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Does the reform of public hospitals' payment system increase the pay of medical personnel? A nationwide cross-sectional study

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Abstract

Background: The reform of public hospitals' payment system (RPHPS) is the focus of medical reform in China. The current medical personnel payment system was formulated under a framework including the whole public sector, and this cannot meet the demands of necessary reform. In 2017, the government piloted the RPHPS to raise the pay of medical personnel and mobilize their work enthusiasm. Here, we examine whether the RPHPS provides a way to influence the pay of medical personnel and examine the factors determining this pay.

Methods: This study used data from a cross-sectional survey of 699 public hospitals across 21 provinces of China in 2017, the China Public Hospitals Pay Reform Survey. We used a coarsened exact matching method and hierarchical linear analysis to enhance the comparability between groups. A total of 178,622 medical personnel were included in our study.

Results: We found that the RPHPS was significantly associated with total annual pay and annual performance pay. Those who worked in the treatment group had significantly higher total annual pay and annual performance pay than those in the control group. The pay of medical personnel was strongly associated with the average salary of an urban worker and the hospital type, and their gender, age, education status, work characteristics, position, professional titles, seniority in years and departments.

Conclusion: There was a strong relationship between the implementation of the RPHPS and the pay of medical personnel. From a policymaker perspective, this shows that there may be value in further promoting the development of the payment system in public hospitals. The government should scale up the piloted areas for RPHPS and

increase the total salary and the total performance-based wage-control level of public hospitals to reflect the value of the technical and labor services provided by medical personnel.

Keywords: the reform of public hospitals' payment system; medical personnel; total annual pay; annual performance pay; China

Background

As the core of new health reform, the payment system for medical personnel can directly induce a rapid behavioral response from physicians and influence the operation of public hospitals [1]. More recently, the pay of medical personnel, especially at major nonprofit hospitals, has come under the public spotlight [2]. Changing the payment system for physicians is one way to change provider behavior and achieve lasting improvements in patient outcomes [3]. From a policymaker perspective, one possible and intuitive way to retain medical personnel is to increase their income [4]. If the pay level stipulated by the state can meet the demands of doctors, this will effectively prevent a drain of physicians from public hospitals [5].

At the Mayo Clinic, physicians have been paid under structured pay schemes for more than 40 years, a system which aims to reinforce the fundamental value of the organization by eliminating financial incentives; it has no incentive plans, negotiations or bonuses, and non-wage compensation and benefits are consistent across locations and departments. By adhering to a wage-only model in which clinical and academic productivity are not specifically compensated, medical personnel are allowed to focus their intellectual energies on the benefits of the practice, research, education and management [6]. However, expense accounts and other allowances can serve as important supplements for base salary. In the UK, the NHS uses financial incentives in the context of the overall Quality and Outcomes Framework. This incentive scheme involves an annual bonus paid to a physician according to their observed levels of performance and is based on cumulative scores across all dimensions [7].

The pay of medical personnel in Chinese public hospitals is generally calculated using a post-merit-based payment system. This mainly consists of four parts: post salary, salary scale, performance-based pay and allowances. However, the current salary system for medical personnel was formulated under a framework considering the whole of the public sector, which implements the same standards as other public institutions and fails to reflect the specific labor value of medical personnel [4]. In addition, it has been noted that the assessment mechanism is not reasonable and the low level of pay may affect the work efficiency and satisfaction of medical personnel [8]. Therefore, to reach their desired income, some physicians have been found to engage in supernormal prescription, which leads to a prevalence of grey income and induced demand [9]. These are problems that can affect the quality and efficiency of medical services.

To improve the working enthusiasm of medical personnel, their professional identity and the quality of the medical services they provide, Xi Jinping, the General Secretary of China, proposed the "two allowances" policy in August 2016, which sets out the direction for reform of the payment system in public hospitals. Firstly, this allows medical and health institutions to break through the current wage-control level of public institutions; secondly, it allows medical service income to be used for personnel rewards after deducting costs and withdrawing various funds according to regulations. In January 2017, the Ministry of Human Resources and Social Security, the National Health Commission and other ministries jointly issued guidelines on the pilot reform of the public hospitals' payment system, marking the official launch of the reform of public hospitals' payment system (RPHPS) [10]. In 2018, the government issued a notice regarding the expansion of the pilot of the RPHPS, proposing that provinces (autonomous regions and municipalities directly under the central government) further expand the scope of the pilot in light of local conditions. The RPHPS includes features such as steadily increasing the pay level of medical personnel and optimizing the pay structure of public hospitals.

Despite the importance of RPHPS in China, very little is known about whether it is actually increasing the pay of medical personnel. Existing studies have focused on the theoretical analysis [9], but empirical scientific research has been limited. While empirical studies have attempted to investigate the effect of the RPHPS at the provincial-level [11, 12], evaluation of the payment of medical personnel using nationwide data has not been explored. Moreover, researchers often analyze data relating to physicians using single-level regression models [13]; however, these datasets have hierarchical structures, such as medical personnel being grouped within hospitals, that single-level models fail to account for [14]. To address this knowledge gap, we evaluated whether the implementation of the RPHPS is associated with the pay of medical personnel and examined factors that could potentially influence pay at the national level using a hierarchical linear model. This work provides a scientific basis for further improvements in the structure of the RPHPS.

