What Truly Matters for The Implementation of Medical Alliances? A Cross-Sectional Study in China From The Perspective of Physicians

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Abstract

Background

In China, medical alliances (MAs) are a way of integrating medical resources. This study tries to identify the factors that influence the implementation of MAs, explore physicians' views on the MAs, so as to provide experience for the integration of international medical resources.

Methods

Physicians in district D and district F of Beijing were recruited by a self-reported questionnaire. Descriptive statistical methods and the Mann-Whitney U test were used to describe and contrast the physicians' evaluations. Factor analysis was used to reduce dimensions and calculate the overall evaluation of physicians. Multiple linear regression was used to identify the influencing factors of MAs.

Results

A total of 1032 physicians participated in this survey and the evaluation of MAs in D district is better. Most physicians express a dissatisfied attitude toward MAs. Regional characteristics, seniority and age of physicians, cognition degree of MA policy, professional competence, income and benefits and job satisfaction of physicians affect the implementation of MAs.

Conclusions

Physicians undertake more unpaid tasks in MAs, resulting in lower satisfaction. MAs in developed regions can stimulate the enthusiasm of physicians through extra rewards. Besides, the medical competence of physicians in small hospitals was improved with the help of physicians from large hospitals in the region, so physicians in these areas have better evaluations. The findings suggest that governments should focus on the personal development of physicians and improve their policy cognition to facilitate the implementation of MAs. In conclusion, the implementation of MAs varies in regions and developed regions have a more obvious effect on improving the implementation effect of MAs.

Background

Throughout the world, healthcare systems face the ongoing predicament of being “isolated” and “fragmented”, which often results in inefficient resource utilization and poor system performance.¹ The Chinese government proposed medical alliances (MAs) in 2012 to promote the vertical integration of medical resources.² MAs are one of the methods to implement hierarchical diagnosis and treatment systems, which are similar to the integrated delivery networks (IDNs) in the US and the integrated care

network (ICN) in the UK.^{3,4} A vertical medical system can reduce medical resource waste and alleviate the pressure of patient congestion in high-level hospitals.⁵ In addition, MAs can leverage the strengths of the concentration of high-quality resources in tertiary hospitals.

In China, MAs are mainly created by the government in a district and consist of tertiary hospitals with high medical technology levels in a region and a certain number of second-level hospitals, primary hospitals or CHCs (Community Health Services) in the region.⁶ In MAs, high-level hospitals, as core hospitals, are responsible for the diagnosis and treatment of critical and acute diseases and difficult diseases, the training of physicians, teaching, research and other tasks. In contrast, cooperative hospitals undertake cases of frequently occurring and common diseases, the rehabilitation of patients transferred back and public health tasks.⁷ Physicians from core hospitals go to cooperative hospitals to teach, make rounds, and participate in scientific research cooperation. Through technical assistance and physicians' training, MAs improved the medical capabilities of CHC.⁸ By the end of March 2018, Beijing had established a total of 58 MAs that included 55 core hospitals and 528 cooperative medical institutions, meeting the goal of full coverage of the residents in a medical community service area.

MAs determine the success of medical resource integration, so the evaluation of MAs becomes significant.⁹ There are many studies that have conducted detailed evaluation of medical confederations (or integrated care) in current.^{10–12} However, due to the influence of the widely popular concept framework of patient-centered, the majority of studies evaluated MAs from the perspective of patients, while few included the views of physicians.^{13,14} Physicians are important stakeholders and the foundation of MAs and their cognition and behavior basically determine the mode of medical service delivery, but many studies show that physicians express a negative attitude toward integrated care.^{15–19} Obviously, this situation is not conducive to the implementation of MAs' policy, so it is necessary to explore the view of physicians for MAs and examine the relationship between the implementation of MAs and physicians' participation. However, few studies have evaluated MAs from the perspective of physicians, and there is no evidence from China.^{20,21} Compared with other studies, this study integrating physicians' cognition degree and participation in MAs and the possible impact of MA construction and enabled physicians to evaluate MAs. This study explores physicians' views on MAs, aiming to expand the scant literature devoted to exploring physicians' views on the MAs and a better way was suggested to stimulate the enthusiasm of physicians to participate in MAs and provides appropriate suggestions for MAs.

