International Experience and Implications of Health Workforce Training Models in Rural and Remote Areas: Postprint

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Abstract

To address the global issue of regional imbalance in health workforce distribution, many countries have implemented diversified talent cultivation programs tailored to their national contexts. Since 2010, China has implemented a free training policy for order-directed medical students in rural areas, aiming to alleviate talent shortages in primary-level health service systems. Despite years of policy implementation, significant gaps in primary-level health personnel persist, making the optimization and expansion of talent cultivation models a critical current task. To draw upon international experience and provide valuable measures for China' s primary-level health talent cultivation policies, this study employs content analysis to systematically summarize and compare health talent cultivation policies implemented in rural and remote regions across multiple countries. It analyzes their primary program structures and operational characteristics, categorizing them into three models: directed cultivation model, incentive model, and regional medical education model. The study further synthesizes the definitions, features, and limitations of these three models while identifying common causes of program failures. Overall, foreign countries possess extensive experience and relatively mature systems for health talent cultivation in rural and remote areas, whereas China currently relies predominantly on the directed medical student system with relatively singular training pathways. Therefore, by fully integrating international experience with China' s actual conditions, this paper proposes multi-dimensional policy measures and practical recommendations to provide a valuable reference for health talent cultivation in China' s rural and remote areas.

Full Text

1. Targeted Training Model

1.1 Model Overview

The targeted training model involves students entering into legally binding agreements with relevant healthcare departments or schools in their home regions. These contracts explicitly detail the services supporting their education, such as scholarships and loans, and stipulate that upon graduation, they must fulfill a designated period of compulsory healthcare service in specified locations. This model effectively promotes the cultivation of medical talent for rural and remote areas while providing participants with stable employment opportunities and broad career development platforms, creating a win-win scenario for both parties. The specific implementations of this model vary across countries and can be compared through typical project cases. This study examines four ongoing targeted training programs from different nations, analyzing them across dimensions including target participants, contracting parties, support policies, service duration, service locations, and breach-of-contract provisions .

1.2.1 Strong Contractual Framework Defining Rights and Obligations

First, the agreements clearly specify both parties: one party consists of students at various educational stages (high school, undergraduate, and graduate), while the other comprises government agencies, medical institutions, and universities. Second, participants are typically required to have rural or remote area backgrounds and demonstrate strong interest in serving rural communities. The contracts also specify academic requirements, program duration, and corresponding support strategies. Additionally, to ensure orderly program operation, targeted penalties are imposed for contract violations, such as revoking previously provided support measures or benefits.

1.2.2 Clear Regulations for Targeted, Time-Limited Service

The targeted model emphasizes that medical graduates and other target groups must undertake compulsory service in designated locations for specified periods. Agreements typically mandate explicit service locations and durations. For instance, all targeted medical graduates in China serve six years in rural areas (including three years of standardized residency training), while Thailand requires graduates to return to their hometowns for 12 years of service. To ensure compliance, penalties are imposed for failure to provide service as agreed or for early withdrawal. Australia and Japan primarily enforce compliance by revoking or reclaiming support measures provided under the agreement. Due to such strong constraints, over 95% of Japanese medical students complete their service at designated locations, with the proportion practicing in rural areas being 13 times higher than that of non-targeted graduates, demonstrating significant effectiveness [6].

1.2.3 Diverse Supportive Policies Safeguarding Participant Rights

Diverse support strategies directly benefit program participants, such as students. Using Thailand as an example, participants receive comprehensive support throughout their journey—from medical education to employment—including educational opportunities, government scholarships, and post-employment allowances. Supportive policies encompass various types, such as appropriate educational measures, substantial welfare benefits, and scholarships, ensuring that contracting parties enjoy their entitled benefits and facilitating smooth policy implementation. In terms of outcomes, Thailand' s "One District, One Doctor" program and similar initiatives have achieved over 75% retention rates at the grassroots level, far exceeding that of ordinary medical graduates, with participants working at the grassroots for no fewer than three years.

1.3 Model Limitations: Recruitment and Policy Continuity Need Optimization

First, targeted medical students are admitted with lower entrance scores, raising concerns about student quality. Having signed employment agreements before enrollment and enjoying policy benefits without financial burden or employment pressure, these students exhibit limited motivation. Some domestic universities have relatively low requirements, mandating only timely graduation for contract fulfillment, which indirectly affects learning attitudes and performance. Second, environmental factors contribute to low retention rates post-contract. Literature indicates that only 9% of medical students in some countries remain in rural areas after completing their compulsory service, with reduced willingness to stay due to low grassroots salaries and working conditions [10].

