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New Knowledge from Research - Can Global Congenital Cardiac Surgery Play a Part? A Call for International Collaboration

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Abstract

Over 1.3 million babies are born each year with congenital heart defects (CHD), with the highest incidence in low-income countries (LIC) and low-middle income countries (LMICs)[1]. The Lancet Commission on Global Surgery found that surgically treatable conditions make up 28-32% of the total global burden of diseases, of which most are cardiovascular diseases[2]. Currently, high-income countries (HICs) undertake mission trips to LICs and LMICs to provide surgical care for those who otherwise would not have access. These trips also provide an opportunity to train the local surgical teams. It has been proposed that there should be a shift in thinking from 'humanitarian surgery' to 'global surgery', as this benefits both the provider and the receiver. With this change, we should address several limitations in our current infrastructure, including but not limited to, the lack of international research collaboration, the need for globalising and scaling up the paediatric cardiac surgical workforce, offsetting greenhouse gas emissions from mission trips, and opportunities for mentorship and training in LICs.

Why We Do What We Do

Firstly, there exists the moral axiom for providing surgical care to LICs and LMICs - 'to heal' should have no borders. Current inequalities, conflicts, and disasters continue to disadvantage those living in the poorest of countries. Even with interventions from the World Health Organisation (WHO) and other international bodies, the issue persists. The right to health is a global issue. COVID-19 has only strengthened this argument. The pandemic is a paragon in highlighting the co-operation between countries when the situation warrants. Surgery is as essential a treatment option as any pharmaceutical on the WHO Model List of Essential Medicines. Though it is deemed indispensable in any healthcare model in HICs, it is still considered a luxury elsewhere in the world - a therapeutic available only with the help of philanthropic organisations and insurance. Only 6% of the world's total number of surgical interventions take place in the poorest third of the world's population, compared to 74% of all major surgeries performed in the wealthiest third[2]. There ought to be a substantial leap from the current infrastructure to ensure every child has access to appropriate medical and surgical care. The cost of 'not doing' is too catastrophic, and reneges on the core undisputed promises of the UN Convention on the Rights of the Child including the right to life and provision of necessary medical assistance and health care to all children[3].

Meeting these challenges requires clinical evidence pertinent to the local settings, an adequate number of well-trained personnel, improvement in nursing and medical education, research, and quality improvement activities[4]. All of these requirements are financially demanding and therefore can be extremely difficult for LMICs to achieve. 58% of the burden of disease of CHDs could be averted by scaling up selected surgical care in LMICs through various mechanisms[5]. Patients suffering from CHD are significantly more likely to achieve lower education and are more often unemployed than their counterparts[6]. With the globalisation of industries and sectors, there exists an economic argument as to why the entire global cardiac community should intervene and do so immediately. Even with an increase in surgical workforce, the continuous increase in CHDs warrants a demanding ask to reduce gaps given the current resource allocation.

The Need for A Paradigm Shift

There have been major advancements within global surgery in the past few years. However, substantial gaps remain in merging humanity and surgery. Lockdowns due to the pandemic have only exacerbated current disparities in service delivery. Cardiac screening, check-ups, and mission trips came to a halt, allowing existing conditions to worsen, paving way for further deterioration in health. The pandemic has unreservedly changed the way we conduct business.

With the use of telehealth monitoring for check-ups to the utilisation of virtual MDT meetings, the internet has paved way for alternative ways of service delivery without compromising on quality. With this, we limited the carbon emissions from transport modalities required to attend meetings and conferences, and to encourage cross-country research collaboration, which was unfathomable prior to the pandemic without, for example, attending a large international symposium.

Mission trips provide an opportunity for those who do not have the luxury of accessing cardiac surgical care. However, with the pressing dangers of global warming and climate change, it is becoming harder to justify cross-continental trips for a handful of operations. A carbon-conscious humanitarian effort will have to balance the travel-related emissions with sustained efforts to reduce CO_2 in all surgical settings, at home and abroad. A recent eco-audit performed in France highlights that on average a heart operation emits 124.3kg of CO_2, 89% of which come from disposable plastics[7]. This is the equivalent to driving 2,273 miles in an averaged sized petrol-powered car. Almost all operations in LMICs utilise significantly less resources whilst maintaining excellent quality of care, compared to their HIC counterparts. HICs can better understand how to reduce plastic usage and surgical carbon emissions by studying how such operations are performed in LMICs with reduced costs, optimising resources, and minimising reinterventions.

