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Journal of Anesthesia & Clinical Research

Research Article

The Evaluation of Anaesthesia Workforce Capacity, An Index of Safe Perioperative Care in the South-Eastern Nigeria

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ABSTRACT

Anaesthesia and surgical care are essential for the treatment of many of the health-related conditions in our environment and they are integral component of a functional and resilient health system. The WFSA Global Anaesthesia practice projected that at least 5 physician anaesthesia providers per 100,000 population is needed to effectively ensure leadership of anaesthesia services as well as the delivery of emergency and essential patient care. This study aimed to evaluate the anaesthesia provider capacity in the south-eastern Nigeria, as an index of safe perioperative care. We conducted a study to survey the anaesthesia provider capacity in the south-eastern Nigeria, during the period of September through December 2021 by contacting the various Heads of Anaesthesia Department in public and private hospitals on phone and via Whatsapp messages. We also analyzed the 2016 edition of Nigerian Society of Anaesthetists Membership Directory. The total number of physician-anaesthetists and non-physician anaesthetists in the various states in south-eastern Nigeria were evaluated relative to the population density. Data was collated using Microsoft excel spread sheet analyzed using SPSS version 27.0 and presented as frequencies, proportions and ratios in tabular and descriptive forms. This survey showed that there are 50 consultant anaesthetists (anaesthesia specialist physicians) working in the south-eastern part of Nigeria, serving 21,955,414 population at the rate of 0.2 per 100,000 populations. The non-physician anaesthesia providers were the nurse anaesthetist (83), anaesthesia technicians (29) and anaesthesia attendants (39). This study showed that there is critical shortage of qualified physician anaesthetists and other anaesthesia providers in south-eastern Nigeria.

Keywords: Specialist anaesthesia physician; Anaesthesia provider; safe perioperative care

INTRODUCTION

Anaesthesia and surgical care are essential for the treatment of many of the health-related conditions and they are integral component of a functional, responsive, and resilient health system [1, 2]. It is estimated that 313 million surgeries are performed every year to alleviate some disabilities and reduce the risk of death from some common conditions, but developing countries account for only 6% of this volume [3]. Surgeries are facilitated by anaesthesia, which makes it possible to establish a safe, pain and anxiety free procedure, with no discomfort to the patient even in certain screening and diagnostic tests, tissue sample removal and dental work.

Anaesthesia as a medical discipline and profession is involved in perioperative patient care, patient's resuscitation, critical care medicine, transportation of critically ill patients, acute and chronic pain management, sedation services, as well as healthcare system management, advocacy, simulation and medical education and research [4]. Nevertheless, anaesthesia services are often found to be severely deficient in the resource limited countries due to lack of political will, government prioritization, regional conflicts, insecurities, poor infrastructural development and equipment, poor numeration and funding.

Access to safe surgery and anaesthesia remains unreached in the developing or resource limited regions and countries. It is estimated

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Received: 04-Jan-2023, Manuscript No. JACR-23-21588; **Editor assigned:** 06-Jan-2023, PreQC No. JACR-23-21588 (PQ); **Reviewed:** 20-Jan-2023, QC No. JACR-23-21588; **Revised:** 27-Jan-2023, Manuscript No. JACR-23-21588 (R); **Published:** 03-Feb-2023, DOI: 10.35248/2155-6148.23.14.1096

Citation: Nnaji CT, Okoli EC (2023) The Evaluation of Anaesthesia Workforce Capacity, An Index of Safe Perioperative Care in the South-Eastern Nigeria. J Anesth Clin Res. 14:1096

that 9 out of 10 people in the world third poorest countries cannot access safe surgery and anaesthesia [3]. Also, a global study shows that 5 billion people are unable to access safe surgical treatments [3]. This has resulted in World Health Organization (WHO) calling on member states to ensure that anaesthesia and surgery are properly prioritized within the overall context of the health system and that support, follow-up, reporting, and bench-marking take place [5].

