

Analyzing the Impact of Cardiothoracic Surgery Rotation in Africa on The Interest and Perception of Medical Students Towards a Career in Cardiothoracic Surgery - A Continental Cross Sectional Study

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Abstract

Objective: Globally, there have been a gradual decline in medical students' interest to consider cardiothoracic surgery as a future career. Recruiting African medical students to cardiothoracic surgery is important given projected cardiothoracic surgeon shortages in Africa and new training models. With little representation of cardiothoracic surgery in medical school curriculum, we assessed the impact of cardiothoracic surgery rotation in Africa on the interest and perception of medical students towards a career in cardiothoracic surgery.

Method: A cross-sectional study was carried out in which a Google form e-survey was disseminated to African clinical medical students between September 5th and October 5th, 2022. The questionnaire included a five-point Likert scale, Yes/No questions, free-text questions and multiple-choice questions. Data on exposure and length of cardiothoracic surgery rotation and perception of, and interest in, cardiothoracic surgery were collected. Data was analyzed using

Result: A total of 527 participants take our questionnaire with the majority being males 305 (57.9%). Most participated age group was 21-25 with 360 (68.3%) participants. The countries with highest participations rates were Kenya, Africa, Ivory Coast, and Ghana with 71 (13.5), 64 (12.1), 53 (10.1), and 44 (8.3), respectively. Most of our responders were medical students at either 5th year 154 (29.2%) or 6th year 129 (24.5%) of medical school. 247 (46.9%) stated that they don't have a cardiothoracic surgery (CTS) rotation as an option in their surgical training while 230 (43.6%) stated to have a CTS rotation in their hospital of whom only 182 (34.5%) have been exposed to CTS rotation. Of whom exposed to CTS sortation the duration was either one to two weeks or less than a week with 64 (12.1%) and 50 (9.5%).

Conclusion: This study shows the importance of quality cardiothoracic surgery exposure and its impact on medical students' interests in pursuing a career in CTS. The negative relationship between exposure and interest in CTS can be linked with the realization of the barriers that come with pursuing CTS. Mentorship is essential in closing the gap between male and female medical students regarding their interest in pursuing a CTS residency slot

Keywords: medical students; cardiothoracic surgery; interest; perception; africa

Abbreviations

CT- Cardiothoracic

CTS- Cardiothoracic Surgery

Introduction

Cardiovascular disease (CVD) is the leading cause of death in the world and is responsible for 17.5 million deaths each year, 80% of which occur in low and middle-income countries [1]. Most cardiovascular diseases (CVDs) often require surgical intervention, especially congenital heart disease (CHD), rheumatic heart disease, ischemic heart disease, and valvular and

aortic conditions. More than 6 billion people lack access to necessary cardiac surgical care in low- and middle-income countries (LMICs) [2]. Despite this, there has been a looming shortage in the number of cardiothoracic surgeons compared to the prevalence of cardiovascular conditions that would require surgery. Low-income countries have 0.04 adult and 0.03 Paediatric cardiac surgeons per million population, compared to 7.15 adult and 1.67 Paediatric cardiac surgeons in high-income countries [3].

Cardiothoracic manpower is relatively unavailable in West Africa. The availability of cardiac surgeons per million of the population in North America and Europe is more than 10 times the figure for Africa [3]. In 2011, it was reported that the number of active cardiothoracic surgeons in Nigeria was about 26 whereas only 22% were active in cardiac surgery [4]. In 2018, there were 40 cardiothoracic surgeons with an estimate of about 2–4 cardiothoracic surgeons' output per annum [5]. Without a paradigm shift by the Medical and Dental Council of Nigeria, and other stakeholders to effective changes in the medical school curriculum, it will take years to close the workforce gap [5]. Hence, the role of cardiothoracic surgical rotation cannot be overemphasized and as such, there is a need for a compensatory rise in the number of medical students who will develop and sustain their interest in choosing cardiothoracic surgery as a career.

