

Ten Years of Experience Training Non-Physician Anesthesia Providers in Haiti

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Abstract Surgery is increasingly recognized as an effective means of treating a proportion of the global burden of disease, especially in resource-limited countries. Often non-physicians, such as nurses, provide the majority of anesthesia; however, their training and formal supervision is often of low priority or even non-existent. To increase the number of safe anesthesia providers in Haiti, Médecins Sans Frontières has trained nurse anesthetists (NAs) for over 10 years. This article describes the challenges, outcomes, and future directions of this training program. From 1998 to 2008, 24 students graduated. Nineteen (79%) continue to work as NAs in Haiti and 5 (21%) have emigrated. In 2008, NAs were critical in providing anesthesia during a post-hurricane emergency where they performed 330 procedures. Mortality was 0.3% and not associated with lack of anesthesiologist supervision. The completion rate of this training program was high and the majority of graduates continue to work as nurse anesthetists in Haiti. Successful training requires a setting with a sufficient volume and diversity of operations, appropriate anesthesia equipment, a structured and comprehensive training program, and recognition of the training program by the national ministry of health and relevant professional bodies. Preliminary outcomes support findings elsewhere that NAs can be a safe and effective alternative where anesthesiologists are scarce. Training non-physician anesthetists is a feasible and important way to scale up surgical services resource limited settings.

Introduction

The poor availability of surgical services in developing countries is a long-neglected problem that has recently gained attention [1]. Violence, injury, and obstetric emergencies have long ranked as leading causes of mortality and morbidity, and many deaths can be avoided through surgical intervention.

The need for trained anesthesia providers is critical if surgery is to be a safe and cost-effective public health intervention. Extremely high avoidable anesthesia-related mortality rates have been reported in a number of resource-limited settings, from one in 504 deaths in a central hospital in Malawi to one in 133 in a teaching hospital in Togo [2, 3]. A recent inquiry into maternal deaths in South Africa identified anesthesia as one of the top four causes of avoidable deaths [4]. It is estimated that safe obstetric anesthesia can prevent 5% of deaths during cesarean section [5].

However, the availability of health workers in resource-limited countries able to deliver safe surgical services remains extremely limited, and this applies acutely in the case of specialist physicians such as anesthesiologists. Some African countries have as few as one anesthesiologist per million residents [6–8]. Task shifting is one approach to overcoming the lack of specialists in resource-limited settings, including surgeons and anesthesiologists [9]. In the absence of specialists, non-physician anesthetists (NPA) have been mobilized to perform anesthesia in many resource-limited settings [10, 11].

Non-physician anesthetists

The delivery of anesthesia care by non-physician anesthetists (NPA) is not unique to resource-poor settings. In

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the United States, certified registered nurse anesthetists (CRNAs) have performed anesthesia since the 1800s. At present CRNAs administer anesthesia for approximately two-thirds of the 30 million annual procedures performed in the US, especially in rural hospitals. In the United States, CRNAs receive 2–3 years post-nursing training and recertify every 2 years. Their training and certification is monitored by the regulatory body of the American Association of Nurse Anesthetists. Nurse anesthetists (NA) in Western Europe are similarly accredited. In general, NPAs are respected by anesthesiologists, hospital staff, and patients [12, 13]. Numerous studies have shown that NPA administered anesthesia results in equivalent outcomes compared to those of anesthesiologists [14–16].

In many resource-limited countries, NPAs deliver a significant proportion of anesthetic services [17]. A recent study demonstrated that 107 of 200 countries surveyed used non-doctors to administer anesthesia, with or without anesthesiologist supervision [18]. However, the deployment and acceptance of NPAs is not uniform: in some countries training programs and formal supervision of NPAs is a low priority or non-existent [8]. In a study from Zambia, over three-quarters of anesthesia services were performed by NPAs who had little or no formal training [19]. This type of unregulated service can lead to unsafe practices and unacceptable morbidity and mortality, and it can also undermine acceptance of NPAs as a means to increase service provision.