Methods

Study design and setting

This study was an observational, cross-sectional, survey-based study conducted in 2017. We compared the salary gap between the first batch of pilot hospitals' medical personnel and the expanded pilot hospitals' medical personnel for the year 2017. The first batch of pilot hospitals is in the treatment group because they were subject to the RPHPS in 2017, while the expanded pilot hospitals were included as the control group because they did not implement the RPHPS until 2018.

Data sources and study sample

The data were derived from the China Public Hospitals' Payment Reform Survey, which was conducted by the Department of Personnel of the Health Commission and the Health Development Research Centre in 2017 and 2018. The 2018 cross-sectional survey was conducted in 699 public hospitals across 21 provinces of China. A multistage stratified cluster-sampling method was used in our study. First, 188 cities were selected according to the list of cities in the first RPHPS pilot and the list of cities in the expanded pilot. Second, 699 hospitals within those towns were selected according to the list of hospitals in the first RPHPS pilot and the list of cities in the expanded pilot. Finally, all health workers were selected from each public hospital, representing a total of 562,616 people.

We used the "Health Workers' Salary Questionnaire" to obtain the data, which collected both salary data and demographic information. The questionnaires were filled out by the staff in charge of the finance department of each hospital and sent back via email. Demographic data included the hospital type and hospital level to which the medical personnel belonged, and their gender, age, education status, work characteristics, position, professional titles and departments. Payment data included each individual's total annual pay, annual performance pay, annual base pay, annual allowance pay and annual other pay. For the study sample, we chose medical personnel who had obtained practicing certificates and who were working in a clinical medical technical post, including physicians, registered nurses, pharmaceutical personnel and laboratory staff. In this study, for the final sample before coarsened exact matching (CEM) (Figure 1), 71,724 such people were identified in the first batch of the pilot group, and 110,492 were identified in the expanded pilot group.

[Insert Figure 1 about here]

Measurements

Dependent variables

We used the pay of medical personnel as the outcome, and this was the main subject of the evaluation of the payment reform. This was measured via total annual pay and annual performance pay in RMB yuan, which can intuitively illustrate the impact of the RPHPS on pay.

Independent variables

The main independent variable was group, accounting for whether or not the RPHPS had been implemented. The first batch of pilot hospitals implemented the reform in 2017, and these formed the treatment group; the expanded pilot hospitals implemented the reform in 2018, and these formed the control group. In light of the existing literature, we chose control variables for the province-level, hospital-level and individual-level. For the province-level, we controlled for the gross domestic product (GDP) per capita (10 000 RMB yuan) and the average pay of an urban worker (10 000 RMB yuan). The hospital type and hospital level were used as variables that reflect hospital features. Demographic variables included gender, age, education status, work characteristics, position, professional titles and departments.

[Insert Table 1 about here]

Statistical analyses

Coarsened exact matching

A rough comparison of salaries between the first pilot group and the expanded pilot group would ignore the fact that there may be other potential confounding characteristics in the groups. Therefore, we employed the CEM method, a new technique for making valid causal inferences and guaranteeing balance between matched treatment and control groups [15]. The multivariate imbalance measure $L1$ was used for balance checking before and after matching. The values of $L1$ range from 0 (completely balanced) to 1 (completely unbalanced), with 0 indicating that the data from the two comparison groups are completely balanced and 1 indicating that the data are completely unbalanced [16]. If the value of $L1$ is reduced after matching, this indicates that the level of matching has been improved.

Hierarchical linear model

To characterize the matching results, we summarized the provincial characteristics, hospital characteristics and medical personnel demographic characteristics of the two groups and compared them using a Student's *t*-test for continuous variables and a chi-squared test for categorical variables. All analyses were performed using Stata 14.0 (StataCorp, College Station, TX, USA). All tests were two-tailed, and we considered a *p*-value less than 0.05 to be statistically significant.

Since the data used in this study were collected by stratified sampling, the dependences between samples originated from multiple levels. We employed pooled medical-personnel-level survey data, hospital-level survey data and provincial-level information to estimate micro and macro effects. Multilevel models, also known as hierarchical linear models, do not assume independence and are employed specifically to analyze multilevel datasets [14]. Hierarchical linear models are powerful statistical tools and are the preferred method for processing hierarchical data [17]. Before applying the method, the intraclass correlation coefficient (ICC) was used to check the validity of our hierarchical linear model [18]. The ICC measures the degree of correlation among observations within a cluster and ranges between 0 and 1. If the value of the ICC is 0, there are no clustering effects, and if ICC is greater than 0, a hierarchical linear model is appropriate for the analysis. This is calculated using

$$\mathrm{ICC} = \frac{\sigma_{u0}^2}{\sigma_{u0}^2 + \sigma_{e0}^2} \tag{1}$$

where σ_{u0}^2 is the variance of the clusters and σ_{e0}^2 is the variance of the observations.

