Global Surgery – A Review of the Paediatric Surgical Workforce in South Africa

by

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DECLARATION

I, Angela June Dell, hereby declare that the work on which this thesis is based is my original work (except where acknowledgements are indicated otherwise) and that the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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ABSTRACT

There is limited data with regard to the available paediatric surgical workforce in South Africa as well as their employment prospects upon completion of their specialist training. These data are essential in developing a *National Surgical Plan* to address the burden of surgical disease as well as determining where resource allocation is needed. In addition, specialist paediatric surgeons who are unable to find suitable employment are more likely to emigrate, leading to further collapse of the surgical health care system.

This aim of this study was to quantify and analyse the paediatric surgical workforce in South Africa as well as to determine their geographic and sector distribution. This research builds on previous research conducted in the field of general surgery and continues to grow the national database on surgical resource in South Africa. This study involved a quantitative descriptive analysis of all registered specialist as well as training paediatric surgeons in South Africa, and included their demographic data, the geographic location of their practice, as well as the sector in which they work. Quantitative data included their plans for public, private or dual practice once they have completed their specialization training.

The results showed 2.6 paediatric surgeons per one million population under 14 years. More than half (69%) were male and the median age was 46.8 years. There were however, more female surgical registrars currently in training. The majority of the paediatric surgical practitioners were found in Gauteng (43%), followed by the Western Cape (26%) and Kwa-Zulu Natal (16%). The majority of specialists reportedly worked in the public sector (40.9%), however this number may have been over-reported as hours spent in public practice were not specified.

Interprovincial differences as well as intersectoral differences were marked indicating geographic and socioeconomic maldistribution of paediatric surgeons. The public sector paediatric surgeon density (per million population under 14 years) was 2.4 which fell below the private sector paediatric surgeon density of 9.4.

These numbers fell far below developed countries such as the United States, Germany and the Netherlands but the private sector density compared favourably with Ireland and Canada.

Access to paediatric surgical care requires an adequate supply of experienced surgeons distributed over a wide geographical area. Additionally, paediatric surgeons require a wide range of ancillary support staff and hospital facilities. Without these resources, surgical access for the most vulnerable of populations is limited. Addressing the maldistribution of paediatric surgical workforce requires concerted efforts to expand existing training posts as well as equipping the remainder of level three hospitals to provide paediatric surgical training.

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Chapter 1 - INTRODUCTION

An estimated 30% of the global burden of disease may be alleviated by surgical care. [1, 2] Despite the substantial burden of surgical disease, surgical services are not being delivered to many of those who need them most. An estimated 2 billion people lack even the most basic surgical care, [1] but the Lancet Commission estimates this may be as high as 5 billion people. [2] Only 3.5% of all surgical operations worldwide are performed in the poorest 35% of the world's population. [3] Despite the magnitude of these estimates, surgery remains a neglected aspect of health systems development in Lower- and Middle-Income Countries (LMICs). [2, 4]

An inadequate workforce remains a major challenge in surgical capacity building, with the emigration of health workers from LMICs often cited as a major impediment to workforce development. [5] Building surgical capacity is essential to addressing the burden of surgical disease and is an important aspect of overall health systems strengthening in LMICs; however, the scope of the surgical workforce shortage is not well-quantified in many LMICs and effective strategies to increase the surgical workforce and promote local retention of surgeons have not been well tested. [6] In order to address the shortage of health personnel, gathering and sharing national data about the surgical workforce could assist in achieving this goal.

Despite increasing awareness of the unmet burden of surgical conditions, little information is available on surgery and anaesthesia in children. One study from Bickler et al reported an 11% in-patient burden and a 20% out-patient burden of surgical disease in Gambia, but these data from low income countries (LICs) were likely to under-represent the true burden. [7] Many surgical conditions of childhood are amenable to simple surgical intervention, but if left untreated, complications, lifelong disability or death can ensue. [8] The paediatric surgery workforce around the world consists of thousands of paediatric surgeons, however their distribution varies greatly. [9]

Despite the difficulties in quantifying the paediatric surgery workforce, previous studies have reported that paediatric surgeons are in a shortage around the world. [10-12] These studies highlighted reasons which may contribute to the differences in the delivery of paediatric surgical care, yet limited data exist on paediatric surgery workforce globally. Identifying and addressing the most influential causes of variation can ultimately lead to an increase in the supply of paediatric surgeons to meet the worldwide need. The purpose of this study is to analyse the geographic distribution as well as the future career plans of paediatric surgeons (both qualified and in training) in South Africa.

1.1 Background of the Problem

The Disease Control Priorities Project (DCP3) estimated that more than 30% of the disability adjusted life years (DALY's) were from conditions which may be surgically treated. [13, 14] This Global Burden of Disease (GBD) comprised of injuries (38%), malignancies (19%), congenital anomalies (9%), complications of pregnancy (6%), cataracts (5%) and perianal conditions (4%). Almost one third of injury-related mortality affected 15 to 44 year-olds, the most economically productive segment of the population. Many of these deaths could be prevented by access to surgical services. [14, 15] Surgical care, which has been shown to be cost effective, could avert 20–40 % of this burden in LMICs, saving nearly 2 million lives annually. [16-18] The Lancet Commission on Global Surgery 2030 report estimated that without the urgent upscaling of surgical care, LMICs will have a projected economic loss of $12.3 trillion dollars, reducing the annual income growth by as much as 2% in some countries. [2] In the absence of surgical services, common conditions such as appendicitis, fractures and complicated labour would result in high mortality rates. Injuries resulting from interpersonal violence, road traffic accidents and burns remain the highest cause of mortality in children over 5 years worldwide, including South Africa. [19]

Understanding the baseline surgical and anaesthetic capacity in a country is critical to improving the quality of services and outcomes. The lack of human resources in developing countries often is the greatest challenge to providing surgical care. Africa has less than 1% of the surgical work force in comparison to the United States, and a significantly greater share of the burden of disease. [21] Major shortages in the surgical workforce are compounded by maldistribution of the existing workforce resulting in gross inequity. LMICs are disproportionately affected by low surgical workforce density, and in particular, people living in rural areas, those with a low income, and those who are marginalised are the most affected by these shortages. [2] Of the 47 countries in sub-Saharan Africa, 38 do not meet the WHO recommended minimum of 20 doctors and 100 nurses per 100 000 population, or the surgical specialities combination required to deal with the burden of surgical diseases. [22]

Even less is known about the global burden of paediatric surgical conditions and congenital abnormalities, although an estimated 94% of severe congenital anomalies occur in LMICs. [23] Despite recognition that children have distinct surgical needs when compared with adults, major gaps persist in the accessibility and delivery of paediatric surgical care. Global paediatric surgery has a similar focus as global surgery in adult, but with a focus on a broad range of surgical conditions, namely infections, injuries, malignancy and congenital anomalies. These childhood conditions are unique in that they may present in the neonatal period or may present later in teenage years. Similarly, these conditions may require once-off interventions, or may require follow-up throughout childhood. [24]

1.2 Statement of the Problem

South Africa is classified as an upper middle income country (UMIC) and provides reasonable surgical services, however these services vary across the regions, between urban and rural settings, as well as between public and private hospitals. There is limited data with regard to the available paediatric surgical workforce in South Africa as well as their employment prospects upon completion of their specialist training. These data are essential in developing a *National Surgical Plan* to address the burden of surgical disease as well as determining where resource allocation is needed. In addition, specialist paediatric surgeons who are unable to find suitable employment are more likely to emigrate, leading to further collapse of the surgical health care system.

1.3 Purpose of the Study

This aim of this study was to quantify and analyse the paediatric surgical workforce in South Africa as well as to determine their geographic and sector distribution. This research builds on previous research conducted in the field of general surgery and continues to grow the national database on surgical resource in South Africa.

1.4 Theoretical Framework

The Lancet Commission began to address the gaps in the human and economic effects of surgical conditions, the state of surgical care, and the potential strategies for the upscale of surgical services in LMICs. The Commission brought together an international, multidisciplinary team of 25 commissioners, supported by advisors and collaborators from more than 110 countries and six continents. [2] According to the World Bank, the WHO and UNICEF, surgical indicators are lacking. The Lancet Commission recommend that their *six core surgical indicators* should be tracked and reported by all countries. [2]

One of the Lancet indicators included the assessment of specialist workforce density with a recommendation to have at least 20 surgical, anaesthetic and obstetric providers per 100 000 people, in 100% of countries by 2030. [2] Other indicators included access to timely surgery, surgical volume, perioperative mortality and protection against impoverishing expenditure.

The commission proposed a template for a National Surgical plan which involves infrastructure (tracking number of facilities), workforce (density and distribution of surgical, anaesthetic and obstetric specialists), service delivery (*Bellwether procedures*), financing, and information management (robust information systems). [2] Of particular relevance to this research was the assessment of surgical workforce density. By mapping surgical providers, these crucial data may be directed towards the development of a National Surgical Plan aimed at dealing with the global burden of surgical disease. Data collection, analysis, and reporting of a limited set of indicators, can focus attention and rouse support for surgery, this would hopefully translate into the provision of safe and affordable surgical care to those in need.

1.5 Research Hypothesis

The research hypothesis is that surgical workforce in South Africa is limited and the number of surgeons per million population under 14 years are inadequate compared to developed countries. These limited numbers are inadequate to deal with the paediatric surgical burden and these important indices are lacking nor have they been adequately assessed. Although absolute surgeon numbers provide some insight into surgical capacity, they have limitations as these numbers do not directly correlate with surgical output.

1.6 Importance of the Study

This national audit will provide much needed data on the available paediatric surgical workforce and would allow policy makers to implement public health policies which better cater for the surgical needs of paediatric patients. This includes demonstrating where gaps in surgical care provision lie. This could influence decision making about funding distribution, resource and training post allocations, as well as identifying inequalities in service delivery. This study attempts to provide data on the Lancet Commission surgical workforce indicators and follows on a similar study which mapped the general surgical resources in South Africa.

1.7 Overview of the methodology

This study involved a quantitative descriptive analysis of all registered specialist as well as training paediatric surgeons in South Africa, and included their demographic data (sex, age) as well the location of their practice. Quantitative data included their plans for public, private or dual practice once they have completed their specialization training. Surgeons were contacted telephonically and/or via email during the period of 15th January and 31st May 2017. A questionnaire requesting the same data was administered to paediatric surgeons and registrars attending the annual registrar symposium held in the first week of February.

1.8 Limitations of the study

Reporting bias could have occurred as data was obtained from individuals, although captured variables were requested in the least ambiguous manner and none of the respondents needed clarification on the data being requested. The Health Profession Council of South Africa (HPCSA) and College of Medicine of South Africa (CMSA) databases were the most accurate source of determining specialist surgeon numbers, although not all surgeons could be reached and there a small number who were thought to have emigrated.

This audit only captured paediatric surgeon number and not obstetric, orthopaedic, anaesthetic or other surgical sub-speciality number. In order to accurately assess South Africa's ability to deal with their burden of surgical disease, these other specialities would need to be quantified.