Methods

Study sites and sample

This study focused on physicians and excluded nurses, medical technicians, and hospital managers. The physicians came from second-level hospitals and CHCs in district D and district F of Beijing (Table 1). The professional titles of physicians are divided into three categories: senior titles (director physicians

and deputy chief physicians), intermediate titles (attending physicians), and junior titles (residents). Stratified sampling was conducted based on the professional titles. All physicians with senior titles in second-level hospitals were surveyed, and 20% of physicians with intermediate and primary titles were sampled. All physicians with senior titles in CHC were surveyed, and 50% of the physicians with intermediate and junior titles were selected for this study.

Table 1
Comparison of districts D and F in 2017

	District D	District F
Household registration population (10,000 people)	96.7	113.9
GDP per capita (yuan/person)	232,386.30	125,332.70
General public budget expenditure (100 million yuan)	54.5	32.4
Per capita disposable income (yuan)	70,289	55,871
Number of health institutions	579	539
Beds per thousand population (zhang/thousand people)	11.6	9.3
Number of practicing (assistant) physicians per 1000 population (person/thousand population)	10.9	6.6
Registered nurses per thousand population (person/thousand population)	11.2	7.2
Number of patient visits (thousands)	21,463.90	10,112.90
Number of admissions (thousands)	398.7	197.1

Variable Selection And Questionnaire Exploration

Since there are no validated MA evaluation frameworks, this study developed a questionnaire based on extensive material summaries and interviews. The questionnaire was inspired by measurement tools of David J. Kolko¹⁷ and mainly referred to a comprehensive Performance Evaluation Index System of MAs proposed by the National Health Commission of China in 2018. After expert’s discussion and the previous study experience of the research group^{22,23}, this study included the four most important indexes from the evaluation index system as the evaluation indexes of MAs in this study: Degree of improvement in community residents' satisfaction, improvement in primary diagnosis at CHC and two-way referral, evaluation of information construction and evaluation of mutual recognition of medical examination results.

Then 10 personal in-depth interviews and 38 focus group interviews with hospital managers, directors and clinicians in the two districts were conducted by the semi-structured interview guidelines. Through interviews, we found that some physicians don't know what MA is. Besides, the interests of various

institutions are inconsistent, the workload of physicians is increased, satisfaction is poor, and the implementation effect is not as good as expected of MAs. Therefore, we included questions about physicians' personal conditions to the original questionnaire, including whether the establishment of MAs improved their workload, income and medical technology, to explore whether MAs are truly beneficial to physicians.

The questionnaire consists of 28 questions in four parts. The first part concerns sociodemographic characteristics (including 7 questions related to gender, age, education, etc.). The second part focuses on the physicians' cognition of and participation in MAs (including 12 questions about the cognition of MA policy and the degree of MA collaboration). The third part is physicians' evaluation of MAs (mainly including 4 questions related to, e.g., satisfaction and effect evaluation). The fourth part concerns the effect of MAs on physicians (mainly including 4 questions related to, e.g., the impact on workload and income from MAs after MA establishment). Finally, physicians need to recommend improvements to the MA.

Data Collection And Questionnaire Tests

This investigation was conducted anonymously to protect physicians' privacy and was approved by the Ethical Review Committee of Capital Medical University. Participation in the survey was completely voluntary and they can refuse to participate in or withdraw from the investigation. To ensure an effective recovery rate, we issued questionnaires through the administrative channel of the Beijing Municipal Commission of Health. This study distributed a total of 1047 questionnaires, of which 1032 were returned, for an effective recovery rate of 98.57%. Among them, 677 questionnaires were sent to district D, and 665 were returned. Furthermore, 370 questionnaires were distributed in district F, and 367 were returned. The effective return rates of the questionnaires sent to districts D and F were 98.23% and 99.19%, respectively. Reliability tests were performed on the basic information part and MA evaluation part; the Cronbach alpha coefficients were 0.663 and 0.702, respectively. The Kaiser-Meyer-Olkin (KMO) value was $0.749 > 0.6$. The sample met the requirements for an acceptable data structure, $p < 0.001$. Additionally, Bartlett's test of sphericity obtained passing results, and the total variance explained was 69.38%. In summary, this questionnaire has good reliability and validity.