Nurse anesthetist training in Haiti

Médecins Sans Frontières (MSF) has been working in Haiti since 1991 and currently provides emergency surgical services in several cities. In 1998, MSF established a NA training program in response to the severe shortage of anesthesiologists outside the capital. This article describes the challenges, outcomes, and future direction of MSF's 10-year experience with this training in Haiti.

Haiti is the poorest country in the Americas and has the highest maternal mortality [20]. Less than 40% of the population has access to basic health services [21]. Like most of the sub-Saharan African countries, Haiti suffers from a critical shortage of doctors, nurses, and midwives [22]. It has the fewest doctors in the Americas, with only 0.24 per 1,000 population (by comparison, the United States, Haiti's wealthy neighbor, has almost 100 times more [23]). Over half of the country's doctors have emigrated, mainly to the United States, United Kingdom, Canada, and Australia [24]. The few doctors who have remained are unevenly distributed, mostly working in Port au Prince, the capital city [25]. There are about 35 anesthesiologists in the country, but few work outside Port au

Prince. Anesthesiologists from Cuba provide some care in rural areas (P.R., S.G., personal observations). Nurse anesthetists are recognized as a cadre of anesthesia providers; however, certified training programs for NA do not exist and many NA have been informally trained.

Training locations

Hôpital Saint Nicolas (HSN) is the referral hospital for the Artibonite Department, an agricultural valley in the northeastern part of Haiti. In the 1990s, MSF provided primary health care in several districts in the department. Given the absence of qualified anesthesia providers at HSN, MSF began a NA training program in 1998 in conjunction with a training program in surgical skills for general practitioners, with the agreement of the Ministry of Public Health and Population (MSPP). The initial objective was to train NAs to provide anesthesia independently at HSN. After the first class was successfully trained, other hospitals asked MSF to train their nurses in anesthesia as well. Four subsequent classes were trained. In 2003 MSF stopped the NA training at HSN and ended its primary health care support. In 2007, MSF restarted the NA training program at Hôpital Bon Saveur in Canges, a private hospital run by the NGO Partners in Health.

The goal of the training program was to train nurses to provide anesthesia independently and safely in rural Haiti. The students were certified nurses who were nominated by government hospitals or who applied independently. Preference was given to those who had a guaranteed position in a hospital and those least likely to emigrate. The Haitian Medical Association and the Haitian Society of Anesthesiologists were invited to participate in the training; however, neither responded to this request.

Curriculum

The curriculum, developed by MSF, was based on earlier experiences with NA training programs in sub-Saharan Africa, and it included theoretical and a practical components (Table 1). Students attended lectures 3–4 h per week and were provided lecture notes and textbooks. The program was coordinated by expatriate anesthesiologists; Haitian doctors and surgeons were engaged as trainers and lecturers whenever possible.

Student evaluation

Students maintained operating case logbooks. Written tests and individualized evaluations were given monthly. The final examination tested theoretical and practical knowledge and was invigilated by doctors from MSPP as well as Haitian and MSF anesthesiologists. The program lasted

Table 1 Description of the nurse anesthetist training program in Haiti

Theoretical

Applied anatomy and physiology of the circulatory, cardiac, respiratory, and autonomic nervous systems of children and adults

Physiopathology of cardiac and respiratory system

Physiology of pregnancy and its complications

Practical pharmacology of general and local anesthetics, sedatives, opioids, analgesics, muscle relaxants, catecholamines, and antibiotics with a focus on WHO essential drugs

Anesthesia techniques such as local, spinal, and general anesthesia customized for resource-limited settings

Anesthesia equipment and circuits

Noninvasive cardiac and respiratory monitoring

Blood transfusion management

Antibiotic prophylaxis

Perioperative complications such as hypotension, hypoventilation, hypoxia, anemia, and transfusion reaction

Critical care medicine

- Basic and advanced cardiac life support
- Fluid and electrolyte management
- Nutrition
- Cardiopulmonary resuscitation
- Primary trauma care

Other: hospital hygiene, asepsis, quality control, medico-legal and economic issues, use of Internet as source of professional information

Practical

Supervised clinical anesthesia as a part of the routine surgical services

Preoperative assessment and optimization

Anesthesia techniques

- Local anesthesia
- Intravenous locoregional anesthesia
- Spinal anesthesia
- General anesthesia (intravenous, inhaled gases, and combined techniques)
- Intubation, ventilation, and other airway management skills
- Additional training in obstetric and pediatric anesthesia

Postoperative care focusing on cardiac and respiratory monitoring and pain management

Stock and pharmacy management

WHO World Health Organization

15 months but was extended to 18 months for some students if their midterm evaluation recommended additional training or to compensate for illness or pregnancy leave.

