

A healthy heart for all: boosting cardiac surgery access in low-income countries

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A wide disparity is present regarding accessing high-quality health-care services in low-income countries (LICs). In such regions, safe and affordable clinical care and/or surgical interventions are difficult to provide due to several political and socioeconomic factors^[1]. Of note, among invasive surgical disciplines, cardiovascular, and robotic surgery continues to be cited as some of the least accessible operations in LICs^[2]. Considering that deficient healthcare infrastructures are not able to ensure the provision of decent dental, pediatric, and public health services in poor countries, access to cardiovascular surgery and its heavy financial outlay is more difficult and complicated, and often unavailable in several countries^[3].

Cardiovascular surgery is a surgical subspecialty focused on the invasive treatment of pathologies within the heart chambers, valves, and large thoracic vessels. Currently, it remains one of the most competitive fields sought by medical school graduates, with a notoriously demanding training pathway^[4]. Also of note, cardiovascular disease (CVD) is the leading cause of mortality worldwide, with more than 17 million attributable deaths annually; 80% of which occur in middle- and low-income countries. However, despite such drastic statistics, interventional cardiac care remains a relatively low priority on the global public health and global surgery agenda^[5].

Currently, a large disparity in access to cardiac surgical care exists between low- and middle-income countries compared to high-income regions. In fact, of the 313 million surgical interventions made every year, ~6% are performed in the poorest one-third of the world's population^[6]. This statistic is made more frightening when considering that these regions account for 80% of the globe's CVD burden^[5]. More so, when comparing the availability of cardiac surgery centers, in sub-Saharan Africa, excluding South Africa^[7], there is ~1 center per 38 million persons, compared to one center per 120,000 persons in North America and Europe^[8].

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In a study by Vervoort *et al*^[9], utilizing the Cardiothoracic Surgery Network database, the authors noted a worldwide maldistribution in adult and pediatric cardiothoracic surgeons. In the case of adult cardiac surgeons, there were 11.12 adult cardiac surgeons per one million persons in North America, yet this number decreased dramatically to only 0.12 per one million persons in sub-Saharan Africa. More so, despite their massive population in sub-Saharan Africa, no cardiac surgeons were registered in Congo and Ethiopia, while only 1.04 adult cardiac surgeons per million population were documented in South Africa (Fig. 1). Conversely, in the United States, there were 11.54 adult cardiac surgeons per one million people and Monaco was the nation with the highest density of adult cardiac surgeons with 181.82 adult cardiac surgeons per million persons. In the case of pediatric cardiac surgeons, only 0.08 pediatric cardiothoracic surgeons were registered per one million people in Angola and Tanzania, compared to 2.08 per one million people in North America. Similarly to their adult cardiac surgeon counterparts, Congo and Ethiopia did not have any registered pediatric cardi-

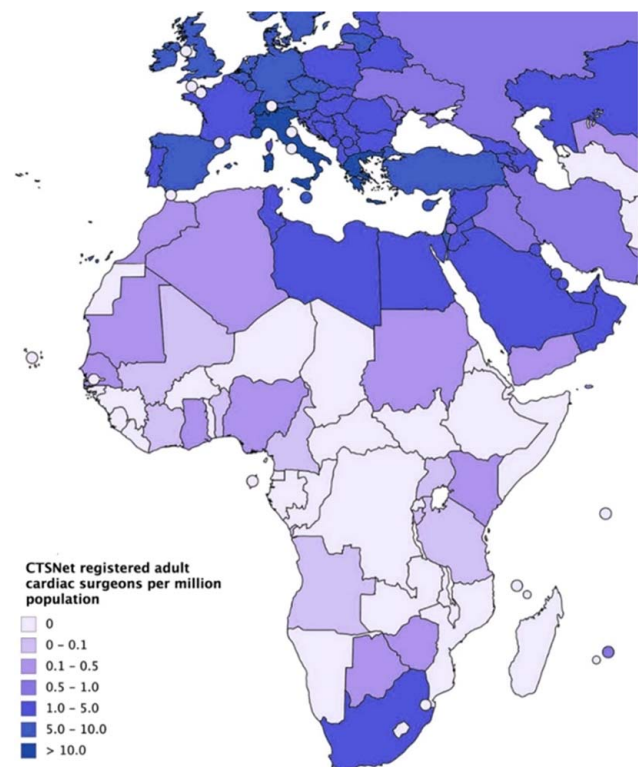


Figure 1. Adult cardiac surgeons per million population registered with the CTSNet in August 2017 ($n = 12,180$). Map created at <http://www.mapchart.net>. CTSNet, Cardiothoracic Surgery Network.