Statistical analysis

The data were recorded twice using EpiData 3.1 and analyzed using SPSS 22.0. The age and seniority of physicians were demonstrated by means and standard deviation (SD). Descriptive statistical analysis was used to analyze the frequency of the questionnaire indicators. The Mann-Whitney U test was used for the single-factor statistical test.

Degree of improvement in community residents' satisfaction, improvement in primary diagnosis at CHC and two-way referral, evaluation of information construction and evaluation of mutual recognition of medical examination results as the measurement index of the construction effect of MAs. Factor analysis

is used to reduce the dimensions of the four evaluation indexes to integrate them into a new overall evaluation index. The new overall evaluation is calculated by the model as:

$$Y_{\text{overall}} = W_1 * X_1 + W_2 * X_2 \dots W_n * X_n \quad (1)$$

where $X_1, \dots, X_n$ represent the evaluation index of the construction effect of MAs and $W_1, \dots, W_n$ represent the weight of the index.

Multiple linear regression analysis was used to explore the factors that influence MAs. Regarding the definition of the variables, physicians' overall evaluation of MAs was the dependent variable. The independent variable consisted of three parts: cognition degree of MA policy, impact of MA construction on individuals (changes in professional, income and benefits and job satisfaction) and institutional characteristics (district and hospital level). Confounding factors were controlled by adding independent variables into the Multiple linear regression step by step, and $p < 0.05$ was considered statistically significant (Table 2).

Table 2
Variable definitions of multiple linear regression

Characteristics	Assignment
Gender	0 = female; 1 = male
Age, years	< 31 = 1; 31–40 = 2; 41–50 = 3; 51–60 = 4; >60 = 5
Educational level	Less than junior college = 1; undergraduate = 2; postgraduate = 3; Ph.D.=4; postdoctoral = 5
Positional title	Junior title = 1; intermediate title = 2; deputy senior title = 3; senior title = 4
Seniority, years	< 11 = 1; 11–20 = 2; 21–30 = 3; >30 = 4
Rehired after retirement	No = 0; yes = 1
The cognition of MAs policy	1 = do not understand very much; 2 = less understanding; 3 = general understanding; 4 = more understanding; 5 = high-level understanding
Professional competence	No improvement = 1, not obvious improvement = 2, average improvement = 3, good improvement = 4, significant improvement = 5
Income and benefits	Decrease = 1, not obvious improvement = 2, average improvement = 3, good improvement = 4, significant improvement = 5
Job satisfaction	Very dissatisfied = 1; somewhat dissatisfied = 2; neither satisfied nor dissatisfied = 3; somewhat satisfied = 4; very satisfied = 5
District	District D = 1; District F = 0
Hospitals Level	CHC = 0; Second-level hospitals = 1
Overall evaluation of MAs	-
Note: MAs represent medical alliances, CHC represents community health service center	

Results

Sociodemographic characteristic analysis

A total of 1032 physicians were surveyed. Two-thirds of the respondents were female. The mean (SD) age of the physicians was 40.15 (SD = 9.59) years, the average number of seniorities was 15.54 (SD = 10.55) years, and 56.88% of the physicians held a bachelor's degree. More than one-third (34.88%) of the physicians had an intermediate title, and only 4.65% of the physicians had been rehired after retirement (Table 3).

Table 3
Sociodemographic characteristics of the study sample (N = 1032)

Variable	Overall n (%)	Physicians in district F n (%)	Physicians in district D n (%)
Gender			
male	345 (33.43)	146 (39.78)	199 (29.92)
female	687 (66.57)	221 (60.22)	466 (70.08)
Age, years			
< 31	177 (17.15)	58 (15.80)	119 (17.89)
31–40	364 (35.27)	149 (40.60)	215 (32.33)
41–50	322 (31.20)	102 (27.79)	220 (33.08)
51–60	117 (11.34)	44 (11.99)	73 (10.98)
> 60	32(3.10)	8 (2.18)	24(3.61)
missing	20 (1.94)	6 (1.63)	14 (2.11)
Educational level			
college diploma or less	117 (11.34)	56 (15.26)	61 (9.17)
university diploma	587 (56.88)	176 (47.96)	411 (61.80)
master's degree	291 (28.20)	126 (34.33)	165 (24.81)
doctoral degree	22 (2.13)	8 (2.18)	14 (2.11)
postdoctoral	2 (0.19)	0 (0.00)	2 (0.30)
missing	13 (1.26)	1 (0.27)	12 (1.80)
Seniority, years			
less than 1 year	10 (0.97)	9 (2.45)	1 (0.15)
1–10	427 (41.38)	169 (46.05)	258 (38.80)
11–20	265 (25.68)	86 (23.43)	179 (26.92)
21–30	243 (23.55)	75 (20.44)	168 (25.26)
31–40	58 (5.62)	20 (5.45)	38 (5.71)
41–50	16 (1.55)	6 (1.63)	10 (1.50)
Over 50 years	1 (0.10)	0 (0.00)	1 (0.15)
missing	12 (1.16)	2 (0.54)	10 (1.50)

