



## Multiple realization pathways of county-level medical alliances to improve service capacity: A fuzzy set qualitative comparative analysis<sup>☆</sup>



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### ABSTRACT

**Background:** The long-standing dilemma of difficulties in the improvement of primary care in China has led to county-level medical alliances reforms in various regions throughout the country.

**Objective:** To analyze the combination of pathways that contribute to improving the service capabilities of county-level medical alliances, providing a reference for the improvement and promotion of county-level medical alliances.

**Methods:** CNKI and Wanfang Data Knowledge Service Platform were searched by using "county-level medical alliance" "county health care unit" as keywords from 2020-01-01 to 2022-11-26 to obtain 662 related papers, a total of 9 papers and 11 cases were selected in the analysis. Based on literature review and policy analysis, variables including scale of planning and implementation, close organizational structure, collaborative management system, information platform integration, regional resources sharing, medical insurance payment reform, and incentive mechanism design were identified as outcome variables. The fuzzy set qualitative comparative analysis was used to identify multiple realization pathways for the service capability improvement of county-level medical alliances.

**Results:** Four combinations of pathways were found to improve the service capability of county-level medical alliances. Pathway S1: planning and implementation scale \* close organizational structure \* collaborative management system \* regional resources sharing \* medical insurance payment reform \* incentive mechanism design. Pathway S2: close organizational structure \* collaborative management system \* information platform integration \* regional resources sharing \* medical insurance payment reform \* incentive mechanism design. Pathway S3: smaller scale of planning and implementation \* close organizational structure \* collaborative management system \* non-integrated information platform \* non-sharing of regional resources \* medical insurance payment reform \* incentive mechanism design. Pathway S4: smaller scale of planning and implementation \* close organizational structure \* collaborative management system \* non-integrated information platform \* regional resource sharing \* medical insurance payment reform \* no incentive mechanism design.

**Conclusion:** The improvement of service capability of county-level medical alliances needs to focus on close organizational structure, establish management system focusing on the collaboration of departments and member institutions, and promote medical insurance payment reform such as global budget management system of medical insurance funds and diagnosis related groups (DRGs).

### Introduction

China has long faced the dilemma of regional inequality in the distribution of health service resources.<sup>1-2</sup> About 80 % of China's medical resources and patients are concentrated in urban tertiary hospitals, while the remaining 20 % are concentrated in primary medical and health institutions such as primary hospitals and community health service centers.<sup>3-4</sup> In addition, the irrational allocation and utilization of health

resources have correspondingly reduced the trust of rural patients in the ability of primary medical services, resulting in a large number of patients leaving the county and flowing to public general hospitals in large cities.<sup>5-6</sup> Primary health care institutions, such as primary hospitals and community health service centers, are faced with a large area of idle and wasted medical resources, and the capacity of primary health services cannot be utilized, and it is therefore difficult to improve.<sup>7-8</sup> In 2015, the Chinese government first explicitly put forward the concept

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of medical alliances in a policy document to reshape the regional medical treatment pattern and accelerate the improvement of primary health service capacity.<sup>9</sup> In 2017, the "Guiding Opinions on Promoting the Construction and Development of Medical Consortiums" was promulgated, and the county-level medical alliance model with county-level hospitals as the leader, linking them with several township health centers and village clinics to form a single medical group was recognized as one of the four core medical consortium formation models at the national level.<sup>10</sup> In May 2019, the National Health Commission issued the "Guiding Plan for the Pilot Construction of Close-knit County-level Medical and Health Alliances", exploring a new chapter in the county-level medical alliance towards a "close-knit" reform.<sup>11</sup> In September of the same year, the National Health Commission and the State Administration of Traditional Chinese Medicine released a list of pilot counties for the construction of a compact county-level medical alliance, and 567 counties across the country became the "leaders" in the exploration of the construction of a close-knit county-level medical alliance.<sup>12</sup> By the end of 2020, a total of 4 028 county-level medical alliances had been established across the country.<sup>13</sup> In order to ensure the long-term development and continuous benefit of the reform of county-level medical alliances, and to promote the construction of an integrated medical and health service system in China, it is of great research value and guiding significance to analyze the multiple realization paths of county-level medical alliance service capabilities based on the analysis of local practice effects.<sup>14-15</sup>

