

# Evaluation of the Effect of the Capitation Compensation Mechanism among Tuberculosis Patients with a Full Period of Treatment

xingyu hu

Capital Medical University

guangying gao (✉ [gaoguangying@yeah.net](mailto:gaoguangying@yeah.net))

Capital Medical University

---

## Research Article

**Keywords:** tuberculosis, payment method, capitation, bundle payment, evaluation

**DOI:** <https://doi.org/10.21203/rs.3.rs-138235/v1>

**License:**   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

---

# Abstract

**Background:** To explore the compensation mechanism for pulmonary tuberculosis patients with a full period of treatment, to alleviate the financial burden of pulmonary tuberculosis patients and to provide a reference and basis for the reform of tuberculosis payment methods in other regions and countries.

**Methods** The funding operations of medical insurance institutions and the actual operating expenses of pilot hospitals from the Dehui Tuberculosis Hospital in Jilin Province were collected from the first half of 2015 to the first half of 2018, and the operational effects were analysed through quantitative and qualitative methods.

**Results** After implementing the compensation mechanism, the medical expenses of tuberculosis patients decreased significantly, and the economic burden of the disease was reduced; the hospital's medical service capacity was improved, and internal management was significantly improved; and the medical insurance fund did not experience overspending, thus leading to a "triple win-win" situation.

**Conclusion** The capitation compensation mechanism with a full period of treatment is a suitable payment method for TB diagnosis and treatment, and its effect is obvious, achieving a "triple win-win" for medical insurance, hospitals and patients. It is recommended to continue to promote this model to effectively reduce the financial burden of tuberculosis patients. However, in the early stage of the implementation of the plan, due to the relatively low understanding of the reform of hospitals and patients, there will be patient loss and poor compliance. Therefore, the hospital should change the management concept, incorporate the goal of payment method reform into performance management, and require all patients to be included in the treatment path to achieve standardized management of the entire treatment process. This mechanism also provides a reference for the reform of payment methods for tuberculosis in other regions or countries.

## Background

The World Health Organization "Global Tuberculosis Report 2019" pointed out that in 2018, an estimated 10 million people worldwide suffered from tuberculosis, and approximately 1.2 million people died. China is the world's second-largest country and has a high burden of tuberculosis [1]. According to China CDC statistics, the number of tuberculosis cases in the country in 2018 was 823342, accounting for 10.6% of the total number of infectious disease cases (ranking third in infectious disease). The number of tuberculosis deaths was 3149, accounting for 13.47% of the total number of deaths from infectious diseases; in fact, it has become the second leading cause of death from infectious diseases after AIDS [2]. Due to the high incidence, high mortality, and wide impact of tuberculosis, it has become a major public health problem that seriously endangers the health of Chinese residents. TB is also called the "poverty disease." Eighty percent of its patients are concentrated in rural areas, and the economic burden of the disease is heavy. TB has become one of the major diseases that sends individuals back into poverty due to illness, initially causes poverty due to illness, and restricts rural social and economic development [3]. From an economic point of view, TB is a contagious disease, and the spread of TB has obvious negative external effects. If TB is not controlled, it will not only increase the medical economic cost of patients but will also cause social costs that far exceed personal costs. [4]. Since health services have the special nature of supply-side leadership and demand-side passiveness, reducing the economic burden of TB patients must start from the source to improve supplier behaviour and effectively control medical expenses. At present, an effective means and method to control medical expenses involve the reform of the medical insurance payment mechanism. According to the characteristics of TB disease itself, based on the clinical path of diagnosis and treatment, this study formulates reasonable service packages, calculates scientific payment standards, and determines the compensation

mechanism of "patients with a full period of treatment". According to the characteristics of tuberculosis disease itself, based on the clinical path of diagnosis and treatment, this study formulates reasonable service packages, calculates scientific payment standards, and determines the compensation mechanism of "pay per person for the entire treatment course". It is hoped that this change in the compensation mechanism will not only reduce the economic burden of patients' disease but also strengthen the compliance management of tuberculosis patients, which will further help reduce the burden on society. Additionally, the exploration of the compensation mechanism also provides a reference for other regions and countries in the reform of payment methods.

