EVALUATION OF THE RESULTS OF THE CONGENITAL HEART SCREENING TRAINING PROGRAM AT LAO CAI PROVINCE HOSPITALS

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ABSTRACT

Objective: *Describe the current situation of medical capacity to diagnose and treat children with congenital heart disease in Lao Cai in the period 2022-2023, including infrastructure, human resources and pharmaceutical warehouses product.*

Research subjects and methods: *During the period from November 2023 to January 2025, a prospective study was conducted at the Obstetrics and Pediatrics Hospital of Lao Cai province and 8 district hospitals of Lao Cai province, with 97 doctors, nurses and midwives participated in the study.*

Result: *For the screening class, in terms of professional qualifications, there are 77 doctors (accounting for 79.4%), 13 nurses (accounting for 13.4%), and 7 midwives (accounting for 7.2%). For the ultrasound class, there are 20 medical doctors participating in the Pediatric Echocardiography training class, 3 doctors from the provincial level (accounting for 15%) and 17 doctors from the district level (accounting for 85%). The average age of doctors participating in the training class is 30.8 ± 3.9 years old, the lowest age is 27 years old, the highest age is 37 years old. The average theoretical score in the group of provincial doctors increased from 6.0±1.95 points to 8.8±0.87 points after training, (p<0.001). The average score of the group of district doctors increased from 5.7±0.79 points to 8.0±0.82 points (p<0.001). The average theoretical score of the nursing group at the district level increased from 5.2±0.69 points to 7.5±0.66 points (p<0.001). The midwifery group at the district level had an average theoretical score increase from 5.1±0.69 points to 7.0±1.0 points (p<0.001).*

Conclusion: *Medical staff at the provincial and district levels in Lao Cai have limitations in the field of congenital heart disease, and these limitations are partly enhanced thanks to a theoretical training program combined with practice and supervision closely after the study.*

Keywords: *Screening, congenital heart disease in children*

I. INTRODUCTION

Congenital Heart Disease (CHD) refers to abnormalities in the structure of the heart present at birth that can adversely affect the formation and function of the heart (1). This congenital defect contributed to an estimated 261,247 deaths in 2017, of which 69% were infants under 1 year of age (2). Furthermore, the highest mortality rate from CHD is in low-income and lower-middle-income countries, including Vietnam (2). The main reasons for this dangerous outcome may be the vulnerability of children, limited access to

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life-saving interventions due to lack of funding, equipment, and qualified medical staff (3). Therefore, assessing the status of infrastructure, human resources, and pharmaceutical stocks is an important step in measuring the capacity of health facilities in a region. Although Vietnam has emerged from one of the poorest countries to become a lower middle-income country, many provinces in northern Vietnam still face significant challenges, especially Lao Cai (4). Lao Cai, a mountainous province in Vietnam, is geographically fragmented with two large mountain ranges, the Elephant Mountains and the Hoang Lien Son Mountains (5). Furthermore, two major rivers flow through Lao Cai, the Red River and the Chay River (6). This can limit health service coverage and may lead to increased mortality, especially among children (7). Therefore, understanding the current state of health resources (infrastructure, facilities and human resources) is important to motivate governments, donors and organizations to invest in improving resources for people's health services.

Although there have been studies evaluating the health system in Lao Cai, we did not find any studies specifically on congenital heart disease (8). Therefore, this study aims to describe the current situation of medical capacity for children with CHD in Lao Cai in the period 2022-2023, including infrastructure, human resources and pharmaceutical stocks. The results of this study are expected to provide basic evidence to promote authorities and policy makers to make appropriate interventions to improve medical capacity for children with CHD.

II. RESEARCH METHODS

2.1. Research design

Descriptive cross-sectional study with convenience sample

2.2. Research location and time

The study was conducted at Lao Cai Provincial Obstetrics and Pediatrics Hospital and 8 district hospitals of Lao Cai province, including Bac Ha, Bao Thang, Bat Xat, Bao Yen, Muong Khuong, Van Ban, Sa Pa and Simacai General Hospitals from November 2023 to January 2025.

2.3. Research subjects

For the training course on "Early congenital heart disease screening in newborns", the study selected 94 doctors, nurses and midwives who participated in the training but did not have a certificate in theory and practice of congenital heart disease screening. Similar to the "Color Doppler Echocardiography Technique Transfer" course, the study participants were 20 pediatricians, obstetricians and radiologists who were directly providing pediatric and obstetric care at provincial and district hospitals in Lao Cai province but did not have a cardiac ultrasound certificate.