At present, the academic community is making progress in improving the service capacity of county-level medical alliances, mainly focusing on three aspects: first, the construction path of county-level medical alliances to improve the capacity of primary health services through case analysis, such as internal governance structure, medical insurance payment methods, personnel and salary system reform, and information system integration<sup>16-19</sup>; second, quantitative analysis of hospital factors affecting the capacity of primary health services in the context of county-level medical alliance construction (such as solid assets and regional health centers) and environmental factors (e.g., level of economic development, government subsidies, geographical location)<sup>8,20</sup>; and third, the impact of a single path on the capacity of primary health services in the context of the construction of county-level medical alliances, such as informatization construction and medical insurance payment reform<sup>21-23</sup> quantitative methods to analyze the combination of paths to improve the capacity of primary health services from the practice paths of county-level medical alliances. While case analysis is common, integrating quantitative methods to examine combined strategies for improving primary health services from county-level medical alliances remains rare among scholars. Additionally, there is a lack of quantitative evaluation studies on the implementation effects of many county-level medical alliance policies and measures.<sup>24</sup> To fill this gap, this paper introduces the fuzzy set qualitative comparative analysis (fsQCA) method for the first time to explore the combined effects of multiple policy measures on improving the service capacity of county-level medical alliances. The contribution of this study is to broaden the research

perspective in the field of county-level medical alliance and provide empirical evidence for the extensive practice and long-term development of county-level medical alliance.

## Information and methodology

### Research methods

Qualitative comparative analysis (QCA) is a configuration analysis method that combines qualitative and quantitative research, founded by MILL<sup>25</sup> in 1843. In contrast to traditional correlation analysis, which measures the independent effects of individual influencing factors, it analyzes the causal pathways that lead to the same outcome in different contexts in order to investigate the combined conditions for achieving this outcome.<sup>26</sup> The QCA approach mainly includes Clear Set Qualitative Comparative Analysis (csQCA), which is based on a dichotomy that requires the transformation of variables into 0 or 1 according to unaffiliated and full membership, and fsQCA, which is mainly for continuous variables and can be set to 0~1 according to the degree of partial membership.<sup>27-28</sup>

At present, although the QCA method has been widely used in the fields of economics and management, its research in the field of medical and health care is still in its infancy. Most studies in this field have used the method to analyze the influencing factors or combination paths of medical and health related cases, such as the influencing factors that cause the irrational use of antibiotics in village doctors, the combination path that affects the quality of elderly care services and the condition configuration of promoting the accountability of health policies.<sup>29-31</sup> Given that few scholars have used this method to analyze the antecedents of the improvement of the service capacity of the county-level medical alliance, this paper innovatively introduces this method to study the combination of policy measures that affect the improvement of their service capacity by integrating multiple cases. This research can inform the deepening reform and long-term development of the county-level medical alliance, and broaden the research horizon of the development analysis of the county-level medical alliance.

### Data collection and sample selection

In order to facilitate case comparison, the search time range is 2020–01–01 to 2022–11–26. A total of 662 articles were retrieved from CNKI and Wanfang Data Knowledge Service Platform, and duplicate literature was eliminated. Then, a total of 20 papers (including journal papers and dissertations) were selected to study the case background, policy measures and quantitative implementation effects of county-level medical alliances. Next, we carefully read the paper and removed the literature with case studies in 2016 and before, and those whose data type of the implementation effect did not meet the research needs of this paper. Finally, a total of 9 articles<sup>32-40</sup> and 11 cases were screened, and the case information is shown in Table 1.

**Table 1**  
Information on the cases of county-level medical alliances.

No	Location of case(county-level medical alliance)	Province	Reference
1	L city	Hunan	Li Yuqing (2021) <sup>32</sup>
2	Hangzhou city Xiaoshan district	Zhejiang	Huang Xin (2020) <sup>33</sup>
3	Zherong county	Fujian	Zhan Yuanjiu <sup>34</sup>
4	Linchang city L district	Yunnan	Chen Yanshu(2020) <sup>35</sup>
5	Liling City	Hunan	Chen Junjia <sup>36</sup>
6	Anji county	Zhejiang	Chen Junjia <sup>36</sup>
7	H county	Guangxi	Chen Lihua (2022) <sup>37</sup>
8	Deqing county	Zhejiang	Zhao Minjie (2020) <sup>38</sup>
9	Dongyang county	Zhejiang	Zhao Minjie (2020) <sup>38</sup>
10	Nanling city Shanglin county	Guangxi	Pang Ting, et al (2020) <sup>39</sup>
11	"Internet +"Shimian Model"	Sichuan	Li Xinggui, et al(2021) <sup>40</sup>

