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Tarlia Govender; Juanett Scribante; Theshni Govender; Aletha Withers; Jerome Loveland

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Responding to the need: An evaluation of the subspecialty units in a pediatric surgical department in a limited resource setting using selected optimal resources for children's surgery strategies

T. R. Govender[1] | J. Scribante[1,2] | T. Govender[1] | A. Withers[1] | J. A. Loveland[1,2,3]

[1]Department of Pediatric Surgery, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

[2]Surgeons for Little Lives, Johannesburg, South Africa

[3]Department of Transplant Surgery, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

Correspondence

T. R. Govender, Department of Pediatric Surgery, Chris Hani Baragwanath Academic Hospital, 26 Chris Hani Road, Diepkloof, Soweto, Johannesburg 1860, South Africa.
Email: tarliar@gmail.com

Abstract

Background: The Global Initiative for Children's Surgery group published the Optimal Resources for Children's Surgery (OReCS) document outlining the essential criteria and strategies for children's surgical care in low-resource settings. Limited data exist on subspecialties in pediatric surgery and their contribution to global surgery efforts. The study aimed to evaluate the development of subspecialty units within Chris Hani Baragwanath Academic Hospital (CHBAH) Department of Pediatric Surgery (DPS) from January 1, 2018 to December 31, 2021 using selected OReCS strategies for the improvement of pediatric surgery.

Methods: A retrospective descriptive research design was followed. The study population consisted of CHBAH PSD records. The following data were collected: number of patients managed in PSD subspecialty unit (the units) clinics and surgeries performed, number of trainees, available structures, processes and outcome data, and research output.

Results: Of the 17,249 patients seen in the units' outpatient clinics, 8275 (47.9%) burns, 6443 (37.3%) colorectal, and 2531 (14.6%) urology. The number of surgeries performed were 3205, of which 1306 (40.7%) were burns, 644 (20.1%) colorectal, 483 (15.1%) urology, 341 (10.6%) hepatobiliary, and 431 (12.8%) oncology. Of the 16 selected strategies evaluated across the 5 units, 94% were available, of which 16.4% was partly provided by Surgeons for Little Lives. Outcome data in the form of morbidity and mortality reviews for all the units is available, but there is no data for timeliness of care with waiting lists. There were 77 publications and 41 congress presentations.

Conclusion: The subspecialty units respond to the global surgical need by meeting most selected OReCS resources in the clinical service provided.

KEYWORDS

global surgery, low middle income countries, optimal resource for children's surgical care (OReCS), subspecialties

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1 | INTRODUCTION

The Lancet Commission on Global Surgery reported that five billion people lack safe surgical healthcare.[1] It is estimated that 1.7 billion children younger than 19 years cannot access safe surgical care worldwide.[2] Of these, 453 million are under the age of 5 years, and most of these children live in low-middle-income countries (LMICs).[2] It is estimated that 85% of children in Africa will require surgical care before 15 years[3] The surgical burden of disease in children in sub-Saharan Africa differs from high-income countries (HIC) with high rates of congenital anomalies, surgical infections, and trauma.[4]

In 2015, three publications, namely the World Bank Disease Control Priorities 3: Essential Surgery,[5] Lancet Commission on Global Surgery,[1] and World Health Assembly Resolution 68.15,[6] served as catalysts for the global surgery movement.[7] These landmark publications have recognized the health and economic impact of surgical conditions in LMIC.[8] The perceived high cost of infrastructure, specialized equipment, and skilled workforce has been outweighed by the greater economic burden of disability-adjusted life years associated with untreated surgical conditions.[9]

Despite highlighting this global predicament, these publications lack detail regarding children's surgical needs.[10] This deficit is being addressed by the Global Initiative for Children's Surgery (GICS), an organization formed in 2016 to address health, advocacy, and policy in different regions.[11] GICS created the Optimal Resources for Children's Surgery (OReCS) guideline in 2019, which provides a guideline to standardize children's surgery in low-resource settings.[12] The document classifies healthcare facilities, details the resources needed at different levels of facilities, and suggests quality improvement strategies.[12]

