

## Anaesthesia workforce and infrastructure in a north central state of Nigeria: a survey

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### Abstract

**Background:** Anaesthesia has evolved over the decades to have become a specialty in medicine. The dearth of personnel and unavailability of required equipment world over has made safe delivery of anaesthesia difficult. This study evaluated workforce situation and availability of anaesthetic drugs/equipment in public secondary health facilities.

**Methods:** A multi-centre study using an interviewer administered questionnaire was carried out in September 2013. Information about the anaesthesia personnel situation, surgical work force, as well as infrastructure, equipment and drugs was obtained.

**Results:** Nine (64.3%) out of the 14 public hospitals surveyed had general physicians (medical officers who performed surgeries) and nurse anaesthetists. Ten (71.4%) of the hospitals had at least one back-up generator as a source of electricity. All the hospitals had laryngoscopes but there were no functional

anaesthetic machines and none had oxygen or pulse oximeters. None of the hospitals had pipe-borne water though 11 (78.6%) had wells as a source of their water supply. However, 12 (85.7%) of the hospitals had laboratories where blood could be grouped and cross matched.

**Conclusion:** There is a dearth of anesthetic and surgical workforce and basic infrastructure in public hospitals. Capacity building, revamping of existing infrastructure and workforce expansion in anaesthesia is needed as an integral part of tackling the burden of surgical diseases.

**Key words:** Anaesthetic workforce, infrastructure, equipment, drugs, Plateau State, Nigeria

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### Introduction

Anaesthesia has evolved over the decades to have become a specialty in medicine. The scope of this discipline has grown so wide that, it is no longer restricted to the operating theatre, but now includes providing care in intensive care unit, labour and delivery suite, radiology department, acute and chronic pain service and even disaster management.<sup>1</sup> Anaesthesia however, is a specialty beset by current and future personnel shortage the world over. Many countries, for instance the United States of America, Great Britain, Canada, Hong Kong, Sri Lanka and France, have reported shortage.<sup>2</sup> The ratio of anaesthetists to the general population is at least 1:300,000 in the West African Sub-region compared to 1:10,000 in developed countries.<sup>3</sup> A sad reflection is the worse representation of physician anaesthetic personnel per 100,000 populations in African nations, which is quite low (ranging from 1:250,000 to 1:2,000,000).<sup>4</sup> Most anaesthetic procedures in Africa are carried out by nurse-anaesthetists.<sup>5,6</sup> These nurses strive to offer safe anaesthesia to their patients despite limitations such as lack of functional anaesthetic machines, oxygen and required drugs.<sup>7,8</sup>

The motto of the Nigerian Society of Anaesthetists is "Safety First" but many facilities lack access to key elements such as oxygen, oropharyngeal airways, intravenous cannulae and essential drugs needed to provide safe anaesthesia.<sup>9</sup> Blood transfusion facilities and other laboratory services are often lacking too. Anaesthesia as a specialty has not received commensurate recognition compared to other disciplines of medicine in Africa.<sup>9</sup> Funding priorities in Africa typically favours infectious diseases, while surgery and perioperative care have been neglected.<sup>10</sup> We undertook this study to appraise the specialty's workforce situation in Plateau State government owned health facilities.

### Materials and Methods

This was a multi-centre study carried out in the public secondary health facilities located in the 17 local government areas of Plateau State, Nigeria, in the month of September 2013. Information about the anaesthesia personnel situation, surgical work force, as well as anaesthesia infrastructure, equipment and drugs was obtained. Personnel information included employment status, qualification, job description/professional status. The availability of water, electricity, sterilization of equipment, waste disposal, blood banking facilities, anaesthetic equipment, and consumables were also examined. Data collected was analysed and presented as frequencies, mean and standard deviation. Diagrams and tables were generated using microsoft excel.