Vervoort et al.[8] proposed a collaborative

framework required for safe, timely and affordable cardiac surgical care for all children in need. With this initiative, the global cardiac surgical community still need to bridge the gap from good intentions to reportable outcomes. Currently, there exists limited open-sharing international database which provides real-world data on the number of operations performed in LICs and LMICs, and the different characteristics of such operations. The International Quality Improvement Collaborative (IQIC) is one of such organisations that has a registry of outcomes of CHD surgical programmes operating in LICs and LMICs. The IQIC data has shown a negative correlation of gross domestic product (GDP) and health expenditure per capita to mortality[9]. This calls for more data collection at a regional and local level to identify the exact the reasons of such outcomes. Vervoort et al.[10] has already investigated the current state of paediatric cardiac surgical service provisions in LMICs and HICs. We add to this by determining new issues presented to global surgery, and potential benefits and solutions for both HICs and LMICs. **Table 1.** states the key messages and potential benefits and solutions encountered in global paediatric cardiac surgery.

More Data for Better Decision Making

Currently, several databases exist which aims to collect various data points from mission trips and surgery in LMICs. However, there exists no global repository with a minimum dataset requirement for global cardiac surgery. Even with such databases, language barriers and interchangeable terms warrants no uniformity in data collection. For example, cardiac surgery is also known as cardiovascular surgery, cardiothoracic surgery, CT surgery, chest surgery etc. The inception of the common diagnostic code allowed clinicians to jump semantic barriers to uphold the integrity of key terminologies used to manage patients and their conditions. Such utility for data collection on a global scale will limit the issue of language barriers when cross-country audit and research collaboration are required.

Is it too ambitious to think that a common effort can now generate a minimum dataset for humanitarian surgery, which will then inform data-driven practice in this area? To our knowledge, the IQIC database is the main database that aims to collect data to aid the development of global paediatric cardiac surgery. More unique repositories such as the IQIC database, or a combined effort within IQIC, are needed to go from an idea to a measurable outcome. Such databases in other fields are not uncommon - the British Heart Foundation (BHF) Data Sciences Centre[11], or the aortic valve insufficiency and ascending aorta aneurysm international registry (AVIATOR)[12] are examples of starting grounds for research by providing granular data on what exactly needs to be done in LICs[13], other than just the need for 'operating more'.

Table 1. Table outlining key messages of global paediatric cardiac surgery and potential benefits and solutions for HICs and LICs

Key Messages	Potential Benefits & Solutions
New issues in global paediatric cardiac surgery	New age of frugality Climate change and travel barriers Overshadowed by infection, public health and economic issues
Potential opportunities	Recognition that global surgery is a 'two-way street' Mutual benefits for LICs and HICs Reduction of surgical carbon footprint is a common goal Education and research can be done in a more global framework New developments are best informed by data
Research opportunities	Reviving old concepts for new treatments (e.g., central shunts for pulmonary hypertension) Reviewing indications in late diagnosis and late treatment scenarios Creation of a unique dataset for global congenital surgery with a data sharing framework Follow-up via routinely collected data Simple studies of new technologies and interventions

The shift from humanitarian surgery to global cardiac surgery provides a framework for which both HICs and LICs benefit. Currently, there are only 0.07 congenital cardiac surgeons per million paediatric population in LICs, compared to 9.51 congenital cardiac surgeons per million in HICs[14]. We postulate that HICs should acknowledge the benefits of global cardiac surgery. The opportunity for additional training, most of which would not be possible in Western surgical training programmes are one of such key opportunities for HICs. The recent paper by Vinck et al.[15] only highlight this further. With the globalisation of the paediatric cardiac surgical workforce, globally coordinated training programmes including those in LMICs will enable the next generation of global surgeons to understand the disease process in a broad spectrum of patients and support research development.