Multilevel linear regression models are increasingly popular and are the preferred method for finding the relationships between an outcome and independent variables at different levels of multilevel data. Multilevel linear regression analysis was conducted using the natural logarithms of the annual total salary and the annual performance salary values as the dependent variables, which can more accurately reflect the distribution of the salaries of medical personnel [19]. The three levels of multiple linear regression model were calculated using [18]

$$y_{ijk} = \beta x_{ijk} + \gamma \omega_{jk} + \eta z_k + \mu_{jk} + \nu_k, \tag{2}$$

where y_{ijk} is the continuous outcome; x_{ijk}, ω_{jk} and z_k represent the independent variables of level 1, level 2, and level 3, respectively; β, γ and η represent the fixed regression coefficients of the explanatory variables at level 1, level 2 and level 3, respectively; and μ_{jk} and ν_k are multilevel residuals.

Results

Coarsened exact matching

Values of $L1$ and mean statistics are displayed in Table 2. After matching the samples of the treatment group and the control group, the values of $L1$ for the samples and all variables between the treatment group and the control group were all close to zero and were much lower than those before matching. This indicates that the matching between the groups was good, and the two groups became more comparable in the baseline. Therefore, the CEM succeeded in balancing the covariates among the two groups. As shown in Table 2, a total of 178,622 medical personnel were included in the final sample after matching.

[Insert Table 2 about here]

Descriptive analysis and average annual pay

Table 3 lists the distribution of the provincial characteristics, hospital characteristics and medical personnel characteristics and compares summary statistics of the treatment and control groups. The final sample included 69,862 medical personnel in the treatment group and 108,760 medical personnel in the control group. It can be seen that the majority of staff were from tertiary general hospitals. More than half of these were female, were 31-44 years old, were establishment staff, had a college degree, had a primary professional title, were general staff, were in clinical departments and had more than 31 years of working experience. In addition, results after matching showed that there were no statistically significant differences in the characteristics of the two groups at the three levels.

Table 4 reports summary statistics of the outcome variables for the total sample, treatment group and control group. The mean (SD) total annual pay and annual performance pay among the hospital medical personnel were 108,334.10 (55,074.39) RMB yuan and 61,258.57 (46,035.35) RMB yuan, respectively. On average, the total annual pay and average annual performance pay of the treatment group were higher than the control group, as shown in Figure 2.

[Insert Table 3, Table 4 and Figure 2 about here]

Hierarchical linear model estimates

With total annual pay and annual performance pay as the dependent variables, the fitted results of the three-level empty model showed that the ICC values were 0.092 and 0.281 at the provincial-level and 0.491 and 0.715 at the hospital-level, respectively. The results show that the data have the characteristics of a hierarchical structure, indicating that the selected hierarchical linear model was appropriate for the study. The results from the empty model are presented in Table A in the Appendix.

[Insert Table A about here]

Based on these analyses, our results indicated that, in comparison with medical personnel who worked in the control group, those who worked in the treatment group had significantly higher total annual pay and annual performance pay. A positive association was observed between the average earnings of an urban worker and total annual pay, and the mean change in total annual pay per unit of the average earnings of an urban worker is 2.286 ($p < 0.001$). We also found that medical personnel working in traditional Chinese medicine hospitals ($p < 0.001$) and specialized hospitals ($p < 0.001$) had significantly lower total annual pay and annual performance pay than those working in general hospitals. Furthermore, in the multilevel linear regression analysis, medical personnel who were male, were older than 31 years, were establishment staff, had a junior college or university education, had professional titles, were section leaders or hospital managers, or had seniority > 11 years had significantly higher total annual pay and annual performance pay than their counterparts. It was also found that logistics departments, administrative departments and other departments had significantly lower total annual pay and annual performance pay than clinical departments.

[Insert Table 5 about here]

Discussion

An important contribution of our study is that we provide, to our knowledge, the first empirical research that directly analyses the relationship between the RPHPS and the pay of medical personnel. There are three interesting findings. First, the average total annual pay and the average annual performance pay among hospital medical personnel were 108,334.10 RMB yuan and 61,258.57 RMB yuan, respectively. Secondly, the implementation of RPHPS was a significantly positive contributor to pay levels. Third, the hospital type and the gender, age, education status, work characteristics, position, professional titles and seniority level were factors that appeared to influence the pay of medical personnel in China.

The pay values established in this study were consistent with the average total annual pay of physicians in China. The average total annual pay of 108,334.10 RMB yuan (US$15,448) uncovered for Chinese medical personnel in our investigation is close to the figure reported for those working in Chinese public tertiary hospitals in 2015, which was 96,414.07 RMB yuan (US$13,764) [13]. However, the average total annual pay found in our research was far lower than those reported in England, Canada and Brazil. In England, a hospital consultant's starting salary is £75,000 (US$95,625) a year, rising gradually to £101,000 (US$128,775) after 19 years [4]. In Canada, it has been reported that physicians earned approximately US$130,000 in 2005 [20]. For physicians in Brazil, almost 80% of women were still concentrated in the monthly wage bracket of US$3857–US$7175 in 2014, which is also greater than the earnings of medical personnel in our survey [21].

However, we found some interesting evidence that the implementation of RPHPS had a significantly positive influence on pay. The RPHPS played an important role in increasing medical personnel's total annual pay and annual performance pay, which is in line with the aim of the RPHPS. As most previous studies did not use national data or a hierarchical linear model to examine the effects of the RPHPS, the results of the current study provide rich information about this very important consideration. These findings are consistent with evidence from Sichuan Province and Fujian Province, which found that the RPHPS had achieved initial positive effects; specifically, the pay level of doctors has been significantly improved and the pay structure has gradually been optimized after the implementation of the RPHPS [12, 22].