## **Method**

This study uses descriptive analysis to analyze the effect of the compensation mechanism implemented by the Dehui Tuberculosis Hospital, and combines qualitative interviews with relevant stakeholders to further draw conclusions.

## **Mode implementation introduction**

### **Implementation plan and policy of medical insurance for TB in Dehui City (Before the implementation of the mode)**

Dehui TB Hospital mainly serves NCMS TB patients. Prior to the implementation of the project, the method of reimbursement on a pro rata basis was adopted. The TB hospital implements immediate settlement and reimbursement for NCMS patients. The reimbursement plan includes two parts: outpatient and inpatient. Outpatient TB is a special disease and is compensated according to the inpatient plan. The same outpatient pays a minimum of 600 yuan within a year. Outpatient clinics are not reimbursed for medical treatment outside the county, and the reimbursement rates at the village, township, and county levels are 50%, 55%, and 75%, respectively. If the out-of-pocket expenses of TB patients reach the compensation scope of Jilin Province's critical illness insurance, they can also be reimbursed in proportion. For poor patients with TB, Dehui Civil Affairs has a serious illness medical assistance policy with a ceiling of 20000 yuan. The settlement method of the medical insurance institution to the hospital is a post-payment system, and the actual payment to the hospital is the actual compensation paid by the TB hospital.

### **Current status of TB medical expenses in Dehui City (Before the implementation of the mode)**

According to the baseline survey, Dehui TB Hospital has the following characteristics: 1) High hospitalization rate. As the medical insurance policy of Dehui City does not reimburse the outpatient expenses of TB patients, ordinary people will choose to be directly hospitalized once they have TB, resulting in a hospitalization rate of TB patients as high as 60%. 2) Higher medical expenses. The hospitalized patients included 4 types of ordinary initial TB, ordinary retreated TB, TB pleurisy, and TB with comorbidities or complications (excluding drug-resistant TB). The average hospitalization expenses for these types of TB in 2016 were 6607.72 yuan, 6544.63 yuan, 7548.51 yuan, and 8093.08 yuan, respectively. Among them, the proportion of TB cases with adverse reactions or complications was as high as 16.52%, which is one of the reasons for the high cost of TB in this area. 3) The cost structure is unreasonable. Through the analysis of the diagnosis and treatment items of TB patients in the Dehui TB Hospital in

2016, it was found that the diagnosis and treatment items of TB included drug fees, bacteriological examination fees, imaging examination fees, routine examination fees, diagnosis and treatment service fees, and other expenses. Among them, drug fees and diagnosis and treatment service fees accounted for more than 70%, while diagnosis and examination expenses accounted for less than 3%, and routine examinations accounted for only 4.91%. Other expenses (mainly liver protection drugs) were as high as 21.32%. This shows that hospitals pay attention to the treatment of TB but neglect TB screening and diagnosis and routine monitoring of the patient's condition. 4) The out-of-pocket rate of TB patients is higher. The baseline survey shows that the actual compensation ratio of Dehui TB Hospital is 67.45%, the actual compensation ratio of Dehui hospitals outside the city is only approximately 40%, and the patient self-payment rate is much higher than 30% (required by the China-Gates Project).

## Research on capitation theory

Capitation is a compensation method in which the medical insurance institution determines the payment standard of the fixed fee for each patient based on the medical service package set in advance and after reasonable calculation and pays the medical service provider according to this standard. Its advantage is that it promotes the active control of medical service providers, strengthens health education for patients and standardizes the management of the entire treatment course. The disadvantage is that it is difficult to determine a reasonable payment standard, and prepayments that are too high or too low will have an impact on medical service providers [5] [6].

## Introduction to the capitation compensation mechanism with a full period of treatment

To alleviate the economic burden of TB patients and to solve the problem of a high hospitalization rate, Dehui City designed a "capitation compensation mechanism with a full period" of treatment. All pulmonary TB patients are required to be included in the management of pulmonary TB treatment pathways, and payment is settled in a full-course service model. The model cancels the deductible line and non-listed drugs and inspection items, and implements single-disease payment; the reimbursement ratio is 70%. The model includes two parts: outpatient and inpatient. TB outpatient is a special disease, and compensation is based on the hospitalization plan. The compensation plan is divided into two parts: full clinic and full treatment (outpatient + hospitalization). Pulmonary TB is divided into ordinary TB (including initial treatment and retreatment), TB pleurisy, and TB with comorbidities and complications (calculated according to the incidence).