The need for anaesthesia providers is critical if surgery is to be safe and cost-effective. Studies conducted in Togo [6] and Malawi [7] reported extremely high avoidable anaesthesia-related mortality in public hospitals due to shortage of anaesthesia providers. Another study conducted in Zimbabwe [8] and Nigeria [9,10] identified that there are no specialist anesthetists in public or provincial hospitals that serve as the referral centers in Zimbabwe and Nigeria. Hence, there is need to invest in surgical and anaesthesia services in resource limited countries. This will save lives, and promotes economic growth.

Anaesthesia provider is defined as any health worker providing anaesthetic care to patients, irrespective of the level of training and supervision. This includes the physician anaesthesia providers and non-physician anaesthesia providers. The physician anaesthesia providers encompasses the specialist anaesthesia physician, trainee specialist anaesthesia physician and non-specialist physician. The non-physician anaesthesia providers include the nurse anaesthetist, anaesthesia technicians and other healthcare workers with informal anaesthetic training [11]. The World Federation of Societies of Anaesthesiologist (WFSA) reported in 2017 global anaesthesia workforce survey, that there was a total of 436,596 physician anaesthesia provider in the 153 countries serving a population of more than 7 billion persons. This represents a workforce density of 6.09 anaesthesia physician providers per 100,000 population. Furthermore, the report showed that anaesthesia physician providers included 355,381 (81.4%) specialist anaesthetists, 71,990 trainee specialist anaesthetists (16.5%), and 9225 (2.1%) non-specialist physician providers. Nevertheless, most countries in Africa like Nigeria, Angola, Burkina Faso, Ethiopia, Zimbabwe and Niger has a workforce of <1 per 100,000 physician anaesthesia providers [11]. The WFSA Global Anaesthesia Workforce Survey of 2017 reported that at least 5 physician anaesthesia providers per 100,000 population, even in countries with limited resources will be effective in ensuring leadership of anaesthesia services and delivery of emergency and essential patient care [11].

Nigeria is located in the western part of Africa, with an estimated total population of 206,139,587 people, according to the 2020 census figures by world bank [12]. The country is politically divided into six geopolitical regions; North-East, North-West, North-Central, South-East, South-West and South-South regions. The south-eastern region of Nigeria is predominantly occupied by the Igbo tribe, comprising about five states with a total population of 21,955,414 persons; 3,727,347 in Abia, 5,527,809 in Anambra, 2,880,383 in Ebonyi, 4,411,119 in Enugu and 5,408,756 in Imo States [13].

To meet the present and projected population demands in anaesthesia and surgical services in this region of Sub-Saharan Africa, urgent investment in human and physical resources for anaesthesia care is needed. Scaling up of anaesthesia manpower and services will improve surgical services and save lives. This study aims to evaluate the anaesthesia provider capacity in the south-eastern Nigeria, as an index of safe perioperative care.

METHODOLOGY

We conducted a study to survey the anaesthesia provider capacity in the south-eastern Nigeria relative to the population, during the period of September through December 2021 by contacting the various Heads of Anaesthesia Department in public and private hospitals in the south-eastern Nigeria on phone and *via* Whatsapp messages. Ethic statement was not applicable since this study was not performed on human/animals. We also analyzed the 2016 edition of Nigerian Society of Anaesthetists Membership Directory. The information sought included the state, name of hospital, number of the consultant anaesthetists, anaesthesia resident doctors (trainee anaesthesia specialist doctor), anaesthesia diploma doctors and informally trained medical officers providing anaesthesia services. We also obtained information on the number of nurse anaesthetists, anaesthesia technicians and anaesthesia attendants in the various institutions in the south-eastern Nigeria.

An anaesthesia provider was defined as any health worker providing anaesthesia care, whether supervised or working independently [9]. A consultant anaesthetist was defined as a medical doctor with specialized training and skill in anaesthesia. An anaesthesia resident doctor was defined as a medical doctor undergoing a postgraduate training in anaesthesia specialty, an anaesthesia diplomate was defined as a medical doctor who received a minimum of one-year postgraduate training in anaesthesia specialty to function as a middle level anaesthesia manpower, while an informally trained medical officer in anaesthesia is defined as a medical doctor who received an informal anaesthesia specialty training to provide limited anaesthesia services. A nurse anaesthetist was defined as a registered nurse with post-basic formal training in anaesthesia, an anaesthesia technician was defined as a technician with formal training in handling and maintaining anaesthesia equipments and materials, while an anaesthesia attendant was defined as a healthcare attendant with informal training in handling anaesthesia equipment and materials.