**Table 2**  
Variable settings.

Variable	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11
Condition variable											
Scale of planning and implementation	21	22	9	10	33	16	16	12	15	10	12
Number of community health service centers/stations and township health centers participating in the construction of the medical community	21	22	9	10	33	16	16	12	15	10	12
Tight organizational structure	1.0	1.0	1.0	1.5	1.0	1.0	1.5	2.0	2.0	1.0	1.5
The medical alliance management committee and other unified management bodies shall be established	1.0	1.0	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
The medical alliance defines its status as an independent legal person	0	0	1.0	0.5	0	0	0.5	1.0	1.0	0	0.5
Management system cooperation	2.0	2.0	2.0	2.0	2.5	2.0	3.0	1.5	2.0	2.0	2.5
The constitution or agreement of the medical alliance shall be formulated to clarify the responsibilities, rights and benefits of each member unit	0.5	1.0	1.0	0.5	1.0	0.5	1.0	1.0	1.0	1.0	1.0
Establish a management system for the homogenization of medical service quality	0.5	0.5	0	1.0	1.0	0.5	1.0	0.5	0.5	0.5	0.5
Establish two-way referral standards and procedures	1.0	0.5	1.0	0.5	0.5	1.0	1.0	0	0.5	0.5	1.0
Information platform integration	0	0	0	0	1.0	1.0	0	1.0	1.0	0	1.0
Hospitals at all levels of the medical alliance share a set of business systems and data centers	0	0	0	0	1.0	1.0	0	1.0	1.0	0	1.0
Regional resource sharing	0.5	0.5	0.5	1.0	0.5	1.0	0	1.0	1.0	0	1.0
Medical alliance imaging, inspection and logistics service center sharing	0.5	0.5	0.5	1.0	0.5	1.0	0	1.0	1.0	0	1.0
Healthcare payment reform	1.0	2.0	1.0	2.0	0.5	1.5	0.5	2.0	2.0	1.5	1.5
The multi-institution integrated medical alliance is used as the payment object of medical insurance	0	1.0	1.0	1.0	0	1.0	0	1.0	1.0	1.0	1.0
Introducing a DRGs system	1.0	1.0	0	1.0	0.5	0.5	0.5	1.0	1.0	0.5	0.5
Incentive mechanism design	2.0	2.0	0.5	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Develop a performance-based pay policy that is compatible with the medical alliance	1.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
The evaluation and incentive mechanism to promote the integration and sinking of medical resources was established	1.0	1.0	0	0	1.0	0	1.0	1.0	1.0	1.0	1.0
Outcome variable											
Improvement of service capacity of county medical alliance: Annual growth rate of outpatient and emergency visits (%)	0.60	6.79	1.78	3.12	-3.86	-0.82	32.22	2.27	17.30	2.80	6.56

*Variable setting and calibration*

Based on the policy measures involved in the selected cases, this paper refers to the Work Plan for Comprehensive Performance Appraisal of Medical Consortiums (Trial)<sup>41</sup> (hereinafter referred to as the "Assessment Plan") issued by the National Health Commission in 2018 and several academic studies to determine seven conditional variables: (1) planning and implementation scale, that is, expanding the implementation scale of county-level medical alliances and attracting more member units to participate, which is conducive to the agglomeration of regional medical resources, improving the accessibility of county-level medical alliances to patients<sup>41-42</sup>; (2) organizational closeness, i.e., establishing a close-knit organizational structure through mechanism design, to ensure that county-level medical alliance reform measures have a holistic perspective and can operate efficiently<sup>14,43-44</sup>; (3) management system collaboration, i.e., systematically rationalizing the collaborative order of stakeholders, promoting the smooth service process of the medical alliance, and thus promoting the improvement of the service capacity of the medical alliance<sup>41,45-46</sup>; (4) information platform integration, that is, to integrate the information platform of each member unit to ensure that the patient information circulates sufficiently, enhance the convenience of patients seeking medical treatment in the county-level medical alliance, and correspondingly increases the patient stickiness of the county-level medical alliance member units<sup>23,47-48</sup>; (5) Regional resource sharing, that is, the county-level medical alliance units share resources such as imaging, inspection and testing, and logistics service centers, improve the efficiency of resource utilization, and enhance the medical experience of patients<sup>40-41</sup>; (6) medical insurance payment reform, that is, the reform of medical insurance payment objects and medical insurance payment methods, which optimizes the efficiency of dis-