Variable	Overall n (%)	Physicians in district F n (%)	Physicians in district D n (%)
Positional title			
junior	307 (29.75)	113 (30.79)	194 (29.17)
intermediate	360 (34.88)	126 (34.33)	234 (35.19)
deputy senior	261 (25.29)	83 (22.62)	178 (26.77)
Senior	70 (6.78)	31 (8.45)	39 (5.86)
missing	34 (3.29)	14 (3.81)	20 (3.01)
Rehired after retirement			
yes	48 (4.65)	15 (4.09)	33 (4.96)
no	979 (94.86)	352 (95.91)	627 (94.29)
missing	5 (0.48)	0 (0.00)	5 (0.75)

The impact of MAs on individual physicians

Regarding the cognition degree of MA policy, 40% of the physicians in district D had better cognition degree, while district F had 24.25%. Regarding improvement in professional competence, 38.69% of the physicians in district F indicated "improved" and "significantly improved", while 51.43% of the physicians in district D indicated the same. With respect to improvement in income and benefits, 11.45% of the physicians in district F indicated "improved" and "significantly improved", while 11.88% of the physicians in district D indicated the same. In terms of job satisfaction, 26.15% of the physicians in district F indicated "extremely satisfied" and "relatively satisfied", while 33.09% of the physicians in district D indicated the same. The statistics results show that MAs in two districts had a certain impact on the cognition degree of MA policy and professional competence, income, benefits and job satisfaction of physicians (Table 4).

Table 4
The impact of MAs on individual physicians (N = 1032)

Variable	Overall n (%)	Physicians in district F n (%)	Physicians in district D n (%)	<i>P</i>	
The cognition of MAs policy					
poor	54 (5.23)	30 (8.17)	24 (3.61)	<i>p</i> < 0.05	
below average	333 (32.27)	152 (41.42)	181 (27.22)		
average	285 (27.62)	95 (25.89)	190 (28.57)		
above average	291 (28.20)	65 (17.71)	226 (33.98)		
excellent	64 (6.20)	24 (6.54)	40 (6.02)		
missing	5 (0.48)	1 (0.27)	4 (0.60)		
Degree of improvement in professional competence					<i>p</i> < 0.05
no improvement	70 (6.78)	37 (10.08)	33 (4.96)		
insignificant improvement	119 (11.53)	36 (9.81)	83 (12.48)		
neutral	326 (31.59)	138 (37.60)	188 (28.27)		
improvement	445 (43.12)	123 (33.51)	322 (48.42)		
significant improvement	39 (3.78)	19 (5.18)	20 (3.01)		
missing	33 (3.20)	14 (3.81)	19 (2.86)		
Improvement in income and benefits					<i>p</i> = 0.265
no improvement	197 (19.09)	81 (22.07)	116 (17.44)		
insignificant improvement	356 (34.50)	113 (30.79)	243 (36.54)		
neutral	332 (32.17)	120 (32.70)	212 (31.88)		
improvement	115 (11.14)	39 (10.63)	76 (11.43)		
significant improvement	6 (0.58)	3 (0.82)	3 (0.45)		

Variable	Overall n (%)	Physicians in district F n (%)	Physicians in district D n (%)	<i>P</i>
Missing	26 (2.52)	11 (3.00)	15 (2.26)	
Job satisfaction				
extremely unsatisfied	27 (2.62)	13 (3.54)	14 (2.11)	<i>p</i> = 0.007
relatively unsatisfied	38 (3.68)	10 (2.72)	28 (4.21)	
neutral	616 (59.69)	231 (62.94)	385 (57.89)	
relatively satisfied	287 (27.81)	82 (22.34)	205 (30.83)	
extremely satisfied	29 (2.81)	14 (3.81)	15 (2.26)	
missing	35 (3.39)	17 (4.63)	18 (2.71)	

