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REGULAR ARTICLE

Neonatal resuscitation in Vietnam: a national survey of a middle-income country

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ABSTRACT

Aim: Interventions that improve neonatal resuscitation are critical if we are to reduce perinatal mortality. We evaluated the consistency of resuscitation practices, and adherence to the international guidelines for neonatal resuscitation, in a large representative sample of hospitals in Vietnam.

Methods: A questionnaire was sent to 187 public central, provincial and district hospitals, representing the three levels of public hospital-based maternity services in Vietnam.

Results: The overall response rate was 85.7% (160/187 hospitals), and the response rate was 100%, 90.3% and 81.7% for central, provincial and district hospitals, respectively. There were 620 300 births in the surveyed hospitals during the year 2011, representing almost half of all inpatient births in Vietnam. Neonatal resuscitation was provided by obstetricians and, or, midwives at all levels. Half of the hospitals did not follow recommendations for delaying cord clamping. The majority of the hospitals did not have a wall thermometer in the delivery room (80.5%) and did not monitor neonatal temperature after birth (64.1%). A large proportion of hospitals (39.9%) used 100% oxygen to initiate resuscitation and only central hospitals avoided this practice.

Conclusion: Our survey identified significant variations in resuscitation practices between central, provincial and district hospitals and limited adherence to international recommendations.

INTRODUCTION

While the under-five mortality rate is being reduced worldwide, there has been limited progress in reducing the neonatal mortality rate in the last decade (1). Neonatal resuscitation is now receiving increasing attention and having been identified as a missed opportunity for improving morbidity and mortality outcomes. Newton and English reviewed the evidence for neonatal resuscitation and concluded that effective resuscitation in low-resource settings was possible with basic equipment and skills (2). Training the healthcare providers in neonatal resuscitation may prevent 30% of deaths of full-term babies experiencing adverse intrapartum events, as well as 5–10% of deaths among infants born preterm (3,4).

Every 5 years, the American Heart Association (AHA) and the American Academy of Pediatrics (AAP) publish guidelines that aim to provide an organised, sequential and standardised approach to the delivery room resuscitation of newborn infants (5,6). However, these guidelines are generally not designed for resource-limited settings and

Key Notes

- Interventions that improve neonatal resuscitation are critical if we are to reduce perinatal mortality.
- We evaluated the consistency of resuscitation practices, and adherence to international guidelines for neonatal resuscitation, after 160 hospitals providing inpatient maternity services completed our questionnaire-based survey.
- The findings, which covered almost half of inpatient births in Vietnam, identified significant variations in resuscitation practices between central, provincial and district hospitals and limited adherence to international recommendations.

require the presence of more than one healthcare provider with extensive training, as well as advanced technology. In 2012, the World Health Organization (WHO) published updated guidelines on basic newborn resuscitation to ensure that newborn infants who require resuscitation in resource-limited settings are effectively resuscitated (7). In this article, the AHA and APA guidelines are jointly referred to as international guidelines for neonatal resuscitation (5,6). In high-resource countries, national surveys have been conducted to evaluate the adherence to international guidelines and consistency of practice in early delivery room management of neonates (8–12). However, these data are lacking in lower resource countries, where the burden of intrapartum mortality is the greatest and the need for effective neonatal resuscitation is most urgent (13). To strengthen newborn care, it is necessary to identify the points of discord between current evidence and standard clinical practice in low-income and middle-income countries. South-East Asia is the region with the highest percentage of under-five mortality attributable to neonatal causes (1), and Vietnam is a nation of interest, as a protagonist of many initiatives and humanitarian programmes developed in recent years, such as the Delivering as One programme (14). Vietnam is widely considered a model among middle-income countries for its great achievements in economic development, reducing poverty and improving health status over recent decades. However, important challenges remain that need to be addressed to achieve national health and development goals. In health care, these concerns include preventable neonatal mortality (15–17) and the disparity between different geographical and socio-economic regions, in particular between rural mountainous and urban lowland regions (18–20).

The first aim of the present survey was to describe resuscitation practices in a large representative sample of public maternity services in Vietnam and assess adherence to the international guidelines for neonatal resuscitation. Secondly, we wanted to identify differences in resuscitation practices between different levels of healthcare provision, specifically central, provincial and district hospitals.

