

Multi-channel Financing and Payment Mechanism Reform for Tuberculosis Prevention and Control: A SWOT Analysis of the National Pilot in Baoding, China

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Research Article

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Abstract

Background:

Tuberculosis (TB) remains a major infectious disease of poverty in China, imposing substantial economic burdens on patients and challenging the efficiency of healthcare fund utilization. This study systematically evaluates the policy design and implementation outcomes of the national pilot on multi-channel financing and payment mechanisms for TB prevention and control in Baoding, China, identifying its strengths, limitations, and optimization pathways.

Methods:

An embedded single-case study design was adopted. We conducted a comprehensive review of policy documents, including the "Implementation Plan for Multi-channel Financing and Payment Reform of Tuberculosis in Baoding City." From 2024 to 2025, 32 in-depth semi-structured interviews were carried out with stakeholders from municipal medical insurance bureaus, health commissions, designated healthcare institutions, and disease control centers. Core quantitative data on patient costs, fund expenditures, and treatment success rates from 2022 to 2025 were collected and analyzed using the SWOT framework.

Results:

Baoding established an integrated model combining capitation bundled payment, specialized alliance networks, and medical-preventive services. Post-implementation, the standardized full-course treatment completion rate increased from 96.5% to 98.9%, and the drug resistance screening rate rose from 98.1% to 100%. Downward trends were observed in TB incidence, drug-resistant cases, and average per-patient costs, with the medical insurance fund achieving a surplus by 2023. SWOT analysis revealed significant strengths in alleviating patient financial burdens, controlling medical costs, and standardizing clinical practices. However, weaknesses included an incomplete service package (out-of-package expenses accounting for ~ 40.11%), increased administrative burdens on providers (~ 5.2 additional hours/week), and insufficient rapid molecular testing capacity at primary care. Opportunities involved alignment with national TB programs and health reforms, while threats included equity concerns from single-disease compensation and sustainability risks from project-based funding.

Conclusions:

The Baoding model achieved a tripartite win-win outcome for patients, healthcare institutions, and the medical insurance system under a value-based, medical-preventive integrated framework. Its sustainability requires refining the service package, streamlining settlement procedures, strengthening

primary care diagnostics, and establishing long-term financing. This experience holds substantial replicability for TB and similar infectious disease payment reforms, particularly in resource-limited settings.

Background

Tuberculosis (TB) remains one of the deadliest infectious diseases globally and a quintessential disease of poverty. The World Health Organization (WHO) Global Tuberculosis Report 2025 estimates 10.7 million new cases and 1.23 million deaths worldwide in 2024, with China accounting for 696,000 new cases (incidence rate: 49/100,000) and 28,000 multidrug-resistant/rifampicin-resistant TB cases [1]. Beyond its health impact, TB imposes catastrophic financial liabilities on affected households, pushing many into poverty due to direct medical costs and income loss—a critical barrier to achieving Universal Health Coverage (UHC).

China's TB control efforts face three intertwined challenges. First, clinical diagnosis and treatment standardization remain suboptimal. Despite drug resistance screening rates exceeding 95% at primary facilities [2], approximately 13% of patients still lack access to rapid molecular susceptibility testing, delaying targeted therapy. Second, the economic burden on patients is disproportionately heavy. Annual treatment costs for drug-susceptible TB average 15,000 CNY (~ 2,100 USD), while drug-resistant TB ranges from 100,000–200,000 CNY (14,000–28,000 USD), with high out-of-pocket ratios [3]. Third, medical insurance fund utilization is inefficient under the traditional fee-for-service model, which incentivizes volume-driven care and exacerbates the fragmentation between medical treatment and preventive services [4].

International research has shifted from input-oriented to outcome-oriented financing. Kumar et al. [5] demonstrated that capitation combined with performance-based payment improves TB treatment completion by 12–15% in high-burden settings. Barter et al. [6] reported that bundled payments in the UK NHS reduced TB treatment costs by 18% and hospitalization days by 30%. In China, scholars have emphasized the necessity of payment reform from a medical-preventive integration perspective [7, 8, 9]. Recent studies by Zhang et al. [10, 11] and Xu et al. [12] further validated capitation bundled payment models and highlighted potential over-treatment risks, informing the iterative optimization of pilot reforms.

In September 2021, Baoding City was designated as China's largest national pilot for TB financing and payment reform. The city explored an integrated model of "capitation bundled payment, specialized alliance networks, and medical-preventive integration," aligning with the NHSA's Three-Year Action Plan for DRG/DIP Payment Reform [13] and WHO's integrated care guidelines [14]. Using a SWOT analysis, this study systematically evaluates the innovative value and optimization directions of this model, providing evidence-based insights for achieving the "Healthy China 2030" TB targets and informing similar reforms in other low-resource settings.