We compared the consultant anaesthetists numbers with the various state population density in the south-eastern Nigeria. We also summed the total consultant anaesthetist numbers and compared it with the total population density in the south-eastern Nigeria to ascertain the ratio per population density. The total number of physician-anaesthetists in the state and south-eastern Nigeria was also calculated and compared with the population density of various state and all the state in south-eastern region of Nigeria to ascertain the ratio of anaesthesia physicians to the various population density. The total anaesthesia workforce was calculated in various state and in south-eastern region of Nigeria and compared with the population density.

Data were collated using Microsoft excel spread sheet and analyzed using Statistical Package for Social Sciences (SPSS) version

27.0 (IBM, Chicago, IL, USA). Data were presented as frequencies, proportions and ratios in tabular and descriptive forms. Descriptive statistics were used to compare the variables for the states in the region.

RESULT

In Nigeria, there is decentralization of public healthcare services at different levels. This includes primary healthcare centers, general (secondary) hospitals and tertiary hospitals. The tertiary hospitals received referral from the primary healthcare centers, general hospitals, private hospitals and at times from other tertiary hospitals. This survey was conducted in the south-eastern part of Nigeria.

The number of consultant anaesthetist in the south-eastern Nigeria

This survey showed that there are 50 consultant anaesthetists (anaesthesia specialist physicians) working in the south-eastern part of Nigeria, serving 21,955,414 population at the rate of 0.2 per 100,000 populations (Table 1). There are 19 consultant anaesthetists in Enugu State (0.4 per 100,000 population), compared to 10 consultant anaesthetists in Abia State (0.3 per 100,000 population), 8 consultant anaesthetists in Imo State (0.15 per 100,000 population), 7 consultant anaesthetists in Anambra State (0.1 per 100,000 population) and 6 consultant anaesthetists in Ebonyi State (0.2 per 100,000 population).

Physician anaesthesia providers in the south-eastern Nigeria

The total number of physician anaesthesia providers in the south-eastern Nigeria is 174 (0.8 per 100,000 population). This includes the consultant anaesthetist (50), anaesthesia resident doctors (115), trained medical officers with diploma in anaesthesia (4) and uncertified medical officers (informally trained) providing anaesthesia services (5), as shown in Table 2. The survey also shows the distribution of specialist physician anaesthesia trainers and the trainees in each south-eastern state of Nigeria (Figure 1).

Anaesthesia providers in the south-eastern Nigeria

The analysis of the both the physician and non-physician anaesthesia providers shows that the ratio of anaesthesia providers to 100,000 population was lowest with Abia State (0.7 per 100,000 population), compared with Anambra State (0.9 per 100,000 population), Imo State (1.4 per 100,000 population), Ebonyi State (2.3 per 100,000 population) and Enugu State (2.3 per 100,000 population). There are total of 325 anaesthesia providers in the 5 states of the south-eastern Nigeria, with ratio of 1.5 per 100,000 population (Table 3). The non-physician anaesthesia providers includes the nurse anaesthetist (83), the anaesthesia technicians (29) and anaesthesia attendants (39), as shown in Figure 2.

State	Population (No.)	Consultant Anaesthetists (No.)	Consultant Physician Ration to 100,000 Population
Abia	3,727,347	10	0.3:100,000
Anambra	5,527,809	7	0.1:100,000
Ebonyi	2,880,383	6	0.2:100,000
Enugu	4,411,119	19	0.4:100,000
Imo	5,408,756	8	0.15:100,000
Total	21,955,414	50	0.2:100,000

Table 1: Consultant physician anaesthesia (specialist anaesthesia physician) provider in the south-eastern Nigeria.