Global surgery initiatives should no longer be centered on surgeons from HIC seeking an opportunity for short-term volunteerism with little long-lasting benefit to the host country. Focus has now turned to locally championed interventions.[13] Inequities of global surgery were examined by Qin et al.[14] They identified Western epistemology (established from colonialism), unequal participation, and geographic inequity as some of the barriers to inclusive global surgery.[14] The World Bank classifies South Africa as an upper-middle-income country.[15] However, the country has one of the highest inequality rates described globally due to a large percentage of the population living below the upper-middle-income country poverty line.[16] Access to healthcare in South Africa is influenced and impacted by the historical spatial and geographical segregation of racial groups.[17] Significant disparities in access to healthcare exist amongst different ethnic groups in postapartheid South Africa.[18] It is estimated that 84% of the population relies on public healthcare.[19] As in many parts of Africa, general surgeons provide the majority of surgical care to children outside of central hospitals.[4,10]

For national policies to be implemented, contextualizing the burden of pediatric surgical needs in the public healthcare sector and assessing the physical and systems resources is essential.[8] Global pediatric surgery provision was previously considered too expensive to implement in LMICs. However, using cost-effective ratios, Smith et al[18] concluded that there are viable, cost-effective strategies for childhood surgery. If these strategies are implemented, they will not only affect the micro-economies of households and communities, but also reduce the disability-adjusted life years of children, and promote macro-level economic growth.[20] In the Department of Pediatric Surgery (DPS) at Chris Hani Baragwanath Academic Hospital (CHBAH), the surgical burden is addressed by locally championed global surgery efforts.

CHBAH is a central public hospital that provides tertiary services. A central hospital receives patients from more than one province, provides training to healthcare workers, and must be attached to a medical school for undergraduate training.[21] It is the largest hospital in Africa[22] situated in Soweto, the largest township in South Africa.[23] In 2019, there was 48.1% growth in the population of Soweto from the decade prior.[23] The CHBAH DPS is the largest of the three tertiary hospitals in Gauteng province which has an estimated population of 11.4 million.[22] The department provides surgical care that spans from OReCS basic surgical care to complex and advanced surgical care.[12] Each of the subspecialty units developed from a need for advanced surgical care, surgeons with special areas of interest, and with the multidisciplinary team members employed at CHBAH. Subspecialist care and centralization of care are concepts considered at odds with global surgery dogma[24]; therefore, we chose to assess the resources offered by the DPS subspecialty units using a global surgery tool.

In general pediatric surgery, the evolution to subspecialty care is expected, and the development of subspecialty units has multiple benefits.[25] High surgery volumes performed by a dedicated surgical team with tailored multidisciplinary adjuncts result in optimal resource utilization, better patient outcomes, and surgical training.[22,23] In South Africa, general surgeons often perform children's surgery outside tertiary and urban centers.[10] The CHBAH is a central hospital providing what OReCS defines as basic, intermediate, and advanced childhood surgical care.[12] Due to the lack of resources at other levels of care,[8] the DPS was required to serve those patients. These services are still provided by the DPS even after the establishment of the subspecialty units, but numerous OReCS strategies, for advance care, are met since their formation. These include physical resources, including dedicated theater lists and the outpatient and admissions building.

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Additional human resources who form the multidisciplinary team have defined and formal roles with the subspecialty units.

Referring to appendix 2 in OReCS,[12] the DPS covers care offered at all levels of care. Examples of each include (1) incision and drainage of superficial abscesses offered by a health centers, (2) trauma and emergency laparotomies including colostomies offered by a first-level hospitals, (3) trauma thoracotomy offered by second-level hospitals, (4) congenital anomalies including gastroschisis and oncology cases offered by third-level hospitals, and finally (5) what is offered by National Children's hospital which includes the work of the subspecialty units, advanced perioperative care of complex conditions by a multidisciplinary team. This demonstrates how the DPS at CHBAH is able to provide subspecialty care without compromising the basic surgical care offered. In addition to their surgical subspecialties, the specialists working in the DPS operate on emergency pediatric surgery cases, neonatal surgeries, trauma, and elective surgeries falling outside the subspecialties. Furthermore, there are dedicated trainee-run theater lists that serve to address the backlog of day pediatric surgery cases, including inguinal and umbilical hernias, orchidopexies, circumcisions, and excisions of soft tissue masses.