Therefore, this model is based on the idea of capitation, combined with single-disease payment management, and the specific measurement standards are combined with TB disease groupings for determination. This is an innovative compound payment method.

### (1) The hospital conducts settlement with patients participating in NCMS.

Patient compensation amount = actual total medical expenses incurred during diagnosis and treatment × reimbursement ratio (70%) –Formula 1

Amount actually paid by the patient = total medical expenses actually incurred during the diagnosis and treatment-compensation amount –Formula 2

## (2) The hospital conducts settlement with NCMS.

Fixed payment standards include common TB and tuberculous pleurisy. The plan adopts a fixed payment for a single disease, all patients are included in the clinical path, and treatment is required according to the diagnosis and treatment standards. When NCMS settles with the hospital, if the actual total medical expenses incurred do not exceed the payment standard, the payment standard will be settled, and the balance will go to the hospital. Any expenses exceeding the payment standard shall be borne by the hospital.

Hospital compensation amount = fixed payment standard × reimbursement ratio (70%) × number of patients  
 –Formula 3

(3) Medical insurance institutions and hospitals implement quota standards. According to preliminary calculations and determined by Dehui TB Hospital and medical insurance institutions, the final payment type and quota standards for TB are as follows:

Table 1  
 Quota standards for different types of TB

Single disease category code	Single disease category name	Treatment	ICD code	Norm standard (yuan)
CD22000101	Common TB TB	outpatient	A15.300	3600
CD22000102	Common TB	Full period (outpatient + hospitalization)	A15.300	9000
CD22000201	TB pleurisy	outpatient	A16.500x004	5000
CD22000202	TB pleurisy	Full period (outpatient + hospitalization)	A16.500x004	12000

<sup>a</sup> The standard for the full period of treatment has been calculated based on the probability of adverse reactions and complications of the disease.

## Mode features

This model neither involves reimbursement for hospitalization alone nor does it only increase the reimbursement ratio; rather, it provides a medical insurance fund payment implementation plan that combines outpatient and hospitalization. Starting from the characteristics of the disease of TB itself, the plan is based on the principle of prevention first and standardized management, the prevention port is moved forward, and the medical insurance payment mode is changed from the original postpayment system to the prepayment system. The plan adopts the principle of "standardize treatment according to the clinical path and return the surplus to oneself", which has changed the hospital's operation model from treatment-oriented to prevention-oriented.

The plan was determined for the following principles and purposes. □ Relieving the problem of the high hospitalization rate in Dehui. The high hospitalization rate increases not only the financial burden of patients but also the expenditure of medical insurance funds. □ Changing the settlement method between medical insurance

institutions and hospitals and further changing the income method of hospitals. The post-payment system was changed to the pre-payment system, the principle of "savings should be allocated to oneself and reasonable sharing of over-expenditure" was implemented, and the hospital's cost self-discipline mechanism and the medical insurance fund risk sharing mechanism were established to promote the standardized management of TB patients. □ Combined with the law of TB disease itself, the focus of medical insurance payment is shifted from hospitalization to outpatient service, which is conducive to the realization of early prevention and early patient intervention, reducing the incidence, infection rate and hospitalization rate of TB and improving the management level of TB, thereby effectively reducing the negative externalities of the disease. □ Reducing the economic burden of patients' disease and achieving the goal of controlling the self-pay rate at 30%.