2.4. Sample size, sample selection

94 medical staff participated in the training program "Early congenital heart screening in newborns" and 20 medical staff participated in the training program "Color Doppler Echocardiography Technique Transfer"

2.5. Variables

The variables collected in this study included general information of the research subjects, assessment of theoretical scores and practical scores for the trainees.

For general information, the variables included the working line (provincial or district level), age and professional qualifications (doctor, nurse or midwife).

Techniques, tools and procedures for data collection

• Training and supervision: 94 medical staff (doctors, nurses, midwives) participated in the training course on "Early congenital heart screening in newborns" and 20 medical staff (pediatricians, obstetricians, radiologists) participated from September 2023 to November 2024. The training program includes theoretical and practical sessions, using standard checklists for emergency procedures.

• Assessment of effectiveness: Before and after each training session, medical staff were

evaluated through theoretical and practical tests. The effectiveness of the training course was evaluated based on the improvement in test scores and practical skills.

Data processing: Data were updated, cleaned and entered into SPSS 20.0 software for analysis.

Research ethics: The study has been approved by the Decision No. 2620/QD-UBND dated November 3, 2022 of Lao Cai Provincial People's Committee on approving and funding the implementation of 07 scientific and technological tasks in 2022; the Contract No. 27/2022/HDKHCN dated November 18, 2022 between Lao Cai Provincial Department of Science and Technology and the National Children's Hospital on the implementation of scientific research topics;

This is an observational study, not intervening in the treatment process. Data collection methods are carefully designed so as not to affect the health or safety of patients, and their personal information is completely confidential.

III. RESULTS

3.1. General information of the research subjects

With respect to the screening class, there were 97 doctors, nurses, and midwives working at the Provincial Obstetrics and Pediatrics Hospital and 08 district hospitals of Lao Cai province participating in the study (Table 1). Of which, 12 staff were from the provincial level (12.4%) and 85 staff were from the district level (87.6%). The group of staff over 40 years old accounted for the highest proportion (30.9%), followed by the 25-30 age group (28.9%), the 35-40 age group (20.6%) and the lowest was 30-35 years old (19.6%). In terms of professional qualifications, the majority of staff participating in the training class were doctors, with 77 people (accounting for 79.4%), followed by nurses with 13 people (accounting for 13.4%) and the lowest was midwives, with 7 people (accounting for 7.2%).

As for the ultrasound class, 20 medical staff participated in the ultrasound training class. All staff participating in the ultrasound training class were doctors, of which 3 doctors were from the provincial level (accounting for 15%) and 17 doctors were from the district level (accounting for 85%). The average age of the doctors participating in the training class was 30.8 ± 3.9 years old, of which the youngest was 27 years old and the oldest was 37 years old. The 25-30 age group had the highest proportion (45.0%), followed by the 30-35 age group and the 35-40 age group (both accounting for 20%), the >40 age group had the lowest proportion (15.0%).

Table 1. General features of the research subjects

Features		Screening class		Ultrasound class	
		Quantity N = 97	Proportion (%)	Quantity N = 20	Proportion (%)
Working line	Provincial Hospital	12	12.4	3	15.0
	District Hospital	85	87.6	17	85.0
Age group	25-30	28	28.9	9	45.0
	30-35	19	19.6	4	20.0
	35-40	20	20.6	4	20.0
	>40	30	30.9	3	15.0
Qualifications	Doctor	77	79.4	20	100.0
	Nurse	13	13.4	0	0.0
	Midwife	7	7.2	0	0.0

3.2. Training effectiveness of screening class

Table 2 compares the average theoretical scores before and immediately after training between hospitals at all levels and between doctors, nurses, and midwives, showing a statistically significant difference. The analysis results show that the average theoretical score in the group of provincial doctors increased from 6.0±1.95 points to 8.8±0.87 points, the difference was statistically significant (p<0.001). At the district level, the analysis results also show that the average theoretical score before and immediately after training also changed significantly and statistically significantly. Specifically, the average theoretical score in the group of district doctors increased from 5.7±0.79 points to 8.0±0.82 points, the difference was statistically significant (p<0.001). The nursing group at the district level also had an average theoretical score increase from 5.2±0.69 points to 7.5±0.66 points, the difference was statistically significant (p<0.001). The midwifery group at the district level also had an average theoretical score increase from 5.1±0.69 points to 7.0±1.0 points, the difference was statistically significant (p<0.001).