There are several plausible explanations for our findings. First, medical and health institutions have increased the total pay and the total performance-based wage control level of public hospitals, which is of great significance to improving physicians' total pay and performance pay. Second, the RPHPS allows medical income to be used mainly for personnel incentives after deducting expenses and withdrawing funds in accordance with regulations. This provides an economic incentive for medical personnel, playing an important role in increasing their performance pay, encouraging them to improve their work enthusiasm and service quality and reduce induced-demand behavior. These findings also apply to international settings. While most studies examining the impact of pay-for-performance schemes have considered turnover intention [23], patients' health or physicians' satisfaction [24], few have specifically studied the resulting changes in physicians' pay. This finding is in line with the evidence from another study, which considered a structured compensation model that was successfully applied to all physicians at a multisite large academic medical system and may have resulted in pay equity [6]. The findings also align with UK research that found that a proposed new contract payment structure could lead to the pay rise for junior doctors with the most onerous shifts but did not provide much financial compensation for junior doctors who work every other weekend [25]. Third, the pay of medical personnel was strongly associated with the average salary of an urban worker and the hospital type, and the worker's gender, age, education status, work characteristics, position, professional titles, seniority and departments, which is consistent with previous studies [26].

The average earnings of an urban worker, which reflects the overall level of pay in a country, can affect the average pay of medical personnel [13]. A growing body of estimates has demonstrated that there are gender disparities and inequities in compensation, and male physicians tend to earn more than women [27]. These findings run counter to the results obtained from a previous study into a structured compensation model, where gender was found to have no interaction with pay among doctors who earned more than expected or those who earned less than expected [6]. Results from previous studies also suggest that the pay of nurses with more than 18 years' experience is higher than the pay of those with 0 years of experience [28]. Moreover, several studies have also reported that another factor affecting physicians' pay is their designated leadership roles, such as department or division chair or enterprise director positions, and the pay of hospital management frequently exceeds that of most physicians [29]. The findings are also consistent with research that found that differences in speciality and work characteristics are important in explaining differences in pay [30].

The current study has several limitations. First, due to it being a cross-sectional study, we were unable to ascertain causal interpretations between the implementation of RPHPS and the pay of medical personnel. This could be addressed by future follow-up studies. Second, because of data limitations, we had no information on the total hospital revenue or the personnel expenditure as a proportion of total hospital expenditure, which may lead to bias from these omitted variables. However, variables relating to province features, hospital features and individual characteristics were used to offer more information.

Conclusion

The finding that there is a strong relationship between the implementation of RPHPS and an increase in the pay of medical personnel is interesting for policymakers. The pay was found to be strongly associated with the average salary of an urban worker and the hospital type, and the worker's gender, age, education status, work characteristics, position, professional titles, seniority and departments. From the government perspective, there may be value to further promoting the development of the payment system in public hospitals. Policy measures may include scaling up the piloted area of the RPHPS, increasing the total pay and the total performance-based wage control level of public hospitals, and improving incentives and restraint mechanisms to reflect the value of technical and labor services provided by medical personnel.

List of abbreviations

Reform of public hospitals' payment system (RPHPS); coarsened exact matching (CEM); intraclass correlation coefficient (ICC); gross domestic product (GDP).

Declarations

Ethical approval and consent to participate

Not applicable.

Consent to publication

Not applicable.

Availability of data and materials

These data were drawn from the China Public Hospitals' Payment Reform Survey, which is not open to everyone. Researchers who want to use the data should contact Yong Dang (dangyong@126.com).

Competing interests

The authors declare that they have no other competing interests.

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Authors' contributions

YXZ conceptualized the research idea, conducted the analysis and wrote-up the manuscript. YD and YXZ contributed to the analysis and interpretation of data. HY, ZCW and ZLZ made substantial contributions to the study design and critically edited. All authors read and approved the final manuscript.

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Figures, tables and additional files

