

The Non-physician Anaesthetist

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INTRODUCTION

Surgical and anaesthesia care play crucial roles in a well-functioning, adaptable health system¹. Globally, around five billion people lack access to safe surgical and anaesthesia services. In certain regions, this figure surpasses 95% of the population, leaving them without access to safe surgical and anaesthesia care¹. The majority of these individuals reside in low and middle-income African countries (LMICs), where an estimated 266 million surgeries are needed each year to save lives and prevent disabilities. Unfortunately, only 6% of global surgical procedures take place in these countries¹.

Surgery has been described as the neglected step-child of Global Health and in the same breath, anaesthesia has been described as surgery's invisible sister¹. In 2015, the Lancet Commission on Global Surgery (LCoGS) presented the ground-breaking initial report, Global Surgery 2030, highlighting the crucial role of safe surgical and anaesthesia care in improving individual health. The report identified various factors affecting access to timely and secure surgical and anaesthesia care, with the shortage of anaesthesia providers noted as one of the most prominent yet frequently overlooked factors.

The scarcity of anaesthesia professionals is most pronounced in sub-Saharan Africa (SSA), where the majority of countries have fewer than 1 anaesthesiologist per 100,000 population, falling short of the recommended 4 per 100,000 or the 20 per 100,000 seen in many high-income countries (HICs)¹. Adequate anaesthesia providers are crucial for ensuring safe and cost-effective surgery. Studies in Togo and Malawi revealed a high number of preventable anaesthesia-related deaths in their public hospitals, primarily attributed to a severe shortage of anaesthesia providers. The workforce deficiency in SSA is so profound that, even when considering non-physician anaesthesia providers (NPAPs), 16 countries in SSA still report less than 1 anaesthesia provider per 100,000 population¹.

GLOBAL SURGERY AND ANAESTHESIA

The term "Global Surgery" was embraced to characterize a swiftly evolving multidisciplinary domain, serving as the nexus between surgery, anaesthesia, and public health. Its goal is to ensure the provision of safe and equitable surgical care across global health systems². The emphasis lies on increasing awareness about the significant disparities present in international health systems, particularly addressing surgical and anaesthesia care in low-income and middle-income countries, which bear the highest burden of disease and demand².

In 1980, Dr. Halfdan Mahler, WHO Director-General, emphasized that "the vast majority of the world's population lacks access to skilled surgical care, and minimal efforts are being made to address this issue³." Historically, surgical care was viewed as too intricate, costly, and limited in addressing the global burden of disease. However, data has revealed the underestimated prevalence of global surgical diseases, disparities in global surgery delivery, and the cost-effectiveness of surgical treatments. Incorporating this data has led to a heightened acknowledgment of the imperative for affordable access to timely, safe, and quality surgical and anaesthesia services as integral components of a well-functioning health system⁴.

"Global surgery and anaesthesia" are characterized as the initiative to deliver enhanced and fair surgical care worldwide, fundamentally addressing the aspects of necessity, accessibility, and quality³. This definition presents surgery and anaesthesia as an integrated entity, acknowledging the interdependence of these two specialties.



Figure 1: *The multiple facets of global surgery*

NEED

Surgical care plays a role in addressing a wide range of treatable illnesses, constituting 30 percent of the global burden of disease³. Annually, an estimated 266 million surgeries are performed worldwide, predominantly in high-income countries (HICs), leaving the poorest third of the world's population with receiving only 3.5 percent of these surgeries⁵. The demand for surgical care varies across regions, with Western Sub-Saharan Africa, with an estimated 5625 unmet surgical cases per 100,000 compared to nearly negligible unmet surgical needs in Western Europe. Various surgical subspecialties in low- and middle-income countries (LMICs), such as neurosurgery, anaesthesia, and paediatric surgery, exhibit notable variations in unmet surgical cases within their respective fields⁶.

ACCESS

In low- and middle-income countries (LMICs), the accessibility to quality and safe surgical and anaesthesia care encounters numerous challenges. Barriers to individuals in these nations seeking such care are primarily rooted in economic constraints, geographic remoteness, insufficiently equipped services, and various sociocultural factors⁷. The uneven distribution of hospitals and emergency care, often concentrated in urban, academic, and political centres, exacerbates the challenge, particularly in countries with vast rural areas and inadequate transport networks. For example, in Tanzania, patients travel an average of 119 kilometres for surgical care, and in Ghana, the distance is 74 kilometres⁸.