2. Incentive Model

2.1 Model Overview

The incentive model encompasses both economic and non-economic incentives —one stimulating through conditional rewards, the other activating intrinsic needs and motivations. This model emphasizes improving living and working conditions for target groups such as physicians in rural and remote areas to attract them to practice there. This section presents four representative programs from Chile, the United States, Brazil, and Zambia, summarizing their strategic designs across economic and non-economic dimensions .

2.2.1 Substantial Economic Incentives Far Exceed Opportunity Costs

During the career selection process, opportunity costs in rural and remote areas are particularly significant, influenced by factors such as low salary levels, increased commuting costs, and poor housing conditions. High opportunity costs become key considerations for healthcare workers. Economic incentives therefore focus on providing competitive salaries, transportation allowances, and

housing subsidies. Some programs also incorporate region-specific measures, such as Zambia' s housing renovation initiative. In practice, the combined value of these economic incentives significantly exceeds the opportunity costs faced by target groups during career selection, substantially promoting stable retention of local health talent and sustainable implementation of training programs.

2.2.2 Diverse Non-Economic Incentives Demonstrate Humanistic Care

Non-economic incentives focus on enhancing career development opportunities, living conditions, and work environments for rural and remote healthcare workers. Diverse measures are implemented to address actual needs while strengthening job satisfaction and demonstrating humanistic care. In practice, programs provide rich training opportunities and health courses to optimize career ladders. Mentorship from higher-level hospitals enhances skills training and increases participants' sense of achievement. For example, Chile' s Rural Physician Program allows rural practitioners to attend one month of paid training annually at regional hospitals, where they can establish professional networks with specialists. Consequently, nearly 100% of physicians participate in rural service [15], with over half serving for more than six years, effectively improving the uneven distribution of health talent between urban and rural areas in Chile. Additionally, non-economic incentives emphasize infrastructure investment and construction to address talent shortages caused by lagging economic development and insufficient medical resources, including updating medical equipment and renovating healthcare facilities to optimize work environments. Brazil' s program increased the number of practicing physicians per 10,000 residents in remote and impoverished areas from [missing value] to [missing value], demonstrating significant effectiveness.

2.3 Model Limitations: Limited National Financial Support

The WHO stipulates that government health investment should account for approximately 5% of GDP, a threshold met by only a few developed countries. Developing nations often fall below this average, resulting in limited health investment that causes two major problems. First, restricted facility development. Research indicates that rural facilities in Zambia face heavy workloads [14], and limited finances make it difficult to balance facility construction and maintenance with physician allowances, affecting satisfaction among program healthcare workers. Second, compromised human resource management effectiveness. For example, Brazil' s program staff are categorized into multiple groups including material management, disease consultation, and treatment, requiring numerous personnel to ensure stable operation. However, insufficient departmental funding makes it difficult to sustain salaries for these workers, leading to increased turnover and vacancy rates and persistent regional health workforce imbalances.

3. Regional Medical Education Model

3.1 Model Overview

The regional medical education model aims to cultivate health talent for rural and remote areas by establishing regional medical schools or training centers, offering local health curricula, and increasing local internship opportunities. This approach enhances students' understanding and awareness of rural and remote areas, attracting them to choose these locations during career selection. This section presents four typical projects in this model, summarizing their elements based on project timing, target participants, curricula, and other components .

3.2.1 Teaching Focused on Grassroots Service with Emphasis on Practical Skills

The regional medical education model comprises curriculum design and practical training. In curriculum design, it emphasizes grassroots health priorities and adds courses in rural medicine and community health to build a theoretical system aligned with grassroots healthcare realities. For example, the UK has seen a tenfold increase in student enrollment between 2011 and 2018 by focusing on local health priorities while adding general practice courses [17]. In practical training, heterogeneous grassroots practice arrangements are developed for students at different educational stages, emphasizing long-term and frequent grassroots service opportunities to cultivate practical skills through immersive experiences. Effective implementation depends on two core elements running in parallel: integrating medical knowledge with immersive grassroots experience to enhance students' practical capabilities.

3.2.2 Emphasis on Multi-Stakeholder Collaboration to Strengthen Professional Identity

The regional medical education model stresses multi-stakeholder collaboration, with local government agencies leading efforts to establish official communication mechanisms and promote practical, locally actionable policies. This creates an interactive professional environment that strengthens career identity and breaks professional isolation. Medical schools also play an active role by hiring local doctors as mentors who deepen students' understanding of the grassroots physician role through teaching and example, thereby enhancing professional identity. For instance, the UK' s clinical apprenticeship program employs local physicians as clinical consultants who guide students in grassroots clinical services, boosting their professional identity and effectively improving training capacity for rural and remote areas.