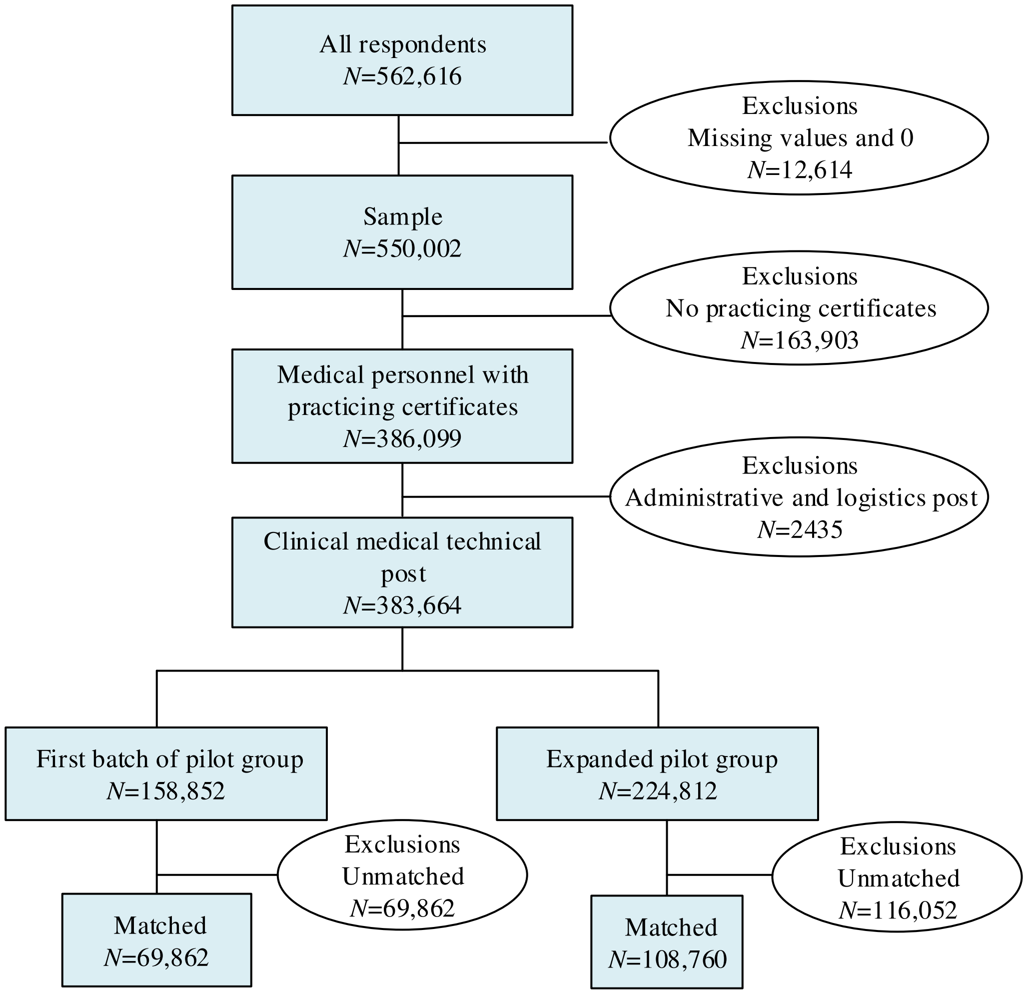

Figure 1. Study sample selection schema

Table 1. Variable definitions

Variable	Type of variable	Description of variable
Independent variables		
Group	Binary variable	0 = Control group, reference; 1 = Treatment group
Provincial level		
GDP per capita (10 000 RMB yuan)	Continuous variable	Continuous variable
Average pay of an urban worker (10 000 RMB yuan)	Continuous variable	Continuous variable
Hospital level		

Hospital level	Categorical variable	0 = Ungraded hospitals, reference; 1 = Secondary hospitals; 2 = Tertiary hospitals
Hospital type	Categorical variable	0 = General hospital, reference; 1 = Traditional Chinese medicine hospital; 2 = Specialized hospital
Individual level		
Gender	Binary variable	0 = Female, reference, 1 = Male
Age (years)	Categorical variable	0 = ≤30, reference; 1 = 31–44; 2 = ≥45
Education status	Categorical variable	0 = Junior High School, reference; 1 = Junior College; 2 = University; 3 = Masters and above
Work characteristics	Categorical variable	0 = Non-establishment staff, reference; 1 = Establishment staff
Position	Categorical variable	0 = General staff, reference; 1 = Section leader; 2 = Hospital manager
Professional titles	Categorical variable	0 = No title, reference; 1 = Primary professional title; 2 = Intermediate title; 3 = Associate senior title; 4 = Senior title
Seniority (years)	Categorical variable	0 = ≤10, reference; 1 = 11–20; 2 = 21–30; 3 = ≥31
Departments	Categorical variable	0 = Clinical departments, reference; 1 = Medical detection departments;

		2 = Logistics departments;
		3 = Administrative departments;
		4 = Other departments
Dependent variables		
Total annual pay (RMB yuan)	Continuous variable	Continuous variable
Annual performance pay (RMB yuan)	Continuous variable	Continuous variable

Table 2. The L1 measure of imbalance before and after coarsened exact matching

Variables	Before matching	After matching
	*L*1 (mean)	*L*1 (mean)
ln (GDP per capita)	0.580 (-0.072)	0.002 (0)
ln (Average pay of an urban worker)	0.653 (-0.025)	0.010 (-0.001)
Hospital level	0.062 (-0.055)	0 (0)
Hospital type	0.036 (0.024)	0 (0)
Gender	0.015 (0.015)	0 (0)
Age	0.028 (-0.048)	0 (0)
Work characteristics	0.008 (-0.008)	0 (0)
Education status	0.041 (-0.016)	0 (0)
Professional titles	0.017 (-0.060)	0 (0)
Position	0.010 (-0.009)	0 (0)
Seniority (year)	0.018 (-0.042)	0 (0)
Departments	0.029 (0.099)	0 (0)
Multivariate *L*1	0.799	0.010
N	383,664	178,622

The parameter *L1* here is *the measured value of L1j, which is the calculated value of L1 for the jth* separate *variable. The* means are shown *in parentheses* to illustrate their differences.