Outcomes of the training

In order to evaluate the outcomes of the training, all graduates were actively traced during August 2008. Telephone interviews with each graduate were attempted;

however, if direct contact was not possible, the graduate's professional colleagues were interviewed.

From 1998 to 2008, 25 students were trained, 24 of them women. Prior to enrolment in the NA program, 17 students (68%) had been working as nurses in government hospitals, 6 (24%) in private hospitals, and 2 (8%) had qualified as nurses but were unemployed. One student did not graduate because of unsatisfactory practical skills.

Of the 24 graduates, 19 (79%) continue to work as nurse-anesthetists in Haiti and 5 (21%) have emigrated. Of those working as NAs, 15 (79%) have practiced for more than 3 years; 12 (63%) work in private hospitals, 5 (26%) work exclusively in public hospitals, and 3 (16%) have a mixed practice.

As well as supporting routine services, NAs have been critical in providing anesthesia during emergencies. In the fall of 2008, MSF established emergency surgical services in Gonaïves, a city heavily flooded by a series of hurricanes. Only one Haitian anesthesiologist was available; however 7 Haitian NAs (6 graduates of the MSF training program) were recruited. The NAs performed anesthesia for 330 procedures over 12 weeks. The median patient age was 27 years (interquartile range: 17–38 years) and 66% were female. Emergency obstetrical, trauma, and non-trauma operations were performed. Cesarean section was the most common procedure, followed in frequency by minor surgery (Table 2). The most common type of anesthesia was general anesthesia without intubation (ketamine), followed in frequency by spinal anesthesia. Half ($n = 162$) of the procedures were supervised by an anesthesiologist. Certain major procedures such as cesarean section were more likely to be supervised by an anesthesiologist than minor procedures such as wound debridement ($P = 0.021$ and $P < 0.001$, respectively). The perioperative mortality rate was 0.3% (1/330) and there was no association between death and lack of supervision by an anesthesiologist.

Discussion

The significant global burden of surgical disease and the effectiveness of surgical treatment are increasingly recognized as public health priorities. Task-shifting is a response to the gap between needs and capacity. Training non-physician anesthetists in a resource limited setting is a feasible and important way to scale up delivery of safe surgical services. The completion rate of our training program, was high and the majority of graduates continue to work as nurse anesthetists in Haiti. Successful training requires a setting with a sufficient volume and diversity of operations, appropriate anesthesia equipment, a structured and comprehensive training program, and recognition of

Table 2 Operations performed with nurse anesthetists in Gonaïves, Haiti

Procedure	No PA	(%)	With PA	(%)	Total	(%)	<i>P</i> value*
Surgery							
Cesarean section	50	29.8	68	42.0	118	35.8	0.021
Minor surgery ^a	32	19.1	25	15.4	50	15.2	0.889
Wound debridement	29	17.3	6	3.7	35	10.6	<0.001
Fracture reduction	19	11.3	15	9.3	34	10.3	0.549
Burns	8	4.8	15	9.3	23	7.0	0.109
Skin graft	7	4.2	7	4.3	14	4.2	0.945
Hernia repair	4	2.4	7	4.3	11	3.3	0.326
Limb amputation	3	1.8	5	3.1	8	2.4	0.442
Exploratory laparotomy	4	2.4	4	2.5	8	2.4	0.958
Cystostomy tube	2	1.2	2	1.2	4	1.2	0.971
Hysterectomy	0	0.0	3	1.9	3	0.9	0.076
Thorocostomy	3	1.8	0	0.0	3	0.9	0.088
Foreign body removal	2	1.2	1	0.6	3	0.9	0.583
Uterine polyp removal	0	0.0	1	0.6	1	0.3	0.308
Congenital orthopedic	1	0.6	0	0.0	1	0.3	0.325
Total	168		162		330		
Anesthesia							
General anesthesia without intubation	57	34.0	83	51.2	140	42.4	0.001
General anesthesia with intubation	13	7.8	15	9.3	28	8.5	0.620
Spinal anesthesia	66	39.3	51	31.5	117	35.5	0.138
Local anesthesia	24	14.3	8	5.0	32	9.7	0.004
Other	6	3.6	5	3.1	11	3.3	0.806
No anesthesia	2	1.2					
Total	168		162		330		