3.2.3 Establishing Regional Medical Education Centers to Enhance Infrastructure

Regional medical education centers include regional medical schools and practical training bases for health talent. While current medical education cen-

ters tend to be located in economically prosperous urban cores to optimize resource allocation, the regional medical education model emphasizes establishing regional medical schools and training centers to strengthen the hardware foundation for local health talent cultivation. This model also advocates close cooperation with local grassroots medical institutions, locating practical training within partner organizations to directly deliver quality health talent to the grassroots. For example, Australia collaborates with aged care facilities [19], arranging student training directly within these institutions to effectively deliver health talent to grassroots aged care services, with nearly 90% of patients [20] expressing satisfaction with medical students, demonstrating significant program effectiveness.

3.3 Model Limitations: Service Experience Goals Exceed Retention Objectives

The regional medical education model emphasizes regular and continuous grassroots health practice, focusing more on accumulating grassroots health knowledge than on long-term retention. In attracting grassroots talent, it primarily relies on enhancing understanding and emotional connection to grassroots areas. Medical education in the United States [21] and other Western countries belongs to an elite education system, and the regional medical education model provides medical education opportunities for students from diverse socioeconomic backgrounds. For example, the US Rural Physician Shortage Area Program only provides grassroots training and practice opportunities for medical students without establishing mechanisms to guarantee their retention or local practice rights. Consequently, participating medical students typically serve at the grassroots for only 2-4 years, resulting in adequate short-term supply but persistently low long-term retention rates.

4. Lessons from Failed Rural and Remote Area Talent Cultivation Programs

Given that rural and remote area health talent cultivation is influenced by multiple factors and requires coordinated participation from various departments, successful cases demonstrate that single policy interventions cannot effectively achieve intended goals. Therefore, intervention measures under various models must be based on specific analysis of regional health human resources and related contexts to identify key factors affecting local physicians' career choices and retention. The following programs encountered problems during implementation, some ultimately deviating from their original purpose and failing. Their experiences warrant careful examination.

4.1 Unclear Policy Provisions Hinder Goal Achievement

Ambiguous policy provisions often lead to four operational problems: arbitrary initial screening, vague definitions of compulsion and support in targeted models,

incentive measures disconnected from reality in incentive models, and unclear curriculum boundaries in regional medical education models. These issues create loopholes that prevent programs from achieving their objectives. For example, in Ecuador [21], ambiguous urban-rural classification affected site selection for physicians' compulsory service, resulting in most doctors ultimately choosing to practice in urban areas. The US Non-Military Loan Assistance Program [22] aimed to deliver internal medicine talent to rural and remote areas, but strict eligibility criteria meant that over half of internal medicine students only expressed interest without further development or participation.

4.2 Mismatched Policy Contexts Undermine Long-Term Sustainability

First, political context mismatches occur when program content conflicts with major provisions of the existing healthcare system, making policy implementation difficult and hindering long-term operation. For example, Russia's one-time housing compensation policy for rural doctors contradicted the Semashko model' s emphasis on unified salaries for health workers. This conflict between differential incentives and unified arrangements made housing allowance distribution difficult, preventing the policy from achieving expected results [23]. Notably, Russia' s healthcare model, inherited from the Soviet Union and based on complete public ownership and high government management levels, has long suffered from severe health insurance funding shortages and low service efficiency, inevitably affecting program implementation. Second, economic context mismatches refer to limited national fiscal investment directly affecting program effectiveness. Insufficient financial support leads to limited infrastructure construction and inadequate living conditions in the short term, while long-term fiscal shortages severely impact the stability and sustainability of incentive programs. For example, Uganda' s Makerere University SPICES model required students to serve for one year at rural health facilities, but over 75% of students reported low satisfaction [24]. As a typical low-income country, Uganda' s limited fiscal investment could not support rural facility construction, preventing long-term guarantee of basic health equipment supply and greatly affecting member satisfaction and motivation.

4.3 Socio-Cultural Differences Directly Affect Policy Outcomes

When medical students and other participants serve in rural and remote communities, lack of understanding and familiarity with local social culture directly increases their workload burden and affects service motivation. Specifically, unfamiliarity with local languages directly affects effective communication between medical students and residents, reducing their sense of professional achievement. For example, South African medical students face language barriers during rural practice due to differences in isiZulu, isiXhosa, and other languages, hindering service provision and significantly reducing their sense of achievement and retention willingness [25]. Additionally, religious and cultural differences also affect

service delivery to some extent. In the University of the Western Cape' s rural service program, Muslim patients' preference for Muslim doctors directly increased the workload burden on the grassroots physician group [26]. Therefore, from screening to training stages, participants need to understand and become familiar with local social culture to ensure smooth communication in grassroots services and improve service efficiency and effectiveness.