Table 3. Descriptive Statistics for control variable after coarsened exact matching

Control variable	Control group	Treatment group	*p*
Provincial level			
ln (GDP per capita) (10 000 RMB yuan)	1.53 (0.17)	1.53 (0.17)	0.500
ln (Average pay of an urban worker) (10 000 RMB yuan)	1.88 (0.06)	1.88 (0.06)	0.238
Hospital level			
Hospital level			
Unrated	246 (0.23)	158 (0.23)	0.996
Secondary hospitals	12,264 (11.28)	7878 (11.28)	
Tertiary hospitals	96,249 (88.50)	61,826 (88.50)	
Hospital type			
General hospital	93,800 (92.93)	61,171 (92.93)	0.998
Traditional Chinese medicine hospital	6331 (6.27)	4129 (6.27)	
Specialized hospital	808 (0.80)	528 (0.80)	
Individual level			
Gender			
Female	85,155 (78.30)	54,700 (78.30)	0.998
Male	23,604 (21.70)	15,162 (21.70)	
Age			
<30	41,304 (37.98)	26,532 (37.98)	1.000
31–44	49,070 (45.12)	31,520 (45.12)	
≥45	18,385 (16.90)	11,810 (16.90)	
Work characteristics			
Non-establishment staff	51,890 (47.71)	33,332 (47.71)	1.000
Establishment staff	56,869 (52.29)	36,530 (52.29)	
Education status			
Junior high school	4782 (4.40)	3072 (4.40)	0.999
Junior college	32,154 (29.56)	20,654 (29.56)	
University	59,857 (55.04)	38,449 (55.04)	

Master and above	12,106 (11.00)	7686 (11.00)	
Professional titles			
No title	3149 (2.90)	2024 (2.90)	0.999
Primary professional title	57,292 (52.81)	36,827 (52.81)	
Intermediate title	32,785 (30.22)	21,074 (30.22)	
Associate senior title	11,411 (10.52)	7335 (10.52)	
Senior title	3841 (3.54)	2469 (3.54)	
Position			
General staff	98,888 (90.92)	63,521 (90.92)	0.999
Section leader	9626 (8.85)	6183 (8.85)	
Hospital manager	246 (0.23)	158 (0.23)	
Sections			
Clinical departments	90,837 (83.52)	58,349 (83.52)	0.997
Medical detection departments	12,846 (11.81)	8252 (11.81)	
General Affairs/Logistics departments	123 (0.11)	79 (0.11)	
Administrative departments	2402 (2.21)	1543 (2.21)	
Other departments	2551 (2.35)	1639 (2.35)	
Seniority (years)			
<10	12,196 (11.21)	7834 (11.21)	1.000
11–20	27,536 (25.32)	17,687 (25.32)	
21–30	21,659 (19.91)	13,913 (19.91)	
≥31	47,369 (43.55)	30,428 (43.55)	
N	108,760	69,862	

Continuous variables are shown as mean *(SD)* and *categorical* variables are shown as *N* (%).

Table 4. Summary statistics for outcome variables

Outcome variable	Obs.	Mean	Std. Dev.	Min.	Max.
Total sample					
Total annual pay (RMB yuan)	178,622	108,334.10	55,074.39	17,832.00	291,842.90
Annual performance pay (RMB yuan)	178,622	61,258.57	46,035.35	0	223,299.80
Treatment group					
Total annual pay (RMB yuan)	69,862	119,708.80	56,484.26	17,832.00	291,842.90
Annual performance pay (RMB yuan)	69,862	70,996.50	48,429.14	0	223,299.80
Control group					
Total annual pay (RMB yuan)	108,760	101,027.60	52,874.28	17,832.00	291,842.90
Annual performance pay (RMB yuan)	108,760	55,003.41	43,289.49	0	223,299.80

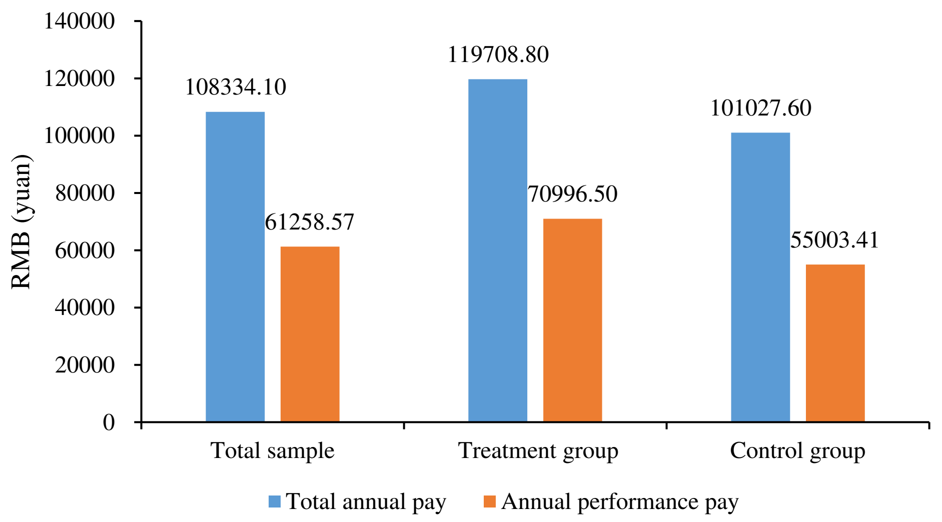

Figure 2. The pay of medical personnel for different groups

Table 5. Multilevel linear analysis of factors associated with medical personnel pay

