theme                              | Characteristic Word                                                                 | Indicators to Join |
|------------------------------------|-------------------------------------------------------------------------------------|--------------------|
| Administrative examination and approval | window, condition, approval, medical insurance, regulations, support, fixed point, land use | Second-level indicator |
| Home care                          | family, subsidy, management, business, home, technology, patrol, practice            | First-level indicator |
| Resource allocation                 | resources, products, facilities, care, quality, land, function, local                | Second-level indicator |
| Institutional services              | cooperation, scope, standard, agreement, hospitalization, signing, check-in, referral | First-level indicator |
| Insurance guarantee                 | guarantee, long-term care insurance, fee, sponsor, payment, agreement, procedures    | Second-level indicator |
| Price policy                        | policy, charge, operation, bed, strength, price, condition, cost                    | Second-level indicator |
| Community service                   | service, community, responsibility, disability, surroundings, equipment, social forces, door-to-door | First-level indicator |
| Financial input                     | social power, subject, investment and financing, input, operation, capacity, government purchase | Second-level indicator |
| Talent construction                 | talent, doctor, team, training, system, nursing, education, treatment               | Second-level indicator |
| Evaluation mechanism                | assessment, management, disease, ability, health, demand, assessment, effect        | Second-level indicator |
| Combination of related industries   | traditional Chinese medicine, network, sports, consultation, medical care, fitness, food, archives | First-level indicator |
| Service supervision                 | department, supervision, local, system, environment, responsibility, condition, fire control | Second-level indicator |
| Evaluation Content | First-level indicator | Second-level indicator |
|--------------------|----------------------|------------------------|
| Policy ideas       | Policy nature        | (X1:1) predict         | (X1:2) describe | (X1:3) diagnosis |
|                    |                      | (X1:4) supervise       | (X1:5) proposal | (X1:6) support   |
|                    | Policy tools         | (X2:1) supply-side     | (X2:2) environmental | (X2:3) demand-side |
| Policy attributes  | Policy limitation    | (X3:1) long-term       | (X3:2) short-term | (X3:3) mid-term   |
|                    |                      | (X3:4) in this year    |                      |                     |
| Policy domain      |                      | (X4:1) economy         | (X4:2) social services | (X4:3) system    |
|                    |                      | (X4:4) politics        | (X4:5) talent      |                     |
| Policy audience    |                      | (X5:1) national ministries and commissions | (X5:2) provincial government departments | (X5:3) colleges and universities |
|                    |                      | (X5:4) community       | (X5:5) institution | (X5:6) family     |
| Whether the public |                      |                        |                      |                     |
| Policy content     | Combination of related industries | (X7:1) combination of traditional Chinese Medicine | (X7:2) CMNC intellectualization | (X7:3) sports |
|                    |                      | (X7:4) food            | (X7:5) tourism     |                     |
| Home care          | (X8:1) home medical care | (X8:2) risk prevention | (X8:3) improve standards |                     |
| Institutional service | (X9:1) signing cooperation | (X9:2) CMNC institution | (X9:3) improve standards |                     |
| Community service  | (X10:1) facility construction | (X10:2) encourage diversity | (X10:3) improve standards |                     |
| Policy implementation | Key content       | (X11:1) service supervision | (X11:2) resource allocation | (X11:3) evaluation mechanism |
|                    | Incentives and guarantees | (X12:1) administrative examination and approval | (X12:2) insurance guarantee | (X12:3) price policy |
|                    |                      | (X12:4) financial input | (X12:5) talent construction | (X12:6) land planning |
|                    |                      | (X12:7) tax preference | (X12:8) publicity effort | (X12:9) legal protection |
|                    |                      | (X12:10) pilot demonstration | (X12:11) social force |                     |
| Policy operability | (X13:1) implementation plans | (X13:2) detailed measures | (X13:3) supporting policies |                     |
|                    | (X13:4) task division |                      |                      |                     |
| Policy evaluation  | (X14:1) sufficient basis | (X14:2) Clear objectives | (X14:3) scheme of science |                     |
include government purchases, tax incentives, pilot demonstrations, etc. (Yue et al., 2020).