Effect evaluation of MAs analysis

In terms of patient satisfaction, 76.09% of physicians in district D and 63.49% of those in district F had a positive evaluation. In terms of primary diagnosis at CHC and two-way referral, 73.09% of physicians in district D had a positive evaluation and 56.68% in district F. In terms of information construction, 64.97% of physicians in district D had a positive evaluation and 29.42% in district F. In terms of mutual recognition of medical examination results, 69.17% of physicians in district D had a positive evaluation and 51.22% in district F. According to the Mann-Whitney U test, there were statistically significant differences in the evaluation of various activities of MAs between the physicians in the two regions. District D had a higher evaluation in all items than district F (Table 5).

Table 5
Physicians' evaluations of MAs(N = 1032)

Variable	Overall n (%)	Physicians in district F n (%)	Physicians in district D n (%)	<i>P</i>
Degree of improvement in patient's satisfaction				
very good	74 (7.17)	33 (8.99)	41 (6.17)	<i>p</i> = 0.002
good	665 (64.44)	200 (54.50)	465 (69.92)	
no change	235 (22.77)	107 (29.16)	128 (19.25)	
not very good	34 (3.29)	12 (3.27)	22 (3.31)	
not good	16 (1.55)	9 (2.45)	7 (1.05)	
missing	8 (0.78)	6 (1.63)	2 (0.30)	
Improvement in primary diagnosis at CHC and two-way referral				
very good	72 (6.98)	28 (7.63)	44 (6.62)	<i>p</i> < 0.05
good	622 (60.27)	180 (49.05)	442 (66.47)	
no change	245 (23.74)	113 (30.79)	132 (19.85)	
not very good	61 (5.91)	27 (7.36)	34 (5.11)	
not good	23 (2.23)	14 (3.81)	9 (1.35)	
missing	9 (0.87)	5 (1.36)	4 (0.60)	
Evaluation of information construction				
very good	60 (5.81)	15 (4.09)	45 (6.77)	<i>p</i> < 0.05
good	477 (46.22)	90 (24.52)	387 (58.20)	
no change	234 (22.67)	75 (20.44)	159 (23.91)	
not very good	70 (6.78)	29 (7.90)	41 (6.17)	
not good	38 (3.68)	17 (4.63)	21 (3.16)	
know nothing	146 (14.15)	140 (38.15)	6 (0.90)	
missing	7 (0.68)	1 (0.27)	6 (0.90)	
Evaluation of mutual recognition of medical examination results				
very good	120 (11.63)	37 (10.08)	83 (12.48)	<i>p</i> < 0.05
good	528 (51.16)	151 (41.14)	377 (56.69)	
Note: Community health service centers is represented CHC.				

Variable	Overall n (%)	Physicians in district F n (%)	Physicians in district D n (%)	<i>P</i>
no change	213 (20.64)	63 (17.17)	150 (22.56)	
not very good	53 (5.14)	21 (5.72)	32 (4.81)	
not good	20 (1.94)	10 (2.72)	10 (1.50)	
know nothing	93 (9.01)	85 (23.16)	8 (1.20)	
missing	5 (0.48)	0 (0.00)	5 (0.75)	
Note: Community health service centers is represented CHC.				

The factor analysis method was used to analyze the data of the four effect evaluation dimensions of MAs, and the Kaiser-Meyer-Olkin (KMO) value was 0.674 and $p < 0.001$. Then, the weights of the variables were calculated through factor loading and eigenvalues. Finally, the overall evaluation was calculated by this model (Table 6). The mean of the overall evaluation was 6.85, and the standard deviation (SD) was 1.73.

Table 6
Factor analysis of effect evaluation of MAs(N = 1032)

Variable	Item	Factor loading	Eigenvalue	Proportional variance (%)	Cumulative variance (%)
X1	Degree of improvement in community residents' satisfaction	0.806	2.4000	59.992	59.992
X2	Improvement in primary diagnosis at CHC and two-way referral	0.792	0.867	21.676	81.668
X3	Evaluation of information construction	0.759	0.420	10.505	92.174
X4	Evaluation of inspection result mutual recognition of inspection results	0.739	0.313	7.826	100.000

$$Y_{\text{overall}} = 0.520421 * X1 + 0.511467 * X2 + 0.489718 * X3 + 0.477086 * X4 \quad (2)$$

Multiple linear regression analysis of overall effect evaluation of MAs

Physicians' evaluation of the overall effect of MAs was taken as the dependent variable of multiple linear regression. The effect of multicollinearity on the results was tested before performing regression. The

results showed that the variance inflation factor (VIF) values of each variable were less than 3, so there was no multicollinearity effect.