METHODS

We conducted a structured survey of delivery room management of newborn resuscitation among public hospital-based maternity services in Vietnam.

The Vietnamese health system provides care through four overlapping administrative levels: central, provincial, district and community (21, 22). Hospital-based maternity services are not provided at the community level.

Participants

A total of 187 hospitals were approached to complete the survey. East Meets West, a nongovernment organisation engaged in neonatal care in Vietnam, created a listing of all 746 maternity hospitals in Vietnam, in consultation with the Ministry of Health and contacted each hospital to ascertain the number of births in that hospital in 2010. A total of 136 smaller hospitals, defined as district hospitals with <500 births in 2010, were excluded, representing 18.2% of all maternity hospitals, but only 3.0% of maternity hospital births. The remaining 610 hospitals constituted the sampling frame for the study, and this listing was used to generate two samples comprising (i) a census sample of all six central hospitals and all 72 provincial hospitals, representing 12.7% of hospitals and an estimated 40.8% of births in the sampling frame and (ii) a 20% sample survey of 532 district hospitals (n = 109) with 500 or more births in 2011. The district hospitals were chosen randomly from each of the eight administrative regions commonly used for reporting purposes by the Government of Vietnam, with each region restricted to providing 20% of the district hospitals in its catchment, following a stratified random sample with proportional allocation approach.

Evaluation instrument

A structured 131-item questionnaire and an accompanying introductory letter were sent by email to the directors of the hospitals. To maximise response rates, a reminder was sent to the nonresponders every 2 weeks for a maximum of three times. If we still did not receive an answer, the participant was contacted by phone by an investigator and a new email was sent. Participation was entirely voluntary. The survey was conducted between May and September 2012.

The questionnaire was structured in two parts. The first part comprised 121 questions and requested information on the epidemiological and organisational characteristics of the hospital and asked questions about the current delivery room practices in relation to neonatal resuscitation: initial steps, such as thermal control, umbilical cord clamping and airway suctioning; ventilation, such as oxygen supplementation, positive-pressure ventilation and surfactant treatment; chest compressions and medications. The second part, comprising of 10 questions, focused on relevant equipment available at the hospital. The questions all referred to the period 1 January to 31 December 2011 and included multiple choice questions, brief responses and yes/no responses. In this article, we report data collected in the first part of the questionnaire.

Statistical analysis

The sample survey was drawn from the sampling frame using the PROC SURVEYSELECT procedure in SAS v9.2 (SAS Institute Inc., Cary, NC, USA), specifying simple random sampling with a sampling rate of 20% within each of eight strata. A randomly chosen seed was used. The resultant sample had a sampling fraction of 0.2 in three strata, and a marginally higher sampling fraction in the other five strata where the number of eligible hospitals was not divisible by five (maximum of 0.21429). National estimates were weighted to account for 100% sampling of central and provincial hospitals versus approximately 20% sampling of districts, and the exact sampling fractions were used for weighting.

Stratified random sampling with proportional allocation was chosen as the sampling method for district hospitals to ensure that none of the eight administrative regions was

under-represented by chance. Missing data were ignored in the analysis in the sense that nonresponding hospitals were not included in either the numerator or the denominator. This is equivalent to assuming that nonrespondents have an identical average response profile to other respondents in their grouping: central hospitals, provincial hospitals and, for district hospitals, other district hospitals in the relevant administrative region.

As the response rate was differential – in particular 100% overall at the central level, 90.3% overall at the provincial level and 81.7% overall at the district level overall, and ranging from 58.3% to 100% in the eight administrative regions – data were inflated by the inverse of the response rate to ensure no systematic bias in the estimated group parameters. A second type of missing data occurs where a survey respondent fails to answer a specific question and when this occurred in our study, results were inflated appropriately before calculating the group parameters. Central level and provincial level estimates represent the percentage calculated among respondents, while district level estimates are the weighted aggregate of responses in the eight administrative regions after accounting for different sampling fractions and nonresponse rates within each region. National level estimates are the weighted aggregate of central, provincial and eight separate district level estimates after reweighting for sampling fraction, for district hospitals only, and nonresponse, for all three levels.