1.9 Definitions of key terms

Bellwether procedures: The Lancet Commission has proposed the use of three Bellwether procedures which are markers of system functioning, viz. caesarean section, management of open fractures and laparotomy. The performance of these procedures suggest a level of complexity advanced enough to do most other surgical procedures.

Central referral hospital (tertiary three): In a very small number of hospitals, currently two, there will be an additional package of subspecialties (Group 3 Specialties in Table 1). These will be referred to as tertiary three hospitals, also called Central Referral Hospitals.

District hospital (level one): This is the first level of referral and generalist staff are be available with access to basic diagnostic and therapeutic services, such as X-rays (provided radiographers are available) and basic laboratory tests. It should have a functional operating theatre in which operations are performed regularly under general anaesthesia (although not performed by specialist anaesthetist). There would be no intensive care unit. Generalists from a range of clinical disciplines provide the services. According to the World Health Organisation's functional definition, district hospitals should provide diagnostic, treatment, care, counselling and rehabilitation services. It should cover the following clinical disciplines at generalist level: Family Medicine and Primary health care, Medicine, Obstetrics, Psychiatry, Rehabilitation, Surgery, Paediatrics and Geriatrics. District hospitals are categorized into small, medium and large district hospitals with the following number of beds: (a) small district hospitals with no less than 50 beds and no more than 150 beds; (b) medium size district hospitals with more than 150 beds and no more than 300 beds; and (c) large district hospitals with no less than 300 beds and no more than 600 beds.

District municipality: The nine provinces of South Africa are divided into 52 districts, which are either metropolitan or district municipalities. They are the second level of administrative division, below the provinces and (in the case of district municipalities) above the local municipalities. As a consequence of the 12th amendment of the Constitution in December 2005, which altered provincial boundaries, the number of districts was reduced from 53. Another effect of the amendment is that each district is now completely contained within a single province, thus eliminating cross-border districts. The districts also cover the entire area of the continental republic.

A **General level three hospital** will have sub-specialty representation in at least 50% of the range of the Group 1 specialties (Table 1). A specialised level three hospital will only have one or two specialities from groups 1, 2 or 3 represented (e.g. cardiology and anaesthetics).In the public sector, these hospitals are defined as **Tertiary one hospitals** (also called Provincial Tertiary hospitals).

Global surgery is an area of study, research, practice, and advocacy that seeks to improve health outcomes and achieve health equity for all people who require surgical care, with a special emphasis on underserved populations and populations in crisis. It uses collaborative, cross-sectoral, and transnational approaches and is a synthesis of population-based strategies with individual surgical and anaesthesia care.

Infant mortality rate: The number of deaths of infants under one year old per 1 000 live births. This rate is often used as an indicator of the level of health in a country.

Lower and middle income countries (LMICs): Economies are divided according to 2013 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income (LIC), $1,045 or less; lower middle income (LMIC), $1,046 - $4,125; upper middle income (UMIC), $4,126 - $12,745; and high income (HIC), $12,746 or more. South Africa is classified as an UMIC.

Maternal mortality rate: Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. It is expressed as a ratio per 100 000 live births.

National referral hospital (tertiary two): Some Tertiary one hospitals will also provide a defined range (package) of other specialised services (Group 2 specialties in table 1). These are classified as Tertiary 2 hospitals and are also called National Referral Hospitals.

Paediatric surgeon: Paediatric surgical specialists were defined as those having completed College of Paediatric Surgery examinations or general surgeons dedicated to the care of children who were recognised as paediatric surgeons prior to the introduction of college examinations. Registrars were practitioners in HPCSA-registered training posts undergoing specialist training at accredited institutions. Medical officers included a few doctors who were not in registered training posts, nor who had completed CMSA examinations, but who fulfilled the role of paediatric surgeons and performed similar surgeries and held similar responsibilities.

Private hospital: A private hospital is a hospital owned by a for-profit company or a non-profit organisation and privately funded through payment for medical services by patients themselves, by insurers, or by foreign embassies.

Public hospital (provincial): A health care institution owned by a federal, state, or local government.

Regional hospital (level two): Regional hospitals are level two facilities that provide care requiring the intervention of specialists and general practitioners. A hospital providing a single specialist service would be classified as a specialised level 2 hospital.

A general level two hospital would need to provide and be staffed permanently in at least five of the following eight basic specialties: surgery, medicine, orthopaedics, paediatrics, obstetrics and gynaecology, psychiatry, diagnostic radiology and anaesthetics. A regional hospital has between 400 and 800 beds.

Semi-private hospital: This type of hospital is associated with hospital service that gives patient more privileges than a public-funded patient but less than a private patient.

Specialised hospital: There are wide a range of possible specialties that could be focused in a hospital. Two common specialised hospitals catering for high incidence chronic conditions that are found nationally are: psychiatric hospitals that provide long term in-patient care for patients with chronic psychiatric conditions and TB hospitals that provide long term in-patient care for patients with chronic TB. It has a maximum of 600 beds.

Surgical condition: This has not been consistently defined but can be seen as any disease state requiring the expertise of a surgically trained provider. A surgical condition may be more broadly defined as ‘‘any condition for which the most potentially effective treatment is an intervention that may require suture, incision, excision, manipulation, or other invasive procedure that usually, but not always, requires anaesthesia.’’ [24]

Surgical workforce: A network of associated surgical and anaesthetic personnel who work in concert to deliver surgical care. This includes but is not limited to all surgical and anaesthetic providers, nurses, pathologists, radiologists, laboratory technicians, theatre managers, community health workers, rehabilitation specialists, biomedical technicians, and engineers.

Tertiary hospital (level three): These hospitals receive patients from, and provide sub-specialist support to a number of Regional Hospitals. Most of the care should be level three care may require the expertise of clinicians working as sub-specialists or in rarer specialties (e.g. within surgery for example urology, neurosurgery, plastic surgery and cardiothoracic surgery). It has a maximum of 1 200 beds.

Table 1: Specialities classified as level three services.

Group 1 specialities	*Group 2 specialities*	*Group 3 specialities*
Anaesthetics	Cardiology	Hepatology
Burns	Cardiothoracic Surgery	Liver transplant
Clinical Pharmacology	Clinical Immunology	
Critical care and ICU	Craniofacial surgery	
Dermatology	Endocrinology	
Diagnostic radiology	Geriatrics	
Ear nose and throat	Haematology	
Gastroenterology	Human genetics	
Infectious diseases	Medical and radiation oncology	
Mental health	Neurology	
Neonatology	Neurosurgery	
Nephrology	Nuclear medicine	
Obstetrics and gynaecology	Paediatric sub-specialities	
Ophthalmology	Renal transplant	
Orthopaedics	Rheumatology	
Paediatric medicine	Spinal injuries	
Paediatric surgery		
Paediatric ICU		
Plastic and reconstructive surgery		
Rehabilitation centre		
Respiratory medicine		
Trauma		
Urology		
Vascular surgery		

1.10 Summary

Surgery is an indispensable part of any health system and improving access to safe surgery remains a challenge in the developing world. Surgery is emerging as a priority in global health and unfortunately there is limited data about the burden of paediatric surgical diseases or the surgical workforce in place to deal with this burden. Surgical care is a critical component of children's health, but significant gaps exist in the provision of paediatric surgical care in LMICs. Mapping the paediatric surgical workforce will facilitate strengthening of the existing workforce and allow for advocacy for training, as well as specialist posts, in areas of need.

Chapter 2 - LITERATURE REVIEW

Global Surgery

The Lancet Commission on Global Surgery was launched in January 2014 and developed key messages, a set of indicators and recommendations to improve access to safe and affordable surgical and anaesthesia care in LMICs. [2] Surgical interventions were previously perceived to be complex procedures which were undertaken by highly trained surgeons, but such specialists are rare in many LMICs. [24] Major shortages in the surgical workforce are compounded by maldistribution of the existing workforce resulting in gross inequity. LMICs are disproportionately affected by low surgical workforce density, and in particular, people living in rural areas, those with a low income, and those who are marginalised are the most affected by these shortages. [2]

Sub-Saharan Africa is most affected by the global shortage of human resources, as available doctors and specialists tend to concentrate in urban areas in tertiary centres. Sub-Saharan Africa has 11% of the world's population and 24% of the estimated burden of surgical disease, yet it has 3% of the global health workforce, only a small percent of whom are qualified surgeons. [24] The proportion of the population under the age of 14 years varies between countries, and ranges from 13% in high income countries such as Germany, to 48% in low income countries such as Uganda. [25] Sub-Saharan Africa has less than 1% (the exact number is unknown) of the surgical work force in comparison to the United States, and a significantly greater share of the burden of disease. [18] The maldistribution of the specialist surgical workforce, measured by the density of specialist surgeons, anaesthetists, and obstetricians per 100 000 population, correlates with specific health outcomes. [1] It has been noted that countries with increased densities of surgical providers per 100 000 population have improved maternal survival. For each ten unit increase in the density of surgeons, anaesthetists, and obstetricians, maternal mortality decreases by 13.1%. [25]

The thresholds of 20 and 40 providers per 100 000 corresponds with a volume of surgery of between 2917 and 5834 procedures per 100 000 population, respectively, and are symmetrically distributed around the estimated global need of 4664 surgical procedures per 100 000 population. [2] Forty four percent of the world's population live in countries with a specialist surgical workforce density lower than 20 per 100 000 population, and only 28% live in countries with a specialist surgical workforce density higher than 40 per 100 000 population. [25] Using the higher workforce density of 40 per 100 000 population as an optimum, it was estimated that in 2015 there was a worldwide shortage of just over one million specialist surgical, anaesthetic, and obstetric providers in 136 LMICs. The global workforce would need to double in the next 15 years to meet this need. [2]

Specialist and sub-specialist surgeons, such as paediatric surgeons, tend to concentrate and work in urban areas and in tertiary and academic hospitals. This limits access for children from rural populations, which often comprises up to 75% of national populations. [20] A lack of paediatric and neonatal equipment and supplies adds to an inability to perform surgeries at most district and regional level hospitals. Specialists working in the public sector are often compelled to carry out dual practice in both public and private sectors. This might affect the quality of care delivered by these practitioners, as well as increase the risk of fatigue and burnout. [26]

Accurate data on the global surgical workforce are crucial for international comparisons as well as the development of national workforce plans personalised to the population's needs. The WHO aimed to quantify the global surgical specialist workforce by country in order to build a WHO surgical workforce database in the process. [27] Data were obtained from 167 countries, representing 92% of the global population. Worldwide, there were an estimated 1.1 million specialist surgeons, 0.5 million anaesthesiologists and 0.4 million obstetricians. Paediatric and other surgical sub-specialities were excluded from this audit.