**PMC Index Calculation**

The calculation of the PMC index includes the following three steps: First, select the policy to be evaluated, refer to the meaning of second-level variables, and assign values to second-level variables using binary 0 and 1, as shown in Eqs. (2) and (3), where \( t \) is the encoding number for first-level variables, and \( j \) is the encoding number of second-level variables. Second, using Eq. (4), the corresponding first-level variable score is obtained. Third, according to Eq. (5), the PMC index of each CMNC policy is calculated and rated according to the standard.

\[
X \sim N[0, 1] \tag{2}
\]

\[
X = \{XR : [0 \sim 1] \} \tag{3}
\]

\[
X_t \left( \frac{\sum_{j=1}^{n} X_{tj}}{T(X_{tj})} \right) = 1, 2, 3, 4, 5, \ldots, \infty \tag{4}
\]

\[
PMC = \begin{cases} 
X_1 \left( \sum_{i=1}^{6} \frac{X_{1i}}{6} \right) + X_2 \left( \sum_{j=1}^{3} \frac{X_{2j}}{3} \right) + X_3 \left( \sum_{k=1}^{4} \frac{X_{3k}}{4} \right) + X_4 \left( \sum_{l=1}^{5} \frac{X_{4l}}{5} \right) \\
+ X_5 \left( \sum_{m=1}^{6} \frac{X_{5m}}{6} \right) + X_6 + X_7 \left( \sum_{n=1}^{5} \frac{X_{7n}}{5} \right) + X_8 \left( \sum_{p=1}^{3} \frac{X_{8p}}{3} \right) \\
+ X_9 \left( \sum_{q=1}^{3} \frac{X_{9q}}{3} \right) + X_{10} \left( \sum_{r=1}^{3} \frac{X_{10r}}{3} \right) + X_{11} \left( \sum_{s=1}^{3} \frac{X_{11s}}{3} \right) \\
+ X_{12} \left( \sum_{t=1}^{11} \frac{X_{12t}}{11} \right) + X_{13} \left( \sum_{u=1}^{4} \frac{X_{13u}}{4} \right) + X_{14} \left( \sum_{v=1}^{3} \frac{X_{14v}}{3} \right)
\end{cases} \tag{5}
\]

The results of the policy rating are divided into four grades: a PMC index score of 14–11 for an excellent policy, 10.99–8 for a good policy, 7.99–5 for an acceptable policy, and 4.99–0 for a poor policy.

**Construction of PMC Index Graph**

One of the advantages of the PMC index model is that it displays policy evaluation results through the PMC surface diagram, which helps researchers to observe the advantages and disadvantages of policies more intuitively through visualization. In this study, PMC surface diagrams and CONTOUR diagrams were constructed to visually display the results of the policy evaluation.

The score of each level index is presented as a 4 × 4 matrix. Since there are only two indexes in the evaluation content of “policy concept,” two virtual
indexes $X$ and $Y$ are introduced into the matrix and the scores of the two virtual indexes are 1, as shown in Eq. (6).

$$\text{PMC(Surface)} = \begin{pmatrix} X_1 & X_2 & X & Y \\ X_3 & X_4 & X_5 & X_6 \\ X_7 & X_8 & X_9 & X_{10} \\ X_{11} & X_{12} & X_{13} & X_{14} \end{pmatrix}$$ (6)

A PMC surface and CONTOUR diagram can be drawn based on Eq. (6). Among them, the lower the index score, the greater the concave degree of the surface, the darker the color. When the index score has a high curved surface protuberance, the color is lighter.

**Result**

**Policy Text Selection**

To explore the advantages and disadvantages of China’s CMNC policies more comprehensively, this study adopted a comparative analysis method and selected the texts of CMNC policies issued by typical provinces in China to conduct horizontal and vertical analyses of different variable levels.