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The state had 14 secondary public healthcare facilities which were visited during a 4-week period. Among them, 8 were general hospitals, one comprehensive health centre and five cottage hospitals. Public Tertiary, faith-based and privately owned centers such as Jos University Teaching Hospital, Bingham University Teaching Hospital and Plateau specialist hospital were excluded from this study. The survey was carried out through site visit by one of the authors, and an interviewer administered questionnaire was used to source for information from the head of the hospitals, anaesthetic nurses, and operating theatre assistants.

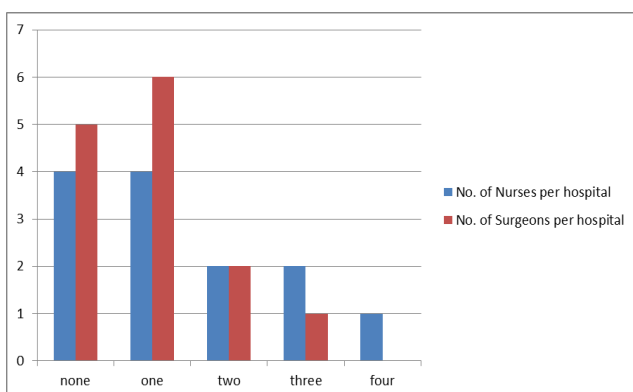
**Results**

The 14 public hospitals surveyed serve an estimated population of 2,769,314 people (excluding the state capital) which was approximately 2% of the total population of Nigeria (2006 census). There were 13 medical officers operating as general surgeons. This means one surgeon to 213,024 persons (Table 1). A total of 18 nurse anaesthetists were found in all the hospitals as shown in Figure 1.

Table 1. Demographics (the ratio of Anaesthesia and surgical workforce to the population using 2006 National Census)

Zone	Population N=2,769,360 Figure	Medical officers that perform surgeries (%)	Nurse- Anaesthetists		Functional theatres	
			No	Ratio to population	No	Ratio to population
Northern zone*	901,108	32.5	4	1:225,277	6	1:300,369
Central zone	962,119	34.8	5	1:192,423	7	1:240,530
Southern zone	906,133	32.7	4	1:226,533	5	1:302,044
<b>TOTAL</b>	<b>2,769,360</b>	<b>100</b>	<b>13</b>	<b>1:213,028</b>	<b>18</b>	<b>1:276,936</b>

\*NB: excluding Jos North local government area (state capital)



Number of Nurse Anaesthetists/Surgeons per facility (Fig 1)

There was no physician anaesthetist at the time of this study in any of the government hospitals visited and five (35.7%) of the hospitals did not have any surgeon or nurse anaesthetist. Anaesthesia assistants were completely absent in all the facilities that were visited (Table 2).

Table 2 Summary characteristics of all 14 Govt hospitals performing major surgery in Plateau State, Nigeria, 2013 (Personnel)

Personnel	Northern Zone		Central Zone		Southern Zone	
	No.	%	No.	%	No.	%
General physicians (n=13)	4	30.8	5	38.4	4	30.8
Specialist surgeons	0	0	0	0	0	0
Nurse Anaesthetists (n=18)	6	33.3	7	38.9	5	27.8
Physician Anaesthetists	0	0	0	0	0	0
Anaesthetic assistants	0	0	0	0	0	0

It was reported that anaesthesia was often administered by the nurse anaesthetists and assisted by the theatre attendants in all the hospitals. Seven (38.9%) of the nurse anaesthetists had been in service for more than 20 years and were nearing retirement. Fig 2.