Categorical data are expressed as numbers and percentages, continuous data as medians and interquartile ranges. Analysis was performed using SAS v9.2. For simplicity in reporting, central provincial and district estimates of categorical variables are only reported as a percentage, while the overall estimate shows the national estimate for hospitals with 500 or more births and the 95% confidence interval around that estimate. Estimates were calculated using the PROC SURVEYMEAN procedure. National estimates of continuous variables, such as medians and interquartile ranges, were calculated using the PROC SUMMARY procedure.

RESULTS

A total response rate of 85.7% (160/187 hospitals) was obtained. The response rate was 100% (6/6), 90.3% (65/72) and 81.7% (89/109) for national, provincial and district hospitals, respectively (Fig. 1). Figure 1 and Table 1 report the characteristics of the hospitals. The results regarding the main four phases of neonatal resuscitation, such as initial steps, ventilation, chest compressions and medications, and, in addition, ethics and educative aspects are reported in Tables 2–5.

DISCUSSION

This study described resuscitation practices in larger Vietnamese public hospitals and assessed their consistency with current international guidance. The main strengths of this study included a nationally representative sample, a high response rate (85.6%) and the large number of births at the

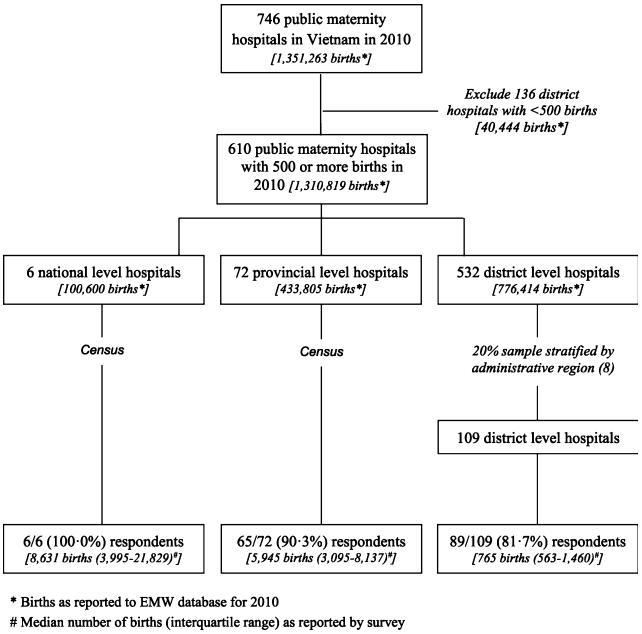

Figure 1 Flow of participants through enrollment, sampling strategy and completion of the study protocol.

hospitals in our sample, almost half of all hospital births in Vietnam.

Overall, the results of this study showed areas of good evidence-based delivery room practice, but they also identified significant variations in delivery room resuscitation practices among the different levels of maternity services. A survey conducted in the UK (11) suggested that the quality of the care in neonatal resuscitation was strongly affected by the level of the hospitals, and the results reported here suggest that this is similarly true in middle-income countries. In Vietnam, priority should be given to district hospitals as the majority of births and larger gaps in quality of care take place at that level.

The healthcare providers most commonly involved in neonatal resuscitation was the obstetrician or the midwife at all hospital levels, while the paediatrician was less often involved, except in central hospitals. Our results contrast with those reported in two Italian surveys where the key person responsible for neonatal resuscitation was usually a neonatologist (8,9), reflecting the different organisation of the maternal–neonatal health system. The different background of the professional figures involved in the management of the newborn at birth could result in a different approach to the patient and could potentially influence the neonatal outcome.

It was noteworthy that the hospitals used different protocols for neonatal resuscitation: the majority of higher level hospitals followed the AHA and AAP international guidelines and the new WHO guidelines (5–7), while the lowest level hospitals based their resuscitative intervention on the national (Minister of Health) standard protocol (22). Although the basic algorithms are comparable, there are a

Table 1 Resuscitation practitioners and protocols

	Overall estimate % (95% CI)	Hospital level		
		Central %	Provincial %	District %
Leader for neonatal resuscitation*				
Paediatrician	12.4 (7.3–17.6)	50.0	30.8	9.5
Obstetrician	71.9 (64.0–79.7)	83.3	83.1	70.3
Midwife	67.0 (59.0–75.0)	83.3	63.1	67.4
Nurse	2.4 (0.0–5.1)	0.0	1.5	2.5
Protocol for neonatal resuscitation†				
Neonatal Resuscitation Program	20.9 (14.1–27.6)	66.7	37.5	18.1
Helping Babies Breath	4.0 (0.6–7.5)	0.0	0.0	4.6
Minister of Health standard protocol	72.0 (64.6–79.4)	33.3	57.8	74.4
Others	3.1 (0.5–5.7)	0.0	4.7	2.9

*Hospitals could indicate more than one type of clinical leader (i.e. does not sum to 100%).
†Data not available in two hospitals.