Such collaboration will not only aid overall surgical training but provide a platform where surgeons worldwide can discuss cases, offer support, collaborate on research on an international scale, team-build to resolve limitations that currently exist within congenital cardiac surgery, and ultimately pave way for the globalisation of congenital cardiac surgeons to ensure every child has access to appropriate and quality surgical care.

Research Initiatives

Transfer of know-how to LMICs rests on data science, surgical education, and healthcare economics. HICs can benefit from understanding how LICs provide surgical care with limited resources by reducing waste, providing real-world data on choice of clinical strategy, and improving overall service delivery. Gouton et al.[16] offers an example on the late management of truncus arteriosus from twenty years of humanitarian experience. Such articles set a precedent on clinical benefits to HICs with the existence of a global network of researchers. **Table 2** outlines examples of previous studies that were conducted, with key messages to highlight the benefit for both HICs and LICs in service delivery and research.

The first study by Lim et al.[18] aimed to evaluate the utility of diuretics post-coronary surgery. The endpoint was assessing if patients achieved pre-operative weight post-operatively. The second study by Lim et al.[19] aimed to assess the clinical significance of pleurotomy-associated morbidity during internal mammary artery harvesting. The patients were divided into a pleurotomy group and an intact pleurae group. It was observed the left pleurotomy was not associated with adverse clinical outcomes. These trials shine a light on the character of research that could take place in LICs, the results of which can aid management in HICs and LICs.

Table 2 outlines examples of previous studies that were conducted which could benefit both HICs and LICs

Study	Author	Year Published	Key Message
Midterm outcomes of the Potts shunt for paediatric pulmonary hypertension, with comparison to lung transplant	Lancaster et al.[17]	2020	Revising old concepts such as central shunts for treating pulmonary hypertension
Late management of truncus arteriosus: 20 years of humanitarian experience	Gouton et al.[16]	2018	Reviewing management of truncus arteriosus for patients who present late in LMICs due to lack of antenatal screening. Can this be used to aid management of such patients in HICs?
Evaluating routine diuretics after coronary surgery: a prospective randomised controlled trial	Lim et al.[18]	2002	Simple prospective single-centre or multicentre studies could be replicated in LICs to assist in transfer of trial 'know-how', whilst gaining support from industry
A prospective study on clinical outcome following pleurotomy during cardiac surgery	Lim et al.[19]	2002	
Assessing long-term outcome after atrial correction of TGA over arterial switch	Turina et al.[20]	1998	Circumstances which do not allow for arterial switch operations can by managed by favouring atrial correction for older children with TGA

The Next Steps

To progress, we must first acknowledge and enhance the mutual benefit global cardiac surgery delivers. Service delivery provides benefit for the provider, as well as the receiver. QI projects and audits ensures health professionals constantly assess, evaluate, and improve current standards. International collaboration, especially with the current climate on 'work from home', aims to subside the barriers of culture, language, and distance for improved surgical care. Cross-country research extends the possibilities of new discoveries, and fostering to more enhanced data collection, sharing, and partnerships.

Additionally, there needs to exist an international repository of data of all mission trips and local training programmes in LMICs. No meaningful change can be made without data, as this outlines what the exact limitations are, and how we can help resolve them. Uniform data collection from all charitable organisations and surgical teams can be used to conduct localised audit programmes to allow for more personalised strategic decisions. Mission trips are effective but not sustainable. The need for setting up local units, and if needed, the ability for online mentorship ensures patients have access to excellent care with compromising on quality. The Cape Town Declaration has been a pivotal turning point in global cardiac surgery[21]. We support its aims and encourage all HICs, including the UK to take part in this global initiative. We have highlighted the next steps in what we think is required for global cardiac surgery in **Figure 2.**

Limitations exist in our current practice which should be addressed. We cannot deliver adequate services and treatments in LICs, and now HICs due to the challenges presented by the pandemic. Additionally, further research will be difficult without first prioritising service delivery in both HICs and LICs. The lack of congenital cardiac surgeons and a global paediatric workforce prevents the cross-country collaboration that is required to achieve the goals of the global cardiac surgery. The heterogeneity in data collection, lack of a central database, and lack of support from industry and local workforces still presents as a challenge in the road for deliverable outcomes.