tribution of medical insurance funds and improves the two-way referral enthusiasm of the member units of the county-level medical alliance, acting as a powerful "engine" to enhance the overall construction level of the county-level medical alliance<sup>49-52</sup>; (7) incentive mechanism design, that is, to encourage the integration and subsidence of medical resources through the design of performance appraisal and other mechanisms, so as to improve the medical care capacity of the subordinate units of the county-level medical alliance and stimulate the motivation of patients to seek medical treatment in the member units of the county-level medical alliance.<sup>41,53</sup> The above seven variables are the classic paths that have been widely practiced in the process of building county-level medical alliances. Next, values were assigned to the condition variables. Among them, except for the variable of planning and implementation scale, the remaining 6 variables were assigned a value of 1.0 if the case information in the literature clearly conformed to the subordinate item, 0 if the case information in the literature clearly did not conform to the subordinate item, and 0.5 if the item was not mentioned in the document. Then, the sum of the entry values under each condition variable was taken as its value. In the "assessment plan", "changes in the outpatient, inpatient", and "surgical volume of member units" and "the distribution of patients' diseases" were taken as one of the evaluation criteria for the improvement of the capacity of the medical alliance. Wang Siqi et al.<sup>23</sup> used the number of outpatient and emergency visits per unit of the medical alliance as the indicators to measure the service capacity of the county-level medical alliance. Considering the data availability and based on the data provided in the paper, we calculated the average annual growth rate of outpatient and emergency visits of the members of the medical alliance using the data provided in the paper, and employed this as the outcome variable to measure the improvement of the service capacity of the county-level medical alliance (Table 2).

Variables need to be calibrated before they can be included in the model of fsQCA. Specifically, it presets 3 anchor points of full membership, middle point and no membership at all, and converts the set membership of variables to 0~1.0. In this paper, with reference to the studies of CODURAS et al.<sup>54</sup> and FISS,<sup>55</sup> the quartile is calculated to calibrate it.

*Statistical methods*

Excel 2017 software was used to enter case data and calculated the average annual growth rate of outpatient and emergency visits. Additionally, fsQCA 3.0 software was employed to analyze the case data. Firstly, the data is calibrated to convert the data into [0, 1.0]. Then, the necessity test is carried out to determine whether the antecedents are necessary. Finally, the consistency threshold is set to 0.8, and the truth table is constructed for conditional configuration analysis.

**Results**

*Necessity test*

Prior to multivariate path analysis, a necessity test is performed on a single variable to see if there are necessary conditions for a given outcome.<sup>56</sup> In general, necessary consistency refers to the degree to which a conditional variable explains the outcome variable. If the necessary consistency of a condition greater than 0.900, then the factor is necessary.<sup>27</sup> As can be seen from Table 3, the consistency threshold of the organizational structure is greater than 0.900, indicating that this variable is a necessary condition for the improvement of the service capacity of the county medical alliance, while the consistency threshold of the other variables is less than 0.900, indicating that it is not a necessary condition for the improvement of the service capacity of the county medical alliance.

*Conditional configuration analysis*

A truth table was constructed to analyze the multiple realization paths that affect the improvement of the service capacity of the county-level medical alliance. Start by setting the Case Frequency Threshold to 1 and the Consistency Threshold to 0.800. Due to its consistency value was greater than 0.900, the organizational structure was set to present. Next, the complex, intermediate and parsimonious solutions were derived using fsQCA software. Among them, if the antecedent condition occurs in both the parsimonious solution and the intermediate solution, it is the core condition. If it only appears in the intermediate solution, it is the marginal condition.<sup>27,57</sup> Existing studies have shown that the coverage

and consistency of complex and intermediate solutions are basically the same, and the intermediate solutions simplify the model better.<sup>58</sup> Therefore, this paper focuses on the analysis of intermediate solutions.

As can be seen from Table 4, the consistency of the solution is 0.990 (> 0.800) and the coverage of the solution is 0.574 (>0.500), indicating that the results of this configuration analysis are highly explanatory. The results of configuration analysis showed that there were four combinations of paths to promote the improvement of the service capacity of the county-level medical alliance.