Methods

Study design

An embedded single-case study design [15] was employed, with Baoding City's TB financing and payment reform as the case unit. This design is well-suited for examining complex, context-dependent health policy interventions where intervention boundaries are not clearly delineated.

Data collection

A mixed-methods approach triangulated three data sources:

1. Policy document analysis: Systematic review of national and local policies, including the Three-Year Action Plan for DRG/DIP Payment Reform [13] and the Implementation Plan for Multi-channel Financing and Payment Reform of Tuberculosis in Baoding City (Baoding Medical Insurance Bureau Document No.6, 2022) [16].
2. In-depth interviews: From 2024 to 2025, 32 semi-structured interviews were conducted with purposively sampled stakeholders: medical insurance administrators (n = 8), health commission officials (n = 6), clinicians from designated TB hospitals (n = 10), CDC public health experts (n = 6), and patient representatives (n = 2). Interview guides covered policy implementation processes, perceived effectiveness, challenges, and suggestions. All interviews were audio-recorded, transcribed verbatim, and analyzed thematically. The interview guide was developed specifically for this study by the research team based on the SWOT analysis framework and a review of relevant literature. An English language version of the interview guide has been submitted as a supplementary file.
3. Quantitative operational data: De-identified data from 2022–2025 were extracted, including patient treatment costs, treatment success rates, drug resistance screening rates, and medical insurance fund expenditure patterns. Descriptive statistics were applied.

SWOT analysis framework

The SWOT (Strengths, Weaknesses, Opportunities, Threats) framework [17] was used to systematically evaluate the reform. Internal factors (Strengths and Weaknesses) were derived from policy outputs, quantitative outcomes, and provider interviews, while external factors (Opportunities and Threats) were mapped from national policy shifts and stakeholder perceptions of the broader environment.

Ethical considerations

Ethics approval

was obtained from the Ethics Committee of Baoding People's Hospital (Baoding, Hebei, China). All participants provided written informed consent. This study was conducted in accordance with the Declaration of Helsinki and relevant national guidelines and regulations. Patient-level data were anonymized prior to analysis.

Results

Policy framework: a multi-dimensional reform design

Baoding established a comprehensive framework based on "medical-preventive integration, disease-based payment, and global budgeting."

* Target population and coverage: All insured patients (employees and residents) with active pulmonary TB at designated hospitals, covering five categories with 58 ICD-10 codes (primary/secondary pulmonary TB, disseminated pulmonary TB, and drug-resistant TB) [16].

* Payment innovation: A capitation bundled payment mechanism integrated full-course outpatient and inpatient expenses. In 2022, the bundled standard was 13,000 CNY (~ 1,800 USD) per patient for drug-susceptible TB and 100,000 CNY (~ 14,000 USD) for drug-resistant TB, with a 5% annual escalation. Under global budgeting, monthly prepayments (90% of billed amounts) were issued, with final settlement upon treatment completion. A "surplus retention, reasonable excess sharing" incentive was linked to a 10% quality performance deposit.

* Reimbursement optimization: Outpatient reimbursement rates were 80% (employees) and 60% (residents), with deductibles eliminated and an annual cap of 3,000 CNY (~ 420 USD). Low-income patients received an additional 10–20% medical assistance. Patients had free choice among 20 designated facilities.

* Medical-preventive integration: Baoding People's Hospital led a specialized alliance with three municipal and 17 district/county hospitals, supported by a 24-member expert panel (deputy senior title or above). Data interfaces enabled bidirectional sharing between hospitals and CDCs.

Reform outcomes

* Patient-level: Standardized treatment completion increased from 96.5% to 98.9%; drug resistance screening reached 100%. Downward trends were observed in incidence, drug-resistant cases, and per-patient costs (Table 1).

* Clinical quality: Pathogen positivity remained stable at ~ 70%; treatment success exceeded 95% (meeting WHO End TB Strategy targets [18]); clinical pathway utilization reached 100% for all five disease categories.

* Fund performance: The medical insurance fund shifted from deficit to surplus by 2023, with reduced unnecessary diagnostic testing.

Table 1
Core outcome indicators before and after the Baoding pilot reform

Indicator	Pre-reform	Post-reform	Change
Full-course standardized treatment completion rate	96.5%	98.9%	+ 2.4 percentage points
Drug resistance screening rate	98.1%	100%	+ 1.9 percentage points
Pathogen positive rate	~ 70%	~ 70%	Stable
Treatment success rate	> 90%	> 95%	Improved
Clinical pathway utilization rate	–	100%	–
Medical insurance fund balance	Deficit	Surplus	Reversed

SWOT analysis summary

The detailed SWOT matrix is presented in Table 2.