An in-depth analysis of provinces at the forefront of CMNC development could help to identify potential problems in the CMNC service system and guide the direction of its development in China. Therefore, the selection basis of policy samples is as follows:

I. As China is still in an exploratory stage of CMNC, only Shandong Province and Sichuan Province are currently CMNC demonstration provinces. To explore the quality of their policies and whether they can be used as reference to other regions, the CMNC policies issued by Shandong Province and Sichuan Province were selected first.

II. In 2011, China started to select competent regions to carry out CMNC pilot projects. All the localities have continuously practiced and explored the CMNC’s new pension model, including the Qingdao, Shanghai, and Suzhou models (Wu & Zhang, 2021). This study selected the policy issued by Jiangsu Province using a special model for the research.

III. In 2016, the State released a list of the first batch of national pilot units for CMNC, which included Shenyang City in Liaoning Province and Xianning City in Hubei Province. This study selected the policies issued by Hubei Province for analysis.

To sum up, this study selected representative CMNC policies implemented by Shandong, Sichuan, Jiangsu, and Hubei Provinces over the past five years, and an important representative policy issued by the State as a control sample.
Table 5 provides a summary of the information contained in the 10 policy samples.

**Overall Results of the Evaluation of CMNC Policies**

The 10 selected policies were added into a multiple input–output table to obtain the PMC index of national and provincial representative policies, as shown in Table 6. On the whole, three of the 10 CMNC policies were rated as “excellent,” while the other policies were rated as “good,” indicating that the overall quality of the CMNC policies in these provinces was good but needed to be improved. Horizontally, the PMC index ranked Shandong Province first, followed by Sichuan, Hubei, and Jiangsu. This is because Shandong Province had been selected as the first national demonstration province for CMNC in 2018, while Sichuan Province was established as a demonstration province only in 2020. Although there is Suzhou, a pilot city with regional characteristics in Jiangsu Province, its provincial policy score is poor, and the scores of variables such as “policy nature,” “policy tools,” “combination of relevant industries,” and “incentives and guarantees” are all below the mean. From the ranking of policy samples (P3, P1, P9, P5, P2, P10, P4, P6, P7, and P8), it can be seen that the scores of policies issued by provinces are higher than those of national control samples except P4, and the quality is generally higher. Comparatively, the implementation policies issued by provinces for the implementation of national policies ranked lower and the quality was also poorer. From the mean score of the first-level variables, the scores of “policy nature,” “combination of related industries,” “home care,” and “community service” were low, and variable performance was relatively poor.

**Evaluation Results of Typical CMNC Policies**

Based on the evaluation level of individual policies, this study intends to implement policies P1 and P4 issued by Shandong Province and Sichuan Province, respectively, which were developed to create a demonstration province for CMNC. We compare the scores of each dimension of the two policies horizontally in combination with the results of the PMC surface chart and CONTOUR chart shown in Figs. 3, 4 and 5, 6.