Table 2 Initial steps (umbilical cord clamping, thermal control, suctioning)

	Overall estimate % (95% CI)	Hospital level		
		Central %	Provincial %	District %
Time for umbilical cord clamping				
Immediately after birth	55.2 (46.7–63.8)	50.0	43.1	56.9
After 1 min	32.4 (24.3–40.4)	16.7	38.5	31.7
After 3 min	8.4 (3.8–13.0)	33.3	9.2	8.0
When umbilical stops beating	4.0 (0.9–7.1)	0.0	9.2	3.4
Presence of wall thermometer in DR	19.5 (13.8–25.2)	66.7	40.0	16.2
DR temperature known	35.9 (27.9–43.9)	66.7	50.8	31.9
DR temperature ≥25°C (if known)	84.6 (73.1–96.1)	100.0	97.0	81.6
Routinely measure temperature of infants after birth	47.8 (40.2–55.4)	83.3	49.2	47.2
Airway suction performed after birth in DR				
In all patients	41.6 (33.5–49.8)	0.0	24.6	44.4
When indicated, based on clinical conditions	46.5 (38.2–54.7)	100.0	64.6	43.4
Only in meconium stained fluid	11.7 (6.5–17.0)	0.0	9.2	12.2
I do not know	0.2 (0.1–0.3)	0.0	1.5	0.0
Use of maximum suction pressure level	36.8 (28.9–44.8)	50.0	53.8	34.4

few differences between AHA and AAP guidelines and WHO guidelines, such as the time for heart rate detection, the use of blender and ventilatory devices, such as flow-inflating bag and T-piece, the chapter on intubation and medications and the use of the oximeter. Local Vietnamese protocol is very similar to the WHO guidelines, but includes also some parts of the AHA and AAP recommendations, such as intubation and medications. The practices that were noted to be inconsistent with the AHA and AAP guidelines and WHO guidelines in the district and provincial hospitals could, in part, reflect the discrepancy between the protocols. A common protocol updated to international standards and adapted to levels of care for the whole country could positively influence both educational and clinical programmes.

The optimal timing for clamping the umbilical cord after birth has been a subject of controversy and debate in recent years, but there is consensus on the benefits of delaying cord clamping compared to immediate cord clamping. AHA and AAP guidelines state that 'delay in umbilical cord clamping for at least 1 min is recommended for newborn infants not requiring resuscitation' (6), while the WHO recommends 1–3 min (23). However, about half of the sampled hospitals did not follow this recommendation.

Our data showed that a large proportion of hospitals (80.5%) did not have a wall thermometer in the delivery room and that two-thirds (65.5%) did not know the environmental temperature in the delivery room. Furthermore, about half of the participating hospitals stated that they did not routinely measure the temperature of the

Table 3 Ventilation (oxygen therapy, PPV, intubation and surfactant)