5. Implications and Recommendations

5.1 Optimize Policy System and Improve Implementation Coordination

Current issues exist in the implementation of China' s rural targeted medical student policy and coordination between central and local policies. First, local deviations occur in receiving targeted medical students. The original policy required at least six years of grassroots service, but this was reduced to three years due to the implementation of standardized residency training, which clearly fails to meet talent service needs. Some regions have unilaterally extended service contracts to ten years or more, leading to frequent and increasing breach-of-contract incidents. Second, higher medical education institutions, secondary-level medical institutions, and township health centers—key organizational entities throughout the process—exhibit loose and weak linkages, especially regarding condition differences between standardized training units and targeted units, which further weakens compliance willingness. Finally, significant provincial-level policy differences exist in specific arrangements for contract management, working and living conditions, and position and title promotion, easily causing psychological imbalance among targeted medical students and affecting both their willingness to comply and fair talent competition across regions. Therefore, standardized residency training and targeted medical students' service fulfillment should be better coordinated to ensure policy consistency between training duration and service time, thereby achieving long-term support for grassroots medical resources. Policy should promote long-term cooperation between standardized training hospitals and targeted grassroots health centers to form fixed training and output channels, making training hospitals effective professional development platforms that meet targeted medical students' learning and growth needs. Finally, we recommend gradually standardizing targeted medical students' benefits and service standards nationwide, particularly breach-of-contract mechanisms, while ensuring basic working conditions and salary levels do not vary significantly across provinces, maintaining policy fairness with appropriate consideration for remote areas.

5.2 Clarify Application Motivations and Expand Recruitment Scope

China's rural targeted medical student free training policy faces implementation challenges. First, some students have insufficient understanding of the program, and their willingness and interest in serving rural and remote areas require further consideration. Research shows that targeted medical students' primary

application motivations are lower college entrance exam scores, parental wishes, and employment security [27], revealing that most students lack adequate understanding of the policy and apply primarily due to external factors rather than active choice based on cognition and interest. Second, targeted medical students sign employment agreements before enrollment and enjoy the "two exemptions and one subsidy" policy (tuition and fee waivers plus living allowances) with relatively low graduation requirements from some universities, resulting in less employment and academic pressure that indirectly affects learning attitudes and performance.

First, given that targeted medical students mainly come from rural areas, county-level health commissions should strengthen cooperation with village committees to enhance families' policy understanding through policy posters, lectures, and parent meetings. We recommend using social media platforms to disseminate latest information during critical periods like college application. Second, utilize programs like "Three Rurals" (technology, culture, and health services to rural areas) to strengthen students' understanding of grassroots service philosophy, allowing them to experience professional spirit in real environments and correctly understand the relationship between "material benefits" and "value confusion" to clearly plan their career paths. Addressing current grassroots medical talent shortages, we can learn from other countries' experiences. Thailand faced similar challenges in the 1990s when private hospitals attracted many doctors by paying breach-of-contract penalties, causing talent drain from the public system. In response, Thailand implemented new recruitment strategies incorporating high school students into talent replenishment plans to lock in potential grassroots healthcare talent early. The Australian National University Medical School optimized grassroots talent replenishment by making medical students' cognition of and willingness toward grassroots healthcare important considerations. Based on this, we recommend that China expand talent cultivation scale for grassroots medical institutions to some extent, establish general practice programs not bound by targeted agreements, allow interested students to freely join or exit under specific conditions, and use their cognition of, willingness toward, and understanding of grassroots healthcare as selection criteria to ensure effective talent cultivation.

5.3 Increase Service Opportunities and Strengthen Emotional Connection to Grassroots

OGDEN et al. [28] demonstrated that medical students' grassroots health service experience during internships helps strengthen their emotional connection to grassroots areas and improves retention rates. Compared to relatively mature grassroots health talent cultivation systems abroad, China primarily relies on the targeted medical student policy, which covers only some medical specialties and limited numbers. Moreover, its curriculum design fails to adequately address grassroots service realities, with few core courses like general practice. Most

medical schools use unified clinical medicine textbooks for targeted medical students, lacking targeted and practical teaching for grassroots healthcare services, leaving some targeted medical students unable to accurately diagnose common diseases after employment and simply referring patients, failing to achieve policy objectives. Furthermore, Western countries encourage general medical students to participate in grassroots services through relevant policies and increase grassroots service components during training. In contrast, China' s general clinical medical students mostly complete internships and clerkships in tertiary hospitals affiliated with medical schools, with limited connection to and understanding of grassroots areas. Although grassroots service teaching institutions exist, teaching conditions and mentorship systems limit their effectiveness, and the lack of dedicated grassroots practice bases further hinders grassroots education and teaching.