## Result

# Analysis and evaluation of the operation effect of Dehui TB Hospital

## (1) Changes in overall hospital service volume

The types of TB treated by Dehui TB Hospital include TB, bone TB, renal TB, TB meningitis and other TB, but TB is the main treatment disease, which accounts for more than 90% of patients in the entire hospital. From 2015 to 2017, the number of patient visits at the Dehui TB Hospital decreased year by year, especially when compared with 2016. The number of patient visits in 2017 dropped by 22.46%, but after the implementation of the payment method reform at the end of 2017, the number of patient visits in 2018 increased 17.10%, showing a trend of recovery. The number of visits for TB patients is the same as that of all patients in the hospital. In 2018, it rose by 14.25%, showing a good trend.

Table 2  
Changes in the number of patient visits to TB hospital at Dehui City in the first half of 2015–2018

Year	Number	Growth	Number of TB cases	Growth	TB percentage of total attendance
First half of 2015	1470	-	1432	-	97.41
First half of 2016	1327	-9.73%	1304	-8.94%	98.27
First half of 2017	1029	-22.46%	977	-25.08%	94.95
First half of 2018	1205	17.10%	1116	14.23%	92.61

From the perspective of different types of visits, the trends of changes in the number of inpatient and outpatient visits are consistent with the trend of the total number of visits. Both numbers of visits increased after the reform of the payment method, indicating that the reform of the payment method played a certain role in the increase in the number of hospital visits (see Table 3).

Table 3  
Changes in the number of TB patient visits to TB hospital at Dehui City in the first half of 2015–2018

Year	Total number of patients	Inpatient visits	Growth	Outpatient visits	Growth
First half of 2015	1432	255	-	1177	-
First half of 2016	1304	165	-35.29%	1139	-3.23%
First half of 2017	977	68	-58.79%	909	-20.19%
First half of 2018	1116	78	14.71%	1038	14.19%

## (2) Changes in the number of visits for TB

From the overall structure, the number of outpatient visits for TB is higher than that of inpatients. From the perspective of changing trends, from 2015 to 2017, the numbers of outpatient and inpatient visits both showed downward trends. In 2018, the numbers of visits of the two companies increased slightly, the rate of increase in outpatient services was relatively large, and the structure tended to be reasonable, showing a good situation, as illustrated in Fig. 1.

## (3) Changes in the length of hospitalization for TB

From the perspective of hospitalization, the total number of hospitalization days has decreased, but the average number of hospitalization days has increased yearly. In 2018, the average number of hospitalization days was 24.94 days. Combined with the common TB clinical pathway, the standard hospitalization days were 25 days, which was close to the standard hospitalization days. Additionally, interviews with hospital managers showed that after the reform of payment methods, medical staff tried their best to perform operations in accordance with clinical pathways, which led to an increase in the average length of hospital stay for patients, but it did not exceed 25 days.

Table 4  
Changes in the number of days in hospital for TB at Dehui TB Hospital in the first half of 2015–2018

Year	Total hospital days	Growth	Average hospital days	Growth
First half of 2015	5081.00	-	19.93	-
First half of 2016	3283.00	-35.39%	19.90	-0.14%
First half of 2017	1505.00	-54.16%	22.13	11.23%
First half of 2018	1945.00	29.24%	24.94	12.67%

## (4) Changes in medical expenses for TB

From the perspective of average outpatient medical expenses, the average outpatient expense in 2018 was 277.16 yuan, which decreased 46.99% compared with 2017. The average outpatient expense was well controlled (Table 5).

Table 5  
Changes in Outpatient Costs of TB at Dehui TB Hospital in the first half of 2015–2018

Year	Total hospital costs (yuan)	Growth	Average hospital costs (yuan)	Growth
First half of 2015	606204.77	-	526.68	-
First half of 2016	599940.92	-1.03%	527.19	0.10%
First half of 2017	480459.50	-19.92%	522.81	-0.83%
First half of 2018	287696.52	-40.12%	277.16	-46.99%

From the perspective of the average cost of hospitalizations, the average cost of hospitalizations in 2018 was 4,151.62 yuan, with a yearly decrease of 31.76% (Table 6). The cost has been greatly controlled, indicating that the cost control effect of the payment method reform is significant.