	Overall estimate % (95% CI)	Hospital level		
		Central %	Provincial %	District %
Oxygen concentration to initiate resuscitation in full-term infants				
FiO_2 = 0.21	13.2 (7.5–18.9)	50.0	12.3	12.9
FiO_2 = 0.40	23.4 (16.3–30.5)	33.3	32.3	22.1
FiO_2 = 1.00	39.9 (31.5–48.4)	0.0	47.7	39.3
Other	23.4 (16.0–30.8)	16.7	7.7	25.6
Oxygen concentration to initiate resuscitation in preterm infants				
FiO_2 = 0.21	10.9 (6.1–15.7)	33.3	15.4	10.0
FiO_2 = 0.40	19.5 (13.1–25.8)	66.7	27.7	17.9
FiO_2 = 1.00	46.4 (38.0–54.4)	0.0	44.6	47.1
Others	23.2 (16.6–30.4)	0.0	12.3	25.0
Use pulse oximetry	22.2 (15.6–28.8)	66.7	53.8	17.4
Use of saturation targets (if using monitoring)	91.9 (84.4–99.3)	100.0	85.7	94.1
PPV administered through				
Self-inflating bag	35.5 (28.4–42.7)	66.7	49.2	33.3
Self-inflating bag and flow-inflating bag	1.9 (0.0–4.3)	0.0	0.0	2.2
Flow-inflating bag	48.2 (40.8–55.5)	33.3	44.6	48.8
T-piece device	1.6 (0.0–3.7)	0.0	3.1	1.4
I do not know	12.8 (7.1–18.6)	0.0	3.1	14.3
Initial interface for PPV*				
Facial mask	86.6 (80.5–92.7)	100.0	93.9	85.5
Laryngeal mask airway	1.4 (0.0–3.6)	0.0	1.5	1.4
Endotracheal tube	3.3 (0.2–6.5)	0.0	3.1	3.4
Nasal tube	0.2 (0.1–0.3)	0.0	1.5	0.0
I do not know	8.5 (3.6–13.5)	0.0	0.0	9.8
Tracheal tubes (when available)†				
Single use	68.6 (59.3–77.9)	100.0	91.7	64.6
Both single use and re-usable after cleaning	0.2 (0.0–0.4)	0.0	1.7	0.0
Re-usable after cleaning	23.7 (15.1–32.2)	0.0	6.7	26.6
I do not know	7.5 (2.1–13.0)	0.0	0.0	8.8
Route of intubation (when tracheal tubes available)†				
Oro-tracheal	86.1 (80.1–92.1)	100.0	98.3	84.1
Naso-tracheal	1.5 (0.0–3.7)	0.0	1.7	1.5
I do not know	12.4 (6.3–18.4)	0.0	0.0	14.5
Respiratory supports available in the NICU‡				
Mechanical ventilator	15.4 (10.4–20.4)	100.0	41.5	10.9
nCPAP	21.8 (15.8–27.8)	83.3	64.6	15.3
Nasal-cannulas for O_2 therapy	73.6 (66.4–80.7)	83.3	69.2	74.1
Hood for O_2 concentration	7.5 (3.4–11.7)	33.3	16.9	6.0
Availability of surfactant§	6.9 (4.3–9.4)	83.3	33.8	2.3

*Data not available in two district hospitals.
†Tracheal tubes not available in five provincial and 18 district hospitals.
‡Hospitals could indicate more than one kind of respiratory support (i.e. does not sum to 100%).
§Data not available in one district hospital.

newborn infants. These practices did not comply with the WHO recommendations (24, 25). These findings suggest that thermal control is an area of concern for Vietnamese hospitals and that simple low-cost interventions, accompanied by relevant training, could improve this important element of neonatal management.

Recommendations for oxygen supplementation at birth have changed markedly in the latest versions of the international guidelines for neonatal resuscitation (5, 6). Our data showed that the new recommendations had been partially implemented at central level hospitals, but were rarely implemented at provincial and district hospitals. Similar findings have also been reported in high-resource settings (11). A blender was rarely available in the district and provincial hospitals that initiated positive-pressure ventilation with 100% oxygen. As the question regarding the oxygen concentration to initiate resuscitation included only three possibilities (FiO2 0.21, 0.40 or 1.00), we believe that this practice reflected a knowledge deficit more than a lack of necessary equipment.

Table 4 Chest compressions and medications

	Overall estimate % (95% CI)	Hospital level		
		Central %	Provincial %	District %
Technique for administering chest compression*				
Two-thumb technique	37.7 (29.4–46.1)	66.7	26.2	39.0
Two-finger technique	11.8 (6.4–17.3)	0.0	9.2	12.3
Both	50.4 (41.7–59.1)	33.3	64.6	48.7
Medications readily available in DR†				
Epinephrine	94.1 (90.2–97.9)	100.0	95.4	93.8
Volume expanders	84.7 (79.0–90.3)	66.7	78.5	85.7
Bicarbonates	59.4 (51.4–67.5)	33.3	55.4	60.3

*Data not available in one district hospital.
†Hospitals could indicate more than one kind of medication (i.e. does not sum to 100%).