CAPACITY

Basic surgical infrastructure is typically scarce in most LMICs, directly impacting the ability of healthcare facilities to consistently provide essential surgical care. Some regions report fewer than 1 operating theatre per 100,000 population⁹, while access to necessities like running water and oxygen supplies is available in less than 40 percent of hospitals in Gambia and Rwanda¹⁰. The high incidence of delayed or cancelled surgical procedures in these LMICs is directly linked to inadequate infrastructure and equipment shortages¹⁰.

WORKFORCE

A substantial shortage persists in the healthcare workforce, with an estimated 2 million surgeons, obstetricians, and anaesthesiologists globally and an additional 1.27 million needed by 2030 to meet minimal surgical workforce densities¹¹. Despite LMICs constituting 48 percent of the global population, only 19 percent of surgeons and 15 percent of anaesthesiologists are distributed in these countries¹². To cope with the shortage, many LMICs have adopted the concept of "task shifting," where non-specialists and non-physician professionals undertake surgical and anaesthesia tasks, respectively¹³. Research looking at task shifting in surgery, obstetrics and anaesthesia, showed surgical task shifting in 19 of 52 countries and anaesthesia task shifting in 119 of 147 countries¹⁴. Assisting the surgical and anaesthesia workforce in this manner emphasizes the role that these healthcare providers have in upscaling the healthcare workforce¹⁴. Clear definitions of scope of practice, adequate training, supervision, recognition, remuneration, and engagement with regulatory bodies are crucial for effective task shifting.

ECONOMICS

The perception that surgical and anaesthesia care is expensive and complex has limited its integration into global health efforts. Economic evaluations have shown surgical care to be cost-effective¹⁴, even surpassing other public health interventions like antiretroviral therapy and oral rehydration solution. The Global Burden of Disease Study in 2010 highlighted that over one-fifth of LMICs' injury burden could be mitigated through basic surgical care, emphasizing its life-saving impact¹⁵. This economic perspective underscores the imperative to enhance the provision of surgical and anaesthesia care within global health improvement programs. The discussion on access to such care highlights the importance the interplay between political, economic, and healthcare factors.

QUALITY

On a global scale, perioperative mortality (deaths within 30 days of surgery) is estimated at 4.2 million people, surpassing the combined fatalities from Human Immunodeficiency Virus (HIV), malaria, and tuberculosis. Half of these perioperative deaths occur in low- and middle-income countries (LMICs)¹⁵. Research indicates that the predominant predictor of overall outcomes is the quality, rather than the access, to surgical and anaesthesia care¹⁵.

While anaesthesia is a crucial component of contemporary surgical practice, its development in many LMICs lags behind. In these countries, anaesthesia machines and the capacity to administer general anaesthesia are available in 43 percent and 56 percent, respectively¹⁵. The current status of anaesthesia care in most LMICs is notably less advanced than surgical care, often viewed as a non-physician or technician role, with inadequate governance and advocacy at ministerial levels hindering improvement efforts. Fortunately, global initiatives like The Global Oximetry Project and the WHO Surgical Safety Checklist have provided a framework for evidence-based anaesthesia quality improvement. Although the utilization of The WHO Surgical Safety Checklist is limited in LMICs, its effectiveness in reducing 30-day perioperative mortality after emergency laparotomy is more significant in LMICs than in high-income countries (HICs)¹⁵. Numerous models have been proposed to enhance the training, recruitment, and retention of anaesthesia providers. However, the severe shortage of funding to support the development of safe anaesthesia in many settings remains a substantial challenge, necessitating attention at regional, national, and international levels.

ANAESTHESIA WORKFORCE

The anaesthesia workforce is collectively made up of anaesthesia providers, which is a term used to define any health care worker providing anaesthesia care to patients, irrespective of the level of training and supervision. The term anaesthesia provider encompasses both the physician anaesthesia providers (PAPs) and the non-physician anaesthesia providers (NPAPs)¹⁶. The PAP's consist of the specialist anaesthesia physician (Fellow of the College of Anaesthesiology), trainee specialist anaesthesia physician (Registrar) and the non-specialist physician (DA anaesthetist). The NPAP's include the nurse anaesthetist, anaesthesia technicians and other healthcare workers who provide anaesthesia¹⁶.

