

Research on the Construction and Capacity Improvement of Training System for Professional and Technical Personnel in Pre-Pregnancy Eugenic Health Examination in Guangxi Region

—From the Practical Perspective of Birth Defect Prevention and Control

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ABSTRACT

Objective: To explore the construction path and implementation effect of the training system for professional and technical personnel in the free pre-pregnancy eugenic health examination project in Guangxi, so as to provide practical reference for improving the ability of primary maternal and child health services and reducing the incidence of birth defects. **Methods:** Taking the free pre-pregnancy eugenic health examination project in Guangxi from 2010 to 2024 as the research object, a training system of “policy guidance - demand orientation - hierarchical training - effect evaluation” was constructed. Various forms such as centralized training, special lectures, field visits, case analysis and further study were adopted to carry out systematic training for primary professional and technical personnel. **Results:** The training covered 112 counties (cities, districts) in Guangxi, with a total of more than 1000 professional and technical personnel trained, including 668 special training for laboratory technicians. The mastery rate

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of professional knowledge and the qualified rate of skill operation of primary personnel were significantly improved. The service rate of eugenic consultation and guidance for high-risk groups reached 100%. A total of 4.832 million person-times of pre-pregnancy examinations have been completed since the implementation of the project, and the effect of birth defect prevention and control has gradually emerged. Conclusion: The systematic training system has effectively improved the service ability of primary professional and technical personnel, promoted the standardized implementation of the pre-pregnancy eugenic health examination project, and is of great significance for promoting eugenics and improving population quality. It can provide reference for talent training in public health projects in underdeveloped areas.

1. INTRODUCTION

Birth defects are a major public health problem affecting population quality and family happiness. As a key link in preventing birth defects, the service quality of pre-pregnancy eugenic health examination directly depends on the ability of professional and technical personnel. In 2010, the state launched the free pre-pregnancy eugenic health examination project, aiming to reduce the risk of birth defects through systematic health intervention. As a large population province inhabited by ethnic minorities, Guangxi is faced with arduous tasks in birth defect prevention and control due to factors such as genetics, environment and uneven distribution of medical resources [1, 2].

As the technical guidance unit of the project, Guangxi Zhuang Autonomous Region Reproductive Hospital has jointly built a training system for primary professional and technical personnel with the Autonomous Region Health Commission since 2010. Based on 14 years of training practice, this study systematically sorts out the training background, implementation path and effects, so as to provide empirical basis for improving the public health talent training mechanism and promoting the implementation of the Healthy China strategy in ethnic areas.

2. TRAINING BACKGROUND AND THEORETICAL FRAMEWORK

2.1. Policy Background and Health Needs

At the national level, policies such as the *National Work Standard for Free Pre-pregnancy Eugenic Health Examination Project* [1] and the “*Healthy China 2030*” *Planning Outline* clearly require strengthening the construction of primary maternal and child health talent teams and improving pre-pregnancy eugenic service capabilities. At the Guangxi level, although the incidence of birth defects showed a fluctuating downward trend from 2010 to 2023, it was still higher than the national average level. Among them, thalassemia, congenital heart disease and other diseases are highly prevalent, and it is urgent to strengthen primary prevention and control capabilities through technical training [2].

There are two prominent problems in primary medical institutions: first, the knowledge update of professionals is lagging behind, and they have insufficient mastery of new technologies such as genetic testing and eugenic consultation; second, the service awareness is weak, and poor communication with the examinees leads to low participation rate in the project. Therefore, building a targeted training system has become the core to solve the above problems.

2.2. Guiding Ideology and Theoretical Basis

This training is guided by “people-oriented, oriented to the grassroots, and serving the people”, integrating the “Competency-Based Education (CBE)” theory and the “hierarchy of needs theory”: the former emphasizes designing training content with post ability as the core, and the latter focuses on meeting the

learning needs of personnel at different levels through hierarchical training. At the same time, combined with the regional characteristics of Guangxi, the contents such as ethnic minority language communication skills and regional high-incidence disease prevention and control are incorporated into the training system to ensure the adaptability of theory and practice.

3. TRAINING OBJECTS AND METHODS

3.1. Training Objects

Professional and technical personnel engaged in pre-pregnancy eugenic health examination in primary maternal and child health care hospitals and township health centers in 112 counties (cities, districts) of Guangxi, including inspectors, clinicians, health consultants, etc., 80% of whom are from county-level and below medical institutions [3, 4].