In contrast, the establishment of a demonstration province in Shandong Province was more successful than in Sichuan Province. Except for “policy operability,” the scores of the other indicators were higher than those for Sichuan Province. For the work plan policy P1 of Shandong province, the overall PMC index score was 11.81 and the grade was excellent. Among the indicators, only the scores of “incentives and guarantees” and “policy operability” were lower than the average. The “incentives and guarantees” score mainly reflected poor results in “price policy” and “incentives and guarantees” due to the lack of incentive policies to encourage social forces to participate in CMNC. “Policy operability” reflected a lack of supporting policies and division of labor among various departments.
| Number | Policy Name                                                                 | Release Time          |
|--------|-----------------------------------------------------------------------------|-----------------------|
| P1     | Notice on Printing and Distributing the Work Plan of Shandong Province for Establishing a National Demonstration Province of Combining Medical and Nursing Care | February 24, 2018     |
| P2     | Notice on Printing and Distributing the Development Plan of Combining Medical and Nursing Care Industry in Shandong Province (2018–2022) | April 21, 2020        |
| P3     | Implementation Opinions on Further Promoting the Development of the Combination of Medical and Nursing Care | December 7, 2020      |
| P4     | Notice on Printing and Distributing the Implementation Plan for Sichuan Province to Create a National Demonstration Province of Combination of Medical and Nursing Care | September 10, 2020    |
| P5     | Notice on Printing and Distributing the Development Plan for the Combination of Medical and Nursing Care Services in Sichuan Province (2018–2025) | September 30, 2018    |
| P6     | Several Measures on Further Promoting the Development of the Combination of Medical and Nursing Care | September 4, 2020     |
| P7     | Notice on the Implementation Opinions on Further Promoting the Combination of Medical and Health Care and Elderly Care Services | July 6, 2017          |
| P8     | Notice on the Implementation Opinions on Promoting the Combination of Medical and Health Care and Elderly Care Services | May 23, 2016          |
| P9     | Several Measures on Further Promoting the Development of the Combination of Medical and Nursing Care | December 29, 2020     |
| P10    | Several Opinions on Further Promoting the Development of the Combination of Medical and Nursing Care | October 23, 2019      |
| Variable                                      | Shandong province | Sichuan province | Jiangsu province | Hubei province | Nation | | | |
|------------------------------------------------|-------------------|------------------|------------------|----------------|--------| |
| Policy nature                                  | 0.83              | 1.00             | 0.50             | 0.50           | 1.00   | |
| Policy tools                                   | 1.00              | 1.00             | 0.67             | 0.67           | 0.67   | |
| Policy limitation                              | 0.25              | 0.25             | 0.25             | 0.25           | 0.25   | |
| Policy domain                                  | 1.00              | 1.00             | 1.00             | 1.00           | 0.8    | |
| Policy audience                                | 0.83              | 0.83             | 0.83             | 0.83           | 0.83   | |
| Whether the public                             | 1.00              | 1.00             | 1.00             | 1.00           | 1.00   | |
| Combination of related industries              | 1.00              | 1.00             | 1.00             | 1.00           | 0.60   | |
| Home care                                      | 1.00              | 0.33             | 0.33             | 0.33           | 0.33   | |
| Institutional service                          | 1.00              | 0.67             | 0.67             | 0.67           | 0.67   | |
| Community service                              | 0.67              | 0.67             | 0.67             | 0.67           | 0.67   | |
| Key content                                    | 1.00              | 0.67             | 1.00             | 0.33           | 0.67   | |
| Incentives and guarantees                      | 0.73              | 0.82             | 0.73             | 0.64           | 0.91   | |
| Policy operability                             | 0.50              | 0.75             | 0.75             | 1.00           | 0.75   | |
| Policy evaluation                              | 1.00              | 1.00             | 1.00             | 1.00           | 1.00   | |
| PMC index                                      | 11.81             | 10.99            | 12.06            | 10.07          | 10.05  | |
| Grade                                          | Excellent         | Good             | Excellent        | Good           | Good   | |
| Provincial average                             | 11.62             | 10.45            | 9.55             | 10.02          | 10.02  | |
| Provincial ranking                             | 1                 | 2                | 4                | 3              |        |
The overall PMC index score for policy $P_4$ of Sichuan Province’s model provincial implementation plan was 10.07, with a good grade. The “policy nature,” “policy tool,” “policy audience,” “home care,” “institutional service,” “key content,” and “incentives and guarantees” in each index were all lower than the average score. Its policy nature failed to reflect diagnosis, description, and
monitoring; the lack of relevant service standards and legal protection for the three types of medical and nursing service models resulted in a lack of environmental policy tools. “Incentives and guarantees” ignores propaganda and pilot demonstration work. Incentives for institutions of higher learning also need more attention.

Discussion

By comparing and observing the PMC index score of policies in various provinces, the main challenges facing China’s CMNC policy are as follows:

1. The formulation of local policies was not always relevant. In terms of policy scores, policies P3, P6, P7, P8, and P9 are all implementation opinions issued by provinces to implement the top-level design policy documents of CMNC derived at a national level. P4 is the implementation plan for Sichuan Province to create a national demonstration province for CMNC. The PMC index table shows that these policies have low scores in terms of policy nature. Among them, P3, P6, and P9 do not have the three characteristics of “prediction,” “description,” and “diagnosis,” while P4, P7, and P8 lack “description” and “diagnosis” policies. The implementation policies of the CMNC in various regions do not consider the development status and existing problems of the province. Most of them apply the principles and framework of the central policy documents, which may lack relevance and easily lead to a waste of policy resources.