State	Population (No.)	Consultant Anaesthetists (No)	Anaesthesia Resident Doctors (No)	Medical officer with Anaesthesia Diploma (No)	Uncertified Medical Officers (No)	Total Physician Anaesthesia providers (No)	Physician Ration to 100,000 Population
Abia	3,727,347	10	1	1	2	14	0.4:100,000
Anambra	5,527,809	7	20	0	0	27	0.5:100,000
Ebonyi	2,880,383	6	22	0	1	29	1.0:100,000
Enugu	4,411,119	19	52	0	0	69	1.6:100,000

Imo	5,408,756	8	20	3	2	33	0.6:100,000
Total	21,955,414	50	115	4	5	174	0.8:100,000

Table 2: Physician anaesthesia provider in the south-eastern Nigeria.

State	Population (No.)	Physician Anaesthesia providers (No.)	Non-Physician Anaesthesia providers (No.)	Total Anaesthesia Providers (No.)	Ratio of Anaesthesia providers to the population
Abia	3,727,347	14	11	25	0.7:100,000
Anambra	5,527,809	27	24	51	0.9:100,000
Ebonyi	2,880,383	29	38	67	2.3:100,000
Enugu	4,411,119	69	33	102	2.3:100,000
Imo	5,408,756	33	45	78	1.4:100,000
Total	21,955,414	174	151	325	1.5:100,000

Table 3: Total anaesthesia provider in the south-eastern Nigeria.

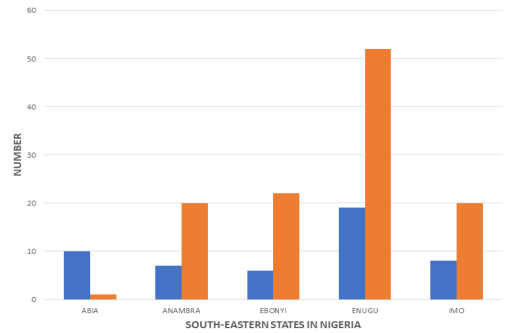

Figure 1: Distribution of specialist physician anaesthesia trainers and trainees among the south-eastern Nigeria. **Note:**( ) Anaesthesia specialty trainers, ( )Anaesthesia traniees.

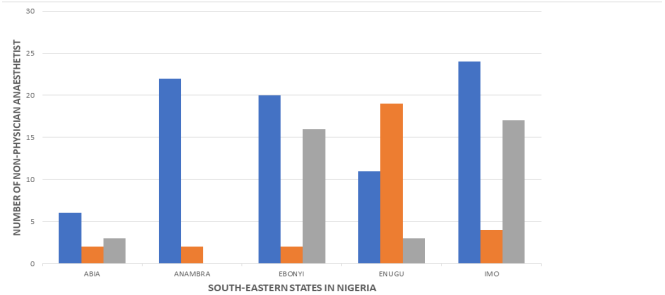

Figure 2: Distribution of Non-physician anaesthesia providers in the south-eastern Nigeria. **Note:** ( ) Nurse Anaesthetist, ( ) Anaesthesia technician, ( ) Anaesthesia attendant.

DISCUSSION

Despite the fact that healthcare is given a strategic priority in the life of people, relatively little is known about the anaesthesia workforce capacity and its impact on the delivery of safe surgical and non-surgical services in Nigeria and most resource limited countries. In this study, we addressed the critical shortage of qualified physician anaesthetists and other anaesthesia providers, a condition peculiar with most of the limited resource regions and countries.

We observed that the south-eastern Nigeria with a population of 21,955,414 persons, has a total of 50 qualified (specialist) anaesthetists working as physician anaesthesia providers, with the ratio of 0.2 per 100,000 population. This is abysmally low in comparison with the recommendation of 5 specialist anaesthetists per 100,000 population stipulated by WFSA [11]. This shows that there is scarcity of specialist anaesthesia physician in south-eastern Nigeria. Nevertheless, the addition of other physician anaesthesia providers like trainee anaesthesia specialist doctors, middle level trained anaesthesia medical officers (diplomates) and uncertified anaesthesia medical officers increased the value to 0.8 per 100,000 population, which was found to be critically low. In a similar national analysis reported in 2017 by a global study, it was found that Nigeria has 1050 physician anaesthesia providers with ratio of 0.58 physician anaesthesia providers to 100,000 population [8].