ANAESTHESIA WORKFORCE SHORTAGE

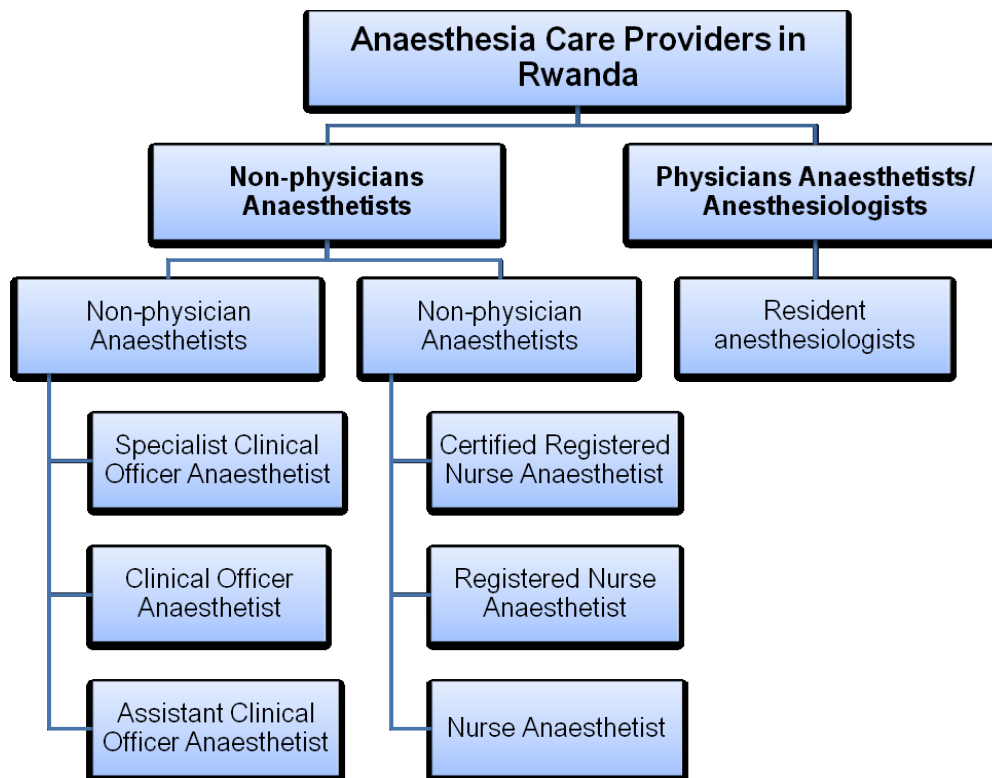
Anaesthesia workforce shortage is a widespread global issue, but the workforce shortage is dire in most African countries. Understanding the reasons behind this shortage is crucial for meaningful solutions. The article titled "The Specialist Anaesthesiology workforce in East, Central and Southern Africa" shed some light on these key issues. It emphasized the scarcity of anaesthesiologists, with the identified density being just one fiftieth of the recommended minimum, highlighting a significant gap when compared to HICs like the United States of America and leading to a reliance on NPAPs in most of the LMICs.

NPAPs significantly outnumber specialist anaesthesiologists in many LMICs, and even with NPAPs the overall number of anaesthesia providers remains insufficient, particularly in sub-Saharan Africa, contributing to the high perioperative morbidity and mortality rates. Addressing these issues requires multiple interventions such as increasing the number of anaesthesia providers, enhancing their competency, fostering interprofessional collaboration, advocating for the importance of anaesthesia and fair compensation for providers.

NON-PHYSICIAN ANAESTHETISTS

Anaesthesia became a distinct speciality post the World War II. Before then, surgeons were responsible for the entire operation, the surgeon would induce anaesthesia and then a nurse would take over and maintain the anaesthesia. Non-physician anaesthetists (NPAs) are defined as licenced non-physicians who have completed a diploma or bachelor's training in anaesthesia. NPAs are vital members of the anaesthesia workforce globally¹⁷.