Low-income and lower-middle income countries, representing 48% of the global population, had 20% of this workforce, or 19% of all surgeons, 15% of anaesthesiologists, and 29% of obstetricians. Africa and Southeast Asia were particularly underserved. In terms of density, low-income countries had 0.7 providers per 100 000 population (IQR 0.5-1.9), compared with 5.5 (1.8-28.2) in lower-middle income countries, 22.6 (11.6-56.7) in upper-middle-income countries, and 56.9 (32.0–85.3) in high-income countries. [27]

The recent advances in global surgery have particular relevance to child health, although this movement has not had an explicit focus on the surgical needs of children. [27] There are still numerous challenges which impede the integration of paediatric surgical care within global child health programs. Paediatric surgery is viewed by some as a luxury, even more so than general surgical care. However, paediatric inguinal hernia repair in sub-Saharan Africa is as cost-effective as tetanus vaccination. [27] Congenital cardiac and anorectal malformations and not recognized as essential surgeries when compared with well-publicized cleft lip and palate repairs. Thus even within the surgical discipline, there is wide variation among levels of global support between conditions. Consequences of leaving childhood surgical conditions untreated may result in these children being socially excluded, abandoned and never being able to attend school. [27]

Ozgediz et al have proposed an adaptation of the Lancet Commission and Disease Control Priorities project (third edition) objectives to outline tasks for the global paediatric surgery community. These included choosing Bellwether procedures which represent childhood surgical conditions, estimating the paediatric surgery and anaesthesia provider density as well as developing recommendation for workforce needs. [28] Essential children's surgical care must be included and prioritized in new national and international health policy. Mapping the paediatric surgical workforce and understanding the current landscape is needed to achieve this. If surgery is the 'neglected stepchild of public health, then paediatric surgery is the child not yet born'. [29]

Global paediatric surgical workforce

A major problem with paediatric surgical care in developing countries is the general lack of knowledge regarding the care of children with surgical disease. [30] More than a billion children will be born in Africa over next 40 years, which will place additional strain on overburdened and under-resourced health systems. With an estimated cumulative risk of 85% for all surgical conditions by age 15 years, the demand for surgical care of children will continue to rise. [31] Currently 44% of sub-Saharan Africa's population are 14 years of age or younger. High birth rates and low life expectancies result in children constituting nearly half of the population in LMICs. [32] This along with the lack of human resources will adversely affect the number of paediatric surgeons per population (*density*). [32] In 2002, only 39 paediatric surgeons were reported to be in sub-Saharan Africa, providing a ratio of 1 surgeon to 5 million children. Similar to general surgeons, the production of paediatric surgeons is not keeping up with the demand, migration or production of doctors. Despite this, surgery continues in rural and district hospitals in the absence of surgeons and paediatric surgeons. [33, 34]

Lalchandani et al performed a global comparison of the paediatric surgical workforce and training. [9] There were difficulties in accurately quantifying the paediatric surgery workforce, however, previous studies have reported that paediatric surgeons are in a shortage around the world. [10-12] They looked at several studies which analysed the geographic distribution, cost of surgical care, social statistics, and length of education and curriculum of paediatric surgeons in select countries. [10-12, 35-37] They also examined various educational, economic and social factors that impacted the paediatric surgery workforce throughout the world. The number of paediatric surgeons, paediatric population, birth rate, gross domestic product (GDP), and length and structure of training in 15 countries were compared and analysed.

It was unclear which factors contributed to the overall scarcity of paediatric surgeons worldwide, however, these studies highlighted areas which may contribute to the differences in the delivery of paediatric surgical care.

There was limited data on the paediatric surgery workforce globally. Identifying and addressing the most influential causes of variation may ultimately lead to an increase in the supply of paediatric surgeons to meet the worldwide need.[9]

Overall, the length of paediatric surgery training varied significantly between countries, ranging from 23 to 29 years of total education from grade (primary) school until the conclusion of sub-specialty paediatric surgery training. Their data showed that it required a large amount of time to become a paediatric surgeon. The definition of a paediatric surgeon was not universal and some surgeons may be certified by a regulating body or organization while others are considered paediatric surgeons by other parameters, such as clinical experience and apprenticeship. [9] Therefore, it was difficult to determine the true number of paediatric surgeons practicing in each country as some might go unrecognized because they are without board certification or practice another surgical specialty as well. [9]

Lalchandani et al found that the number of paediatric surgeons per million children varied from 0.51 to 29.30. There was a positive correlation between GDP per capita and the number of paediatric surgeons per million children in countries with GDP per capital less than US $20 000 ($R^2$=0.81). [9] GDP per capita seemed to play a role in the number of paediatric surgeons per million children, as GDP per capita is an indicator of a country's wealth, and paediatric surgeons are expected to be more common in countries with higher wealth due to the greater availability of resources. They speculated that in countries where paediatric surgeons received a higher annual income compared to their peers, that this may attract more trainees to pursue this career. The number of average work hours per week and intensity of case load may also influence the decision by medical students and residents to pursue paediatric surgery as a career. [9]

Another study by Krishnaswami et al examined the current state of paediatric surgical workforce in LMICs as well as reasons for the current shortfall. [32] They listed the reasons for the current workforce shortfall to be an inadequate number of trainees, limited training resources, emigration of trained providers (*brain drain*), uneven distribution of providers within countries themselves, and the attrition of existing providers. [32]

Paediatric Surgical Workforce Shortages in LMICs

The acute shortage of paediatric surgeons in Africa is severe. [32] In 2009, a cross-sectional survey of paediatric surgical workforce capacity in eight African countries found that there were 231 surgeons covering a paediatric population of 184 million. This ranged between 1 surgeon for 6 million children in Malawi (0.17 per million) to 120 surgeons for 36 million in Egypt (3.3 per million). They estimated the paediatric surgical workforce gap to be 1 per million surgeons when compared with the United States. [32] Literature on paediatric surgical workforce in Asia, Latin America and the Middle East is scarce and outdated indicating an urgent need for data in these regions.

In 2003, Nigeria had 35 paediatric surgeons; however, only 26 were in active service for a population of 133 million. As with most countries, surgeons were concentrated in urban areas in tertiary centres. [32] Countries such as Uganda, Ethiopia and Malawi have also attempted quantify their paediatric surgical workforce as well as the burden of paediatric surgical disease.

Ozgediz et al provided a comprehensive analysis of the surgical workforce in Uganda. [26] They estimated that there were between 4 and 8 physicians per 100 000 people, with an annual output of 150 physicians. For a population of 30 million people, there were approximately 75 specialist surgeons in 2008, and in the surgical sub-disciplines, there were only 3 paediatric surgeons.

More complex procedures were carried out at regional hospitals where specialists were available; however, surgical output was limited by poor infrastructure and by the fact that specialist surgeons worked at private facilities and were overburdened with administrative duties in addition to supervising the district hospitals. [26]

Using the Surgeons OverSeas Assessment of Surgical Need (SOSAS) survey, Butler et al attempted to quantify the paediatric surgical need in Uganda and found that 14% of children had a surgical condition. [38] They found that only half of these received treatment for their condition. Similar SOSAS studies in Sierra Leone, Rwanda and Nepal estimated the unmet paediatric surgical need to be 17.6, 6.3, and 6.0 %, respectively, compared with 7.2 % in Uganda. [39-41] A study conducted in Malawi found that a third of children aged 0-17 years who were admitted to a surgical department underwent surgery. Neonates and patients managed non-operatively had a significantly increased risk of mortality, which emphasises the need for a functional paediatric surgical service. [42]

The differences in surgical care provision between LMICs and HICs are well known. Walker et al conducted a large multi-centre cross-sectional survey during 2007 and 2008, and found that there were only three practicing certified paediatric surgeons and one paediatric anaesthetist in the country. [8] As many children never seek medical care, the true prevalence of surgical conditions in children in Uganda is likely underrepresented by their findings. The objectives were to determine surgical rates of surgery in children and adults to determine if the area's surgical facilities and surgical and anaesthesia workforce complied with the WHO standards for surgery.

They compared their services with England, a HIC. They found that none of the 72 hospitals which were surveyed met the WHO standards for *Essential Surgery*. There were 0.7 accredited surgeons per 100 000 population and no paediatric surgeons. There were only 10 trainees who completed postgraduate training in surgery in the country each year. Externally funded surgeons performed 80% of the 140 cleft lip and palate operations.

There were 43 consultant specialists; specialities included general surgery, obstetrics, orthopaedic surgery, ophthalmology, dental surgery, neurosurgery, otorhinolaryngology and urology. England had 6 260 consultant surgeons and 1 506 consultant obstetricians and gynaecologists in 2007 (15.2 per 100 000). [43, 44]

In Uganda, the number of trained surgeons was 4.6% of what it was in England. Twenty-one surgeons worked in urban centres, either in the regional referral hospitals or in the private hospital. There were no specialized paediatric surgeons in the area and only 62 general physicians (1 per 100 000), who performed surgery. [8] The three most common diagnostic surgical categories in children were trauma and burns (30.2%), general and urological paediatric surgery (25%), or infection (abscess and osteomyelitis drainage, 14.9%). The rate for surgical cleft lip and palate repair was 21% of the rate of England. Paediatric surgery in Uganda was almost entirely of an emergency nature, mainly for burns and trauma and was performed by medical officers, many of whom lacked specialist training. [8] Nordberg et al estimated that in sub-Saharan Africa, the basic public health requirement for major surgery is 1 000 operations per 100 000 population annually and showed the rate of inpatient surgical procedures in Uganda was very low and a mere 3% of the rate of England. [45]

Nigeria and Ethiopia reported similar paediatric surgical workforce shortages. Nigeria recorded a single paediatric surgeon per 2 million people (by comparison, Europe has one paediatric surgeon per 50 000 population). [10, 46] There were 348 Ethiopians who had undergone surgical training since 1985 and served a population of over 100 million people, three quarters of whom continued to practice in Ethiopia, with 80.9% of these practising in the public sector. This positively reflects the increasing likelihood for Ethiopian surgeons to remain in Ethiopia in the public sector. However in most sub-Saharan African countries, this was not the case. [47] Emigration of surgical workforce results in inadequate capacity to the provision of essential surgical care and remains a major challenge to strengthening surgical services. [5, 6, 49]

Task shifting and sharing

Task-shifting and sharing has been proposed to alleviate the workforce shortage, however, support and adequate supervision are needed in order to maintain standards of care. [24, 50, 51] Task–shifting implies the delegation of certain medical responsibilities to less specialised healthcare workers. Some experts suggest that task-sharing may be a more appropriate concept. [24] When no physicians are available, the task of physicians must be *shifted* to non-physicians, and when few physicians are available, their tasks may be *shared* with non-physicians. [24]

In many parts of rural Africa, minor surgical procedures were carried out by suitably-trained, non-physician health care workers, but facilities and resources for surgery outside urban centres are generally inadequate. [52] The temporary substitution of healthcare workers to alleviate workforce shortages has been practiced in many sub-Saharan African countries. [50, 53] This is often met with resistance as paediatric surgery is considered a highly specialized field that requires specialist training over several years. One example would be medical officers who perform certain procedures with limited or no supervision, which are deemed easy to perform with a low level of risk. [51]

Paediatric Surgical Workforce in High Income Countries

BAPS (British Association of Paediatric Surgeons) recommends that there should be one specialist paediatric surgeon per 500 000 population. It is suggested that an ideal department should be planned with no fewer than four paediatric surgeons and one paediatric urologist. Thus, 2.5 million will be the minimum population "needed to ensure that there is sufficient critical mass of workload to ensure the clinical viability and effectiveness of a specialised service". To achieve this target, an expansion of the size of the consultant workforce was recommended. [54]

The majority (25.5%) of paediatric surgeons in the UK practice general surgery of childhood, followed by neonatal surgery (22.4%), gastrointestinal surgery (18.3%), paediatric urology (12.9%), thoracic surgery (9.5%), paediatric oncology (8.7%) and hepatobiliary surgery (2.7%). [52] The age profile of consultants showed that the majority (65.6%) were between the ages of 41 and 55 years, and none were under the age of 35 years. Nearly 10% of consultants were over the age of 60 years, which was nearing retirement age. Half of consultants (53%) worked in the public sector and 44% work in dual practice in both independent and public practice and 95% worked fulltime.