Our report is peculiar with the findings of other regions of Nigeria and most developing countries, establishing that there is scarcity of specialist physician anaesthetist [8-10, 14]. A study conducted in the north-central Nigeria by researcher noted that

there is no specialist physician anaesthetist in 14 public hospitals that undertake major surgeries. In another study conducted in south-south Nigeria by Kalu et al [9], they observed that anaesthesia workforce capacity was grossly inadequate in the 16 district hospitals evaluated, with only one of the district hospitals having a visiting specialist anaesthesia physician. Other studies show that Zimbabwe has only a part time specialist anaesthetist in provincial hospitals that serve as the referral centers for most of the district hospital in Zimbabwe, India has scarcity or even non-existent specialist physician anaesthetist in rural or remote areas, Afghanistan has only 9 physician anaesthetists serving a population of 32 million, while Uganda has 13 indigenous physician anaesthetist serving a population of 27 million [8, 14].

The scarcity of specialist anaesthesia physician can have a negative impact on the safety and lives of perioperative patients, as well as the quality of healthcare services. A study in Malawi reported 504 deaths in a central hospital in Malawi, while Togo noted 133 anaesthesia related mortalities in a teaching hospital in Togo, furthermore, another study done in South Africa observed a 5% of anaesthesia deaths during cesarean section [6-8]. This corroborates the report of Pignaton et al, that the quality of anaesthesia services delivered is highly correlated with perioperative morbidity and mortality. Study suggested that dramatic improvements in patient safety can occur by increasing the specialist surgical (surgeons, anaesthetists and obstetricians) workforce density from 0 to approximately 20 per 100,000 population.

To have an effective and safe surgical and obstetric intervention, there is need to have specialist anaesthesia providers that proffer effective leadership in anaesthesia services and delivery of emergency and essential patient care, to help combat the extremely high avoidable anaesthesia-related morbidities and mortalities, which has been reported in a number of resource-limited settings [6, 7]. The specialist anaesthesia physician in Nigeria is involved in perioperative patient care, patient's resuscitation, critical care medicine, transportation of critically ill patients, acute and chronic pain management, sedation services, as well as healthcare system management, advocacy, simulation and medical education and research [4]. Furthermore, because of the limited number and scarcity of specialist anaesthesia physicians, the private hospitals also depend on their services to sustain safety and quality healthcare in their institutions. Hence, making them overworked and prone to burnouts.

In the present clime of patient safety, people in resource-limited settings continue to suffer due to lack of trained physician anaesthetists, as well as lack of adequate health system infrastructure and equipment, lack of prioritization of anaesthesia and surgical care as part of national health plans. Thus, making it difficult for majority of the population in resource limited areas like south-eastern Nigeria to access safe anaesthesia services both in cities and in the rural and underprivileged areas of the region. Improvements in the safety and quality of anaesthesia is urgently needed, but the challenge is the deficiency in the number of trained physician anaesthetist.

The scarcity of physician anaesthetist affects the West African countries, with little or no recognition of the specialty in this region of the world, in terms of political commitment and local investments in education, training and retention of the anaesthesia workforce. This has resulted in the serious lack of equitable services, especially for surgical and non-surgical patients that requires anaesthesia services at all levels of the health system, thus, resulting in increased morbidity and mortality. To overcome such lapses and fill in the gaps in the shortage of physician anaesthetists, especially in the rural and remote areas, the West African College of Surgeon and National Postgraduate Medical College of Nigeria established Diploma in Anaesthesia training programme some decades ago. The objective was to train middle level manpower physician anaesthetist, that can function at the secondary/district hospitals, rural and remote areas of Nigeria and West Africa. Nevertheless, this gap is yet to be filled.

Our study showed that there are 4 (2.3%) physician anaesthetist with diploma certification and 4 (2.3%) medical officers with informal training in anaesthesia working in south-eastern Nigeria, and they were found in the major cities. In a study conducted by colleagues that audited the current status of the diplomates of the West African College of Surgeons' middle-level Diploma in Anaesthesia program, they observed that most diplomates moved on to acquire further qualifications and a significant proportion migrated to the western countries, while only a few remained in the urban and rural areas to fulfill the objective of having middle level manpower physician anaesthetists functioning at secondary/district hospitals in urban and rural areas. The study showed that a total of 303 (97%) out of 311 of graduates were traced. Eighty percent of them were still practicing anaesthesia, while 5% changed their medical disciplines. 204 (67.3%) of such diplomates still reside in West Africa (183 in Nigeria, 50 in Ghana, 1 in Sierra Leone), while 69 (22.7%) resides abroad: 35 (11.5%) in the United Kingdom, 21 (6.9%) in the United States of America and 4 (1.3%) in Canada. Only 9% of diplomates remained in rural communities, while 31% continued their anaesthesia specialist training to become a consultant and 30% were still undergoing their anaesthesia specialist training.