Table 2
SWOT analysis of Baoding's TB financing and payment reform

Category	Key Findings
Strengths	1. Improved treatment outcomes (completion rate + 2.4%, screening 100%). 2. Effective cost containment (fund surplus, reduced unnecessary tests). 3. Successful medical-preventive integration via specialized alliances.
Weaknesses	1. Incomplete service package (out-of-package costs ~ 40.11%). 2. Increased provider administrative burden (+ 5.2 h/week). 3. Insufficient county-level rapid molecular testing capacity. 4. Potential mismatch for multimorbid patients under single-disease payment.
Opportunities	1. Alignment with 2024 National TB Plan and healthcare reforms. 2. Digital health advances (AI-assisted diagnosis). 3. Strengthened inter-sectoral collaboration (insurance, health, CDC).
Threats	1. Equity concerns over single-disease resource concentration. 2. Settlement conflicts between individual accounts and pooled funds. 3. Sustainability risks due to reliance on project-based funding.

Discussion

Comparison with existing literature and contextualization

The Baoding model validates that capitation bundled payment effectively curbs over-medicalization while incentivizing cost control, extending Kumar et al.'s [5] findings on prepayment. Compared to the UK's Payment-by-Results [14], Baoding's model strengthens the budget constraint role of insurers, making it more adaptable to China's institutional context. The specialized alliance's integrated "diagnosis-treatment-prevention-management" approach breaks traditional public health-clinical silos, offering empirical support for WHO's people-centered integrated care in transitional economies [19].

The quality control loop linking performance indicators to a 10% quality deposit represents a stronger incentive than the Thai experience [20], confirming that financial leverage can significantly reduce non-standard clinical behaviors [21]. However, the high proportion of out-of-package expenses (~ 40.11%) echoes findings from other Chinese pilots [22], highlighting the urgent need to expand benefit packages to prevent catastrophic expenditure—a core concern of Infectious Diseases of Poverty.

Implications for policy and practice

Four priorities emerge:

1. Complete the service package: Incorporate second-line anti-TB drugs and hepatoprotective agents, capping out-of-package expenses at $\leq 15\%$ of total costs, referencing the WHO Essential Medicines List [23].
2. Streamline administration: Develop automated reimbursement using AI-based auditing, learning from Shanghai's "One-Stop Medical Payment" [24].
3. Strengthen primary care: Invest in county-level molecular testing equipment and training, aligning with NHC capacity-building guidelines [25].
4. Ensure fiscal sustainability: Integrate TB funding into routine budgets with long-term mechanisms, drawing from Germany's dedicated infectious disease funds [26].

Global health relevance

While tailored to China, the Baoding experience offers valuable lessons for other LMICs grappling with TB financing. The integration of social health insurance with public health functions demonstrates how fragmented systems can evolve toward UHC without compromising poverty alleviation goals. However, the reliance on project-based funding and the risk of equity dilution serve as cautionary notes for policymakers in similar resource-constrained environments.

Limitations

First, the short observation period (12–18 months) limits conclusions on long-term cost-effectiveness and incidence trends. Second, the single-case design restricts generalizability, though the typical case sampling enhances transferability. Third, SWOT inherently involves subjective stakeholder judgments. Future multi-site comparative studies are warranted.

Conclusions

The Baoding multi-channel financing and payment reform pilot has achieved measurable improvements in reducing patient financial burden, enhancing clinical standardization, and improving fund efficiency. By aligning payment reform with public health goals, it presents a viable model for TB control in resource-limited settings. Addressing the remaining gaps in service packaging, administrative efficiency, and primary care capacity—alongside establishing sustainable financing—will be crucial for scaling up this approach to achieve the "Healthy China 2030" TB targets and contribute to global TB elimination.

Declarations

Ethics approval and consent to participate:

This study was approved by the Ethics Committee of Baoding People's Hospital (Baoding, Hebei, China). All participants provided written informed consent prior to participation. All experiments were performed in accordance with the Declaration of Helsinki and relevant guidelines and regulations.

Consent for publication:

Not applicable.

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Author Contribution

Jintong Ma (JM): Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Visualization. Bin Zhang (BZ): Data curation, Investigation, Formal analysis, Writing – review & editing. Hongna Zhao (HZ): Investigation, Formal analysis, Writing – review & editing. Chaoyang Sun (CS): Investigation, Data curation, Resources. Jianru Jia (JJ): Conceptualization, Supervision, Writing – review & editing, Project administration, Funding acquisition. All authors read and approved the final manuscript.

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Data Availability

The data that support the findings of this study are not publicly available due to privacy and confidentiality restrictions but can be requested from the corresponding author upon reasonable request and with appropriate institutional approvals.

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Supplementary Files

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- [8.25InterviewOutlineBaodingTBFinancingReformPilot.docx](#)