The USA had 2 658 total paediatric surgeons, which translated into 43.16 per million population under 14 years. [55, 56] This figure was nearly twice as many as reported by Krishnaswami, as it included both general paediatric surgeons as well as sub-specialist paediatric surgeons. [32] There was a positive growth in the overall number of paediatric surgeons between 2004 and 2008, with the number of trainees in paediatric and speciality surgery increasing by 35 and 15 %, respectively. There was a stronger growth in the number of female specialist surgeons with 17.9% in paediatric general surgery and 19.5% in paediatric surgical sub-specialities. Female residents comprised 35.7% of paediatric general surgical residents and 37.3% of paediatric sub-specialist surgical residents. Of the total number of paediatric surgeons, 898 were older than 55 years and 168 were older than 70 years. [55]

There were 85 paediatric surgeons in Australia in 2011, 20% of whom were female which was higher than any other surgical speciality. The average age was 56 years, with 51% under the age of 55 years and 80.7% under the age of 65 years. [57]

South African Profile and Healthcare Structure

In 2014, South Africa had an estimated 53.7 million people, with a population density of 44 per km^2. [58, 59] Nearly 30% of the population are under the age of 14 years (16.2 million people). The country had a total health expenditure as a percentage of GDP at 8.8% in 2014, compared with 17.9 % in the United States and 9.4 % in the United Kingdom. [43, 59] Health metrics for South Africa included a life expectancy of 59.1 and 63.1 years for males and females without HIV, respectively. [60] The IMR was 34.4 per 1000 live births, the MMR was 133.3 per 100 000 live births, and the caesarean section rate was 24.4%. [61] The WHO recommended a caesarean section rate of between 5 and 10%. The World Bank designation was that of an UMIC with a GDP of US$ 6 619 per head. [62] Total GDP for 2014 was US$ 350 billion with an annual estimated growth rate of 1.5% and a population total of nearly 54 million people. Provincial health metric data for South Africa are summarized in Table 2. [62]

Table 2: Summary of key indicators by province in South Africa (2013-2014). [34, 62]

Province	Population (millions)	District Health Services expenditure per capita Rands 2013/14	Primary Health Care Expenditure per capita Rands 2013/14	Bed utilization rate	Average length of stay (days)	Early in-patient neonatal death rate (per 1000 live births)	Medical Aid Coverage (%)	Caesarean section rate (%)
EC	6.7	1 323	700	59.5	5.2	14.1	11.4	19.4
FS	2.7	1 119	690	65.1	3.9	12.3	18.0	25.5
GP	12.9	788	622	67.8	4.5	9.3	26.6	25.6
KZN	10.6	1 292	750	64.6	5.8	10.4	12.5	29.9
LP	5.6	1 431	617	64.2	4.5	33.1	8.7	16.5
MP	4.9	1 205	584	70.5	4.3	8.6	13.3	17.5
NC	1.1	1 302	856	64.8	3.2	12.8	15.4	18.9
NW	3.6	1 160	757	61.4	2.5	9.5	13.7	19.2
WC	6.1	1 045	632	88.7	3.7	4.8	25.5	28.6
RSA	54.7	1 137	673	68.3	4.7	10.1	16.0	24.4

EC: Eastern Cape, FS: Free State, GP: Gauteng, KZN: Kwa-Zulu Natal, LP: Limpopo, MP: Mpumalanga, NC: Northern Cape, NW: North West, WC: Western Cape, RSA: Republic of South Africa

There are eleven official languages with 52 municipalities (metropolitan and district) in nine provinces. Since the fall of Apartheid in 1994, South Africa has been divided into nine provinces: the Eastern Cape, the Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West, the Northern Cape and the Western Cape. The boundaries of the provinces have been altered twice by constitutional amendment. [59]

The South African healthcare system comprised of a public and private sector. Public hospitals were classified as district, regional, level three (provincial tertiary/national central) and specialized, according to the National Health Act of 2003, and served nearly 86% of the population. [63] Private hospitals were classified as for profit or not-for profit private hospitals, with the majority being managed as for profit hospitals and being accessible only to those able to afford health insurance or medical aid cover, which were the remaining 16% of the population.

There were a total of 544 hospitals in South Africa in 2014. [34] There were 217 private hospitals and 327 public hospitals. Of the 327 public hospitals, 257 (79%) were district hospitals, 49 (15%) were regional hospitals and 20 (6%) were central or level three hospitals. The 20 central or level three hospitals were comprised of eight national central hospitals and 12 provincial tertiary hospitals. [34]

Information on surgical care for children in this South African context is limited. Children's surgical care must be prioritized and included in local as well as international health policy, training and infrastructure planning. By assessing the paediatric surgical workforce in South Africa as well as determining their future career plans, this would allow policymakers to more accurately strengthen surgical capacity. The surgical workforce shortage has not been well quantified in LMICs, and further research is needed to promote an effective retention strategy as well resource allocation.

Chapter 3 – RESEARCH METHODS

The purpose of this research was to conduct a quantitative descriptive analysis of the paediatric surgeons in South Africa as well as to assess their future work plans. Data looking at paediatric surgical workforce are scarce and there have been recommendations from the global community to quantify the surgical workforce.

3.1 Research Design

This study involved a quantitative descriptive analysis of all registered specialist as well as training paediatric surgeons in South Africa, and included their demographic data (sex, age), their geographic location of their practice, as well as the sector in which they work. Quantitative data included their plans for public, private or dual practice once they have completed their specialization training.

3.2 Inclusion/Exclusion criteria

All registered paediatric surgical specialists, registrars (training surgeons) and permanent medical officers in paediatric surgery in South Africa were included in the study. Paediatric surgeons who were practising abroad or who were found to be deceased and still registered, were excluded from the study.

3.3 Instrumentation

Paediatric surgical specialists, registrars and medical officers were contacted via email and telephonically between the period 15th January and 31st May 2017 in order to obtain the required data. Consent to use the data was obtained from each respondent. In addition, a questionnaire was administered to all specialists and registrars attending the Paediatric Surgery registrar symposium which was held at Red Cross Children's War Memorial Hospital during the first week of February 2017 _ (Appendix A). The captured variables were entered into a Microsoft Excel (2013) spreadsheet.

3.4 Research Procedures and Pilot Testing

As this was an audit, no formal pilot research was conducted. The defined variables did not change throughout the data collection period. Permission to conduct research was obtained from the Departmental Research Council through the University of Cape Town's Department of Surgery (2017/025).

A list of all paediatric surgeons registered with the Health Profession Council of South Africa (HPCSA) was obtained and cross-referenced with the electronic worldwide database of health professionals in South Africa (Medpages). This was then cross-referenced with a list of training paediatric surgeons from individual hospitals as well as from the College of Medicine of South Africa (CMSA).

The population numbers for each province were extrapolated from data obtained from Stats SA estimates from 2011, and was used to calculate the number of paediatric surgeons per million population under 14 years (paediatric surgeon density). These figures were used as a comparison with selected international countries.

3.5 Variables and characteristics measured

The names of paediatric surgeons and their contact details (cell phone and email addresses) were obtained and individuals were contacted via telephone and email. The data requested included: (i) the names of the hospitals and (ii) the sectors in which the surgeons practice, (iii) the province and district municipalities in which they practice, (iv) their demographic data (age and sex), (v) their qualifications, (vi) the year in which they were expected to qualify as paediatric surgeons or had already qualified as paediatric surgeons, (vii), their role as either specialist, registrar or medical officer, (viii) their year of training as registrar if applicable and (ix) their phone numbers and email addresses. The qualitative data included their plans for surgical practice (public, private or dual practice) once qualified, and for the future of current specialist. During the first week of February 2017 a Paediatric Surgery Registrar symposium was held and a questionnaire administered (requesting the same data). This provided a second source of data which was cross-referenced with the responses received via email and telephonically.

Paediatric surgical specialists were defined as those having completed the Fellowship of the College of Paediatric Surgery examinations or having been recognised as paediatric surgeons prior to the college certification. These were often older surgeons who had completed general surgical training and had thereafter completed a certificate in paediatric surgery or an equivalent and were recognized by the CMSA as paediatric surgeons. Medical officers included a few doctors who were not in registered training posts, nor who had completed CMSA examinations, but who fulfilled the role of paediatric surgeons and performed similar surgeries and held similar responsibilities.

Population estimates were obtained from Stats SA. [60] South African population estimates for each province were based on mid-year 2016 estimates. These were extrapolated from census data obtained during the National Census that took place in 2011.

3.5.1 Data Validation

Internal validity was not confirmed through pilot testing, however the data which was requested from individual surgeons was presumed to be true given the similarity between cross-referenced databases. The requested data variables remained the same throughout the data collection process. External validity was not applicable, as this was a descriptive audit of paediatric surgical workforce in South Africa. The results obtained were applicable to the South African population but may be representative of other lower and upper middle income countries, with similar resources.

3.6 Data Analysis

Descriptive statistics indicated absolute paediatric surgeon numbers and tables, graphs and maps were drawn to graphically represent the data.

The total number of surgeons were analysed according to district municipality and province as well as per million population under the age of 14 years. They were sub-analysed according to which hospital they worked in (public, private or both sectors).

The demographic data of paediatric surgeons were analysed and included age and sex. The paediatric surgeons were grouped into (i) registrars, (ii) medical officers and (iii) specialists and their qualifications analysed as well as their year of training and year of expected completion of training in the case of registrars.

Qualitative data included an analysis of their future working plans, which included working in the public sector, the private sector, both sectors, or emigration.

A comparison was made with other high and low income countries around the world.

3.7 Limitations of the study

Reporting bias could have occurred as data was obtained from individuals, although captured variables were requested in the least ambiguous manner and none of the respondents needed clarification on the data being requested. The HPCSA and CMSA databases were the most accurate source of determining specialist surgeon numbers, although not all surgeons could be reached and there a small number who were thought to have emigrated. There may have been reporting bias regarding respondents' willingness to disclose future plans for emigration or work in the private sector but this was minimized by assuring anonymity with analysis and reporting of data.

This audit only captured paediatric surgeon number and not obstetric, orthopaedic, anaesthetic or other surgical sub-speciality number. In order to accurately assess South Africa's ability to deal with their burden of surgical disease, these other specialities would need to be quantified.