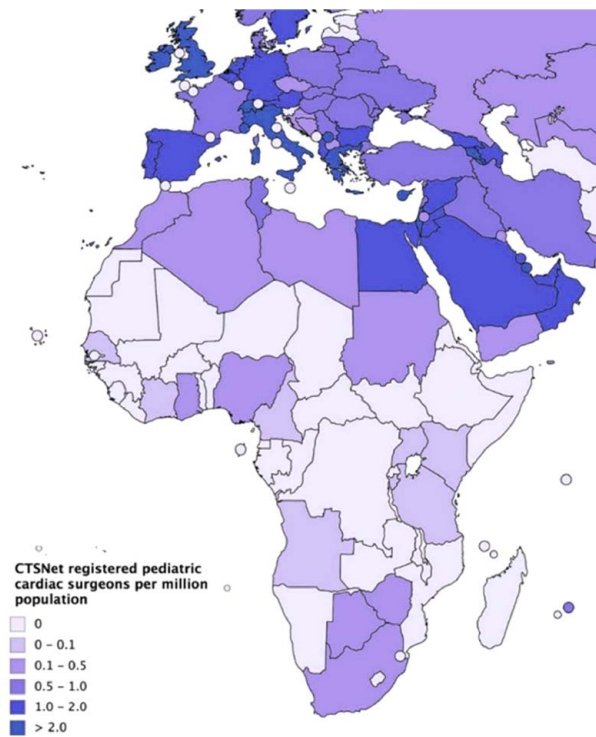


Figure 2. Pediatric cardiac surgeons per million population registered with the CTSNet in August 2017 ($n = 3858$). Map created at <http://www.mapchart.net>. CTSNet, Cardiothoracic Surgery Network.

thoracic surgeons (Fig. 2), while countries like the United States and Monaco had ~2.12 and 25.97 pediatric cardiothoracic surgeons per one million persons, respectively^[9].

Several pertinent limitations hinder cardiovascular surgery access in LICs, including but not limited to a lack of established hospital infrastructures/resources, a low number of trained surgeons/interventionalists, and decreased suitable medical centers for the management of complex cardiovascular pathologies. Moreover, perceived limitations in the quality of regional medical services dissuade many patients from seeking care at local institutions and push those with adequate resources to pursue their cardiovascular surgeries in more developed countries^[10]. For example, in Algeria, it is estimated that more than half a million of the population seek medical treatment abroad, a large percentage of which is cardiovascular patients (<https://laddh-algerie.org/?P=1412>). In addition, the insufficient number of highly skilled cardiac surgeons is one of the strongest reasons for the lack of access to cardiac surgery in poor countries as the availability of qualified surgeons requires several training programs, as well as improved hospital structures and clinical research, all of which remain limited^[11]. Finally, the lack of financial stability in LICs continues to be arguably the most challenging limitation to overcome due to regional sociopolitical instability and lack of established funding sources. In addition, while several underserved areas have historically been able to receive medical services provided by humanitarian/philanthropic efforts, the high cost of

invasive cardiovascular operations makes it unfeasible to provide to a large number of patients^[10] (<https://www.acc.org/latest-in-cardiology/articles/2020/11/19/14/33/financing-cardiac-surgery-in-low-and-middle-income-countries>).

Improving access to high-quality cardiovascular surgery in LICs require a multifaceted targeted initiative, with an emphasis on improved hospital resources, clinical care, and surgical training pathways for postgraduate applicants. We highlight the following: First, establishing high-quality training pathways for cardiovascular surgeons in LICs, as well as increasing the number of available academic and surgical positions is paramount. This may be facilitated through scientific and medical interchangeable conferences and webinars with developed countries such as the United States and European countries. It is also imperative to improve clinical research, which is the keystone of medical and surgical disciplines and crucial to the progression of cardiac surgery. Also, workforce educational meetings, practice facilitation, professional society feedback and guidance, and conferences are strongly recommended to be included in future cardiac surgeon's paths^[12]. Next, there is an urgent need for the development of a more comprehensive and responsive primary healthcare system, equipped with a strong knowledge of the quality of health services, funding, models of care, management policies, and reimbursement strategies. Taking inspiration from other nations that have perfected such modalities and the formation of international partnerships seems to be a strong starting point^[9,12]. In addition, community involvement plays a vital role in improving healthcare and especially cardiac surgery. Community participation in Global Cardiac surgery research^[13] will offer various advantages through solving problem skills, taking responsibility, and making decisions^[14].

Regarding financial stability, there is no denying that improved economies in these regions will be needed to ensure sustainable progress. Of note, the high cost of cardiac surgery, supporting underserved patients and communities, building suitable infrastructures, improving clinical research, and ensuring regular patient follow-up monitoring and visitations can only be achieved in the presence of a strong economy that will finance all these aspects^[12,15]. Local leaders should seek financial support through professional societies, humanitarian organizations, and local government entities, when available. In this regard, transparency is crucial; hospital and healthcare leaders must make active efforts to disclose where funding is going and use quantitative metrics to record, analyze, and showcase progress to foster improved trust and increase donor interest. Mobilizing social media campaigns may also be helpful in this regard.

In closing, despite having a large proportion of civilians with CVD, access to invasive cardiac care in LICs remains limited and far beneath access seen in more affluent regions. Efforts must be made to improve economic stability in these regions and to provide healthcare institutions with adequate resources to train and employ qualified surgeons and interventionalists. Advocacy by professional surgery societies and stakeholders, as well as community participation in Global Cardiac surgery research may also be utilized to help provide sustainable change. A healthy heart should not be looked at as a privilege for those who can afford it, but as a human right in a just world. Initiative is needed to help fulfill this promise, and it is needed now more than ever.

Ethical approval

No ethical approval was given as it is not an experimental or observational study.

Informed consent

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Author contribution

A.K.A. contributed in data collection and writing and accepted the final draft. A.A. contributed in data collection and writing and accepted the final draft. Both A.K.A. and A.A. are first authors to this paper. O.A.A.M. contributed in data collection and writing and figure format. M.A.R. contributed in writing and data collection and revised the paper.

Conflicts of interest disclosure

The authors do not have any conflicts of interest.

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Data availability statement

This manuscript does not contain original data.

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