PA anaesthesiologist

^a Includes incision and drainage of abscess, circumcision, suturing, and dressing changes

* Comparing with PA versus without PA

the program by the national ministry of health and relevant professional bodies (Table 3). Preliminary outcomes support findings from other developed and developing settings that the work of NAs can be safe and effective.

There remains a dire shortage of anesthesia providers in Haiti, and NA training needs to be expanded. However, the training program is currently dependent on international NGO support, which is not sustainable in the long-term. Médecins Sans Frontières, whose main mandate is to provide medical support during emergencies, is set to leave Haiti in 2010; meanwhile, however, because of limited resources, the Haitian Ministry of Public Health and Population (MSPP) has not been able to support this type of training.

Another important limitation is the lack of ownership and acceptance by professional societies [26]. Although MSPP has recognized the training, Haitian anesthesiologists have been reluctant to accept their NA colleagues as more than assistants. Of the NAs that work in Port au Prince, many are relegated to preparing medication doses and assisting the anesthesiologists. While in some contexts,

such as the United States and Europe, NAs are recognized and accepted by their physician colleagues, the lack of recognition of NAs by anesthesiologists has been reported elsewhere [27]. A regulatory and certification body should be established which includes representation by relevant professional bodies, the MSPP, and a society of NAs to define the scope of practice of NAs and provide continuing re-certification and education.

To maximize the benefits of this newly trained anesthesia cadre in Haiti, government hospitals will need to improve their surgical infrastructure. Too often, working conditions are suboptimal, with frequent shortages of equipment, oxygen, anesthetics, and other medications. In Haiti MSF donated equipment to hospitals where some of the NA graduates worked, but this was not a sustainable solution.

Another challenge is to ensure adequate recognition and remuneration of the trained NAs: giving lower cadres of providers more responsibilities is unlikely to be sustainable unless adequate recognition and remuneration is provided. Government wages are low and NAs working in the public

Table 3 Essential components of a nurse anesthetist (NA) training program in a resource-limited setting

Infrastructure
Hospital with reliable quality surgical care
Functioning surgical and anesthesia equipment and stable supply of medications
Adequate surgical type and volume
Training
Clearly defined theoretical curriculum with set objectives
Dedicated trainers
Minimum cases performed in each essential category
Continuing education and recertification
Government
Ministry of Health recognition of training
Recognition and acceptance by national anesthesiologists
Formal recognition of NA job description and salary scale
Job placement guaranteed at the end of the training
Association for nurse anesthetists

health system often supplement their income by working in the private sector. Many NAs continue to work in MSF hospitals, where they are paid at least twice as much as in the public sector. This type of brain drain diverts human resources away from the public sector: however, the salaries offered by the government are unlikely to support retention of staff.

Finally, while task shifting should be seen as a necessary part of scaling up essential surgical services, this does not remove the need for specialists [28], and efforts must also be made to increase the number of anesthesiologists working in resource-limited settings.

Conclusions

The training of local NAs is a strategy used by developed and developing countries alike as a response to an acute lack of anesthesia personnel. The provision of structured training of nurse anesthetists in Haiti by a committed NGO proved feasible and satisfactory for trainees, trainers, surgeons, and hospital directors, and this has led to tangible gains in the expansion of surgical services. The sustainability of this approach depends critically on the establishment of remuneration and support frameworks, and a professional respect of their skills by colleagues and professional bodies.

Worldwide, the shortage of anesthesia providers in resource-limited countries remains massive, and the likelihood this gap will be closed by physician anesthesiologists in the near future is low. Therefore, the training of non-physician anesthesia providers has become an essential component in the provision of safe surgical care.

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