Table 2. Comparison of average knowledge (theoretical) scores before and immediately after training between hospitals at all levels and between doctors/nurses/midwives

Subject		Minimum	Maximum	Mean ± SD	p-value
Provincial hospital					
Doctor	Before training	0	7	6.0±1.95	<0.001*
	After training	7	10	8.8±0.87	
District hospital					
Doctor	Before training	4	7	5.7±0.79	<0.001*
	After training	6	9	8.0±0.82	
Nurse	Before training	4	6	5.2±0.69	<0.001*
	After training	6	8	7.5±0.66	
Midwife	Before training	4	6	5.1±0.69	<0.001*
	After training	6	9	7.0±1.0	
Both levels on 3 subjects (Doctor/Nurse/Midwife)					
General (all subjects)	Before training	0	7	5.5±1.00	<0.001*
	After training	6	10	7.9±0.92	

Table 3 compares the average practice scores before and immediately after training between hospitals at all levels and between doctors, nurses and midwives, showing a statistically significant difference. The analysis results show that the average practice score in the group of provincial doctors increased from 7.8±0.72 points to 8.8±0.87 points, the difference was statistically significant (p<0.001). Similarly, at the district level, the analysis results also show that the average theory score before and immediately after training also changed significantly and was statistically significant. Specifically, the average theory score in the group of district doctors increased from 5.7±0.79 points to 8.0±0.82 points, the difference was statistically significant (p<0.001). The nursing group at the district level also had an average theoretical score increase from 5.2±0.69 points to 7.5±0.66 points, the difference was statistically significant (p<0.001). The midwifery group at the district level also had an average theoretical score increase from 5.1±0.69 points to 7.0±1.0 points, the difference was statistically significant (p<0.001).

Table 3. Comparison of the average practice scores before and after training between hospitals at all levels and between doctors/nurses/midwives

Subject		Minimum	Maximum	Mean ± SD	p-value
Provincial hospital					
Doctor	Before training	7	9	7.8±0.72	<0.001*
	After training	7	10	8.9±1.08	
District hospital					
Doctor	Before training	4	9	6.8±1.0	<0.001*
	After training	5	10	8.7±1.03	
Nurse	Before training	5	7	5.8±0.72	<0.001*
	After training	7	9	7.8±0.75	
Midwife	Before training	5	8	6.3±0.95	<0.001*
	After training	7	8	7.0±0.53	
Both levels on 3 subjects (Doctor/Nurse/Midwife)					
General (all subjects)	Before training	4	9	6.8±1.06	<0.001*
	After training	5	10	8.5±1.07	

3.3. Training effectiveness of ultrasound class

Table 4 compares the average theoretical scores before and immediately after training between hospitals at all levels, showing a statistically significant difference. The analysis results show that the average theoretical score in the group of provincial doctors increased from 7.3 ± 0.58 points to 9.7 ± 0.58 points, the difference was statistically significant (p<0.01). Similarly, at the district level, the analysis results also show that the average theoretical score before and immediately after training changed significantly and was statistically significant. Specifically, the average theoretical score of district doctors increased from 5.9 ± 0.89 points to 8.3 ± 0.99 points, the difference was statistically significant (p<0.001). In general, in both levels, the average theoretical score of doctors participating in the ultrasound training course increased from 6.2 ± 0.99 points to 8.5 ± 1.05 points, the difference was statistically significant (p<0.001).

Table 4. Comparison of the average knowledge (theoretical) score before and immediately after training between hospitals at all levels

Subject		Minimum	Maximum	Mean ± SD	p-value
Provincial hospital					
	Before training	7	8	7.3 ± 0.58	0.001*
	After training	9	10	9.7 ± 0.58	
District hospital					
	Before training	4	7	5.9 ± 0.89	<0.001*
	After training	7	10	8.3 ± 0.99	
Both levels					
	Before training	4	8	6.2 ± 0.99	<0.001*
	After training	7	10	8.5 ± 1.05	

Table 5 compares the average practice scores before and immediately after training between hospitals at all levels, showing a statistically significant difference. At the district level, the analysis results also show that the average practice scores before and immediately after training changed significantly and were statistically significant. Specifically, the average practice score of district doctors increased from 6.3 ± 0.81 points to 6.7 ± 0.87 points, the difference was statistically significant (p<0.001). In general, at both levels, the average practice score of doctors participating in the ultrasound training course increased from 6.5 ± 0.89 points to 6.9 ± 0.88 points, the difference was statistically significant (p<0.001).