A comparison of the provincial scores shows that the average scores of Jiangsu Province and Hubei Province in the two first-level indicators of “policy nature” and “combination of relevant industries” are lower than those of Shandong Province and Sichuan Province, as shown in Fig. 6. At present, CMNC in China lacks practical experience and provincial policies lack innovative exploration based on local realities; most choose traditional Chinese medicine and Internet, which are two industries with strong universality, to combine development with CMNC. The series of policies (P1, P2, and P4) issued by Shandong Province and
Sichuan Province in order to build a CMNC demonstration province have to a large extent considered the development basis and the situation faced by the province, and promoted the integrated development of health, tourism, sports, and other industries combined with local characteristics, which can serve as a reference for other local governments.

(2) Policy tools were not used comprehensively. From the results of the policy evaluation, the structure of policy tools for CMNC in China is unbalanced, and environmental policy tools are seldom used. At present, CMNC is still in a development stage and has not yet formed a mature service system for the health and care of older adults. The relevant policies and regulations are mostly administrative regulations and other normative documents, and lack laws to guarantee the implementation of CMNC in various regions. The average score of Shandong Province’s policies on the three first-class indicators of “home care,” “community service,” and “institutional service” is significantly higher than that for other provinces. Most provincial policies lack the capacity to “improve standards,” among which “community service” is the most serious. Only Policy P3 of Shandong Province proposes the establishment and improvement of standards and specifications for the community-type CMNC services, and the local standard "Basic Specifications for Community Integrated Medical and Nursing Care Services" was issued in 2020.

(3) There are also “omissions” in the policy’s coverage. An overview of the analysis and evaluation results of the representative CMNC policies in various regions shows that although the policies’ coverage areas are relatively comprehensive, there are still “blank” and “missing items” in some policies. Policies P3-P10 ignore the indicator “publicity effort,” which is a new CMNC service paradigm, and most older adults use the traditional family pension model. Insufficient publicity by government departments means that older adults have a low understanding of this new model and the CMNC fails to form a consensus among older adults.

In terms of the development of skills, policies P4, P5, P7, and P8 do not specify an insurance guarantee mechanism for home-based medical staff, which can easily affect the professional enthusiasm of medical staff. Moreover, P4 and P8 do not include systematic planning for colleges and universities to cultivate professional talents with CMNC.

In terms of policy implementation, policies P1, P2, and P7 do not specify the “division of tasks” of various government departments, and the unclear responsibilities of the executive body will affect the smooth implementation of the policy.

In summary, the optimization of China’s CMNC policy system should focus on the following aspects. First, at the national level, the top-level design of the CMNC should be strengthened, and the future development goals and directions should be clarified based on the actual situation in China’s provinces. The legal system needs to be improved and legal guarantees for its implementation should be provided. Various incentive measures should be refined and improved, including price policy, health assessment mechanisms for older adults, insurance guarantee mechanisms, and assessment mechanisms for relevant employees. Colleges and universities

Springer
should be encouraged to add relevant majors to their curriculum to cultivate high-end professionals. The publicity and promotion of the CMNC model and changes to the traditional concept of care for older adults should be addressed. Second, at the local level, local governments at all levels should adjust measures to local conditions and earnestly analyze the problems faced by the local CMNC. They should also explore the service mode of CMNC-based local characteristics, refine the local norms of various CMNC services, pay more attention to community-type services, provide full play to local resources and industrial advantages, and vigorously promote the combination of CMNC and related industries.

Conclusion

In this study, LDA topic clustering technology was introduced in the construction of a PMC policy evaluation index system. An evaluation model of the CMNC policy based on LDA–PMC was established to quantitatively evaluate nine CMNC policies in four typical provinces in China. In terms of research methods, the LDA theme model was used to improve the comprehensiveness and objectivity of the index system. In terms of research content, the policies of four representative provinces were selected to analyze the characteristics, advantages, and disadvantages of China’s CMNC policies at a local level.