Clinical experience is important in cultivating the interest and confidence in selecting any specialty for residency and fellowship; [6-13] however, there is limited research in Africa on the impact of cardiothoracic surgery rotation on medical students' perception and interest in pursuing a career. It is critical to identify medical students' current perceptions of the specialty in order to determine the actions needed to maintain specialty interest and ensure adequate recruitment in the future. Specialty exposure is the most common factor associated with interest [14]. Other factors that may influence specialty interest include current perceptions of cardiothoracic surgeons, the changing demographics of medical students, social pressures of the job, and the rigorous training pathway [15].

Ideally, surgical rotations in cardiothoracic units by medical students will give them timely exposure to the field and arouse their interest from an early onset [16]. This would naturally initiate a professional relationship between the consultants and the students to build and foster a mentor-mentee arrangement that would ease their journey in pursuing a career in cardiothoracic surgery [16]. This will not only make it a consideration but will make them well committed to becoming cardiothoracic surgeons. In a study conducted in 2017, 72% out of 110 cardiothoracic resident doctors who underwent cardiothoracic surgical rotation believed that the cardiothoracic rotation they had in medical school had a huge influence on their surgical career generally [17].

A previous study showed that receiving appropriate exposure to cardiothoracic operations and disease management was strongly linked with improved satisfaction ratings for cardiothoracic procedures, particularly for the treatment of lung cancer, empyema, and pleural effusions [18]. Positive correlations between beneficial exposure and effective mentoring and the lack of abuse were also been found [18]. Therefore, a resident doctor's preference for a future in cardiothoracic surgery may be influenced by their medical school's exposure to the field. This study provides a detailed analysis of the impact of cardiothoracic surgery rotation in Africa on the interest and perception of medical students in their choice of cardiothoracic surgery as a career.

Methodology

The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines was used to report cross sectional study [19].

Study Design

A continental cross-sectional survey of African medical students was carried out using a self-administered electronic questionnaire (Google form). Those eligible for this study were medical students studying in Africa who were in

their clinical years (fourth to sixth year or higher year of study) while those ineligible for this study were medical students studying in Africa who were in their preclinical years (first year to third year). This group was excluded because they had not done any formal clinical rotations arranged by their medical schools.

Sample Size

It was a challenge establishing the minimum sample size required for this survey due to the fact that there is currently no published data on the total number of medical students enrolled in African medical schools

Data Collection

A 29-item, electronic survey (e-survey) was developed by a group of medical students and a cardiothoracic surgery resident using Google Forms. The questionnaire was categorized into four sections: socio-demographic characteristics, cardiothoracic surgery rotation information and pre-training/training information. The questionnaire included a five-point Likert scale, Yes/No questions, free-text questions and multiple-choice questions to improve the granularity of the data collected. Every question in the survey required a response to reduce any potential missing data at submission. A pilot survey was distributed to 10 clinical medical students in Africa who were randomly selected. These medical students were not involved in the conception or design of the study and this was done to seek feedback, improve clarity, and ensure objectivity.

Clinical medical students in the African continent were invited to complete the online questionnaire between September 5th and October 5th, 2022. The questionnaire was made available in both English and French language to increase broad coverage. The English version of the questionnaire was designed by four authors (FA, AO, DV and IH) and translated to a French version by one of the authors (FA) who is a native French speaker.

The questionnaire was distributed via social media platforms (Telegram, Facebook, WhatsApp, Facebook and Twitter) and through the Executives of medical student associations in various countries. Participation for this study was voluntary, and those who participated were informed before starting the survey that all data collected was non-identifiable and it would serve for the purposes of analysis, distribution and publication. The first page of the questionnaire contained the mandatory selection box for the participants to consent to participation and confirm that this was their first time completing the survey. This ensured a 100% consent rate. Participants who were not willing and those who were unable to give consent for the study were excluded.

Data Analysis

Responses were retrieved from the google forms in the form of Microsoft Excel. Afterward, the data were analyzed using R software. Categorical data were reported as frequency/percentage. Continuous data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov–Smirnov and Shapiro–Wilk tests). Between-group comparisons were analyzed by one-way ANOVA. Associations between different parameters were analyzed through Chi-Square test and logistic regression.

