



Developing and transferring a children's surgical training program from India to Africa a south-to-south global initiative

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Abstract

Purpose The availability of children's surgical care in lower middle-income countries is lacking. The authors describe a hub and spoke global training initiative in children's surgery for adult teams from district hospitals (spokes) comprising general and orthopaedic surgeons, anaesthetists, and nurses and specialist children's surgical trainers from tertiary centres (hubs) in delivering the course.

Methods The training course developed in Vellore, trained several sets of district hospital adult teams and trainer teams in India. Six specialist children's surgical trainer teams were invited from African countries to the course delivered in Vellore, India. The aim was to train them to deliver the course in their countries.

Results Participants underwent a precourse 'train the trainer' program, observed and assessed the suitability of the district hospital training course. The program received positive feedback, government supported planning of similar courses in some of the countries and discussions in others.

Conclusion The availability of children's surgical care is similarly limited in the Asian and African continent, and the regions have shared challenges of disease burden, lack of access, poverty, deficient infrastructure, and trained human resources. They would benefit from this 'South to South' collaboration to impart training skills and modules to the children's surgical trainers.

Keywords Global children's surgery · Lower middle-income countries · Global surgical training · South to south surgical training collaboration · Lancet Commission · WHO sustainable developmental goals · Global south · Surgical training · District hospital children's surgery

Introduction

The World Health Organisation (WHO) reports that 1.7 billion children worldwide lack surgical care [1]. Access to surgical care is particularly limited in low and middle-income countries (LMICs), with less than 3% of children in low-income countries and less than 8% in lower-middle-income countries having access to surgical care [2]. The deficiency in children's surgical care in LMICs is due, in large part, to a lack of trained children's surgical providers. In South Asia and Africa, children's surgical services are primarily

centred in mega-cities, especially for ages under six [3]. Consequently, with few exceptions, access to surgical services for acute and common surgical conditions in children at the local district general hospital level is severely limited.

The Lancet Commission 2015 highlighted the global burden of surgical diseases and the need to provide access to safe anaesthesia and surgery worldwide [4]. Although many high-income countries (HIC) to LMIC global surgical partnerships have emerged since the Lancet Commission report, their success is often limited by complex ethical, cultural, financial, and planning differences and challenges [5]. In addition, surgical challenges in HICs vary significantly in type and magnitude from those in LMICs, making the experience of trainers from HICs less applicable to LMIC contexts [6]. There are also increasing reports of a power imbalance in these collaborations, with the interests of HICs dominating due to LMICs relying on HICs for their resources and expertise [7, 8]. The lack of local ownership in these collaborations could significantly hinder their

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long-term sustainability and may indicate a misallocation of resources. Similarly, the ethos of sending LMIC trainees to HICs for training as part of these collaborations may inadvertently contribute to the Brain Drain phenomenon, as these individuals may permanently migrate to HICs, depleting their home countries' already scarce trained workforce [9]. Furthermore, the trainees sent for training from LMICs to HIC often find it challenging to use the expertise they acquire upon their return due to inadequate equipment, infrastructure, trained personnel, and mentoring support [10].

Context for the development of the training program in India

In response to an urgent need, the Government of India initiated the Rashtriya Bal Swasthya Karyakram under the National Rural Health Mission [3]. This program aimed to screen all children for key medical and surgical conditions and to refer them to existing healthcare providers for treatment.

However, there was a significant lack of adequately trained specialists to manage children's surgery in orthopaedics, trauma, general surgery, urology, neurosurgery, thoracic surgery, ENT, and ophthalmology. In addition, support services provided by anaesthesia and intensive care units for children under 6 years of age were absent or inadequate, except in large cities. The lack of a trained workforce and child-appropriate equipment in the district-level hospitals (first-level/rural/regional hospitals) contributed to the inaccessibility of healthcare for children's surgery. It meant that children often could not access or obtain quality care locally, even when identified as needing surgical care.

Development of the training program

Recognising these challenges, the first meeting of the authors at the Global Initiative for Children's Surgery (GICS) in 2016 brought forth a novel concept: training teams for children's surgery in district-level hospitals [11, 12]. The concept involved training general surgeons, orthopaedic surgeons, anaesthetists, and nurses in children's surgery at district-level hospitals. The dialogue between surgeons from India and GICS led to a collaboration between the Royal College of Surgeons, England, and children's surgical trainers from Christian Medical College Vellore. After a Delphi process with rural/district-level teams, a curriculum was developed for healthcare professionals to identify and grade critical surgical conditions, have a decision-making algorithm, and acquire skills to prevent and treat early-stage diseases at the district level (Spokes). An essential referral network and communication portals (WhatsApp®) were established to forward

advanced cases to the training centres (Hubs)—the program aimed to connect the 'Hub and Spokes' to provide continuous, seamless care.