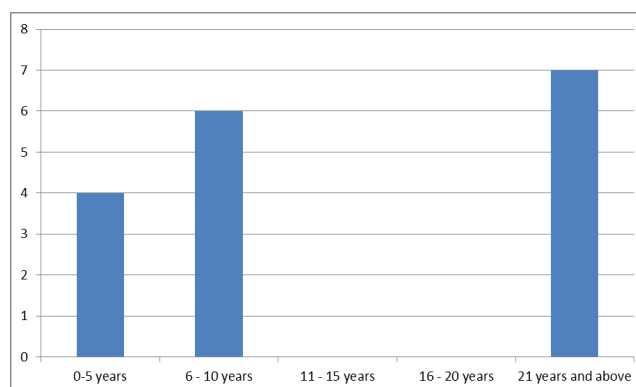


Figure 2: Number of Nurse-anaesthetists and their years of experience

A variety of mostly intravenous anaesthetic drugs were available in the hospitals but none had volatile anaesthetics (Table 3). There was no oxygen source in any of the hospitals though some had empty oxygen cylinders. The commonest form of anaesthesia given was intravenous anaesthesia using ketamine.

**Infrastructure and Equipment**

Ten (71.4%) out of the 14 hospitals had operating theatre units; that is an average of a theatre unit per 276,936 people in the locality where the hospital is located. Table 1.

All the hospitals had laryngoscopes but there were no functional anaesthetic machines and none had pulse oximeters (Table 4). None of the hospitals had pipe-

Table 3. Summary characteristics of all 14 Govt hospitals performing major surgery in Plateau State, Nigeria, 2013 (Drugs)

Drugs	Quantity (average number of ampoules/ bottles per facility)	Hospitals having drugs [n ( %)]
Ketamine	18	14 (100)
Local anaesthetic	13	14 (100)
Thiopentone	4	9 (64.3)
Suxamethonium	1	1 (7.1)
Volatile agent	0	0
Opioid	13	14 (100)
Adrenaline	10	10 (71.4)
Vasoconstrictor (ephedrine)	5	9 (64.3)
Oxygen source	0	0

Table 4. Summary characteristics of all 14 Govt hospitals performing major surgery in Plateau State, Nigeria, 2013 (Equipment)

Anaesthetic equipment/disposables	Quantity average number per facility	Hospitals that had items (N=14 [%])
Anaesthesia machine (functional)	None	0
Laryngoscopes	1	14 (100)
Pulse oximeter	0	0
Facemasks	6	8 (57.1)
Suction machine	1	8 (57.1)
Sterile gloves	5	14 (100)
Disposable (examination) gloves	4	12 (85.7)
Oropharyngeal airways	2	10 (71.4)
Endotracheal tubes	9	3 (21.4)
Spinal needles	8	8 (57.1)

Table 5. Summary characteristics of all 14 Govt hospitals performing major surgery in Plateau State, Nigeria, 2013 (General facilities)

General facilities for surgery	Availability in hospitals	Percentage of hospital that had facilities (%)
Electricity (with back-up generator)	10	71.4
Source of Water supply	11	78.6
Facilities to measure haemoglobin	10	71.4
Facilities to measure blood sugar	12	85.7
Facilities for grouping and cross-matching blood	8	57.1
Waste disposal system	14	100

borne water though 11 (78.6%) had surface wells as a source of their water supply. Table 5. All the 14 hospitals had electricity supplied from a national grid with frequent power outages reported. Ten of the hospitals (71.4%) had access to at least one generating set as either primary or alternative source of electricity. Table 5.

All of the hospitals visited had waste disposal systems that ranged from a dug pit for human waste disposal to incinerators. There was a National Blood Transfusion Service Centre located within the state capital that served the hospitals in the local government areas visited. However, 12 (85.7%) of the hospitals had laboratories where blood could be grouped and cross matched. Table 5.

### Discussion

There are many challenges encountered when providing comprehensive and safe surgical care to a population in a low-income country, especially in hospitals.<sup>11</sup> This study sought to evaluate the availability of anaesthesia and surgical personnel as well as infrastructural availability in public hospitals across the 17 Local Government Areas of Plateau State, Nigeria. The scarcity of both anaesthetic and surgical work force in Sub – Saharan Africa has been well documented in recent literature.<sup>12</sup> This was confirmed in this study as evident by the lack of physician anaesthetists as well as specialist trained surgeons in all the hospitals visited. Low-income countries lag far behind in the provision of, and training for, safe anaesthesia practice. The number of physicians per 10,000 population is a health indicator collected and reported by the World Health Organization (WHO) for the 146 member states<sup>13</sup>. Health indicators are indicators of the well being of the population. Our results show a far cry from what may be considered a fair indicator of the well being of any population.