The limitation of this study is that the choice of local policies could be more extensive. In a follow-up study, the author intends to conduct an in-depth analysis of the implementation effect of CMNC policies based on policy evaluation.

Author Contributions X.M.L and X.L. conceived and designed the study. X.M.L. acquired the data. X.M.L. performed the data analysis and interpretation. X.M.L. drafted the article. All authors contributed to the critical revision of the article and approved the final version prior to submission.

Funding This work was supported by the National Natural Science Foundation of China under Grant number 72074100, and Graduate Research and Innovation Projects of Jiangsu Province under Grant number KYCX21_3430.

Data Availability The data that support the fundings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethical Approval This study did not constitute human subjects research and ethical approval was not required.

Conflict of Interest No potential conflict of interest was reported by the authors.
References

Li, C., Zhang, H. (2021). The role orientation and the financial responsibility boundary of the supply sub-jects of the combination of medical care and elderly care. Contemporary Economic Management, (02), 65–72. https://doi.org/10.13253/j.cnki.ddjjgl.2021.02.009.

Yue, X., Mu, K., & Liu, L. (2020). Selection of Policy Instruments on integrated care in China: Based on documents content analysis. International Journal of Environmental Research and Public Health, 17(7), 2327. https://doi.org/10.3390/ijerph17072327

Hande, M. J., Taylor, D., Keefe, J. (2021). The role of volunteers in enhancing resident quality of life in long-term care: Analyzing policies that may enable or limit this role. Canadian Journal on Ageing, 11–12. https://doi.org/10.1017/S0714980821000106.

Estévez-Abe, M., & Ide, H. (2021). COVID-19 and long-term care policy for older people in Japan. Journal of Ageing & Social Policy, 33(4–5), 11–15. https://doi.org/10.1080/08959420.2021.1924342

Jeon, B., & Kwon, S. (2017). Health and long-term care systems for older people in the republic of Korea: Policy challenges and lessons. Health Systems & Reform, 3(3), 214–223. https://doi.org/10.1080/23288604.2017.1345052

Martens, M., Danhieux, K., Van Belle, S., Wouters, E., Van Damme, W., Remmen, R., ... & Van Olmen, J. (2021). Integration or fragmentation of health care? Examining policies and politics in a Belgian case study. International Journal of Health Policy and Management. https://doi.org/10.34172/ijhpm.2021.58.

Chen, Y. Y., Chen, H., & Song, P. (2020). Promises and pitfalls of integrating home-based health services into Shanghai’s elder-care system. Ageing & Society, 40(3), 480–500. https://doi.org/10.1017/S0144686X18001095

Chandran, V. G. R., Nourani, M., Selvarajan, S. K., & Baskaran, A. (2021). Selective research funding policy and catching up the ladder in university research performance in Malaysia. Managerial and Decision Economics, 42(3), 539–550. https://doi.org/10.1002/med.3252

Morseletto, P. (2020). A new framework for policy evaluation: Targets, marine litter, Italy and the Marine Strategy Framework Directive. Marine Policy, 117, 103956. https://doi.org/10.1016/j.marpol.2020.103956.

Peng, R., & Wu, B. (2021). The impact of long-term care policy on the percentage of older adults with disabilities cared for by family members in China: A system dynamics simulation. Research on Ageing, 43(3–4), 147–155. https://doi.org/10.1177/0164027520925367.

Vallance, K., Stockwell, T., Wettlaufer, A., Giesbrecht, N., Chow, C., Card, K. G., & Farrell-Low, A. (2021). Strategies for engaging policy stakeholders to translate research knowledge into practice more effectively: Lessons learned from the Canadian Alcohol Policy Evaluation project. Drug and Alcohol Review. https://doi.org/10.1111/dar.13313

Cheng, L., Brown, G., Liu, Y., & Searle, G. (2020). An evaluation of contemporary China’s land use policy – The Link Policy: A case study from Ezhou, Hubei Province. Land Use Policy, 91, 104423. https://doi.org/10.1016/j.landusepol.2019.104423.