The subspecialty units at CHBAH were developed by the DPS without formal centralization of pediatric surgical care. The impact of responding to the need and developing subspecialty units within the DPS was unknown. This study evaluated the development of subspecialty units within the DPS from January 1, 2018 to December 31, 2021 using selected OReCS strategies for improving pediatric surgery.[12]

2 | MATERIALS AND METHODS

CHBAH is a 2680-bed central public hospital where, on average, the DPS have 11,932 patient encounters and 2316 surgeries are performed annually.[26] The hospital functions as an OReCS third-level hospital and also fulfills some of the functions of a national children's hospital.[12] Affiliated to the DPS is Surgeons for Little Lives (SFLL), a registered nonprofit organization, committed to saving sick children's lives.[27]

The definition of a subspecialty in the DPS differs from the traditional definition. Pediatric surgeons with a special interest lead the subspecialty units as the College of Pediatric Surgeons of South Africa offers no formal subspecialty training. The current subspecialty units in the DPS are burns, colorectal, hepatobiliary (which includes upper gastrointestinal surgeries), oncology, and urology. The weekly activities of the subspecialty units are independent. Each has regular theater lists, scheduled weekly multidisciplinary meetings, and clinic days.

A supernumerary trainee is a non-funded, international, or from another South African province postgraduate doctor training to become a specialist pediatric surgeon with the College of Medicine of South Africa (CMSA). To specialize as a pediatric surgeon in South Africa, you are required to complete 5 years of training, to pass the CMSA examination, and achieve a master's degree in the field.[28] A fellow is a specialist pediatric surgeon with a special interest in continued professional development and spends dedicated time in a subspecialty unit under an experienced surgeon in the field, and these fellowships are not formally accredited. A supernumerary fellow is a non-funded, specialist pediatric surgeon with a special interest in continued medical education and spends dedicated time in a subspecialty unit under an experienced surgeon in the field.

The study population consisted of departmental records. The departmental records used to obtain and cross-reference the data included the departmental outpatient clinic register, ward admission books, theater logbook, departmental training record, subspecialty unit records, weekly morbidity and mortality (M and M) documents, and departmental research reports. The undergraduate pediatric surgery training records were excluded from the study. This was a retrospective descriptive study; therefore, a sample size calculation was not required.

A REDCap data collection sheet was developed for the study. A summary of the data collected is shown in Table 1. One author (TRG) collected the data to ensure credible data. Quality improvement in this study included selected OReCS improvement strategies, namely physical, financial, and human resources, available processes, consultant supervision, patient outcomes, and research.[12]

TABLE 1 Summary of collected data.

Section 1
- The number of patients managed in the outpatient department
- The number of surgeries performed by each subspecialty

Section 2
- The number of doctors undergoing training
  a. Trainees
  b. Supernumerary trainees
  c. Supernumerary fellows

Section 3
- Available structures (physical, financial, and human resources excluding doctors)
- Available processes (standard operating procedures (SOP), guidelines, and consultant supervision)
- Outcome data (M and M document review and waiting lists)

Section 4
- Research resources
- Research output (degree and nondegree)
- Publications
- Conference presentations

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The DPS provides the resources needed for general pediatric surgery; therefore, the strategies selected exclude those specific to other specialties in OReCS, such as orthopedic surgery, neurosurgery, pediatric anesthesia, and intensive care.

Data analysis was performed using Microsoft® Excel® 16.78.3. Categorical variables were reported as numbers and percentages.

3 | RESULTS

During the study period, the DPS managed 51,268 outpatients and 17,303 patients in three subspecialty units: burns, colorectal, and urology. The numbers for the oncology and hepatobiliary subspecialty outpatients were unavailable as these patients are seen in the general pediatric oncology clinic and the general pediatric gastrointestinal clinic and do not differentiate in their record keeping between their medical and surgical patients. The five subspecialties performed 3205 surgeries. The number of outpatients managed in the three subspecialty units and the number of surgeries performed during the study period are shown in Table 2. The surgeries reflected do not include emergencies or surgeries outside the listed subspecialties.