Modern anaesthesia practice has become increasingly dependent on complex equipment and expensive drugs, but this is only obtainable in high income countries. The resource limited regions and countries depend on basic equipment and essential drugs, however, in most places even the basic anaesthesia equipment and essential drugs are not available. Thus, these factors are considered in the training of physician anaesthetist in developing countries, to enable the trainee physician anaesthetist to be flexible and adaptable with the available resources, to sustain standard of anaesthesia care and high-quality treatment for the patients. Training of physician anaesthetist in resource limited regions also incorporate culture of rational decision-making, reasoning, and the ability to practice knowledge in accordance with local resources and culture. The trainee physician anaesthetist in the south-eastern Nigeria were 115 (66.4%). They were all found in the tertiary hospitals located in the major cities of the state. This observation could be related to

lack of good remuneration, facilities and equipment and insecurities associated with most rural and remote areas of Nigeria. This is not different from the findings, that reported that the trainee specialist anaesthetists prefer to work in major cities, thus, making anaesthesia resources more unevenly distributed. Some that acquired their specialty training outside the country, usually stay at western countries, because of good remuneration, available of anaesthesia resources, equipment and materials, as well as securities of lives and properties.

In most areas in developing countries, due to scarcity of physician anaesthetist, the majority of anaesthesia procedures were administered by non-physician anaesthesia providers, who work alone without any support from specialist physician anaesthetists, and they handle cases beyond their qualifications or training, with the number of morbidity and mortality relating to inappropriate care rising. Thus, despite the efforts, there is lack of safe anaesthesia services to majority of population in developing countries, especially the rural areas. This is due to the fact that non-physicians, such as nurse anaesthetists training and formal supervision is often of low priority or non-existent in this region. Successful training requires a setting with a sufficient volume and diversity of operations, appropriate anaesthesia equipment, a structured and comprehensive training program, and recognition of the training program by the national ministry of health and relevant professional bodies. Our study showed that the non-physician anaesthesia providers were 151 persons in south-eastern Nigeria. This includes the nurse anaesthetist (55%), anaesthesia technicians (19%) and anaesthesia attendants (26%).

This shortage in manpower creates a major hindrance for anaesthesia services in the southeastern Nigeria. Availability of specialist anaesthesia physician in the south-eastern Nigeria, as well as other resource limited regions will be effective in ensuring leadership of anaesthesia services, delivery of emergency and essential patient care and training of medical students, resident doctors and allied healthcare workers to provide a sustainable anaesthesia services.

CONCLUSION

This study has shown that there is critical shortage of qualified physician anaesthetists and other anaesthesia providers in south-eastern Nigeria, a condition which is peculiar with most of resource limited regions and countries. The knowledge of this current state of anaesthesia manpower is the right step is determining the appropriate interventions in anaesthesia workforce capacity development. We recommend the availability and sustainability of anaesthesia services at different centers of healthcare system in the south-eastern Nigeria and other part of the country and resource limited countries, with adequate specialist anaesthesia physician in the referral hospitals, appropriate environmental condition, anaesthesia equipment, continuous professional development and financial remuneration that are consistent. Furthermore, there should be some political will and policies that must support the remote and rural anaesthesia workforce with necessary technologies and incentives.

ACKNOWLEDGMENT

We extend our deep appreciation to all the Head of Anaesthesia in the South-Eastern Nigeria, our fellow colleagues, and other members of staff of the Departments of Anaesthesia, for their role in contributing informations that helped in the birth of this study.

FINAL SUPPORT AND SPONSORSHIP

No financial support or sponsorship was received for this study.

CONFLICTS OF INTEREST

There were no conflicts of interest.

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