The per capita anaesthetist manpower in Nigeria is extremely low when compared to developed countries. The physician anaesthesia provider per 100,000 people in Nigeria was put at 0.113 in a recent study and is nothing near the indicator being considered in the millennium development goals.<sup>10,11,14</sup> A similar situation is faced in Uganda (population 30 million), where there were only 14 physician anaesthetists, and 330 were non-physician anaesthesia providers.<sup>4,15</sup> In contrast, the United Kingdom with a population of 60 million has about 12,000 medical anaesthetists of all grades, whereas the United States has an estimated 70,000 anaesthesia practitioners, divided fairly evenly between physician anaesthetists and nurse anaesthetists.<sup>4,15</sup> Working in various combinations and independently, they perform 54 million anaesthetics each year on a population of approximately 306 million.<sup>7</sup>

The World Federation of Societies of Anaesthesiologists on the 13<sup>th</sup> June 1992, reviewed in 2010, recommended standards for anaesthesia professionals throughout the world.<sup>16</sup> It advocates that facilities, equipment, medications and appropriate equipment, both in quantity and quality, should be present wherever anaesthesia is undertaken. Oxygen is an essential component in resuscitation and

maintenance of anaesthesia, yet this vital component is unavailable in most secondary health facilities. General anaesthesia using volatile anaesthetics is impossible without the availability of oxygen. Ketamine is considered to be an anaesthetic with a good safety profile margin, its use as a sole anaesthetic is not devoid of complications such as respiratory depression and sometimes even death.<sup>17</sup>

Modern sophisticated and expensive anaesthetic machines which have been designed for use when conditions are ideal, have been unable to meet the rigorous challenges prevailing in the developing world and consequently attempts to introduce them have generally been expensive failures<sup>18</sup>. The use of anaesthetic machines with attached oxygen concentrators may be cheaper to maintain in this setting. A good example is the Glostavent<sup>®</sup> anaesthetic machine, specifically designed to enable anaesthetists to overcome the problems they encounter when working in difficult environments.<sup>18</sup> It has been shown to be inexpensive, economical, versatile, uncomplicated, robust and reliable. Another area of practical intervention will be in the area of power supply. In the midst of poor electricity supply from the main grid, solar energy could be tapped to help drive these equipments in our environment. The initial cost of installation of solar power might be high but in the long run it is generally cost-effective.<sup>19</sup> Pulse oximetry is mandatory during anaesthesia in many countries, a standard endorsed by the World Health Organization 'Safe Surgery Saves Lives' initiative.<sup>20</sup> Unfortunately, many health care facilities operate without monitoring oxygen saturation.

Blood transfusion is life-saving and over 50% of all blood is administered perioperatively.<sup>21</sup> Sadly, some hospitals lacked blood transfusion facilities. Indeed, none of the hospitals in the state achieved WHO standards for essential and emergency surgery.

The importance of safe anaesthesia for best possible surgical outcome in every patient is not disputable in high resource settings. Investing in human resources, hospital facilities, essential equipment and supplies should be a priority.

*Limitations:* the investigators relied on information obtained from the heads of the health facilities and the nurses

### Conclusion

Our survey has revealed that, the distribution of anaesthetic/ surgical workforce in our state hospitals is not near the figure as well as quality recommended by WHO, as a good indicator of the wellbeing of the population. Collaboration needs to be sought for, as this might have a way of upgrading the status as well as the

quality of the health delivery in the facilities made available by the public health sector. Capacity building, revamping of existing infrastructure and workforce expansion in anaesthesia is highly recommended as an integral part of tackling surgical diseases.

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