Ethical Approval

Ethical Approval was obtained from Ethics Committee RECRResearch. Informed consent (online) was obtained from the participants before the commencement of the study.

Result

Sociodemographic Characteristics

A total of 527 participants takes our questionnaire with the majority being males 305 (57.9%). Most participated age group was 21-25 with 360 (68.3%) participants. The countries with highest participations rates were Kenya,

Africa, Ivory Coast, and Ghana with 71 (13.5), 64 (12.1), 53 (10.1), and 44 (8.3), respectively. Most of our responders were medical students at either 5th year 154 (29.2%) or 6th year 129 (24.5%) of medical school. Our participants did their surgical training at a teaching hospital 361 (68.5%) or university hospital 108 (20.5%) with nearly 80% 421(78.2%) stated that they didn't predetermine their surgical sub-specialties.

Cardiothoracic Surgery Rotation Information

247 (46.9%) stated that they don't have a cardiothoracic surgery (CTS) rotation as an option in their surgical training while 230 (43.6%) stated to have a CTS rotation in their hospital of whom only 182 (34.5%) have been exposed to CTS rotation. Of whom exposed to CTS rotation the duration was either one to two weeks or less than a week with 64 (12.1%) and 50 (9.5%). In the CTS rotation, most of participants either participated in teaching sessions 193 (36.6%), in-patient clinical ward rounds 178 (33.7%), or bedside procedure observations 128 (24.2%) with only 6 (1.1%) students witnessed 3D training session. Furthermore, most 324 (61.5%) of those who got CTS training felt that they weren't actively taught most of whom were males 190 (62.3%), yet only quarter 138 (26.2%) were actively taught by their supervisor CTS surgeon. The general state of upset from the CTS rotations may be attributed to the feeling that time allocated to rotation was inadequate 410 (77.8), yet only 54 (10.2%) agreed and 63 (12%) were felt maybe time was adequate.

Pre-Training/Training Information

Regarding a defined route for CTS training in their countries, 202 (38.3%) had a defined route while 168 (31.9%) has no define route for CTS training. Among our participated countries, CTS training took 6 years or less 138 (26.1%) while 147 (27.9) were not sure about training years. Of those who had CTS training at their hospitals, when asked about the efficacy of their CTS training to produce surgeons goes along the global scale 119 (22.6%) agreed, 108 (20.5%) disagreed, yet most of them were neutral 196 (37.2%). 141 (26.8%) participants -78 (25.6%) males and 63 (28.6%) females-disagreed, while 225 (42.7%) were neutral regarding having adequate CTS research opportunities at their institutions. Moreover, the opportunity to present research project at either local or international CTS conferences couldn't be assessed by 241 (45.7%) were neutral about opportunities, and 121 (23.0%) disagreed on having opportunities, while only 89 (16.9%) agreed. Despite the lack of research project and ability to attend conferences, medical students were able to scrub and attend CTS procedures with 168 (31.9%) agreed on this -most of them were males 106 (34.8%)- 138 (26.2) were neutral, and only 107 (20.3%) disagreed. Most of participants were neutral 229 (43.5%) about CTS surgeons having good work life balance with 73 (13.9%) agreeing vs 100 (19.0%) disagreeing. Thus, 154 (29.2%) were neutral that CTS rotation influenced their decision to specialize in CTS, yet 137 (26.0%) disagreed with only 75 (14.2%) agreed. For medical student, CTS rotation was adequate for the level of knowledge required at the time for 107 (20.3%) while 132 (25%) disagreed that it was adequate.

With 400 (75.9%) -mostly males 236 (77.4%)- finding CTS an interesting subspecialty and 237 (45.0%) agreeing on embarking on training in CTS -mostly males as well 139 (45.6%); Fortunately, 133 (25.2%) -mostly males 76 (24.9%)- disagreed that gender-based disparities in surgery have influenced the likelihood to embark on cardiothoracic surgery with 186 (35.3%) were neutral -mostly females 72 (32.7%)- and 66 (12.5%) agreeing on this, respectively. However, 185 (35.1) were neutral and 86 (16.3) disagreed upon that exposure to CTS rotation increased their interest in the specialty with 111 (21.1) agreeing that lack of having CTS rotation has negatively affected their interest in CTS.