	ln (Total annual pay)		ln (Annual performance pay)	
	Coeff. (SD)	95%CI	Coeff. (SD)	95%CI
Fixed effects				
Group	0.068 (0.030)**	(0.008, 0.127)	0.186 (0.072)***	(0.044, 0.327)

ln (GDP per capita) (10 000 RMB yuan)	-0.229 (0.095)**	(-0.415, -0.041)	0.202 (0.404)	(-0.590, 0.994)
ln (Average pay of an urban worker) (10 000 RMB yuan)	2.286 (0.293)***	(1.712, 2.859)	1.865 (1.244)	(-0.572, 4.302)
Secondary hospitals	-0.234 (0.035)***	(-0.302, -0.165)	-0.334 (0.052)***	(-0.436, -0.231)
Tertiary hospitals	0.018 (0.045)	(-0.070, 0.106)	-0.032 (0.104)	(-0.235, 0.172)
Traditional Chinese medicine hospital	-0.206 (0.036)***	(-0.275, -0.136)	-0.360 (0.039)***	(-0.436, -0.283)
Specialized hospital	-0.084 (0.028)***	(-0.138, -0.028)	-0.132 (0.060)**	(-0.249, -0.014)
Male	0.043 (0.007)***	(0.028, 0.057)	0.063 (0.012)***	(0.040, 0.085)
31–44 (years)	0.114 (0.014)***	(0.086, 0.141)	0.127 (0.019)***	(0.091, 0.161)
≥45 (years)	0.193 (0.013)***	(0.167, 0.218)	0.066 (0.015)***	(0.036, 0.094)
Establishment staff	0.103 (0.018)***	(0.067, 0.137)	0.035 (0.019)*	(-0.001, 0.071)
Junior College	0.014 (0.009)*	(-0.002, -0.031)	0.047 (0.023)**	(0.001, 0.091)
University	0.069 (0.015)***	(0.039, 0.099)	0.103 (0.024)***	(0.055, 0.150)
Masters and above	0.029 (0.008)**	(0.012, 0.044)	0.032 (0.022)	(-0.011, 0.075)
Primary professional title	0.418 (0.095)***	(0.233, 0.603)	0.513 (0.150)***	(0.219, 0.805)
Intermediate title	0.569 (0.094)***	(0.384, 0.752)	0.676 (0.146)***	(0.391, 0.961)
Associate senior title	0.728 (0.972)***	(0.537, 0.918)	0.843 (0.145)***	(0.559, 1.125)
Senior title	0.858 (0.102)***	(0.657, 1.058)	0.993 (0.146)***	(0.706, 1.279)

Section leader	0.118 (0.018)***	(0.083, 0.152)	0.156 (0.013)***	(0.129, 0.183)
Hospital manager	0.293 (0.038)***	(0.218, 0.367)	0.381 (0.046)***	(0.291, 0.471)
Medical detection departments	0.005 (0.014)	(-0.002, 0.031)	0.002 (0.018)	(-0.032, 0.036)
General Affairs/Logistics departments	-0.060 (0.025)**	(-0.109, -0.009)	-0.148 (0.033)**	(-0.213, -0.083)
Administrative departments	-0.116 (0.020)***	(-0.154, -0.076)	-0.196 (0.040)***	(-0.273, -0.117)
Other departments	-0.154 (0.025)***	(-0.203, -0.104)	-0.277 (0.056)***	(-0.385, -0.168)
11–20	0.194 (0.041)***	(0.114, 0.273)	0.222 (0.051)***	(0.122, 0.321)
21–30	0.210 (0.053)***	(0.106, 0.313)	0.243 (0.060)***	(0.124, 0.360)
≥31	0.226 (0.053)***	(0.122, 0.329)	0.273 (0.056)***	(0.162, 0.383)
Random effects				
Level 3	0.004 (0.004)***	(0.001, 0.021)	0.137 (0.076)***	(0.008, 0.127)
Level 2	0.078 (0.008)***	(0.062, 0.096)	0.345 (0.068)***	(0.008, 0.127)
Observation	178,622	178,622	178,622	178,622

*Significance level: *p < 0.1; **p < 0.05;***p < 0.01.*

Table A. Three-level empty model of factors associated with salary

	ln (Total annual pay)		ln (Annual performance pay)	
	Coeff. (SD)	95%CI	Coeff. (SD)	95%CI
Fixed effects				
Constant	11.359 (0.050)***	(11.259, 11.462)	10.357 (0.136)***	(10.104, 10.639)
Random effects				
Level 3	0.028 (0.013)***	(0.015, 0.058)	0.257 (0.116)***	(0.083, 0.696)
Level 2	0.120 (0.009)***	(0.094, 0.152)	0.397 (0.030)***	(0.264, 0.599)
Residual	0.153 (0.001)***	(0.114, 0.194)	0.261 (0.001)***	(0.210, 0.290)
Observation	178,622	178,622	178,622	178,622