In order to evaluate the influencing factors of MAs, the factor of impact on physicians was included in model 1. Then, the cognition of MAs policy was included in model 2, and Sociodemographic characteristic and institutional characteristics were controlled in model 3. The model 3 analysis results showed that the seniority and age of physicians, the district, the cognition degree of MA policy, and impact on physicians affected the evaluation of MAs (Table 7).

Table 7

Multiple linear regression analysis of the physicians' overall effect evaluation of MAs (B, 95% CI, N = 1032)

Variable	Model 1	Model 2	Model 3
Impact on physicians			
professional competence	0.327(0.216–0.437)*	0.256(0.146–0.366)*	0.207(0.100-0.313)*
income and benefits	0.191(0.079–0.302)*	0.205(0.096–0.314)*	0.247(0.132–0.362)*
job satisfaction	0.382(0.236–0.527)*	0.345(0.202–0.487)*	0.259(0.119–0.398)*
The cognition of MAs policy		0.342(0.247–0.438)*	0.266(0.170–0.362)*
Sociodemographic characteristic			
gender			-0.092(-0.294-0.111)
age			0.031(0.003–0.058)*
educational level			-0.136(-0.305-0.032)
positional title			0.074(-0.219-0.072)
seniority			-0.034(-0.060–0.009)*
rehired after retirement			0.119(-0.424-0.663)
Institutional characteristic			
Hospitals Level			-0.088(-0.311-0.135)
District Level			1.229(1.028–1.430)*
Constants	4.119	3.412	3.050
The significance of model	< 0.001	< 0.001	< 0.001
R ²	0.140	0.181	0.288
F	54.355	55.145	31.434
Note: *P < 0.05. CHC represents a community health service center, and the regression results are shown as B (95% CI).			

Discussion

This study surveyed 1032 physicians in China, examined the implementation influencing factors of MAs, and explored physicians' views toward MAs. We found that only a fraction of physicians were satisfied(30.62%). Although physicians believed that MAs had effect on promoting the integration of medical resources, they have undertaken more work without additional compensation in MAs, and there were differences at the regional level.

The regression results show that whether physicians' benefit from MA will affect their evaluation. Specifically, the improvement of physicians' medical technology, the better income and benefits, and the higher degree of satisfaction are, the better the evaluation of MAs. The results of single factor analysis showed the same results and district D was better than that of district F. Because district D also invited third-party institutions to conduct comprehensive evaluations of the five MAs in the region each year and issued bonuses based on the evaluation results, directly stimulating the enthusiasm of hospitals and physicians. In addition, due to the rich medical resources in District D, help from core hospitals can greatly improve the medical service capacity of cooperative hospitals. The fact that highly competent physicians carry out visits and rounds in the cooperative hospitals of MAs will attract more patients and increase their trust. Moreover, the core hospitals often hold case discussions and academic conferences, greatly improving physicians' technical level and the number of patient visits at cooperative hospitals. Even core hospitals can help cooperative hospitals through disciplinary co-construction, joint participation in scientific research projects, and the establishment of two-way referral green channels.²⁴ Clearly, district F, which lacks well-known core hospitals, cannot achieve these outcomes. Therefore, physicians in F district were lower in the evaluation of improvement in professional competence, income and benefits than those in D area.