Furthermore, we run a logistic regression to find factors that might affect choosing a CTS training to find that not only 2-3 weeks duration of CTS rotation affected positively choosing CTS as specialty (p value 0.027), but also those who disagreed that their institutional CTS training adequate to produce surgeon on global scale tend to embark CTS surgery (p value 0.032).

Discussion

Just like any specialty, it is important that a consistent stream of dedicated and passionate young medical doctors is recruited into the cardiothoracic surgery career pathway in order to maintain and drive its evolution [20]. A lot of medical and surgical specialties in different parts of the world make a push towards early tracking and specialization. These early elective or clinical rotation experiences are an avenue for a specialty to increase awareness of these specialization pathways [21,22]. Exploring the link between cardiothoracic rotation and the perception and interest in which medical students in Africa may have towards cardiothoracic surgery as a career is important in order to adjust and improve current approaches. Understanding African medical students' perception of Cardiothoracic surgery as well as their attitudes towards different aspects of the career pathway is important so as to stipulate recommendations to increase their access and interest in Cardiothoracic surgery early in medical school.

An important element of developing medical students' interest in Cardiothoracic surgery is exposure to the specialty during medical school via clinical rotations [23,24]. Our study found that with increased cardiothoracic surgery exposure, the interest in the specialty increased. A previous study conducted among medical students at University of Pittsburgh showed that exposure to clinical rotation, residents, faculty and use of simulation had an impact and potentially increase student interest in CT surgery [14]. This was Contrary to what was found by Samuillah Dost et al, where with increased CTS exposure, interest in the specialty among medical students decreased [25]. In another study, Coyan et al. assessed the efficacy of a CTS mini-elective for medical students and found that it greatly increased participants' ability to find a CTS mentor and increased their interest in the field [26].

One major finding from this study was the fact that a little percentage of the participants had been exposed to CTS rotation. The lack of exposure to cardiothoracic surgery was due to the lack of cardiothoracic surgery rotation in most countries in Africa. Repetitive exposure is very effective at creating a good understanding of the clinical presentation, pathophysiology, and treatment topics covered within a specialty [27]. Clinical rotations for medical students, which varies across institutions globally regarding exposure to CTS, will always pose a challenge as we aim to positively influence students' viewpoints on CTS [9,28]. In this vein, clinical or pre-clinical school years may be an important target for recruitment and introduction into the specialty in the future [28].

Even with the negative effect of the lack of clinical rotation in surgical specialties on career choices, the accessibility to Cardiothoracic Surgery like other smaller specialties, is very often limited to large high-volume centres. Even those that are affiliated with medical schools may not offer enough placement opportunities to accommodate the number of medical students. However, this results in limited opportunities for medical students to gain exposure and scrub in theatres. This is supported by data from a previous study conducted in United Kingdom, in which only 10.46% of the medical students had a placement in Cardiothoracic surgery [16].

Our study revealed the influence of gender on the specialty choice. A study conducted in the United States of America some years ago which examined the differences in CT surgery interest between genders showed less baseline interest in female medical students, but there was a desire by a lot of them to become more aware of the field via mentorship and clinical exposure [29]. Another study conducted among medical students in United Kingdom also revealed that the percentage of medical student interest in CTS was greater in men than women at all stages of medical school. This was even with the fact that the exposure for female medical students was higher than that of male medical students during intercalation, however this might represent a small number of respondents [25].

Hiryama et al also added that the major barrier differentiating female and male surgeons' career progression is the culture supporting an inflexible training pathway, restricting permitted time out and furthermore leading to

male domination in the surgical specialty [30]. This is strongly aggravated by the competitive nature of this specialty, where taking extended leaves due to family commitments [31] may be feared by female medical students as an obstacle to their career, maybe decreasing overall interest in applying for CTS [32, 33, 34]. From our study, inadequate exposure to the specialty as well as lack of mentorship could explain this gender difference however this finding could be explained by the fact of increasing exposure to various other specialties progressing through clinical rotation. The findings from our study of a lower baseline interest in CT surgery among females add to the evidence that recruiting efforts to increase female representation in CT surgery should be increased.