Table 6  
Changes in inpatient Costs of TB at Dehui TB Hospital in the first half of 2015–2018

Year	Total hospital costs (yuan)	Growth	Average hospital costs (yuan)	Growth
First half of 2015	1877917.69	-	7364.38	-
First half of 2016	1062069.80	-43.44%	6436.79	-12.60%
First half of 2017	413714.32	-61.05%	6084.03	-5.48%
First half of 2018	323826.18	-21.73%	4151.62	-31.76%

## (5) Changes in TB treatment behaviour

The use of drugs in the clinical treatment of TB is a major method. Since the implementation of the new model, on the whole, adjuvant drugs for the treatment of pulmonary TB account for a large part of the total medical expenses, more than 30%, while liver-protecting drugs account for only approximately 15%. Table 7 shows that the total medical cost has been decreasing yearly, and the cost of adjuvant drugs for the treatment of TB has also been greatly reduced, especially in 2018, when the reduction was 36.45%. This shows that the reform of payment methods still has a certain effect, especially for the abuse of auxiliary drugs in the hospital. Upon further analysis, one of the reasons for the substantial reduction in the cost of adjuvant medication is that when treating pulmonary TB patients, the types of adjuvant medications are reduced, and only 1.41 types are used on average, as shown in Table 8. The types of hepatoprotective drugs are also decreasing, essentially tending to stabilize. After the reform, the hospital reduced the use of nonessential auxiliary drugs.

Table 7

Changes in the cost of hepatoprotective drugs and auxiliary drugs at Dehui TB Hospital in the first half of 2015–2018

Year	Total medical costs (yuan)	Growth %	Hepatoprotective drug costs (yuan)	Growth %	Percentage	Auxiliary medication costs (yuan)	Growth %	Percentage
First half of 2015	5123.71	-	675.48	-	13.18	1752.22	-	34.20
First half of 2016	4599.35	-10.23	606.24	-10.25	13.18	2091.13	19.34	45.47
First half of 2017	4332.72	-5.80	656.06	8.22	15.14	1328.98	-36.45	30.67

Table 8

Changes in the average types of hepatoprotective drugs and auxiliary drugs at Dehui TB Hospital in the first half of 2015–2018

Year	Hepatoprotective drug types	Auxiliary drug types
First half of 2015	1.88	2.50
First half of 2016	1.92	2.30
First half of 2017	1.83	1.41

## Analysis of the operational effect of the Dehui Medical Insurance Fund

### (1) Changes in NCMS fund compensation for TB

Judging from the operation of the NCMS fund, the compensation amount of Dehui TB Hospital decreased yearly from 2015 to 2017, and the proportion of the compensation amount to the total expenditure of the medical insurance fund also decreased yearly. It rebounded slightly in 2018, which is related to the change in the number of visits, and the trends were essentially the same. The main reason is the internal management of the hospital itself, which led to a decline in medical service capacity and the loss of patients.

Table 9  
The expenditure of NCMS medical insurance fund at Dehui City in the first half of 2015–2018

Year	Total expenditure of medical insurance fund (million)	Compensation amount for TB hospital (million)	Proportion (%)	Growth Percentage
First half of 2015	14759.21	156.79	1.06	-
First half of 2016	15493.53	92.78	0.60	-0.46
First half of 2017	19395.39	44.01	0.23	-0.37
First half of 2018	11314.70	35.80	0.32	0.09

## (2) Changes in the actual compensation ratio for TB

The actual compensation ratio for outpatients and hospitalizations decreased in 2018. The reason is that the patient's actual out-of-pocket ratio is the ratio of the patient's actual out-of-pocket expenses to the total cost. After the reform of the payment method, the total cost of TB patients decreased significantly, and the patient's actual out-of-pocket expenses also decreased, but the decline was lower than the total cost, which led to a relative increase in the actual out-of-pocket ratio of patients. However, this does not mean that the patient's medical expenses has increased. In contrast, because the average cost of patients per visit has decreased, the total amount of medical expenses paid by the patient has decreased, and the patient has actually benefited. Moreover, the new payment plan does not have a deductible payment line or out-of-list medical treatment items, and the reimbursement ratio is 70%, indicating that patients actually pay only 30%.