3.8 Ethical Considerations

This study was approved by the Human Research and Ethics Committee at the University of Cape Town. (HREC 177/2017)_ (Appendix B) and the Departmental Research Committee of the Department of Surgery (2017/025). The research complies with the latest version of the Declaration of Helsinki as well as the Department of Health principles, structures and processes. A declaration of no conflict of interest was made. All demographic and contact information was kept anonymous and was not made publically available without the express permission of research participants and consent was obtained from participants _ (Appendix C).

This research involved a quantitative descriptive analysis of the paediatric surgical workforce in South Africa and contributes to the growing global database of surgical resources.

Chapter 4 – RESULTS

The paediatric surgery workforce around the world consists of thousands of paediatric surgeons, however their distribution varies greatly. Despite the difficulties in quantifying the paediatric surgery workforce, previous studies have reported that paediatric surgeons are in a shortage around the world. The purpose of this study is to analyse the geographic distribution as well as the future career plans of paediatric surgeons (both qualified and in training) in South Africa.

Overview of national results

The cohort consisted of 92 medical practitioners, of which four worked overseas, five were retired, one was not working and one was deceased, leaving 81 medical practitioners who were included in the study. The 81 doctors comprised of six medical officers, 31 registrars and 44 specialists.

Demographics

There were a greater number of male (n=45) than female practitioners (n=36), comprising 49% and 51% respectively. Medical officers comprised of an equal number of males and females, with a median age of 50.6 years (range 28-68 years). Registrars were predominantly female (65%) with a median age of 33.8 years (range 29-43 years). Specialists were predominantly male (69%) with a median age of 46.8 years (range 34-73 years). Results are demonstrated in Table 3, Figure 1.

Table 3: Demographic breakdown of paediatric surgical workforce.

Role	Male	Female	Median Age (range)
Medical officers	3	3	50.6 (28-68)
Registrars	11	20	33.8 (29-43)
Specialists	31	13	46.8 (34-73)
Total	45	36	41.8 (28-73)

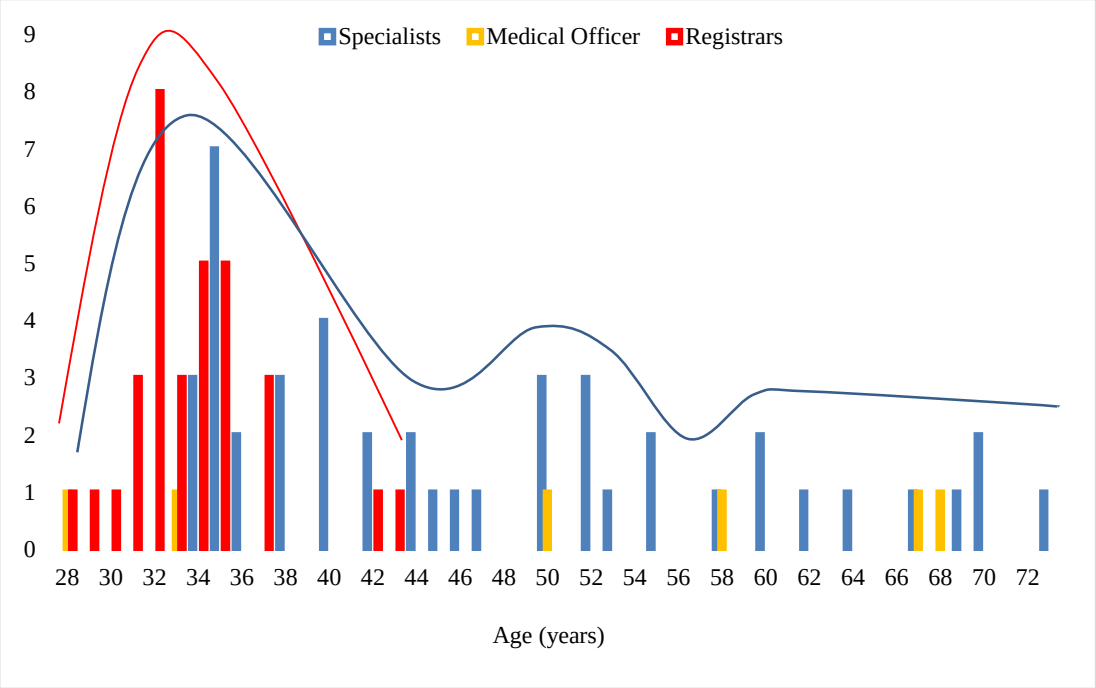


Figure 1: Age distribution of paediatric surgical workforce (medical officers, registrars and specialists).

Sector distribution of paediatric surgical workforce

Medical officers and registrars worked exclusively in the public sector, whereas qualified specialists were able to work in either public, private or dual sectors. All paediatric surgeons working in the public sector worked in level three hospitals. The specialists reported that 18 (40.9%) worked in the public sector, 9 (20.5%) worked in the private sector and 17 (38.6%) worked in dual practice. Table 4.

Table 4: Sector distribution of paediatric surgical workforce.

Role	Public sector only	Private sector only	Dual practice	Total
Medical officers	6	0	0	6
Registrars	31	0	0	31
Specialists	18	9	17	44

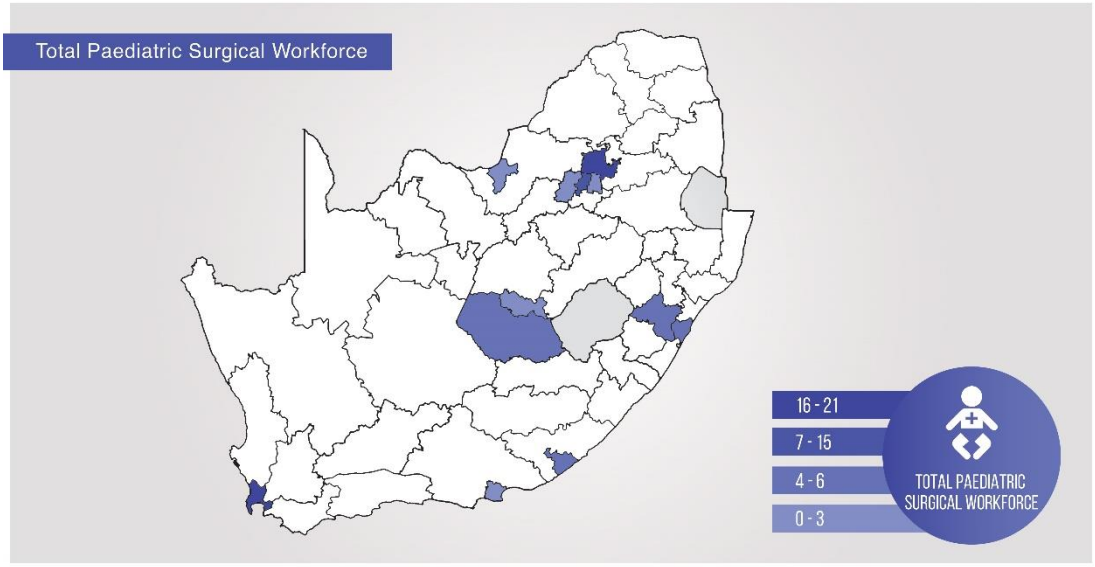
Provincial Results

The majority of paediatric surgical workforce were found in Gauteng (n=35), followed by the Western Cape (n=21), Kwa-Zulu Natal (n=12), the Eastern Cape (n=7) and the Free State (n=5). Table 5 demonstrates the provincial breakdown of the paediatric surgical workforce. The majority of registrars were found in Gauteng (n=16), which were twice as numerous as the Western Cape (n=8). Specialists were predominately located in the urban provinces of Gauteng (n=18), Western Cape (n=12) and Kwa-Zulu Natal (n=9). Maps 1-3 demonstrate the total paediatric surgical workforce distribution, the specialist paediatric surgeon distribution and the paediatric surgical registrar and medical officer distribution, respectively.

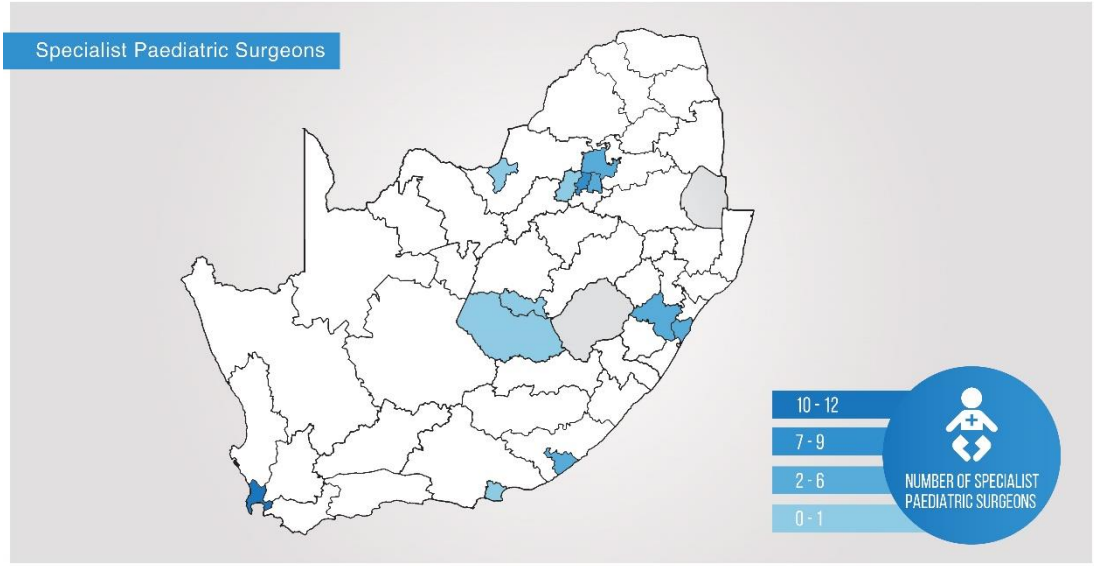
Table 5: Provincial breakdown of paediatric surgical workforce.