The objective was to introduce a solution for improving children's surgical care in LMICs, specifically at district hospitals and other secondary care hospitals. The plan involved the creation of a novel training course by an LMIC specialist unit with a team comprised of nurses, surgeons, orthopaedists, and anaesthetists. This trainer team would then run 'Children's Surgical Courses' to train rural/district teams whose participants included nurses, surgeons, orthopaedists, and anaesthetists. The result would be an improvement in children's surgical care at a national level.

Christian Medical College Hospital, Vellore, implemented the abovementioned hub and spoke training model. The Children's Surgical Courses were carried out three times in India, training both government district and secondary-level mission hospitals in 2017, 2018, and 2019 [13]. The first course served as a pilot children's surgical course, the second included a pilot training course for a team from an advanced training centre in a large city to become future trainers, and the newly trained team conducted the third. The third course was supported by a Vellore team and was attended by two more trainer teams from different regions. A faculty training manual was developed and piloted in the last course. With several district hospitals being trained, the local trainer hospital became a hub for receiving referrals, providing continuity of care for severely ill children with more complex needs, and providing continued educational opportunities for local teams. Ultimately, training the trainers with each provider course had a cascading effect on the workforce training for children's surgery in secondary hospitals while building solid relationships for further skill development, mentorship, and referrals between the spokes and the hub.

Internationalizing the training initiative

The aim of this program was not just to facilitate access to quality children's surgical care but also to create a sustainable model for future training needs. After testing this in India as part of a global surgery initiative, the model was applied to other LMIC countries. The availability of children's surgical care outside of large cities is similarly limited in the African continent and other parts of South Asia. These regions—with their shared challenges of disease burden and neglect, lack of access, poverty, deficient infrastructure, and trained human resources—could benefit from a similar 'South to South' collaboration to impart training skills and modules to the children's surgical trainers. This concept note describes how this intercontinental training was planned and implemented.

Planning

During the development and implementation of Faculty and Participants' training manuals, there was an emphasis on recording the various resources that would be used, including equipment for training and teaching purposes. The pedagogical approach was skill-based and highly interactive, involving intubation dummies, innovative simulation models, e.g., goat chest cages for chest tube insertion, mannequins, and dolls to simulate real-life surgical scenarios. Relevant teaching videos or links to existing videos were included in the manual. Following manual preparation, the sessions were conducted, continuously reviewed, and updated based on feedback from evaluators, who evaluated teaching methods, content, and audience engagement. Each session had an educator or one of the authors as an observer who provided feedback.

The practical sessions were timed, and trainers were observed to ensure adherence to lesson plans. Difficulties encountered were noted, and modifications were made to the plans accordingly. Furthermore, the participants' manual was given to attendees before the session to facilitate familiarisation, thus reducing the time spent explaining theoretical principles during the sessions and allowing participants to maximise their hands-on time.

Six African countries were strategically chosen to participate based on existing collaborations with trainer teams to establish children's surgery training programs for local district hospitals in their respective countries. Teams from Tanzania, Kenya, Ethiopia, Ghana, Uganda, and a senior paediatric surgeon as an observer from Malawi were included. Transferring this training program for children's surgery to African countries has the advantage of having a shared context with similar socioeconomic and healthcare challenges. This shared context allows for developing and implementing training programs while allowing for each country's specific needs and resources. Further internal collaborations in the African continent allow for a more sustainable transfer of knowledge and skills and, over time, could make the training more relevant and acceptable to local healthcare professionals.

The visiting African trainer teams included children's specialists in general and orthopaedic surgery, anaesthesia, and ward and operating room nurse chosen by the hub institution as best matched to deliver the course in their country. Government participation was strongly recommended and established in some African teams so that the existing local hospitals could be resourced and workforce trained to provide child surgical services sustainably. These teams were offered mentorship for the initial courses from the Indian superhub (CMC, Vellore) and funding agency support to aid in establishing the program. A two-phase approach was developed, and the program was divided into (i) Developing

a Country training faculty (Phase I); and (ii) Trainers subsequently delivering the requisite training, customised appropriately for local delivery (Phase II).

Funding

Funding was secured from Kids-OR (www.kidsor.org), a UK-based charity, through a rigorous application process [14]. The financial support was obtained for one year initially to cover the African training teams' travel and expenses to CMC, Vellore, and subsequent courses in Africa with the support of the CMC training team. Additional financial support for the program, subject to review, was confirmed by Kids-OR for four years.

Content of the course

The Children's Surgical Course aimed to improve the screening and diagnosis of children's surgical conditions and train locally available surgeons and orthopaedic surgeons, anaesthetists, and nurses to treat emergencies, infections, trauma, and congenital conditions common to almost all LMICs. The content and the curriculum for the course are provided as a list in supplementary 1.