3.2. Training Implementation Path

Construction of hierarchical training system

- Basic level: For township-level personnel, carry out “theory + practical operation” centralized training, focusing on basic items such as blood routine, urine routine, and infectious disease screening, with 4 - 6 sessions per year, 50 - 80 people per session.
- Advanced level: For county-level backbones, strengthen skills such as eugenic consultation and risk assessment through special training courses (such as the 2016 physician special training and 2023 management training course), and carry out cross-regional exchanges in conjunction with medical institutions in Yunnan, Beijing and other places.
- Backbone level: Select outstanding personnel to further study in top three hospitals inside and outside the region (such as the First Affiliated Hospital of Guangxi Medical University and Yunnan Maternal and Child Health Care Hospital) for 1 - 3 months, focusing on improving laboratory management and quality control capabilities.

Design of training content

- Policies and regulations: *The Central Eight-Point Regulation and Its Implementation Rules, Work Standard for Pre-pregnancy Eugenic Health Examination Project*, etc.;
- Professional knowledge: genetics, molecular biology, epidemiology (focusing on birth defect prevention and control);
- Practical skills: testing technology (such as genetic testing), use of risk assessment tools, establishment of health records;
- Service capabilities: communication skills, ethnic minority language service standards, emergency handling.

Innovation of training methods

- “Case teaching + scenario simulation”: Using typical cases of birth defects in Guangxi as materials to simulate consultation scenarios for high-risk groups, so as to improve practical ability;
- Integration of “online + offline”: Develop WeChat applets to push learning materials, and carry out centralized Q&A and practical operation assessment offline;
- “Supervision + feedback” closed loop: Within 6 months after training, provincial experts go to the grassroots for supervision, collect improvement suggestions and optimize courses.

4. TRAINING RESULTS AND EFFECTS

4.1. Training Coverage and Participation

From 2010 to 2024, a total of 120 centralized training sessions, 15 special training courses were carried out, 92 further study personnel were selected, with a total of 1086 person-times trained, covering all project counties (cities, districts) in the region [5]. The participation rate of primary personnel increased from 65%

in 2010 to 98% in 2024.

4.2. Improvement of Professional Ability

1) Knowledge and skills: The qualified rate of laboratory technicians' assessment increased from 72% in 2013 to 96% in 2024, among which the proficiency in genetic testing technology operation improved the most significantly; 85% of physicians could independently complete risk assessment for high-risk groups.

2) Service quality: Since the implementation of the project, the feedback time of abnormal results of pre-pregnancy examination has been shortened from an average of 48 hours to 24 hours, and the satisfaction of the examinees has increased from 78% to 92%.

4.3. Project Implementation Effects

1) Expansion of coverage: The number of examinees increased from 22,800 person-times in 2010 to 298,800 person-times in 2023, with a total of 4.832 million people served, and the coverage rate of the target population reached 89%.

2) Birth defect prevention and control: The intervention rate of high-risk groups increased from 68% in 2010 to 100% in 2023. The incidence of birth defects in Guangxi decreased from 15.6‰ in 2010 to 11.2‰ in 2023, which was lower than the national average level in the same period.

4.4. Regional Collaboration and Sustainability

A technical collaboration network covering 14 cities in the region has been established, forming a linkage mechanism of “provincial guidance - municipal coordination - county-level implementation”; the training content has been included in the performance assessment indicators of primary medical institutions to promote the transformation of training results into long-term service capabilities. See [Table 1](#) below for details.

Table 1. Statistics of training and project implementation effects for professional and technical personnel in Guangxi pre-pregnancy eugenic health examination from 2010 to 2024.