*Significance level: *p < 0.1; **p < 0.05; ***p < 0.01.*

Figures

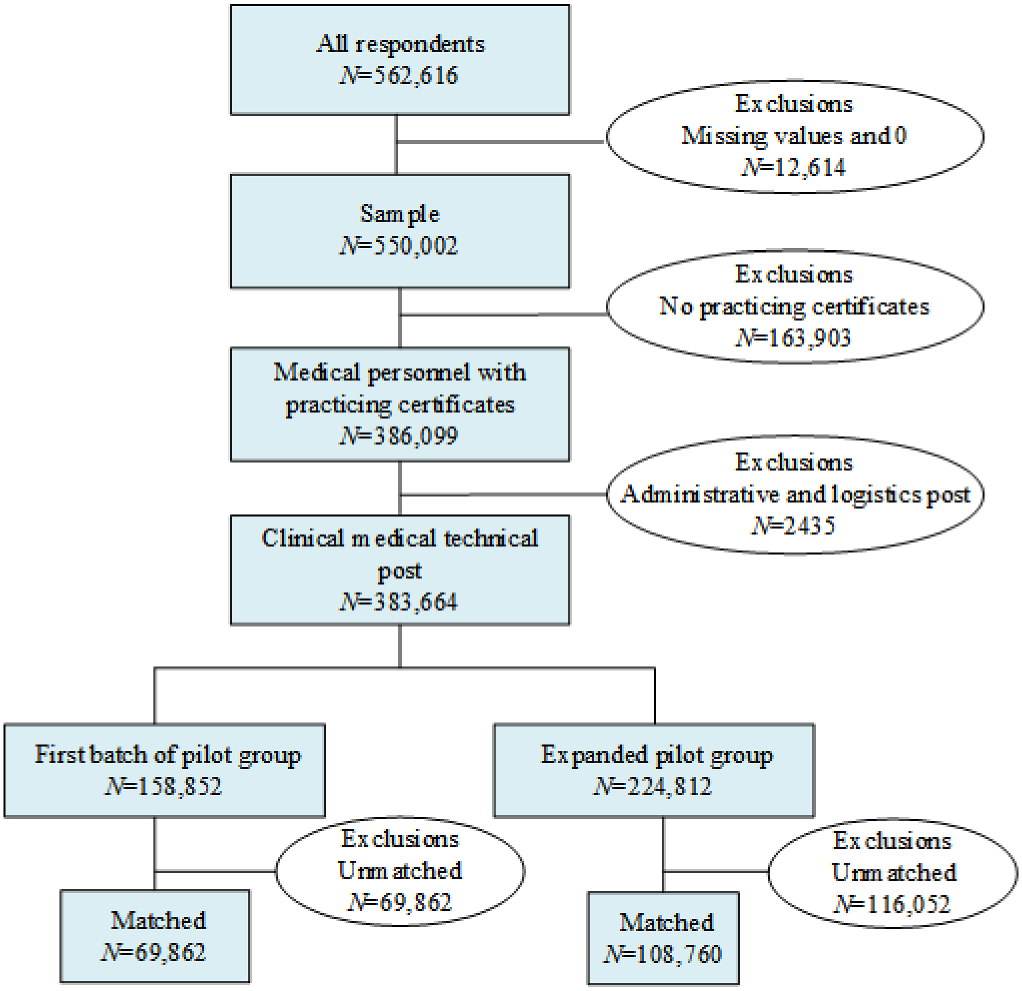

Figure 1

Study sample selection schema

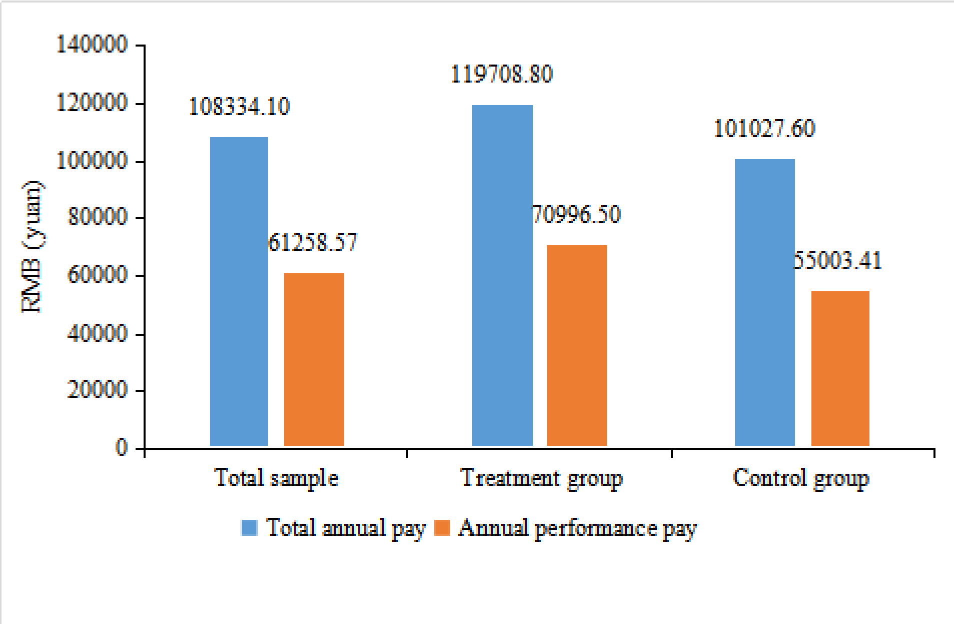

Figure 2

The pay of medical personnel for different groups

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix.docx