In February 2023, CMC Vellore paediatric surgical trainers conducted the fourth Children's Surgical course for secondary hospitals, where nurses, anaesthetists, and surgeons from five Indian secondary hospitals were trained. Senior surgical participants from Tanzania, Uganda, Kenya, Ethiopia, Ghana, and Malawi attended the course. In addition to observing the preparation and conduct of the course, they advised on the suitability of the modules, the training manual, and modifications required for their countries. In this manner, the training modules became organically adapted to each country's unique needs. The distribution of the participants from different geographical locations for the four courses conducted is shown in Fig. 1.

In addition, the African participants underwent an intensive "Train the Trainer" program to enhance their skills in training adult learners. The pre-course "Train the Trainer" program was conducted by a trained educator and held as a day-long intense workshop.

Health professionals dealing exclusively with children know that children are not merely small adults. However, participants from district hospitals who attended were inexperienced in this area. Recognising that children's physiology differs significantly from adults', the first day was an orientation day planned to help adult health professionals understand the unique characteristics of paediatric patients. These sessions set the tone for more focused training the following two days, where participants were divided into groups based on their specialisation, and subject-oriented training was done. Care was taken to ensure that a group

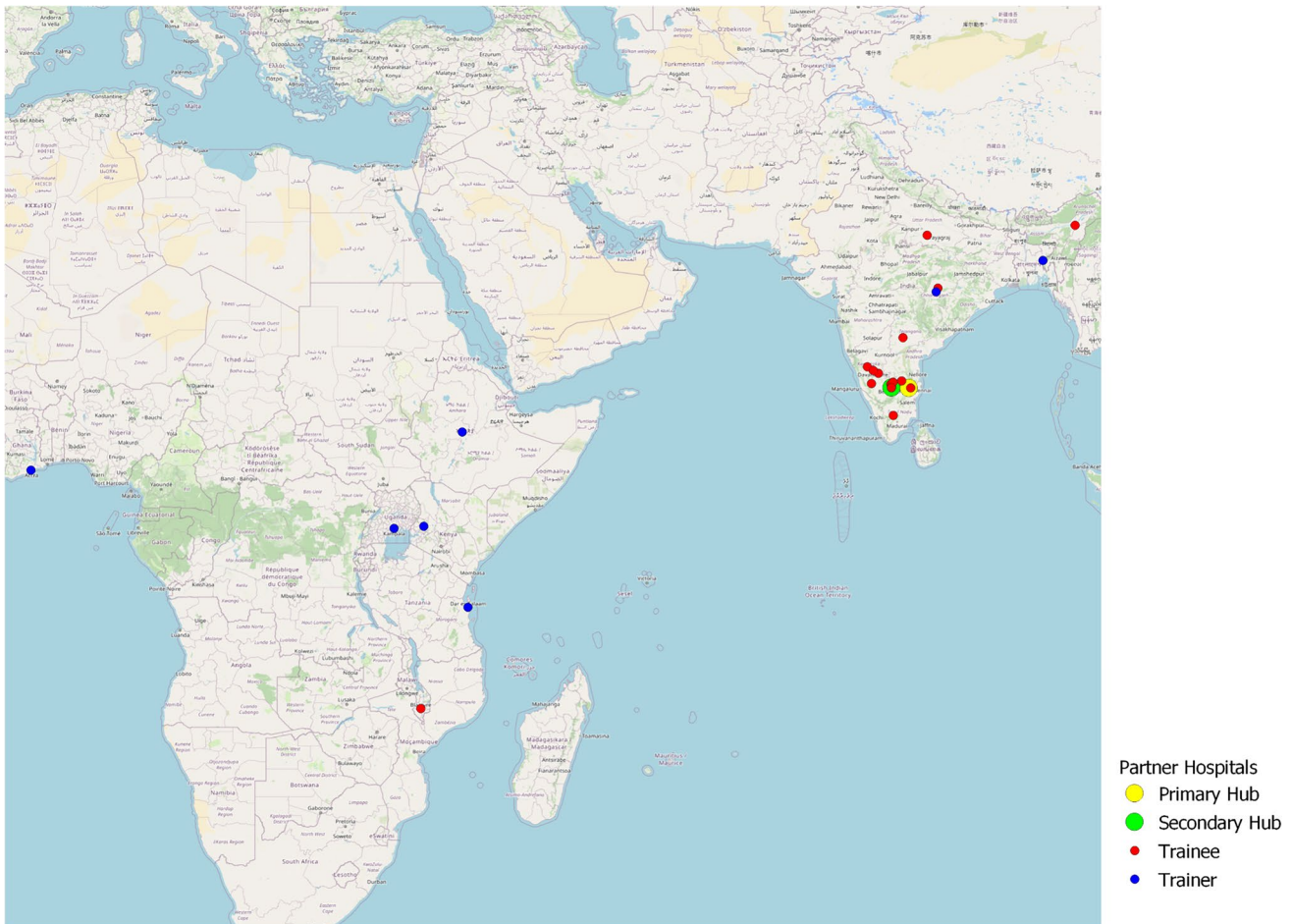


Fig. 1 A map indicating the locations of the institutions of hubs, trainer participants, and trainee participants centres for the four courses conducted in India. A map indicating the locations of the institutions of hubs, trainer participants, and trainee participants centres

for the four courses conducted in India. The yellow dot indicates the primary hub, which is Vellore. The second hub to start training trainers and conducting the provider courses is in green; the trainer participant locations are in blue, and trainee centres are in red dots

consisted of at most five participants for all activities to ensure effective learning.