Table 5 Ethics and education

	Overall estimate % (95% CI)	Hospital level		
		Central %	Provincial %	District %
Presence of local Ethics Committee*	26.7 (18.5–34.9)	50.0	30.9	25.9
Written guidelines for management of ELBWI†	29.0 (20.0–38.1)	60.0	32.1	28.3
Timing for interrupting resuscitation with cardiac arrest‡				
At 10 min	20.7 (13.7–27.7)	16.7	21.5	20.6
After	79.3 (72.3–86.3)	83.3	78.5	79.4
Presence of courses on neonatal resuscitation§	46.5 (38.7–54.4)	100.0	87.7	40.3
Courses on neonatal resuscitation held in the last 2 years§				
0	48.9 (40.6–57.2)	0.0	15.4	54.0
1–2	37.0 (29.1–44.8)	50.0	47.7	35.4
3–4	10.8 (5.8–15.9)	16.7	21.5	9.3
5+	1.8 (1.5–2.1)	33.3	12.3	0.0
I do not know	1.6 (0.0–3.7)	0.0	3.1	1.4

*Data not available for 10 provincial and 16 district hospitals.
†Data not available for one central, nine provincial and 19 district hospitals.
‡Data not available for four district hospitals.
§Data not available for one district hospital.

The use of a pulse oximetry in the delivery room was very limited, at 22.2% of the sampled hospitals, and this is of concern as oximetry in the delivery room has become a standard of care in high-resource settings (9,12).

Positive-pressure ventilation can be administered by a self-inflating bag, a flow-inflating bag or a T-piece device (5,6). A T-piece device is widely used in developed countries (9, 11), but it was used in only a few (1.6%) hospitals in Vietnam. The advantages of this new device have not been demonstrated, but there are theoretical reasons for believing that it could significantly improve the ventilation of newborns at birth (26).

As expected, advanced respiratory supports, such as mechanical ventilators, nasal continuous positive airway pressure systems and surfactant, were available in the delivery rooms of higher level hospitals, but were rarely available in district hospitals. This reflects the health system in Vietnam, which strongly promotes referral of high-risk cases to higher level facilities.

The technique used for administering chest compressions was in agreement with the recommendations of international guidelines for neonatal resuscitation in almost all hospitals (5,6). Due to the limited evidence and the potentially dangerous side effects, bicarbonate is no longer recommended for neonatal resuscitation. It was notable that more than half of the provincial and district hospitals still had bicarbonates readily available in the delivery room.

The presence of a local ethics committee and the availability of written guidelines for the management of very preterm infants were limited to a quarter of the participating hospitals, and these factors were influenced by the level of the hospital. Only 10% of the sample reported that they stopped resuscitation after 10 min when faced

with a newly born baby with no detectable heart rate. These findings may reflect cultural considerations rather than a lack of knowledge of the international recommendations.

Training represents a very important component of the latest versions of the international guidelines (5,6). As expected, the courses on neonatal resuscitation were more frequently held at the highest level hospitals, but the number of courses in the last 2 years still remained very low. About half of the district hospitals had not organised a course in the last 2 years. Moreover, the differences in the adherence to international recommendations between high- and low-level hospitals suggested that district hospitals need additional training, perhaps conducted by national and provincial hospitals, before they in turn train lower level facilities.

There were some limitations to this study. As the survey forms were completed by the directors of the participating hospital delivery rooms, and the responses were not checked against observed clinical practice, the actual practices of individual providers may not be fully represented.

A further limitation of the study was the different size of the three hospital categories. We have chosen to weight our results by hospitals rather than births because we felt this better represented the policy task, by focusing on the percentage of hospitals that require additional policy support and training to improve their neonatal resuscitation services.

In this study, we have highlighted limited adherence to guidelines in a single middle-income country. Clearly, it would be better to compare data with other middle-income countries, but, unfortunately, we did not find similar surveys making the comparison impossible.

CONCLUSION

We identified significant variations in resuscitation practices among levels of hospital-based maternity services in Vietnam. The data showed limited adherence to international recommendations, with lower adherence at lower level hospitals.

This survey identifies the strengths and limitations in neonatal resuscitation practices in Vietnamese hospitals, suggesting the possibility that simple low-cost interventions could be implemented to improve neonatal outcomes, particularly in district hospitals where a large proportion of the births in Vietnam take place. Our study provides useful information for a review of national policy and could guide the planning of future investments and training programmes in Vietnam.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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