He, C., & Fu, Y. (2021). Why does waste separation policy vary across different Chinese cities? A configurational analysis of the pilot scheme. Journal of Cleaner Production, 283, 124613. https://doi.org/10.1016/j.jclepro.2020.124613.

Reuter, M., Narula, K., Patel, M. K., & Eichhammer, W. (2021). Linking energy efficiency indicators with policy evaluation – A combined top-down and bottom-up analysis of space heating consumption in residential buildings. Energy and Buildings, 244, 110987. https://doi.org/10.1016/j.enbuild.2021.110987.

Azevedo, I., & Leal, V. (2021). A new model for ex-post quantification of the effects of local actions for climate change mitigation. Renewable and Sustainable Energy Reviews, 143, 108980. https://doi.org/10.1016/j.rser.2021.110890.

Xu, M., Qin, Z., & Zhang, S. (2021). Integrated assessment of cleaning air policy in China: A case study for Beijing-Tianjin-Hebei region. Journal of Cleaner Production, 296, 126596. https://doi.org/10.1016/j.jclepro.2021.126596.

Wang, J., Yang, Q., & Zhang, Y. (2019). Quantitative evaluation of civil-military integration policy based on PMC-AE index model. Journal of Intelligence, 38(04), 66–73. https://doi.org/10.3969/j.issn.1002-1965.2019.04.011.
Quantitative Evaluation of Policies for combining Medical…

Liu, J., Mai, Q., & Wang, J. (2020). Research on military-civilian science and technology policy evaluation based on grounded theory and PMC model. Science and Technology Management Research, 23, 38–47. https://doi.org/10.3969/j.issn.1000-7695.2020.23.006

Li, Y., He, R., Liu, J., Li, C., & Xiong, J. (2021). Quantitative evaluation of China’s pork industry policy: A PMC index model approach. Agriculture, 11(2), 86. https://doi.org/10.3390/agriculture11020086

Kuang, B., Han, J., Lu, X., Zhang, X., & Fan, X. (2020). Quantitative evaluation of China’s cultivated land protection policies based on the PMC-Index model. Land Use Policy, 99, 105062. https://doi.org/10.1016/j.landusepol.2020.105062

Dai, S., Zhang, W., Zong, J., Wang, Y., & Wang, G. (2021). How Effective Is the Green Development Policy of China’s Yangtze River Economic Belt? A Quantitative Evaluation Based on the PMC-Index Model. International Journal of Environmental Research and Public Health, 18(14), 7676. https://doi.org/10.3390/ijerph18147676

Hong, M., & Wang, H. (2021). Research on customer opinion summarization using topic mining and deep neural network. Mathematics and Computers in Simulation, 185, 88–114. https://doi.org/10.1016/j.matcom.2020.12.009

Huang, C., Wang, Q., Yang, D., & Xu, F. (2018). Topic mining of tourist attractions based on a seasonal context aware LDA model. Intelligent Data Analysis, 22(2), 383–405. https://doi.org/10.3233/IDA-173364

Estrada, M. A. R. (2011). Policy modeling: Definition, classification and evaluation. Journal of Policy Modeling, 33(4), 523–536. https://doi.org/10.1016/j.jpolmod.2011.02.003

Zhang, Y., & Qie, H. (2017). Quantitative evaluation innovation policies of the state council: Based on the PMC-Index model. Scientific and Technological Progress and Countermeasures, 34(17), 127–136. https://doi.org/10.6049/kjbydc.2016110731

Wu, J., Zhang, Y., & Shi, Z. (2021). Crafting a sustainable next generation infrastructure: Evaluation of China’s new infrastructure construction policies. Sustainability, 13(11), 6245. https://doi.org/10.3390/su13116245

Wu, Y., & Zhang, H. (2021). The practice mode and development path of the combination of medical and nursing in metropolis of China. Academic Journal of Zhongzhou, 04, 78–84.

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.