The number of trainees, supernumerary trainees, and supernumerary fellows who were trained during the study period is shown in Table 3. There were no fellows during the study period.

The selected OReCS strategies for quality improvement in each subspecialty unit are shown in Table 4. Previously, general pediatric surgery admissions and outpatient visits were conducted in a small, prefabricated building. SFLL funded and maintains a permanent building for pediatric surgery admissions and outpatients. This building provided the facilities for the formation of subspecialty unit clinics.

A full-time researcher is employed to assist with subspecialty research and a mobile app for data collection and management by administrators. SFLL sponsors all of these research resources. The annual publications and conference presentations for both degree and nondegree purposes are shown in Table 5. There was a 66% increase in published research between 2018 and 2021. Due to COVID-19, in 2020, there was a peak in publications but the slowest number of conference presentations. This reflects that the additional hours gained from lack of elective surgeries were spent on research and publications. Conference presentations were limited due to restrictions on traveling and gatherings that year.

There is a monthly general M and M review. The outcomes for all the subspecialty units are captured. In the study period included, more than 5000 surgeries were reviewed. This number includes those cases which are not subspecialty specific. The subspecialty surgeries accounted for 3205 of those cases. As stipulated in OReCS, predetermined filters for complications are used to classify morbidities. Although no specific classification model is used, during discussion, actionable aspects are identified and emphasized in order to improve future outcomes. Examples of how M and M reviews have influenced clinical work include laparoscopic procedures being done under consultant supervision in response to high relook rates from appendicitis and burns backlog addressed by both burn theater and other theater lists being utilized for burns cases. And finally, for the registrar rotations in subspecialty units to be no less than 3 months in order to benefit from training under consultants in the unit.

TABLE 2 The number of outpatients managed and the surgeries performed in the selected subspecialty units.

Subspecialty unit	2018	2019	2020	2021	Total
Outpatients managed					
Burns	1371	2487	2652	1765	8275
Colorectal	1618	2264	932	1629	6443
Urology	571	726	405	883	2531
Total	12,460	15,089	10,661	13,058	17,249
Surgeries performed					
Burns	482	326	219	279	1306
Colorectal	238	187	63	156	644
Urology	161	120	60	142	483
Hepatobiliary	156	86	35	64	341
Oncology	124	116	80	111	431
Total	1161	835	457	752	3205

4 | DISCUSSION

The benefits of subspecialty units have been demonstrated in adult[25] and pediatric surgery[29] operative volume, institution designation, and fellowship training, improving patient outcomes with shorter hospital stays, and fewer morbidities and mortalities.[27,28]

The number of elective surgeries performed by each subspecialty has increased over the study period except in 2020 during the COVID-19 pandemic when elective surgery was limited. However, the burns and

TABLE 3 The number of trainees, supernumerary trainees, and supernumerary fellows.

	2018	2019	2020	2021
Trainees	7	8	8	8
Supernumerary trainees	5	4	5	3
Supernumerary fellows	1	1	1	1

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TABLE 4 The selected Optimal Resources for Children's Surgery strategies for quality improvement in subspecialty units.

Strategies	Burns	Colorectal	Hepatobiliary	Oncology	Urology
Physical resources					
Building	Yes[a]	Yes	Yes[a]	Yes	Yes[a]
Dedicated theater list	Yes	Yes	Yes	Yes	Yes
Financial resources					
Department of health	Yes	Yes	Yes	Yes	Yes
SFLL	Yes	Yes	Yes	Yes	Yes
Human resources (excluding doctors)					
Nurse	Yes	Yes[a]	Yes	Yes	Yes
Physiotherapist	Yes[b]	Yes[b]	Yes	Yes	Yes
Occupational therapist	Yes	Yes	Yes	Yes	Yes
Speech therapist	Yes	Yes	Yes	Yes	Yes
Dietician	Yes[b]	Yes[b]	Yes	Yes	Yes
Psychologist	Yes	Yes	Yes	Yes	Yes
Art facilitator	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]
Available processes					
SOP	Yes	Yes	Yes	Yes	Yes
Guidelines	Yes	Yes	Yes	Yes	Yes
Consultant supervision					
Office hours	Yes	Yes	Yes	Yes	Yes
After hours	Yes	Yes	Yes	Yes	Yes
Outcome data					
M and M review	Yes	Yes	Yes	Yes	Yes
Waiting list	No	No	No	No	No