Therefore, we can learn from foreign experiences of hiring local clinicians as mentors to establish and improve domestic mentorship systems, helping students better familiarize themselves with grassroots service positions and optimize immersive experiences to deepen emotional connections and improve retention rates. Second, we should build a general practice curriculum system with characteristics, adding general practice courses and hours based on principles of appropriateness and sufficiency. For example, schools should incorporate common diagnosis and treatment protocols for local prevalent diseases into teaching based on their location' s actual conditions, enabling students to build theoretical systems and practical skills adapted to grassroots services earlier and faster. Finally, establish a multi-stakeholder co-construction mechanism to strengthen cooperation among universities, grassroots medical institutions, and local governments (health commissions), creating a virtuous cycle where grassroots institutions provide personnel and skill needs, universities conduct targeted cultivation, and governments strengthen process management and practice arrangements [30]. This achieves a two-way empowerment system for grassroots health talent cultivation where education promotes practice and practice informs education.

5.4 Enrich Incentive Strategies and Alleviate Career Concerns

Domestic and international studies show that medical students' career selection concerns focus on low grassroots salaries, poor working conditions, and relatively narrow career development space. These issues further exacerbate limited family support, rising opportunity costs, and weak contract compliance among targeted medical students. Research shows that generous compensation and benefits, stable establishment positions, and harmonious, supportive family and marital relationships effectively improve targeted medical students' contract compliance and retention rates [31-32]. Currently, foreign countries have formed relatively comprehensive incentive systems through salary increases, hardship subsidies, and career development optimization, achieving good results. Therefore, localities should actively implement the "Notice on Employment Placement

and Contract Management of Rural Targeted Free Medical Students," continuously stabilize and implement the grassroots service establishment system and targeted medical student assignment system, introduce corresponding social security policies, and continuously improve hardware conditions in rural medical institutions to encourage targeted medical students to actively work and remain in grassroots positions. Second, in developed countries, general practitioners' salaries generally range between 2.5 to 4 times the average social salary, a ratio only achieved in economically developed Beijing and Shanghai in China. Currently, salary levels remain low for most targeted medical students after employment. The main reason is that performance wages are limited by township health centers' total payroll, coupled with rigid performance assessment methods that result in small salary variation ranges. Therefore, under the guidance of the "two allowances" policy, we should increase the total performance pay for grassroots medical institutions and learn from the UK' s mixed payment system primarily based on "capitation fees" to reflect general practitioners' service value and promote reasonable income growth. Finally, to address post-contract talent loss, first, enhance targeted medical students' professional identity and sense of honor by strengthening contract spirit during training. We can establish "contract scholarships" or "compliance funds" to recognize and reward students who uphold contract spirit, and increase publicity and provide preferential title promotion and material incentives for outstanding practice in grassroots service after graduation, leveraging role model effects. Second, to reduce regional talent loss after contract fulfillment, we can organically combine county medical community construction with targeted general practitioner retention strategies. After targeted graduates fulfill their contracts, based on assessments of their practice level and comprehensive abilities, they can be prioritized for inclusion in county hospital workforces at their targeted units, utilizing their rich grassroots practical experience to provide professional guidance for medical staff at township health centers and village clinics, thereby encouraging more targeted medical students to commit to and remain at the grassroots level and effectively improving overall grassroots medical service quality.

The targeted training model, incentive model, and regional medical education model provide effective solutions for grassroots health talent cultivation through their distinctive institutional designs and practical innovations, yet each has inherent limitations. The targeted training model's compulsory contracts may suppress students' professional autonomy while ensuring talent supply; the incentive model' s fiscal dependence makes it difficult to sustain in economically underdeveloped regions; and the regional medical education model, while strengthening professional identity, lacks long-term retention mechanisms. Failed projects reveal the common problem of policy design disconnecting from implementation contexts. Therefore, cultivating health talent for China' s rural and remote areas requires both learning from foreign models' strengths to build a diversified, multi-level talent cultivation system that precisely matches regional and stage-specific needs, and rooting efforts in China' s national conditions to strengthen policy coordination and coherence, optimize implementation details, and focus

on resolving difficulties and bottlenecks in policy implementation, gradually constructing a grassroots health talent cultivation model with Chinese characteristics.

Note: Figure translations are in progress. See original paper for figures.