Although the main goal of MAs is centered on patients and to provide better medical services, another important purpose of MAs is often overlooked: improving the medical skills of physicians, especially in CHCs and second-level hospitals.²⁵ The improvement of physicians' medical technology will increase the number of services provided in these institutions and indirectly improve the income and benefits of physicians. The medical capacity of physicians has been improved in MAs, which is also conducive to promoting the formation of the first diagnosis and two-way referral of patients at the CHC and finally forming a virtuous cycle to improve the performance of the health system. Therefore, more attention should be paid to the opinion of physicians in MAs and focus on the personal development of physicians so that the effect of MAs can be better.²⁶

Then the results show that cognition degree of MA policies is the influencing factor of the implementation effect of MAs. Some Chinese studies have revealed that the cognition degree of MA policies by physicians will affect the implementation of policies. A study in Jiangsu, China, found that physicians' cognition degree of the policy was 61%, and the higher the policy cognition degree was, the higher the satisfaction with the MAs was.²⁷ Another study in Guangdong, China, found that physicians' cognition degree of the policy was 75.98%, and the higher the policy cognition degree was, the higher the support for MAs.²⁸ These results are consistent with this study. However, this result is rarely mentioned in

the international literature.^{29,30} As physicians are important stakeholders of the MA policy and the agent of patients, physicians' cognition will be indirectly passed on to patients and even affect patients' medical behavior (such as whether they are willing to receive the first diagnosis at CHC and be referred to the primary medical institution after recovery).³¹ Therefore, if physicians do not have a high understanding of policy, the supporting of MAs will be greatly reduced. Therefore, the healthcare departments should use various measurements to improve policy cognition degree.

Finally, region is the most important factor affecting MAs. Through an international literature review, regional characteristics have always been one of the important factors affecting the development of healthcare systems, and regional factors are more likely to be attributed to economic level and medical resource level.^{32–35} Due to the relatively developed economy of district D, investment in the health care system is relatively large, and there is better financial support for MAs. The informatization level of MAs in area D is obviously better than that in area F, which makes the cooperation between hospitals in District D more convenient. In summary, the operating conditions of MAs varies in different regions, and the government's financial investment is necessary, especially when the MA incentive mechanism is incomplete at present. For a district where medical resources are scarce, it is important to establish a unified management organization in MAs, to coordinate all resources within MAs.³⁶ In addition, the experience of District D reveals that the government should conduct an annual performance assessment of MAs and establish a reward and punishment system.

Strengths and Limitations

There are some strengths and limitations in this study. This study is based on the perspective of physicians, who are important stakeholders in the development of MAs. Through the overall evaluation of MAs by physicians, we find that medical service providers reflect the problems and provide scientific suggestions on the construction of MAs. However, MAs should be evaluated using a mature theoretical framework and included more comprehensive objective data. In this study, MAs were evaluated only from the perspective of physicians, but the evaluation should be multi-dimensional. Although this study contains some missing data, it still provides Chinese experience for the practice of international medical resource integration. Finally, the regional factors that affect MAs deserve further exploration, and many subregional factors need to be identified.

Conclusions

Physicians undertake more unpaid tasks in MAs, resulting in lower satisfaction. MAs in developed regions can stimulate the enthusiasm of physicians through extra rewards. Besides, the medical competence of physicians in small hospitals was improved with the help of physicians from large hospitals in the region, so physicians in these areas have better evaluations. The findings suggest that governments should focus on the personal development of physicians and improve their policy cognition to facilitate the implementation of MAs. In conclusion, the implementation of MAs varies in regions and developed regions have a more obvious effect on improving the implementation effect of MAs.

Abbreviations

MA

Medical Alliances, CHC:Community Health Service Center, SD:Standard Deviation, KMO:Kaiser-Meyer-Olkin, CI:Confidence Interval, VIF:Variance Inflation Factor

Declarations

Ethics approval and consent to participate

Participation in the survey was completely voluntary and their verbal informed consent was obtained. The respondent had the right to refuse to participate in or withdraw from the investigation. Anonymity, confidentiality and data protection were all guaranteed. The study was approved by the Ethical Review Committee of Capital Medical University (No. 2018SY95 and No. 2018SY96). In this study, data were collected only by questionnaires, and there was no use of the human body as a material for experiments or obtaining research data.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated or analyzed during the current study are available from the corresponding author on reasonable request. E-mail: mengkai@ccmu.edu.cn.

Competing interests

The authors declare that there are no competing interests.

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Authors' contributions

Each author complies with the *BMC health services research* standards for authorship. CSC and XZ conducted the investigation and data curation, performed the formal analysis, gathered resources and drafted the manuscript. YJW, XMF and JYS involved the investigation. KM initially proposed the concept and methodology of this study, made comments and helped modify the manuscript. KM was also responsible for project administration, funding acquisition and monitoring the article. All authors approved the final version of the manuscript.

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