Table 5. Comparison of the average practice scores before and immediately after training between hospitals at all levels

Subject		Minimum	Maximum	Mean ± SD	p-value
Provincial hospital					
	Before training	7,5	8	7.7 ± 0.29	-
	After training	7,5	8	7.7 ± 0.29	
District hospital					
	Before training	5	7,5	6.3 ± 0.81	<0.001*
	After training	5	8	6.7 ± 0.87	
Both levels					
	Before training	5	8	6.5 ± 0.89	<0.001*
	After training	5	8	6.9 ± 0.88	

IV. DISCUSSION

The results of the theoretical knowledge assessment before the course participation highlighted serious limitations in the knowledge base of the medical staff participating in the study. The average theoretical score of the trainees was only 5.5 ± 1.00 (on a 10-point scale), of which the rate of unsatisfactory performance was up to 77.6%. This is a sign of a lack of basic knowledge related to newborn screening and basic knowledge in caring for children with congenital heart disease, especially at the district level, where up to 91.8% of trainees did not meet the required level, compared to 50.0% at the provincial level.

The disparity between the district and provincial levels reflects a problem that has been pointed out by many studies: inequality in training and medical capacity between the grassroots levels. At the district level, the average pre-training theoretical scores of all groups (doctors, nurses, midwives) were lower than the average of the whole province. Notably, the average scores of the nursing and midwifery groups at the district level were 5.2±0.69 and 5.1±0.69 – the lowest among the surveyed groups. This not only shows a lack of specialized knowledge but also suggests that this group has little opportunity to access basic and advanced training programs. The survey in content 1 also shows that training programs on congenital heart screening in newborns and care for children with congenital heart disease have not been updated at district hospitals. Most children with congenital heart disease are operated on, treated, and monitored at the provincial Obstetrics and Pediatrics Hospital and units with cardiovascular surgery services at higher levels. Similarly, the results of knowledge on basic color Doppler echocardiography techniques for diagnosing congenital heart diseases in children of the trainees before the training also showed gaps in knowledge on pediatric echocardiography. All 20 trainees have knowledge and practice of ultrasound, and are directly working as

ultrasound doctors diagnosing diseases at provincial and district hospitals. Therefore, continuous knowledge updating for doctors in all specialties is extremely necessary and needs to be carried out continuously at all hospital levels of Lao Cai province.

The results of the study showed that the practical skills of medical staff were improved after both training courses. With respect to the congenital heart screening training class, the average score immediately after the course was 8.5±1.07, the lowest score was 5, and the highest score was 10. And the practice of the Color Doppler Echocardiography Transfer class after the training, the average score after the course was 6.9±0.88, the lowest score was 5, and the highest score was 8 on a scale of 10. This is a step forward compared to before the course, but there is still a rate of unsatisfactory performance in both theory and practice. The unsatisfactory group fell into the district-level trainees, accounting for 7.1% of the theory and 1.2% of the screening practice class. This reflects that there are still trainees who have not fully mastered the basic skills in newborn screening. With respect to the cardiac ultrasound class trainees, the average theoretical score after the course was 6.9±0.88, although no student had not yet passed, the assessment score was not too high. It is noteworthy that this improvement was not uniform across levels and target groups. At the provincial level, the rate of passing practical skills was higher than at the district level (100% compared to 88.2%), suggesting that access to modern equipment and better working conditions may have supported provincial medical staff to practice more effectively. However, even at the provincial level, the results were still modest, raising questions about the effectiveness of short-term practical training.

This result is consistent with previous studies, which have shown that short-term practical training is often only optimal when combined with post-training supervision and support programs. A study in China on congenital heart screening training also found that only when training was combined with on-site clinical supervision activities did the practical skills of medical staff improve significantly. (9) Lessons from other developing countries suggest that the use of simulation tools and direct patient instruction can help trainees master skills more quickly.

This study has some limitations. First, the assessment of pre-training theoretical knowledge in this study mainly relied on a set of 10 theoretical questions. Although the set of questions was designed to cover important content, the number of questions and the range of assessment may not be sufficient to comprehensively reflect the trainees' abilities. In addition, the results may also be affected by factors such as psychological stress during the test or the trainees' experience in answering multiple-choice questions. Second, the practical training time is short. In the total 10 days of the congenital heart screening course, only 8 days are devoted to practice, and congenital heart is a difficult knowledge in Pediatrics, which may not be enough for trainees to master complex techniques as well as fully assess pediatric patients. Finally, the practice conditions are not optimal. At the district level, limitations in equipment and facilities may have affected the trainees' ability to practice. The lack of simulation models or real patients for practice in the course may reduce the effectiveness of the lessons.

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