Path S1, planning and implementation scale \* close organizational structure \* management system coordination \* regional resource sharing \* medical insurance payment reform \* incentive mechanism design. The coordination of the management system, the reform of medical insurance payment, and the design of the incentive mechanism exist as the core conditions, and the scale of planning and implementation, the close organizational structure, and the sharing of regional resources exist as the marginal conditions. The integration of information platforms is optional. That is to say, in a county-level medical alliance with a relatively large scale and a tight organizational structure, the implementation of a collaborative management system, the reform of medical insurance payment, the design of incentive mechanisms, and the guarantee of regional resource sharing, regardless of whether the information platforms are integrated, can promote the improvement of the service capacity of the county-level medical alliance.

Path S2, close organizational structure \* management system collaboration \* information platform integration \* regional resource sharing \* medical insurance payment reform \* incentive mechanism design. The coordination of the management system, the reform of medical insurance payment, and the design of incentive mechanisms exist as the core conditions, and the organizational structure is close, the integration of information platforms, and the sharing of regional resources exist as marginal conditions, and the scale of planning and implementation is dispensable. That is to say, regardless of the scale of planning and implementation, in a county medical alliance with a close organizational structure, the implementation of a collaborative management system, the guarantee of information platform integration, the sharing of regional resources, the implementation of medical insurance payment reform and the design of incentive mechanisms will help to promote the improvement of the service capacity of the county medical alliance.

Path S3, small scale of planning and implementation \* close organizational structure \* management system collaboration \* non-integration of information platform \* non-sharing of regional resources \* medical insurance payment reform \* incentive mechanism design. Management system collaboration and medical insurance payment reform exist as the core conditions, organizational structure closeness and regional resource sharing exist as marginal conditions, planning implementation scale and incentive mechanism design are the absent core conditions, and information platform integration is the absent marginal condition. That is to say, in the county-level medical alliance with a small scale of planning and implementation but a close organizational structure, the development of a collaborative management system, the sharing of regional resources, the implementation of medical insurance payment reform, and the integration of information platforms and the design of incentive mechanisms can also promote the improvement of the service capacity of the county-level medical alliance.

Path S4, small scale of planning and implementation \* close organizational structure \* management system collaboration \* non-integration of information platform \* regional resource sharing \* medical insurance payment reform \* no incentive mechanism. Management system coordination, medical insurance payment reform, and incentive mechanism design exist as the core conditions, organizational structure closeness exists as the marginal conditions, planning and implementation scale as the absent core conditions, and information platform integration and regional resource sharing are the absent marginal conditions. That is to say, in the county-level medical alliance with a small scale of planning and implementation but a close organizational structure, the implemen-

**Table 3**  
Necessity testing results.

Condition variable	Consistency	Coverage
Scale of planning and implementation	0.480	0.532
~ Scale of planning and implementation	0.727	0.610
Tight organizational structure	0.945	0.674
~ Tight organizational structure	0.445	0.643
Management system cooperation	0.822	0.691
~ Management system collaboration	0.620	0.685
Information platform integration	0.392	0.412
~ Information platform integration	0.608	0.532
Regional resource sharing	0.712	0.546
~ Regional resource sharing	0.531	0.673
Medical care payment reform	0.758	0.691
~ Medical care payment reform	0.542	0.544
Incentive mechanism design	0.846	0.570
~ Incentive mechanism design	0.255	0.417

Note: ~ is a counterfactual result identifier, such as the counterfactual result of incentive design is not to carry out incentive design.

**Table 4**  
Configuration analysis results of realization pathways to improve the service capacity of county-level medical alliances.

Condition variable	Configuration S1	Configuration S2	Configuration S3	Configuration S4
Scale of planning and implementation	.	.	○	○
Tight organizational structure	.	.	.	.
Management system cooperation	●	●	●	●
Information platform integration	.	.	○	○
Regional resource sharing	.	.	.	○
Medicare payment reform	●	●	●	●
Incentive mechanism design	●	●	○	●
Consistency	0.982	0.973	1.000	1.000
Primary coverage	0.311	0.210	0.168	0.185
Unique coverage	0.065	0.065	0.113	0.086

Note: ● = core condition is present, ○ = core condition is absent, = edge condition is present, ○= edge condition is absent, - indicates that the condition may or may not occur.

tation of a collaborative management system, the reform of medical insurance payment, and the design of incentive mechanisms, but do not integrate the information platform or share regional resources, can promote the improvement of the service capacity of the county-level medical alliance.