Province	Medical Officers	Registrars	Specialists	Total	Paediatric specialist surgeons per million population (0-14 years)
EC	2	2	**3**	7	1.2
FS	0	3	**2**	5	2.5
GP	1	16	**18**	35	5.5
KZN	1	2	**9**	12	2.4
LP	0	0	**0**	0	0
MP	0	0	**0**	0	0
NC	0	0	**0**	0	0
NW	1	0	**0**	1	0
WC	1	8	**12**	21	7.4
RSA	6	31	**44**	81	2.6

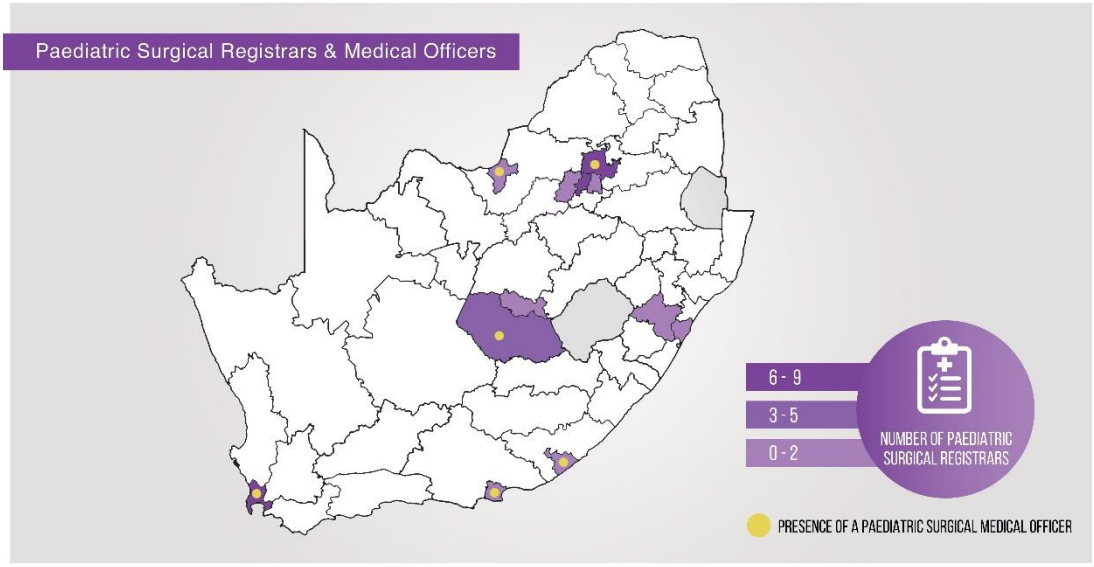
EC Eastern Cape, FS Free State, GP Gauteng, KZN Kwa-Zulu Natal, LP Limpopo, MP Mpumalanga, NC Northern Cape, NW North West, WC Western Cape, RSA Republic of South Africa



Map 1: Total paediatric surgical workforce distribution according to province.



Map 2: Specialist paediatric surgeon distribution according to province.



Map 3: Paediatric surgical registrar and medical officer distribution according to province.

Children under 14 years comprised 29% of the total population. [58] The largest number of paediatric surgeons per population (per million children under 14 years) were found in the Western Cape (7.4), followed by Gauteng (5.5). These were far above the national average of 2.6 per million. Kwa-Zulu Natal (2.4) and the Free State (2.5) had a similar number of paediatric specialist surgeons per million children under the age of 14 years as the national average. There were provinces in South Africa with no paediatric specialist surgeons.

The majority of paediatric specialist surgeons working in the public sector were found in Kwa-Zulu Natal (n=7), Western Cape (n=5) and Gauteng (n=5). Surgeons working exclusively in the private sector were found in Gauteng (n=5) and the Western Cape (n=4). Those who reportedly worked in dual practice were most numerous in Gauteng (n=8), Western Cape (n=3) and the Eastern Cape (n=3). Table 6.

Table 6: Provincial breakdown of paediatric specialist surgeons according to sector.

Province	Public only	Private only	Dual	Total
EC	0	0	3	3
FS	1	0	1	2
GP	5	5	8	18
KZN	7	0	2	9
LP	0	0	0	0
MP	0	0	0	0
NC	0	0	0	0
NW	0	0	0	0
WC	5	4	3	12
Total	18	9	17	44

EC Eastern Cape, FS Free State, GP Gauteng, KZN Kwa-Zulu Natal, LP Limpopo, MP Mpumalanga, NC Northern Cape, NW North West, WC Western Cape, RSA Republic of South Africa

Paediatric surgeons per population in the private sector were more numerous than in the public sector. There were 9.4 paediatric surgeons per million insured population under 14 years versus 2.4 per million uninsured population under 14 years. The Western Cape had the largest number of public sector surgeons per population (6.6), followed by Gauteng (5.0) and the Free State (3.0).

The Western Cape had the largest number of private surgeons per insured population (16.9), followed by Gauteng (13.8) and the Eastern Cape (10.9). (Table 7). These numbers were comparable to other upper middle income and high income countries.

Table 7: Paediatric surgeons per million population in public and private sectors (dual practice surgeons included).

Province	Public	Paediatric surgeons per million uninsured population (0-14 years)	Private	Paediatric surgeons per million insured population (0-14 years)
EC	3	1.4	3	10.9
FS	2	3.0	1	7.0
GP	12	5.0	12	13.8
KZN	9	2.7	2	4.2
LP	0	0	0	0
MP	0	0	0	0
NC	0	0	0	0
NW	0	0	0	0
WC	8	6.6	7	16.9
RSA	34	2.4	25	9.4

EC Eastern Cape, FS Free State, GP Gauteng, KZN Kwa-Zulu Natal, LP Limpopo, MP Mpumalanga, NC Northern Cape, NW North West, WC Western Cape, RSA Republic of South Africa

Qualifying specialist paediatric surgeons

There were an average of two paediatric surgeons qualifying as specialists per year since 1979, with a spike of 7 specialists qualifying in 2012. These numbers were expected to increase in the next four years. The majority of registrars will be expected to qualify in 2019. Of these, 9 registrars are expected to qualify in 2017, 7 in 2018, 12 in 2019 and 3 in 2020. The annual specialist qualification distribution is shown in figure 2, with blue representing qualified specialists and red representing registrars expected to qualify.

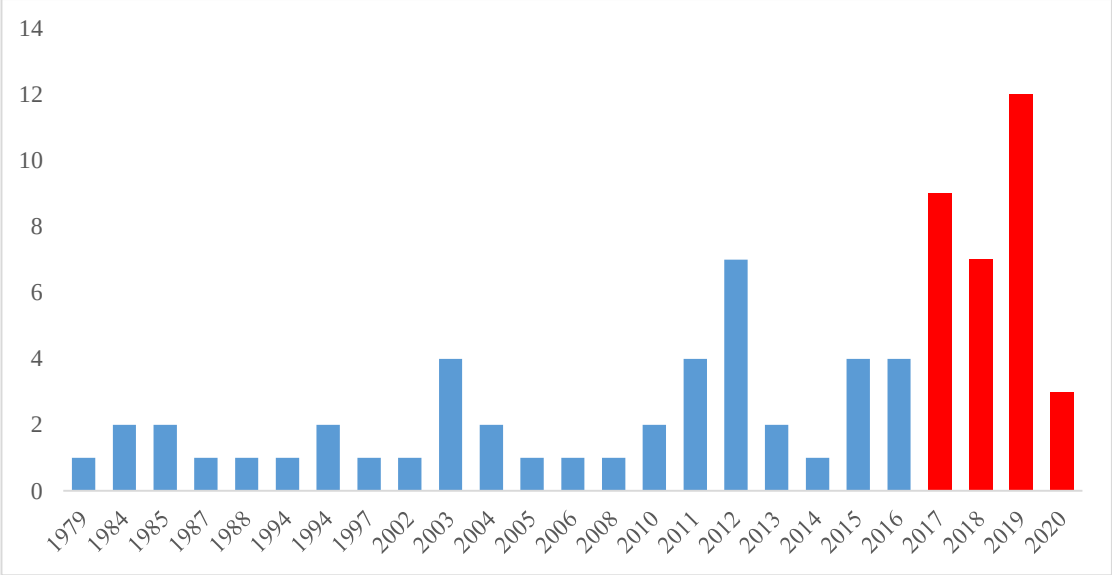


Figure 2: Number of paediatric surgeons qualifying as specialists per year.

Future career plans

The future career plans of all six medical officers involved remaining in the public sector. The 31 registrars reported that 3 supernumeraries were planning on returning to their country of origin to work in dual practice, 16 planned on carrying out dual practice in South Africa, 10 would work exclusively in the public sector, one exclusively in the private sector and one reported being unsure. The 44 specialists reported that 23 planned to carry out dual practice, 16 planned on exclusive public practice and 5 on exclusive private practice.

This compared to the 18 specialists who were currently working in public practice, 9 who were in private practice and 17 who were currently carrying out dual practice. This meant that 2 were planning on leaving the public sector, 4 were planning on leaving the private sector and 6 were planning on moving to dual sector practice. Table 8.

Table 8: Current and future practice plans of paediatric surgeon specialists.

Sector	Current practice	Future plans	Difference
Public	18	16	-2
Private	9	5	-4
Dual	17	23	+6

International Comparison

These data were compiled from various sources such as the World Bank as well as individual publications (Table 9). South Africa had 2.6 paediatric surgeons per million population under 14 years. As shown, provincial numbers varied markedly according to sector and population with health insurance. Some provinces with paediatric surgeons were well resources when compared to the rest of the world however, having four provinces without paediatric surgical specialists meant that the national average was reduced. Table 7.

Table 9: International comparison of paediatric surgeon density.

Country	Number of Paediatric surgeons	Population (2014) Millions	Paediatric surgeons per million population	0-14 years (%)	Population (0-14 year) Millions	Paediatric surgeons per million (0-14 years)
United States	2 658	324	8.20	19	61	43.16
UK	338	54	6.18	17	9	36.37
Netherlands	24	16	1.43	17	0.9	26.61
Germany	250	80	3.10	13	10	23.83
Taiwan	61	23	2.61	13	3	20.00
Australia	85	24	3.38	19	4	17.80
Brazil	851	210	4.04	23	48	11.70
Norway	10	5	1.88	18	0.9	10.47
China	1 850	1 382	1.33	17	234	7.87
Canada	45	36	1.24	16	5	7.75
Ireland	4	4	0.85	22	1	3.86
South Africa	**44**	55	**0.80**	29	16	**2.60**
India	470	1 326	0.35	29	384	1.22
Philippines	30	102	0.29	32	32	0.92
Zimbabwe	5	16	0.31	42	6	0.74
Nigeria	42	189	0.22	44	83	0.50
Malawi	1	18	0.05	44	7	0.12
Ghana	5	28	0.18	39	11	0.45
Uganda	3	40	0.07	48	19	0.15
Rwanda	0	12	0	41	4	0
Mozambique	0	29	0	45	13	0

Summary

There were 2.6 paediatric surgeons per one million population under 14 years. Specialists were predominantly male (69%) with a median age of 46.8 years. The majority of the paediatric surgical workforce were found in Gauteng, the Western Cape and Kwa-Zulu Natal and the majority of qualified specialists reportedly worked in the public sector or in dual practice. The national paediatric surgeon density fell far below developed countries such as the US, Germany and the Netherlands. Interprovincial differences as well as intersectoral differences were marked, with urban provinces and the private sector having a much higher paediatric surgeon density.

Chapter 5 – DISCUSSION

To enhance the priority of surgical care among the national health agendas of low- and middle-income countries (LMICs), it is important to quantify the current surgical resources and workforce available to treat the burden of surgical disease among children. It has been estimated that 85% of children in LICs are likely to require the treatment of a surgical condition by the age of 15 years. [3] Many paediatric surgical conditions are congenital, and therefore carry the risk of life-long disability, disproportionately increasing the number of disability-adjusted life years (DALYs) lost. Similarly, many surgical conditions of childhood are amenable to simple surgical intervention, but if left untreated, complication, disability or death may result. [31]

This study analysed the current as well as the projected geographic distribution of the paediatric surgical workforce in South Africa. Previous studies reported far more surgeons than were demonstrated as part of this research, which may have been as result of flawed methodology. [9] They reported in excess of 100 qualified paediatric surgeons in South Africa, whereas this study found 44 paediatric surgeon specialists. There were an additional 31 registrars in training and 6 medical officers performing surgeries but not yet in specialist training posts.