Note: Provided by SFLL.
[a]Completely.
[b]In part.

TABLE 5 The annual publications and conference presentations for both degree and nondegree purposes.

	Publications		Conference presentations	
Year	Degree	Non-degree	National	International
2018	2	9	5	7
2019	3	11	9	15
2020	2	17	2	2
2021	7	26	7	6

oncology units showed an increase in the number of surgeries during 2020 due to the predominant emergency nature of the surgery. Although there has been an increase in the number of elective surgeries performed by each subspecialty unit, the impact made on the surgical need could not be determined as the subspecialty waiting lists do not include the waiting time. Therefore, timeliness of care as an OReCS strategy is not measured by the DPS.

In the DPS, there is a monthly general M and M review. The outcomes for all the subspecialty units are captured. OReCS emphasizes the M and M review as an essential part of quality improvement affecting patient care by facilitating loop closure.[12] Elective and emergency surgeries performed by the subspecialty units and the subsequent outcomes of these patients are areas for further investigation.

The Lancet Commission on Global Surgery estimated that by 2030, there would be a deficit of 2.3 million surgical providers globally.[1] Specialist surgical workforce is a key indicator as an inadequate workforce is a significant challenge to improving surgical capacity.[1,10] The American Pediatric Surgical Association recommends one pediatric surgeon (including subspecialists) per 100,000 children.[30] Dell et al[10] in 2018 highlighted the pediatric surgical density in South Africa with a national average of 0.26 pediatric surgeons per

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100,000 children. Most surgeons were in major metropolitan areas, highlighting this resource's geographic and socioeconomic maldistribution. There is also a low density of pediatric surgeons in sub-Saharan Africa.[10] The Health Professionals Council of South Africa regulates the number of training positions allocated to each training department. Following a strong motivation from the DPS, the CMSA has issued additional training posts, but the lack of funding for these posts by the National Department of Health has limited the utilization of these posts. In response to this, the Department has increased funded training posts from two to eight since 2010. By establishing the subspecialty units, more trainee posts were created due to the increased clinical demand.

In 2017, Toobaie et al[3] established that there should be 4700 pediatric surgeons in Africa. There are no full-time pediatric surgeons in more than half of African countries.[13] The DPS recognized the global surgery burden from the sub-Saharan countries and other South African provinces, and a supernumerary trainee training program was initiated. The supernumerary trainees complete the full requirements of pediatric surgical training and exams as stipulated by the CMSA.[28] Once qualified, these trainees return to their respective countries and provinces, improving the pediatric surgical density and geographical distribution while maintaining a collaborative relationship with the DPS and Wits. The subspecialty units have attracted national and international trainees and qualified pediatric surgeons with special interest areas.

The Global Pediatric Surgery Network proposed a model for networking and guidelines for international partnerships.[13] Ethical and culturally sensitive practice in patient care and data mining for research is essential.[13] Numerous trainees and qualified surgeons from HIC have spent various amounts of time in the DPS. With a clear stance against exploitation and through long-term collaboration, the DPS, in association with Wits, has shown that these relationships can be mutually beneficial. The contribution of the visiting trainees and surgeons to the workforce, surgeries performed, and research is regarded as invaluable by the DPS. Zanini et al in 2021 demonstrated that of the European surgical trainees (both pre and postqualification) who visited the DPS, operative experience was higher in South Africa for all general and index pediatric surgical cases than in their country of origin, except for minimally invasive surgery.[31]

The results of this study demonstrate that resources are available for the selected OReCS strategies for quality improvement in the subspecialty units of the DPS.