Table 10  
Changes in the actual compensation ratio of TB outpatients at Dehui TB Hospital in the first half of 2015–2018

Year	Total costs (yuan)	Actual compensation costs(yuan)	Actual compensation ratio %	Growth percentage
First half of 2015	606204.77	355161.10	58.59	-
First half of 2016	599940.92	333618.08	55.61	-2.98
First half of 2017	480459.50	272988.70	56.82	1.21
First half of 2018	287696.52	134835.03	46.87	-9.95

Table 11

Changes in the actual compensation ratio of TB inpatients at Dehui TB Hospital in the first half of 2015–2018

Year	Total costs (yuan)	Actual compensation costs(yuan)	Actual compensation ratio %	Growth percentage
First half of 2015	1877917.69	1288659.10	68.62	-
First half of 2016	1062069.80	721999.93	67.98	-0.64
First half of 2017	413714.32	279874.48	67.65	-0.33
First half of 2018	323826.18	202727.32	62.60	-5.05

## Patient satisfaction

In general, patients are satisfied with the new plan for TB, 88.15% of the patients are quite satisfied, 10.37% of the patients think it is fair, and only 1.48% are dissatisfied, indicating that the new plan for TB is essentially unanimously approved by the patients (Table 12).

Table 12

Patient satisfaction with the new TB regimen

Satisfaction	Number	proportion(%)
Very satisfied	51	37.78
More satisfied	68	50.37
general	14	10.37
Not satisfied	2	1.48
Very dissatisfied	0	0.00
total	135	100.00

## Discussion

### The capitation compensation mechanism with a full period is suitable for TB disease itself and is worthy of promotion and experimentation.

After years of clinical practice and exploration, China has clear technical specifications for the prevention and treatment of TB. If the patient can be treated in accordance with standardized procedures, the disease can essentially be cured. However, the current medical insurance reimbursement method for TB is mainly hospitalization, leading to the problems of irregular treatment and a high hospitalization rate for TB patients, further leading to the possibility of delaying the disease, forming multidrug resistance and increasing the expenditure of medical insurance funds. Adopting the capitation compensation mechanism with a full period and combining outpatient treatment and

inpatient treatment promote effective control of TB patients in the outpatient stage, thus effectively avoiding the situation of additional hospitalization for patients to obtain medical insurance reimbursement. Additionally, the surplus is used to encourage medical institutions to carry out TB management and to improve the compliance of patients with standardized treatment.

## **The medical expenses of TB patients have decreased significantly, and the economic burden of the disease has been reduced.**

The average cost per time is an indicator that directly reflects the cost control effect of the payment method. As medical costs increase yearly with economic growth, the change in average cost per time is also a direct indicator to evaluate the effect of medical cost control. Compared with before the implementation of the project, the average outpatient cost for Dehui TB Hospital decreased by 46.99%, the average inpatient cost decreased by 39.43%, and the average costs of outpatients and hospitalizations were greatly reduced. Payment method reform has a significant effect on cost control. Additionally, the new payment plan does not have a deductible line and out-of-list medical treatment items, the reimbursement ratio is 70%, and patients actually pay only 30%, which effectively reduces the economic burden of patients' diseases.

## **The hospital's medical service capabilities have been improved, and internal management has improved significantly.**

Due to the implementation of clinical pathways, hospitals are urged to strengthen the management of medical service quality and to improve medical service capabilities. Additionally, the new plan implements the prepayment system of packaged payments with a full period of treatment and requires standardized management. It can be clearly seen that after the implementation of the capitation compensation mechanism with a full period of treatment, the cost of auxiliary drugs has been greatly reduced, and the types of liver protection drugs have gradually decreased and stabilized. Additionally, the hospital began to pay attention to and strengthen the awareness of the management of the entire treatment course of patients, minimize hospitalization, reduce costs, and help improve the standardized management of TB.