Demographics of paediatric surgeons in South Africa

Paediatric surgery is viewed as a surgical discipline more likely to attract female trainees as a results of the nature of the type of surgery and its involvement with children. [64] Since 1990, at least 50% of UK medical school entrants were females, although women comprised only 2% of surgical consultants.

A study conducted in the UK looked at female paediatric surgeon career satisfaction and professional development, and found that 67% took a career break for maternity leave but that most (93%) were satisfied with their career choice and would choose paediatric surgery again. Most felt they were able to ensure a healthy work-life balance and were allowed flexibility with training and establishing consultant practice.

Data from the American College of Surgeons (ACS) showed that only 17.9% of practising paediatric surgeons were female. [55] This study demonstrated a greater number of male (69%) than female specialist paediatric surgeons (31%) overall. However, medical officers comprised an equal number of males and females and registrars were predominantly female (65%). This could indicate that the larger numbers of female trainees represent a shift in the gender balance, which is more aligned with current representation of medical school entrants. The ACS also noted an increase in the number of female registrars and fellows from 16 to 25 between 2008 and 2009. [55]

It must mentioned that the CMSA has different ways in which paediatric surgeons were able to qualify since the 1970's. Various terms such as 'Fellow', 'Corporate Fellow', 'Corporate Certificant', 'Associate' and 'Honorary Fellow' have been used to describe the way in which surgeons obtained their specialisation. A fellow is someone who has done training accepted by the CMSA and successfully completed the fellowship examination as a specialist. An associate is someone who has been nominated by their constituent college for associateship. They are specialists on the HPCSA specialist register but do not have a fellowship, and usually have a Master of Medicine (MMed). A certificant is a specialist who has done further training that is accepted by the CMSA in a recognized subspecialty and has successfully passed the subspecialist examination.

The other categories for specialists are that of: Fellowship by Peer Review which is given to specialists of high academic standing who have contributed to the CMSA and this is given as an honour, and Fellowship ad eundem which is reserved for South African specialists of high regard to the country in a specific discipline.

This is the highest honour given to South African specialists. Honorary Fellowships are usually given to Presidents of sister colleges overseas or to politicians in South Africa (of the stature of Nelson Mandela).

Paediatric surgery was initially recognized as sub-speciality, which meant greater financial compensation. The CMSA then introduced a certificate in paediatric surgery which meant individuals with primary surgical degrees had to sit a formal examination. Previously, general surgeons who spent more than 2 years in one of 6 accredited paediatric surgery training posts were eligible for admission for accreditation as a Paediatric Surgeon in South Africa (i.e. general surgeon with an additional certificate in paediatric surgery (CERT. Paediatric Surgery SA).

Paediatric surgery then changed from a sub-speciality to a speciality in 2007 and was registered as a full 4 –year Fellowship in 2008. Surgeons who sat the examinations and completed the necessary training were admitted to the Fellowship of the College of Paediatric Surgeons of South Africa _ FC Paed Surg (SA) and their clinical practice was restricted to paediatric patients only. The training time has decreased slightly and this may have attracted more women to the speciality, as starting families and maintaining a work-life balance is now more attainable.

The overall age distribution of all paediatric surgical practitioners showed a median age of 41.8 years with an interquartile range (IQR) of 28-73 years. These combined both trainee and specialist surgeons which could be seen by the large IQR. Graphically this is seen as a bi-modal distribution with a large peak at 35 years and a smaller peak at 50 years. Medical officers tended to be older than registrars as these posts were filled by doctors with many years of experience whom were unlikely to specialise in the future, or were waiting for limited registrar training posts to become available.

Registrars had a median age of 33.8 years (IQR 29-43 years). These doctors were at varying points along a 3 to 5 year continuum of their registrar training time. The age of paediatric surgeon registrars was older than general surgical registrars as many paediatric surgeons sit their fellowship college examination while awaiting a training post. This prolonged training time could be a hindrance to attracting potential trainees and in particular, women who have competing priorities when it comes to starting families. If education and training were shortened, it may incentivize young medical professionals to follow this path and therefore increase the supply of paediatric surgeons worldwide.

Specialist paediatric surgeons had a median age of 46.8 years with a large IQR (34-73). With the retirement age of government employees being 65 years, this shows an ageing paediatric surgeon specialist population who have less than 20 years of practice left. The age profile of UK paediatric surgeons showed that 65.6% of respondents were between 41 and 55 years, with the majority (30.4%) between 46 and 50 years. [54]

Data from the ACS showed that 39.1% of specialist surgeons were between the ages of 55 to 69 years in 2009, which demonstrated an increasing trend over four years. [55] A second study which looked at paediatric workforce trends in the US found that the median age of specialists were 45 years; the median age of graduating trainees was 34 years and the estimated age at retirement or death was 65 years. [65]

Provincial distribution of the paediatric surgical workforce

As expected, the majority of paediatric specialist surgical workforce were found in the urban provinces of Gauteng, the Western Cape and Kwa-Zulu Natal. Although, the Eastern Cape and the Free State had far fewer specialist surgeons, this was better than four of the nine provinces in South Africa without any paediatric surgeons. These provinces would need to transfer patients to neighbouring provinces, as great expense and over far distances in order for them to access paediatric surgical care.

Training posts were available in provinces with tertiary level hospitals, which were in urban areas (albeit some of them in rural provinces such as the Eastern Cape). The majority of registrars were found in Gauteng, which were twice as numerous as the Western Cape. The Free State had 3 registrars whereas, the Eastern Cape and Kwa-Zulu Natal had 2 registrars each. Specialist geographic distribution followed a similar pattern and they were predominately located in Gauteng, the Western Cape and Kwa-Zulu Natal.

A more accurate representation of paediatric surgical workforce was demonstrated when numbers of specialist paediatric surgeons per million (population under 14 years) was used in order to determine paediatric surgeon density. In 2014, South Africa had an estimated 53.7 million people, with a population density of 44 per km^2. [58, 59] Nearly 30% of the population were under the age of 14 years (16.2 million people). [60] The largest number of paediatric surgeons per population (per million children under 14 years) were found in the Western Cape (7.4), followed by Gauteng (5.5). These were above the national average of 2.6 per million.

Sector distribution of paediatric surgical workforce

The South African healthcare system is comprised of a public and private sector. Public hospitals are classified as district, regional, level three and specialized, according to the National Health Act of 2003, and serve nearly 86% of the population. [63] Private hospitals are classified as for profit or not-for profit private hospitals, with the majority being managed as for profit hospitals and being accessible only to those able to afford health insurance or medical aid cover, which were the remaining 16% of the population. [34]

Medical officers and registrars worked exclusively in the public sector, whereas qualified specialists were able to work in either public, private or dual sectors. All paediatric surgeons working in the public sector worked in level three hospitals as paediatric and neonatal intensive care units as well as paediatric anaesthetists are essential to paediatric surgical care provision.

These surgeons are responsible for training registrars which often detracts from their ability to carry out service delivery and perform surgeries. Therefore it could be falsely reassuring when tertiary centres report larger numbers of surgeons, as these numbers may not accurately represent surgical outputs.

The paediatric surgical specialists reported that the majority were working exclusively in the public sector (40.9%), followed by dual practice (38.6%) and lastly exclusively in the private sector (20.5%). It must be emphasized that although every effort was made to eliminate reporting bias, this was a potential confounder in the reliability of these results. A second source of bias could be that surgeons carrying out dual practice did not quantify the hours spent in the each sector, which may underestimate the time spent in private practice and overestimate the time spent in public practice.

The majority of paediatric surgical specialists working exclusively in the *public sector* were found in Kwa-Zulu Natal (n=7), followed by the Western Cape (n=5) and Gauteng (n=5). Specialist paediatric surgeons working exclusively in the *private sector* were found in Gauteng (n=5) and the Western Cape (n=4). Those who reportedly worked in *dual practice* were most numerous in Gauteng (n=8), the Western Cape (n=3) and Eastern Cape (n=3).

Paediatric surgeons per population in the private sector were more numerous than in the public sector. The surgeon density for the public sector was calculated using the proportion of children under 14 years who were uninsured. Similarly, the surgeon density for the private sector was calculated using those with health insurance. [58] There were 32.4 paediatric surgeons per million uninsured population under 14 years versus 9.4 per million insured population under 14 years.

The Western Cape had the largest number of public sector surgeons per population (6.6), followed by Gauteng (5.0) and the Free State (3.0). The Western Cape had the largest number of private surgeons per population (16.9), followed by Gauteng (13.8), the Eastern Cape (10.9), Free State (7.0) and Kwa-Zulu Natal (4.2). The remaining provinces in South Africa were without any paediatric surgeons.

These densities indicated that public sector surgeon density was poor and comparable to other LMICs. Private sector surgeon densities were reasonable in some provinces when compared with HICs, however they were non-existent in other provinces leading to marked geographic maldistribution of resources.

Qualifying specialist paediatric surgeons

There were an average of two paediatric surgeons qualifying as specialists per year since 1979, with a spike of 7 specialists qualifying in 2012. These numbers were expected to increase in the next four years. The majority of registrars will be expected to qualify in 2019. These numbers are far fewer than the number of general surgeons qualifying each year in South Africa, which was closer to 50. [34] Data from US showed that there were 32 registrar training programs; 21 of them graduated one registrar per year and 11 one registrar every other year, producing a total of 26.5 graduates per year. In Canada there were six programs, with 5 graduating one resident each year and one every other year producing a total of 5.5 graduates per year. [65]

The Association of Surgeons of Great Britain and Ireland (ASGBI) had expressed concerns over the future of paediatric surgical services. General surgeons who were providing a paediatric service were not being replaced by appointees willing to continue it. The Senate of Surgery for Great Britain and Ireland recommended in April 2005 that all general surgical trainees should have a compulsory period of 6 months' training in paediatric surgery under the supervision of an accredited general surgical trainer. There were concerns that adequate numbers of experienced general surgical trainers did not exist and that there were insufficient training slots in the tertiary centres to compensate for this deficiency. [66]

Future career plans

The future career plans of all six medical officers involved remaining in the public sector. This may have been true of those planning to remain as medical officers, although at least one of the respondents were awaiting a registrar post at the time of the data capture.

South Africa hosts a variable number of supernumerary registrar posts which are filled by doctors from other LMICs. These countries do not provide sufficient resources or expertise to train paediatric surgeons who are therefore required to advance their training abroad. Of the 31 registrars, three reported that they were planning on returning to their country of origin to work in dual practice. This relationship is mutually beneficial to both the countries, as practitioners are paid and contracted to work in South Africa in order to obtain the necessary qualifications upon which they return to their country and provide a scarce skill.