Poor work–life or lifestyle factors balance is an unfortunate reality in which many CT surgeons face that discourages most of them who want to balance home and work life [32]. From our study, Work-life balance was a perceived reason why the medical students were not interested in cardiothoracic surgery as a career in future. A study conducted by Preece and colleagues revealed that long working hours was one of the most common reasons why medical students do not want a cardiothoracic surgery career [35]. Clearly, there are data to support this with multiple surgical emergencies that demands immediate intervention by CT surgeons [36,37]. Surgical emergencies do not constitute a vital part of a CT surgeon's practice, and familiarity with practice patterns may help inform medical student opinion pertaining to lifestyle. Increasing training posts for cardiothoracic surgery can solve this problem because it will reduce the competitiveness and increase the future workforce of cardiothoracic surgeons, thereby resulting in a reduction in work pressure and an improved work–life balance for the surgeons.

In America, Medical students who apply for integrated CT surgery residency programs have been seen to be interested in academic careers in CT surgery through dedicated research time. This has led them to have a lot of peer-reviewed publications at the time of residency application [38]. Our study revealed that majority of the medical students in Africa do not have adequate research opportunities in CTS and even the ones that have these opportunities do not have the access to present these research abstracts at local or international CTS conferences. This contributed to these medical students lack of interest in cardiothoracic surgery as a future specialty. A study conducted by Trehan et al. evaluated the effect of a 4- to 8-week scholarship in clinical or research activity on CTS interest of the second-year as well as the first-year medical students. Out of all the medical students who received the scholarship, about 44% remained interested in CTS throughout medical school. Out of all the medical students who had received this scholarship that matched into General Surgery residency, 73% remained interested in CTS [12]. Medical students should make a decision very early on to set themselves up for success in their residency application, as building research portfolios and specific interests is becoming a criterion for career growth and specialization in the future [39]

Study Limitations

Even though our study analyses the responses of 527 medical students across 35 nations within Africa, there was a preponderance of responses from students based in Kenya, Ivory coast, Nigeria, Ghana and Ethiopia. Due to this fact, our sample distribution and size may show a degree of underrepresentation of African clinical medical students within some nations across Africa. Furthermore, the survey was only distributed in French and English. Distributing the survey in other languages, such as Arabic and Portuguese, would have helped to enhance the diversity of representation and reach a larger population of the medical students. Although, due to resource constraints, that was not possible. Moreso, given the mode of data collection for the survey, some recent medical graduates and preclinical medical students who were ineligible for the study may have responded. In addition, medical students in areas with poor access to the internet or unstable internet connection or those in rural areas may have been unable to participate in the survey. Finally, some of the questionnaires were distributed on specialty

interest social media groups; however, selection bias was present as medical students who were more likely to have been exposed to cardiothoracic surgery through clinical rotation were targeted.

Conclusion

This study shows an interesting link between cardiothoracic surgery rotation and students' interests in pursuing a career in Cardiothoracic Surgery. The implementation of a clinical rotation in cardiothoracic surgery for medical students increases interest and exposure to the field of CT surgery. The rotation encourages medical student interaction with faculty/residents in CT surgery and also provides a valuable insight for these residents/faculty into the challenges experienced by medical students, and factors which are seen as barriers or motivators in pursuing CTS. Clinical rotation is important in recruiting and retaining the highest-performing African medical students to the field of CT surgery to battle the impending surgeon shortage in Africa. Mentorship is also essential in closing the gap between male and female medical students regarding their interest in pursuing a CTS residency slot, as identified by our study. Longitudinal studies encompassing focus groups will be needed to thoroughly understand medical students' perceptions of this demanding specialty including the barriers and attractive aspects of it. This would give a more holistic view and provide for targeted recommendations for methods to improve CTS rotation for medical students in Africa at the most appropriate time in their education.

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