On the first day, they commenced with airway and physiological differences between adults and children, triaging a sick child, essential fluid and electrolyte management, common analgesics and sedatives, and general dosing for children. Following these lectures, groups went through various workstations: airway management, vascular access, hip spica/immobilization, and intercostal drainage tube insertion. The second half of the day, practical 'Basic Life Support' training with mannequins was followed by sessions on burns, transportation of a sick child, and managing head injuries.

The program on Day 2 was specialty-based. The paediatric surgeons conducted interactive sessions covering topics relevant to district hospital surgeons, giving them insight into diagnosis, stabilization, and safe transfer. Minor problems that could be dealt with at the local level were

discussed in detail. The orthopaedic team had sessions on managing simple infective pathologies in children, neuromuscular diseases, common hip problems, elbow and long bone trauma, and congenital anomalies that need to be addressed soon after birth rather than as delayed referrals to tertiary centres. The anaesthesia team spent the day in the operating theatre, where interactive lectures were interspersed with a demonstration of patient induction, caudal analgesia, regional blocks, and airway management. The nursing team learned bedside care of patients pre and post-operatively and patients' nutritional needs, which included skills stations, such as the care of stomas, traction, catheter management, and enteral feeding.

On Day 3, the general surgeons had a demonstration on herniotomy and orchidopexy in the operating room. Similarly, the orthopaedic surgeons observed a clubfoot release, a hip spica application, and eight plate insertion procedures. Anaesthetists were provided with a practical demonstration

of induction. The nurses discussed the care of children with Spina Bifida, genitourinary conditions, and foreign body aspiration. The day closed with a demonstration of the WHO checklist with the goal that the teams adapt the checklist to suit their respective institutions.

The course schedule allowed ample opportunities for networking and team-building among participants to foster future collaboration and mutual support as the participants implement this program in their respective African countries. The course was considered as a continued professional development initiative aimed at both the participating African teams as well as the district hospital teams from India. The teams received certifications authorized by the medical education department of the institution.

Feedback and outcome

Pre- and post-test were reviewed by the pilot team and the course directors. The program received overwhelmingly positive feedback from the participating African teams. A primary challenge identified was securing the support of each country's Ministry of Health to incorporate the course into the local healthcare system and secure local funding. The Tanzanian team, which included representatives from the Ministry of Health, expressed their intent to host the first Africa course due to strong links with their Ministry of Health. We expect to progress in Uganda with a course in Kampala and similarly in Addis Ababa, Ethiopia. Discussions are ongoing with the Kenyan and Ghana teams. We anticipate that the network forged during the meeting will aid in future collaborative training endeavours, and complete the set of hubs across these nations.

Further expansion is planned to export this course to some of the other SAARC countries (South Asian Association for Regional Cooperation), which include India, Pakistan, Sri Lanka, Nepal, Bhutan, Maldives, and Afghanistan, with CMC Vellore as a super hub. We hope that this course will be accepted on a global scale.

As the low- and middle-income countries strive to enhance their expertise in children's surgery, they can exchange knowledge, experiences, and skills, fostering professional growth. The other intangible benefits of this south-to-south collaboration are the facilitation of ongoing support, mentorship, and knowledge sharing beyond the training program, creating a network of professionals working toward advancing children's surgical care.

Conclusion

The development of a course specifically designed by the authors and implemented by trainers from India to provide training in conditions commonly seen in LMICs has been

initiated in Africa. The African teams are now equipped to modify the course to suit their needs and replicate it for trainers and participants in their countries. The intent is to significantly improve the surgical care available to children in remote areas. The initiative is a true example of a south-to-south global surgery collaboration addressing one of the challenges highlighted by the United Nations as a Sustainable Development Goal by 2030 [15].

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00383-024-05720-1>.

Author contributions All three authors were involved in the design of the course, obtaining funding, editing the trainers manual, and planning the course. M.V. wrote the manuscript, S.RJ and L.K edited the manuscript. All three authors approved the manuscript.

Data availability There is no additional data available. However, the participant and faculty manuals are accessible and can be provided upon request.

Declarations

Conflict of interest The authors declare no competing interests.

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