The provision of anaesthesia care by non-physician anaesthetists (NPA) is not limited to resource-limited settings only. In the United States, certified registered nurse anaesthetists (CRNAs) have been delivering anaesthesia since the 1800s. Presently, CRNAs administer anaesthesia for about two-thirds of the 30 million annual procedures in the US, particularly in rural hospitals¹⁷. Their training involves 2–3 years post-nursing education and recertification every 2 years, overseen by the regulatory body of the American Association of Nurse Anaesthetists. Nurse anaesthetists (NA) in Western Europe undergo similar accreditation. The training is comprehensive in both the scientific and medical aspects of anaesthesia, equipping NPAs with necessary skills to administer anaesthesia effectively. NPAs fall into various categories based on their level of education¹⁷.



1. **Specialist Clinical Officer Anaesthetist (SCOA):** Holds an advanced academic and clinical expertise in anaesthesia, having obtained a Master's Degree or its equivalent from a recognized institution. Although not a physician, they possess essential knowledge in anaesthesia and are qualified to make independent anaesthesia-related decisions based on their education, licensing, and certification¹⁷.
2. **Clinical Officer Anaesthetist (COA):** Has undergone extensive academic and clinical training in anaesthesia, achieving a Bachelor's Degree or its equivalent from a recognized institution. Despite not being a physician, they possess essential expertise in anaesthesia and are competent in independently evaluating various aspects of anaesthesia care, relying on their education, licensure, and certification¹⁷.
3. **Assistant Clinical Officer Anaesthetist (ACOA):** Has expertise in anaesthesia acquired through academic and clinical training, earning an advanced Diploma or its equivalent from a recognized institution. Although not a physician, they hold vital anaesthesia knowledge and are capable of making independent decisions regarding anaesthesia care, drawing on their education, licensing, and certification¹⁷.
4. **Certified Registered Nurse Anaesthetist (CRNA):** Is a registered nurse with specialized academic and clinical education in anaesthesia, having earned a Master's Degree or its equivalent from a recognized institution. They have the capability for independent decision-making in various aspects of anaesthesia care, relying on their education, licensing, and certification¹⁷.
5. **Registered Nurse Anaesthetist (RNA):** Is a registered nurse with dedicated academic and clinical training in anaesthesia, holding a bachelor's degree or its equivalent from a recognized institution. They possess the qualifications to independently evaluate different aspects of anaesthesia care, drawing on their education, licensure, and certification¹⁷.

6. **Nurse Anaesthetist (NA):** Is an enrolled nurse with specialized academic and clinical training in anaesthesia, having earned an advanced Diploma or its equivalent from a recognized institution. While not a physician, they possess the capability to independently assess different aspects of anaesthesia care based on their education, licensure, and certification¹⁷.
7. **Anaesthetic Technician (AT):** Is an individual who hold a Diploma or Bachelor's degree, primarily tasked with the upkeep of anaesthesia equipment. They do not administer anaesthesia, making clinical registration and licencing not mandatory for their practice¹⁷.

NON-PHYSICIAN ANAESTHETISTS SCOPE OF PRACTICE

The scope of practice of non-physician anaesthetists includes, but not limited to the following:

<p>SCOA: This scope pertains to the CRNA with appropriate and equivalent qualifications in nurse anaesthesia.¹⁷</p>	<ol style="list-style-type: none"> 1. Conducting and documenting a pre-anaesthetic assessment and patient evaluation, including requesting consultations and diagnostic studies; choosing, obtaining, ordering, and administering pre-anaesthetic medications and fluids; and obtaining informed consent for anaesthesia. 2. Developing and executing an anaesthetic plan. 3. Initiating the anaesthetic technique, which may involve general, regional, local, and sedation methods. 4. Selecting, applying, and inserting suitable non-invasive and invasive monitoring modalities for continuous patient physical status evaluation. 5. Choosing, obtaining, and administering the necessary anaesthetics, adjuvant and accessory drugs, and fluids to manage the anaesthesia. 6. Managing a patient's airway and pulmonary status using current practice modalities. 7. Facilitating emergence and recovery from anaesthesia by selecting, obtaining, ordering, and administering medications, fluids, and ventilatory support. 8. Discharging the patient from a post-anaesthesia care area and providing post-anaesthesia follow-up evaluation and care. 9. Implementing acute and chronic pain management modalities. 10. Responding to emergency situations by providing airway management, administration of emergency fluids and drugs, and utilizing basic or advanced cardiac life support techniques. 11. Administration/management: Scheduling, material and supply management, policy and procedure development, fiscal management, performance evaluations, preventative maintenance, billing, data management, and supervision of staff, students, or ancillary personnel. 12. Quality assessment: Data collection, reporting mechanisms, trending, compliance, committee meetings, departmental reviews, problem-focused studies, problem-solving, interventions, document and process oversight. 13. Performing BLS, ACLS, and, where resuscitation committees exist, being a part of it. 14. Education: Clinical and didactic teaching, BCLS/ACLS instruction, in-service commitments, EMT training, supervision of residents, and facility continuing education. 15. Research: Conducting and participating in departmental, hospital-wide, and university-sponsored research projects. 16. Interdepartmental liaison: Interface with other departments such as nursing, surgery, obstetrics, post-anaesthesia care units (PACU), outpatient surgery, admissions, administration, laboratory, pharmacy, etc. 17. Clinical/administrative oversight of other departments: Respiratory therapy, PACU, operating room, surgical intensive care unit, pain clinic, etc. 18. Collaborating indirectly or directly with an anaesthesiologist who has been privileged to administer anaesthesia in the concerned hospital/institute/organization.¹⁷
<p>COA: This scope pertains to the RNA with appropriate and equivalent qualifications in nurse anaesthesia.¹⁷</p>	<ol style="list-style-type: none"> 1. Perform pre-anaesthetic assessments, which involve requesting consultations and diagnostic studies, administering pre-anaesthetic medications, and obtaining informed consent. 2. Develop and execute anaesthesia plans. 3. Initiate diverse anaesthesia techniques, encompassing general, regional, local, and sedation methods.

	<ol style="list-style-type: none"> 4. Choose, apply, and insert monitoring modalities for continuous evaluation of the patient's physical status. 5. Administer necessary anaesthetics, adjuvant drugs, and fluids for anaesthesia management. 6. Manage a patient's airway and pulmonary status according to current practices. 7. Facilitate the emergence and recovery from anaesthesia. 8. Discharge patients from post-anaesthesia care areas and provide subsequent follow-up care. 9. Implement acute and chronic pain management strategies. 10. Respond to emergencies, providing basic or advanced cardiac life support. 11. Perform BLS, ACLS, and actively participate in resuscitation committees. 12. Undertake administrative responsibilities, including scheduling, material and supply management, policy development, fiscal management, performance evaluations, and staff supervision. 13. Conduct quality assessments, involving data collection, reporting mechanisms, trending, and participation in departmental reviews and research projects. 14. Collaborate with anaesthesiologists, either indirectly or directly. 15. Seek privileges to assume duties akin to SCOA and CRNA if functioning as the most senior anaesthesia provider in a specific setting. 16. Abide by restrictions related to patient classification, age, and specific cases, ensuring supervision or assistance in designated scenarios by senior anaesthesia providers like SCOA, CRNA, or other superior staff, except in emergency situations or instances where transfer to a higher institution is unlikely to yield improved patient outcomes.¹⁷
<p>ACOA: This scope pertains to the NA with appropriate and equivalent qualifications in nurse anaesthesia.¹⁷</p>	<ol style="list-style-type: none"> 1. Conducting and documenting a pre-anaesthetic assessment and patient evaluation, including requesting consultations and diagnostic studies; selecting, obtaining, ordering, and administering pre-anaesthetic medications and fluids; and obtaining informed consent for anaesthesia. 2. Developing and implementing an anaesthesia plan. 3. Initiating various anaesthesia techniques, encompassing general, regional, local, and sedation methods. 4. Selecting, applying, and inserting suitable non-invasive and invasive monitoring modalities for continuous evaluation of the patient's physical status. 5. Selecting, obtaining, and administering the necessary anaesthetics, adjuvant drugs, and fluids to manage anaesthesia. 6. Managing a patient's airway and pulmonary status using current practice modalities. 7. Facilitating emergence and recovery from anaesthesia by selecting, obtaining, ordering, and administering medications, fluids, and ventilatory support. 8. Discharging patients from post-anaesthesia care areas and providing subsequent follow-up care. 9. Implementing acute pain management modalities. 10. Responding to emergency situations by providing airway management, administration of emergency fluids and drugs, and using basic or advanced cardiac life support techniques. 11. Performing BLS in all settings as required; if trained in ACLS, delivering the necessary ACLS services, and participating in resuscitation committees where they exist. 12. Seeking privileges to undertake the duties of COA and RNA in case of being the most senior anaesthesia provider in a specific setting. 13. Except in emergencies or situations where transfer to a higher institution is less likely to yield better patient outcomes, the ACOA and NA shall not provide anaesthesia to patients beyond ASA II classification and children under 3 years, neurosurgery, and cardiothoracic cases without being supervised or assisted by another SCOA, CRNA, or anaesthesiologist.¹⁷