CHBAH is a public hospital funded by the provincial Department of Health. Major obstacles exist in pediatric surgery service delivery in South Africa.[32] OReCS acknowledges private organizations often supplement low-resource healthcare facilities. Thus, affiliated with the DPS, the SFLL charity was launched in 2015 with the specific intention of improving clinical care and supporting training and research within the DPS, enhancing the pediatric surgical service provided.[11] SFLL has built the building where most of the subspecialty units operate, contributes to numerous day-to-day aspects of this care, and as part of their contribution to holistic patient care, SFLL built a parental sleepover facility to allow parents to be part of their children's care. SFLL also improved existing facilities, including the burns and ICU, general pediatric surgery wards, and neonatal and main theater waiting areas. In 2002, Bickler and Rode[4] highlighted, “We do not advocate wholesale changes to existing structures, as many are very successful, but consider that existing services should be built on and that community participation should be encouraged”. Community participation is important in progressing global pediatric surgery in Africa.[9] Our colorectal and urology units have established patient support groups, and SFLL has initiated numerous community-based primary prevention programs.

The establishment of the subspecialty units facilitated focused research, which has impacted the quality-of-service delivery of the units. That also contributed to the international body of knowledge, specifically that of a low-resource setting. This increased research demand for the subspecialty units lead to the employment of a full-time researcher by SFLL. The role of healthcare researchers is emphasized as an OReCS strategy to create a database that can inform both local and national policy. To ensure prospectively collected data, OReCS recommends databases with a point-of-care (mobile device interface), which includes online and offline modes and has remote cloud storage.[12] SFLL sponsors administrative staff to maintain the department's electronic database.

Limitations of this study are that it was done retrospectively at one hospital and may not represent other contexts. OReCS describes quality improvements to outcomes of care. These strategies were, in some part, reflected in the M and M reviews; however, to adequately measure the improvement of services, each subspecialty should have documented outcomes, including outpatient follow-up. Other outcome improvement strategies the department does not employ include assessment of quality of life, risk-adjusted mortality, and financial risk protection. Regarding process improvement, waiting lists exist for each subspecialty; however, the length of time to surgery and timeliness of care are process improvement strategies not measured by the department. On appraisal of the clinical burden, subspecialty units in trauma and neonatal surgeries will be valuable additional units. For subspecialty training to progress, fellowship posts by the CMSA are necessary.

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5 | CONCLUSION

The subspecialty units in the DPS at CHBAH respond to the global surgery need by meeting the majority of OReCS strategies in the clinical service provided. SFLL contributes substantially toward the physical and human resources, research, and training. The DPS employs OReCS quality improvement by training trainees and fellows, including those from sub-Saharan countries, contributing to the pediatric surgical workforce in South Africa and beyond. The DPS research quantifies the local disease burden, advocates for equitable resources, and provides a global surgical service for children in need.

AUTHOR CONTRIBUTIONS

T. R. Govender: Conceptualization; data curation; formal analysis; methodology; writing – original draft; writing – review and editing. **J. Scribante**: Formal analysis; project administration; supervision; validation; visualization; writing – review and editing. **T. Govender**: Conceptualization; formal analysis; methodology; project administration; supervision; writing – review and editing. **A. Withers**: Conceptualization; methodology; project administration; supervision. **J. A. Loveland**: Conceptualization; formal analysis; methodology; project administration; resources; supervision; visualization; writing – original draft; writing – review and editing.

CONFLICT OF INTEREST STATEMENT

None declared.

ETHICS STATEMENT

Approval to conduct the study was obtained from the University of the Witwatersrand (Wits) Human Research Ethics Committee (Medical) (M220501). A retrospective descriptive research design was followed.

ORCID

T. R. Govender https://orcid.org/0000-0001-7937-749X
J. Scribante https://orcid.org/0000-0002-2221-5024
T. Govender https://orcid.org/0000-0002-9613-7938
A. Withers https://orcid.org/0000-0001-5941-9824
J. A. Loveland https://orcid.org/0000-0002-3341-0749

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