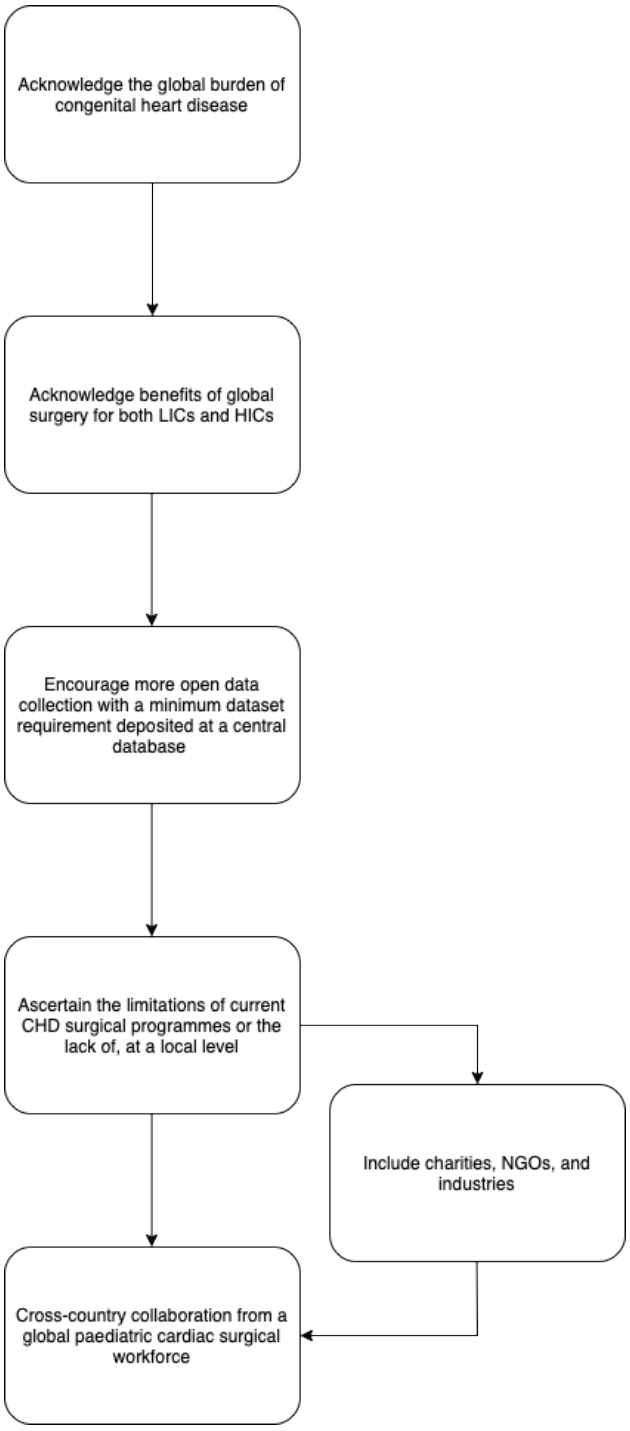

Figure 2. Highlights the steps required for the establishment of Global Paediatric Cardiac Surgery

Finally, there exists a financial burden in maintaining a high-level surgical team and ICU infrastructure necessary for successful CHD surgery. The stark contrast in surgeries performed and surgeons available between HICs and LMICs attests to this[22]. Furthermore, the medical network required to successfully maintain a cardiac centre is extensive and complex; and requires logistical planning. In LMICs, such convenience is not a readily available commodity, and patients find that they cannot access the care available to them, and that the care they receive may not be adequate for survival. Mission trips provide temporary support with travelling surgeons, anaesthetists, and nursing staff. However, when such trips come to an end, the local surgeons are held responsible for less-than-optimal results.

In light of COVID-19, we know change is possible. With the new problems presented by climate change, the pandemic, and the globalisation of all aspects of society, it is important that we too adapt our practices to ensure no child is left helpless. Recent advancements by cardiac surgical organisations have identified the vast surgical inequalities that exist between our borders. The way forward is more enhanced data collection and data sharing, the utilisation of which will allow for workforces to identify limitations at a local level and provide solutions to yield sustainable contributions to further bridge the gross inequalities our neighbours feel.

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