THE SOUTH AFRICAN ANAESTHESIA WORKFORCE

South Africa stands out as one of the most unequal nations globally, marked by a significant Gini coefficient of 0.63 in 2015. The country operates a dual healthcare system encompassing both private and public healthcare facilities, reflecting its diverse and historically racialized demographic makeup¹⁸. There is a maldistribution of doctors between the private and public sectors, the latter which serves 86 percent of the population but has less than half of the human resources. This disparity positions South Africa significantly below other middle-income countries concerning the availability of anaesthesia specialists¹⁸.

Research found a highly uneven distribution of the anaesthesia workforce. The density of specialists in Western Cape, an urban and densely populated province, was nearly twenty times greater than that in Limpopo, a rural and sparsely populated province. Addressing this imbalance among anaesthesiologists between the private and public sectors within South Africa is crucial¹⁸.

The South African Society of Anaesthesiologists (SASA), has noted that the significant shortage of skills, particularly evident in the healthcare domain, poses a pressing concern. According to data from 2015 by Econex, representing the Hospital Association of South Africa, South Africa falls notably short in the number of doctors and specialists per 100,000 population when compared to other BRICS nations (Brazil, Russia, India, China and South Africa).

According to the World Federation Societies of Anaesthesiologists (WFNA), the current South African anaesthesia workforce is as follows:

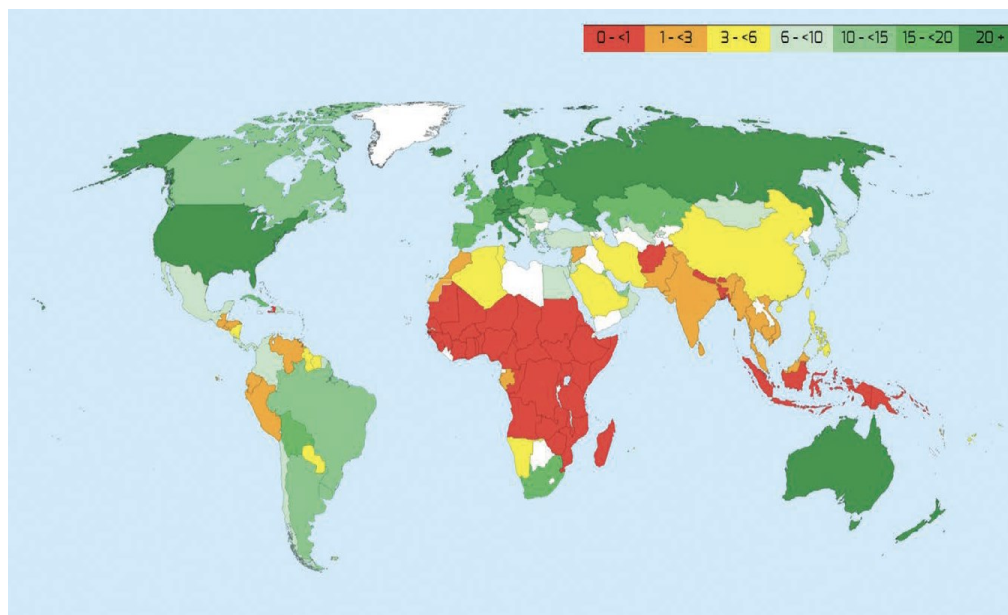


Figure 2: Global distribution of physician anaesthesia providers per 100,000 population. White indicates no data.

- Physician Anaesthesia Provider Density: 16.18
- Population: 54,490,000
- Physicians: 39,541
- Physician anaesthesia providers: 8,814
- Surgeons: 3,453

The work force density of specialist anaesthesiologists sits at 16.18, which is above the recommended density and is comparable with most HICs. However a high capacity of this workforce functions in the private sector and does not contribute meaningfully and address the service shortfall in the public sector. The scarcity of anaesthesiology specialists, especially in the public sector, remains a concerning issue, significantly impacting the accessibility of quality surgical care for the population. Studies like the African Surgical Outcomes Study emphasize the drastic shortfall in surgical care, indicating that the number of surgeries performed per 100,000 population is alarmingly low across Africa, falling far below the necessary volume to meet essential surgical needs.