## **Clinical treatment methods have been effectively improved, and changes in rational drug use have become clear.**

In the past, the medical expenses of pulmonary TB patients accounted for more than 30% of the medical expenses, the use of hepatoprotective drugs averaged 2–3, and there were also more than 3 treatment options. Since the implementation of the capitation mechanism with a full period of treatment, the total medical expenses have decreased yearly, and the cost of adjuvant drugs for the treatment of TB has also been greatly reduced, especially in 2018, when it was reduced by 36.45%, and the types of adjuvant drugs for the treatment of TB patients have decreased, with an average of only 1.41. After the reform, the hospital reduced the use of nonessential auxiliary drugs. Additionally, because the implementation of this model standardizes the clinical path, the types of hepatoprotective drugs are also effectively controlled, and the effect of rational use of drugs is beginning to appear.

## Conclusion

The capitation compensation mechanism with a full period of treatment is a suitable payment method for TB diagnosis and treatment, and its effect is obvious, achieving a "triple win-win" for medical insurance, hospitals and patients. It is recommended to continue to promote this model to effectively reduce the financial burden of tuberculosis patients. However, in the early stage of the implementation of the plan, due to the relatively low understanding of the reform of hospitals and patients, there will be patient loss and poor compliance. Therefore, the hospital should change the management concept, incorporate the goal of payment method reform into performance management, and require all patients to be included in the treatment path to achieve standardized management of the entire treatment process.

If patients have been discontinued or have not undergone regular review, they should be contacted through the TB prevention and control network and encouraged to continue to return to the prevention institution for treatment to reduce the possibility of the acquisition of drug resistance [6]. Prevention and medical treatment should be combined, striving for "patients not to get sick, less sick, and minor diseases"; furthermore, standardized treatment of TB patients should be improved to reduce the infection rate of TB patients, thereby reducing the impact of TB patients on the social population and realizing TB's external effects. In general, this mechanism also provides a reference for the reform of payment methods for tuberculosis in other regions or countries.

## Abbreviations

TB: tuberculosis.

## Declarations

## Acknowledgements

We sincerely thank the Jilin Provincial Center for Disease Control and Prevention and Dehui Tuberculosis Hospital for providing us with data support, thank the China-Gates Project for providing us with platform support, and thank all the team members for participating in this research.

## Authors' contributions

Hu XY wrote the first draft of the manuscript. Gao GY and Hu XY conceived and revised the manuscript. All authors reviewed the final manuscript. All authors read and approved the final manuscript.

## Funding

This study was supported by National Natural Science Foundation of China,

Grant No. 7187040110.

And the study was supported by the Bill and Melinda Gates Foundation , Grant No. OPP1137180.

## Availability of supporting data

All data generated or analyzed during this study are kept confidential by Dehui Tuberculosis Hospital in Jilin Province of china. The datasets are available from the corresponding author on a reasonable request.

## Ethics approval and consent to participate

This article was based on analysis of routine surveillance data from China Dehui Tuberculosis Hospital. No personal information was disclosed.

## Consent for publication

Not applicable.

## Competing interests

Not applicable.

## Author details

1 School of Public Health, Capital Medical University

No.10 Xitoutiao, Youanmenwai Street, Fengtai District, Beijing, 100069, China.

## References

1. World Health Organization. Global tuberculosis report 2019[RZ].
2. China CDC. Survey of statutory infectious diseases nationwide [Z]. 2019.
3. The former Bureau of Disease Control and Prevention of the Ministry of Health, the former Medical Administration Department of the Ministry of Health, and the Chinese Center for Disease Control and Prevention. Guidelines for the implementation of China's tuberculosis prevention and control program[M]. Beijing: China Union University Press, 2008:1.
4. Chen Wen, Liu Guoxiang, Jiang Qicheng, Li Shixue, "Health Economics" Beijing: People's Medical Publishing House, 2017.
5. Qiao Jiajun, Zhu Zhaofang, Jing Qi, etc. Discussion on the reform of pay-per-capita payment methods based on case analysis[J]. Chinese Journal of Hospital Management, 2019(05):358-361.
6. Wu Jie. Thoughts on the per capita payment method for outpatient services in public hospitals[J]. Decision Exploration (Part 2), 2019(02): 89-90.
7. Tao Jianqing, Lu Hong, Wu Guoqiang, et al. Evaluation of the effect of clinical pathways in the inpatient treatment of tuberculosis[J]. Journal of PLA Hospital Management, 2015, 22(7): 604-607.