**Robustness test**

It is necessary to perform a robustness test on the multi-path configuration obtained by the operation of QCA method. In this paper, the case consistency threshold in the fsQCA analysis was increased from the original 0.800 to 0.850, and the configuration analysis was performed again. The result showed that there are still 4 path combinations, which are consistent with the original path combinations, indicating that the research findings are relatively robust.

**Discussion**

Reconstructing the order of regional medical resources through the construction of county-level medical alliances and promoting the improvement of primary medical service capacity is a useful exploration for China to move towards an integrated medical service system.<sup>59</sup> This paper screens and classifies the cases of county-level medical alliance construction through fsQCA, and analyzes the multiple realization paths for the improvement of county-level medical alliance service capacity by using a combination of quantitative and qualitative methods. The study found that there are four combined paths that can improve the service capacity of the county-level medical alliance: (1) Path S1, planning and implementation scale \* Tight organizational structure \* Coordination of management system \* Regional resource sharing \* Medical insurance payment reform \* Incentive mechanism design; (2) Path S2, close organizational structure \* Coordination of management system \* Integration of information platform \* Regional resource sharing \* Reform of medical insurance payment \* Design of incentive mechanism, (3) Path S3, small scale of planning and implementation \* Tight organizational structure \* Coordination of management system \* Non-integration of information platform \* (4) Path S4, small scale of planning and implementation \* Close organizational structure \* Coordination of management system \* Integration of information platform \* Regional resource sharing \* Reform of medical insurance payment \* No design of incentive mechanism.

The results show that, first, in the construction of the county-level medical alliance, regardless of the size of the county-level medical alliance, it is of great significance to build a close organizational structure, ensure cross-department coordination within the management system, and implement the reform of medical insurance payment to improve the service capacity of the county-level medical alliance; second, for small-scale county medical alliances, integrating information platforms

is not very important for upgrading service capacity, but it is imperative to ensure that the management system is collaborative and to promote health insurance payment reform; third, in improving the service capacity of small-scale county medical alliances, if regional resources can be shared, then the design of incentives is not very important; otherwise, the design of incentives needs to be considered.

To this end, the following policy recommendations have been put forward to enhance the service capacity of county medical alliances: first, it is necessary to further promote the construction of close-knit county medical alliances, encourage the unification of their corporate bodies, formulate a constitution or agreement for the medical alliances, clarify the rights and responsibilities of each member, and establish a system for homogenizing the quality of medical care and a system for two-way referrals. Second, accelerate health insurance payment reform, promote the global budget management system for health insurance funds, and encourage the transformation of the payment target from a single medical institution to multi-institution integrated medical alliances, and implement a multi-dimensional and compounded health insurance payment method mainly based on payment by disease types (DRGs). Finally, tailor the payment method according to the size of the county medical alliances. For the smaller county medical alliances with fewer members, there is no need to force the construction of a perfect information platform for interoperability. Instead, efforts should be made to strengthen the effective cooperation among the management departments, and establish a system of equal rights, responsibilities, and benefits.

**Conclusion**

Based on the local experience of county-level medical alliances, this paper combines quantitative and qualitative methods to identify the combination of paths that are conducive to improving the capacity of primary medical services in the context of the implementation of the county-level medical alliance model. This is relatively new compared with the previous qualitative studies on the construction path of county-level medical alliances, and also provides strong empirical evidence for the further promotion and reform of county-level medical alliances. However, this paper still has the following limitations: first, due to the availability of data, most of the case information included in the analysis in this paper comes from dissertations, and its academic quality may be insufficient compared with the literature officially published in academic journals; second, in the variable assignment and calibration procedure, the author assigns a value of 0.5 to the items not mentioned in the literature, which may lead to a certain bias in the research results; third, due to data limitations, only the average annual growth rate of outpatient and emergency visits is used to measure the improvement of the service capacity of the county-level medical alliance. The explanatory power of the findings may need to be strengthened.

## Declarations

Not applicable.

## Authors' contributions

Yue Xu was responsible for conception and design of the article, implementation of the study, data collection, statistical analysis, interpretation of the results, and writing of the article; Linlin Hu was responsible for conception and design of the article, revision of the article, quality control of the article, and proofreading of the article, and was responsible for revising and reviewing the article; Yuanli Liu was responsible for revision of the article, and was also responsible for proofreading the article.

## Ethics approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Availability of data and materials

Not applicable.

## Authors' other information

Not applicable.

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## Competing interests

The authors declare that they have no competing interests.

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