Category	Specific Indicators	2010/ Initial Data	2023-2024/ End Data	Changes
Training coverage and participation	Number of centralized training sessions	-	120 sessions	A total of 120 sessions were carried out
	Number of special training courses	-	15 sessions	A total of 15 sessions were carried out
	Number of selected further study personnel	-	92 persons	A total of 92 persons were selected
	Total number of trained person-times	-	1086 persons	A total of 1086 persons were trained
	Participation rate of primary personnel	65%	98%	Increased by 33 percentage points

Continued

	Qualified rate of laboratory technicians' assessment	(72% in 2013)	96%	Increased by 24 percentage points
Improvement of professional ability	Proportion of physicians who can independently complete risk assessment for high-risk groups	-	85%	-
	Feedback time of abnormal results of pre-pregnancy examination	48 hours	24 hours	Shortened by 24 hours
	Satisfaction of the examinees	78%	92%	Increased by 14 percentage points
Project implementation effects	Annual number of examinees	22,800 person-times	298,800 person-times (2023)	Increased by about 12.1 times
	Total number of served people	-	4.832 million persons	-
	Coverage rate of target population	-	89%	-
	Intervention rate of high-risk groups	68%	100% (2023)	Increased by 32 percentage points
	Incidence of birth defects	15.6‰	11.2‰ (2023)	Decreased by 4.4 per thousand
Regional collaboration and sustainability	Coverage of technical collaboration network	-	14 cities in the region	Full coverage achieved
	Transformation mechanism of training results	-	Included in the performance assessment of primary medical institutions	A long-term transformation mechanism was established

Note: “-” indicates that there is no clear initial data or the data is not counted separately at the corresponding time node. The qualified rate of laboratory technicians' assessment in 2013 is used as the initial reference data.

5. DISCUSSION

5.1. Core Advantages of the Training System

Demand-oriented hierarchical design: Precisely implement policies according to the ability shortcomings of personnel at different levels in the grassroots, avoiding resource waste caused by “one-size-fits-all” training. For example, adding language service courses for ethnic minority areas has significantly improved the participation rate of the project in local areas [6].

Government-medical collaborative implementation mechanism: The Autonomous Region Health Commission and the Reproductive Hospital cooperate with each other, combining policy support with technical guidance to ensure that training and project promotion are in the same frequency and resonance.

Closed-loop management for quality control: Through the “training - assessment - supervision - feedback” process, the short-term training effect is transformed into long-term service ability, solving the problem of “disconnection between learning and application” in primary training [7, 8].

5.2. Existing Problems and Improvement Directions

Uneven distribution of training resources: Personnel in remote areas have high training costs (transportation, accommodation), so it is necessary to increase investment in online training and develop mobile learning platforms.

Insufficient training on emerging technologies: The training on the application of new technologies such as gene sequencing and artificial intelligence-assisted diagnosis is lagging behind, so it is necessary to cooperate with universities and scientific research institutions to update the curriculum system.

Lack of long-term incentive mechanism: The training results of primary personnel are not closely linked to professional title promotion and salary, so it is necessary to promote the inclusion of training assessment into the personnel management system.

6. CONCLUSIONS

By building a systematic training system for professional and technical personnel in pre-pregnancy eugenic health examination, Guangxi has effectively improved the primary service capacity, promoted the project from “full coverage” to “high quality”, and provided a solid talent guarantee for birth defect prevention and control. Practice shows that carrying out public health project talent training in underdeveloped areas needs to adhere to the principles of “policy guidance, demand-oriented, hierarchical implementation, and continuous improvement”, while strengthening cross-regional cooperation and long-term mechanism construction.

In the future, we should further integrate digital resources, strengthen new technology training, improve the incentive mechanism, and provide sustainable talent support for the in-depth implementation of the Healthy China strategy in ethnic areas.

7. LIMITATIONS OF THIS STUDY

Insufficient coverage of regional differences: Although the training covers the whole region, the unique training needs and effect differences in border remote areas and poverty-stricken areas inhabited by ethnic minorities have not been fully analyzed in detail.

Limited long-term tracking data: There is a lack of tracking on the long-term maintenance of knowledge and skills of trained personnel and their long-term contributions, making it difficult to judge the long-term stability of training results and the impact of personnel flow.

Complex attribution of training effects: The decline in the incidence of birth defects is affected by many factors, and it is difficult to accurately quantify the direct contribution of training.

Limitations of subjective evaluation indicators: The satisfaction of the examinees is easily affected by non-professional factors, and the evaluation of physicians' ability lacks multi-dimensional long-term

standards, resulting in an incomplete evaluation.

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CONFLICTS OF INTEREST

All authors declare that there are no personal conflicts of interest affecting the fairness of this study, no funding that may bias the research results has been received, and the research situation is presented in a scientific and rigorous manner.

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