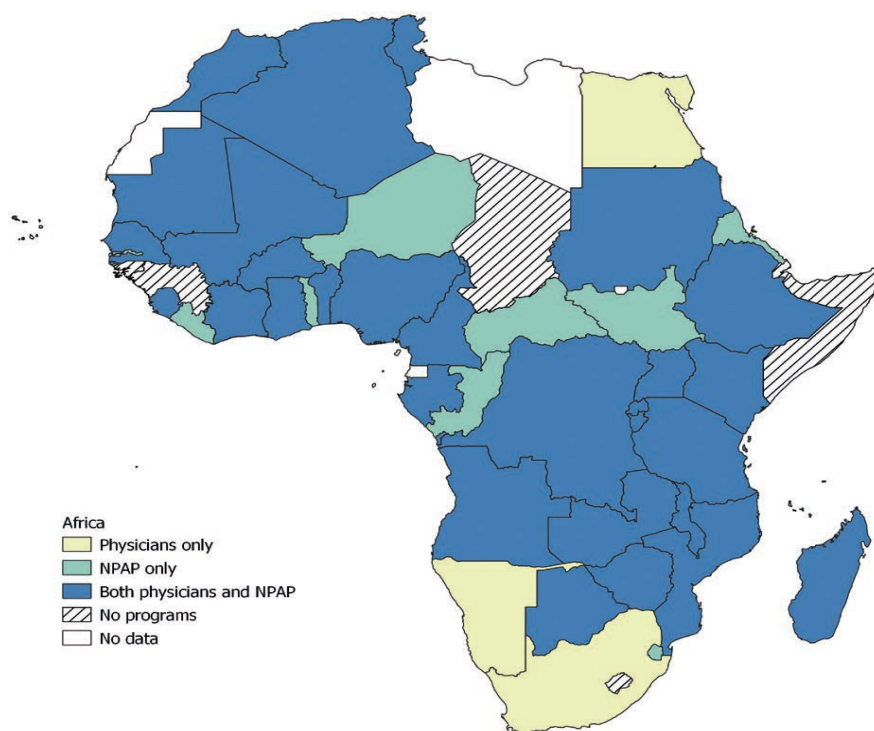


FIGURE 3: Map of training programs in Africa. NPAP indicates nonphysician anaesthesia provider.

- Nurse anaesthesia providers: 0
- Other anaesthesia providers: 0
- No. of physician providers that have an anaesthetic qualification: 2,526
- Minimum duration of training (years) for physician anaesthesia providers: 4
- Typical duration of training (years) for nurse anaesthesia providers: 0
- Typical duration of training (years) for non-physician/non-nurse anaesthesia providers: 0

Even with this significant shortage in the anaesthesia workforce, South Africa currently only provides PAP led anaesthetic services, which consist of the specialist anaesthesia physician (Fellow of the College of Anaesthesiology), trainee specialist anaesthesia physician (Registrar) and the non-specialist physician (DA anaesthetist) and general practitioners. The country has currently has no NPAs and no training avenues for NPA.

CONCLUSION

The fact that 5 billion people in the world cannot access what most of us take for granted, which is access to safe surgical care is a sobering thought. In many countries the limiting factor is the lack of access to safe anaesthesia care. And this lack of anaesthesia care unfairly impacts people living in LMICs, in Sub Saharan Africa and Asia.

Surgery and anaesthesia is required to treat nearly all diseases, trauma and obstetric emergencies and there is no way we can reach universal health coverage without prioritizing safe anaesthesia and surgical care for all.

In order to truly address the scarcity and inadequacy of anaesthesia care, we need to seriously rethink how anaesthesia is delivered and adopt the practice of task sharing in medicine that has been adopted by most LMICs. Safe anaesthesia care can be a reality for billions of people globally by training qualified NPAs, to safely administer anaesthesia and bridge the biggest threat to anaesthesia care, which is the critical anaesthesia workforce shortage.

As with other areas of medicine, we need to embrace innovative training methods to expand the anaesthesiologist and NPAs workforce.

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