South Africa in turn benefits from the additional workforce which alleviates the workload and exposes its registrars to other practice norms. In addition, the foreign workforce is essentially deemed to be 'free labour' as they receive reimbursement from their respective countries.

Problems are encountered during surgical training when South African registrars have to compete with supernumeraries for so-called 'theatre time' and performing the required number of operations necessary to qualify as a specialist.

In addition, registrars from different countries exhibit different levels of surgical experience when they begin specialising and may not perform at equal surgical level when compared to South African registrars. South African doctors undertake a three year post-graduate internship and community service period in which they work or rotate through all medical and surgical disciplines. The experienced gained in this period is renowned for producing doctors with a wide range of medical and surgical skills not seen in other countries.

More than half (52%) or registrars reportedly planned to carry out dual practice in South Africa, a third planned to work exclusively in the public sector, one individual planned to work exclusively in the private sector and one reported being unsure of their future plans.

Reporting bias may have affected the results as data collection were not blinded despite personal information remaining private. There may have been fear of judgement for wanting to emigrate or work exclusively in the more lucrative private sector.

Once registrars complete their training and pass their CMSA examinations they have to compete for a limited number of public sector specialists posts in only 14 of the 20 level three (tertiary or central) hospitals. Many specialists may find themselves unable to find work in the public sector despite their best intentions. Another obstacle is progression in their careers as there are limited senior specialist and head-of-department (HOD) posts. This means that specialists working in public hospitals where these posts are filled have no option of progressing in their careers unless the occupants retire or leave. Many are forced to change hospitals within South Africa, or even emigrate in search of better career opportunities.

The 44 specialists reported that 2 were planning on leaving exclusive public sector practice and 4 were planning on leaving exclusive private sector practice, resulting in 6 who were planning on moving into dual sector practice. Private sector work outside of public practice has been tightly regulated in recent years in an attempt to prevent unscrupulous clinical practice of senior clinical staff.

International Comparison of paediatric surgeons

Comparisons were made between South Africa and other countries to gauge the magnitude of the differences in surgical activity and workforce. These data were compiled from various sources such as the World Bank as well as individual publications. South Africa had 2.6 paediatric surgeons per million population under 14 years.

A unique situation was demonstrated in South Africa where provincial numbers varied markedly according to province and sector. Some provinces had reasonable paediatric surgeon numbers when compared with Ireland, Canada and China however, four provinces were without paediatric surgeons and three had surgeon densities similar to LICs.

The private sector surgeon densities in three provinces were similar to those found in Australia, Norway and Brazil. The remaining six provinces had few to no paediatric surgeons working in the private sector.

It was also noted that high income countries had a much lower proportion of the population who were under the age of 14 years (less than 20%), whereas LMICs and LICs had a higher proportion of the population under the age of 14 years (30-50%). This creates a situation whereby not only do these countries have fewer paediatric surgeons, but they have a far greater burden of paediatric surgical disease.

Summary

The results showed 2.6 paediatric surgeons per one million population under 14 years. More than half (69%) were male and the median age was 46.8 years. There were however, more female surgical registrars currently in training. The majority of the paediatric surgical practitioners were found in Gauteng (43%), followed by the Western Cape (26%) and Kwa-Zulu Natal (16%). The majority of specialists reportedly worked in the public sector (40.9%), however this number may have been over-reported as hours spent in public practice were not specified.

Interprovincial differences as well as intersectoral differences were marked indicating geographic and socioeconomic maldistribution of paediatric surgeons. The public sector paediatric surgeon density (per million population under 14 years) was 2.4 which fell far below the private sector paediatric surgeon density of 9.4. These numbers fell far below developed countries such as the US, Germany and the Netherlands but privates sector density compared favourably with Ireland and Canada.

Chapter 6 – CONCLUSION AND RECOMMENDATIONS

Access to paediatric surgical care requires an adequate supply of experienced surgeons distributed over a wide geographical area. [65] Additionally, paediatric surgeons require a wide range of ancillary support staff and hospital facilities. Without these resources, surgical access for the most vulnerable of populations is limited. If surgeons are too concentrated in a particular area, then training opportunities are diminished and competing services fuel increasing costs of delivery.

The paediatric surgical workforce in South Africa is severely limited in certain areas and falls short of international recommendations. However, some urban areas have surgeon numbers which compared favourably with other UMICs. Addressing the maldistribution of paediatric surgical workforce requires concerted efforts to expand existing training posts as well as equipping the remainder of level three hospitals to provide paediatric surgical training.

Paediatric surgeons often remain at children's hospitals and university teaching hospitals but due to limited posts, surgeons are forced to locate elsewhere. Limited support and lack of pertinent infrastructure in rural provinces in South Africa results in surgeons being driven to work in the private sector or overseas. Surgeons working in the private are also required to practice at multiple institutions demonstrating the increasing demand for paediatric surgical care as well as the financial incentive.

Another consideration in the provision of paediatric surgical care is that some surgeries are performed by general surgeons, paediatric urologists and gastroenterologists. These specialists compete for provision of surgical care but may also contribute to the number of complications seen as a result of inexperienced providers.

The proportion of ageing paediatric surgeons is increasing, however the large number of trainees in their mid-thirties who will qualify in the next few years is much higher. This is reassuring and demonstrates a replenishment of surgeons who emigrated 15-20 years ago. The number of surgeons qualifying each year is also increasing, with a peak expected in the next two years. There is an increasing trend for women to enter the field of paediatric surgery. This was demonstrated through changes in the demographic landscape of the paediatric surgical workforce with most specialist being male and most trainees being female. Women often need to balance their families and careers and tend to have periods where they leave clinical practice in order to have children. Their careers may be shorter with lower productivity during these periods.

Encouraging trainees to remain in the country (and in the public sector) would require provision of a stable political and economic climate in order to facilitate a sense of job security. Incentivised retention policies are also needed to lure specialists back to South Africa after fellowship training abroad.

There is a need for accurate data collection in order for planning of appropriate registrar training programs. This will assist government with decision-making around resource appropriation. Several tasks have been outlined by Ozgediz et al for paediatric global surgery and provide a starting point for establishing a National Surgical Plan, which appreciates certain unique aspects of paediatric surgery. This research contributes to the growing body of literature which is needed in order to develop a National Surgical Plan in South Africa. A recommendation would be to quantify the remainder of the South African surgical and anaesthetic workforce in order for South Africa's Lancet Indicators to be properly analysed. General and paediatric surgeons have been 'mapped', leaving neurosurgery, orthopaedic surgery, cardiothoracic surgery, ophthalmology, otorhinolaryngology, urology, obstetrics and gynaecology, plastic, reconstructive and maxillofacial surgery as well as the anaesthetic workforce. This highlights that workforce analysis needs to be carried out by individual specialities.

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Chapter 8 – APPENDIX

Appendix A – Paediatric Surgery Congress 2017 Questionnaire

Appendix B – Human Research Ethics Clearance

Appendix C - Consent

Appendix A – Paediatric Surgery Congress 2017 Questionnaire

Thank you for contributing towards this study on Global Surgery. We are attempting to map the surgical workforce in South Africa, which allow for more accurate assessment of posts as well as resource allocation. This forms part of the six Lancet Indicators which were recommended by the Lancet Commission on Global Surgery.

The data will form part of a MMed degree and has been approved by the University of Cape Town's Human Research Ethics Committee. Personal data such as names, contact numbers and email addresses will not be published as part of the dissertation, but will be made available to all individuals who form part of the database as well as the HPCSA.

Kind regards,

Dr Angela Dell (Registrar General Surgery, Groote Schuur Hospital)

Name .....

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Surname .....

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Sex .....

Age .....

Email .....

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Contact numbers .....

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University affiliation .....

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Qualifications (year obtained) .....

.....

.....

Year of training in FCPaeds .....

.....

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Year of expected graduation .....

.....

.....

Province .....

.....

.....

List Hospitals currently working at .....

.....

.....

Public / Private sector (proportion of time in each sector- hours per week) .....

.....

Career plans once qualified

Public sector ☐

Private Sector ☐

Both ☐

Emigrate ☐

Other ☐

.....

Appendix B – Human Research Ethics Clearance

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E52-24 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 404 7682 • **Facsimile** [021] 406 6411
Email: nosi.tsema@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

28 April 2017

HREC REF: 177/2017

Prof A Numanoglu
Division of Paediatric Surgery
6th Floor
Red Cross Children's Hospital

Dear Prof Numanoglu

PROJECT TITLE: GLOBAL SURGERY- A REVIEW OF THE PAEDIATRIC SURGICAL WORKFORCE IN SOUTH AFRICA (MMed-candidate Dr A Dell) sub-study linked to 515/2016

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30th April 2018.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student Dr A Dell will be involved in this study.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval before the research may occur.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Yours sincerely

pp TBurgess
PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

HREC 177/2017

Appendix C – Consent

This research is being carried out by Prof A Numanoglu, Dr M Arnold and Dr A Dell who are affiliated with the University of Cape Town. The purpose of this research is to quantify the number of paediatric surgery specialists and trainees in South Africa. In addition, we wish to analyse demographic data such as sex, age and where doctors currently find themselves working (province, hospitals, and health sector). The qualitative part of the research involves analysing your future plans in terms of which sector you plan on working in. This will contribute to the growing body of knowledge towards the global surgery movement, which hopes to provide safe, affordable and accessible surgery to those who need it most.

The research will be conducted over a one month period once ethics approval is obtained and will involve email and telephonic contact of all registered paediatric surgeons, registrars and medical officers as per the current HPCSA database. This information will allow us to compare our paediatric surgical workforce data with those from other countries and will allow policymakers to plan where registrar posts are most needed as well as where surgeons are currently located.

Participating in this research is voluntary and if participants choose not to respond, this will not negatively affect them in any way. The benefits of taking part in this research include being able to contribute to the global paediatric surgical workforce knowledge, in order for policymakers to better cater towards your needs as well as the needs of your patients in terms of resource allocation and future planning. Being part of an up-to-date database will allow you to determine where colleagues are currently working, which will allow you to decide where the so-called gap in market lies as well as where the needs are the greatest. There are no risks associated with taking part in this research, apart from having you contact details available to the researchers. These will however not be published to the public. It must be mentioned that practice and home addresses and telephone numbers are currently available to the public on the HPCSA website. All information will be analysed by the two investigators and names and contact details will not be available as part of the dissertation and publication, however the database will be shared amongst all participants (i.e. those in the field of paediatric surgery in South Africa), unless specified by participants. Data will be kept on password protected personal computer of the investigators. Final analysis and results will also be feedback to those involved in the research.

Kind regards,

Dr Angela Dell (angelajdell@gmail.com 0833166689) and Prof Alp Numanoglu (Alp.Numanoglu@uct.ac.za)

If you wish to contact the HREC in relation to any questions or concerns regarding rights of participants, please contact: Office Address: E53 Room 46, Old Main Building, Groote Schuur Hospital, Tel: 021 4066626

I agree to voluntarily participate in the research as outlined above.

Name and date Signature