

# Global geographical discrepancy in numerical distribution of cardiovascular surgeries and human resource development in South Asia



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## ABSTRACT

**Objective:** The region South Asia is in the south-central part of the Asian continent. The 8 countries of the area, Afghanistan, Bangladesh, Bhutan, India, Nepal, The Maldives, Pakistan, and Sri Lanka collectively possess 1.8 billion people living in 5.1 million square miles. Covering 2.96% of World's surface, this area is inhabited by 23.9% of the world population. The objective of this study was to observe the number of cardiac operations in South Asia and the human resource development facilities of cardiac surgery in the region.

**Methods:** Information was collected from the surgeons and anesthesiologists through personal visits, phone calls, and emails. The websites of various organizations were also checked.

**Results:** The estimated number of cardiac operations collectively performed in the South Asian countries was between 250,000 and 300,000 as of 2019. With more than 6 times the US population, these nations combined performed less than half of the annual number of cardiac operations performed in the United States. The number of operations per million population ranged from 62 to 271 in different countries. This indicates that there should be more capacity-building of surgeons to meet the growing demand of operations. India, Pakistan, Bangladesh, Sri Lanka, and Nepal have their own education and training systems for cardiovascular surgeons. A substantial portion of the seats available for cardiovascular surgery courses remained vacant in South Asia these days.

**Conclusions:** Five countries have their various surgical education and training programs. There should be coordinated efforts to increase the production of new cardiac surgeons in the region. (JTCVS Open 2022;11:192-9)



South Asia at a glance.

## CENTRAL MESSAGE

To face the prevailing numerical discrepancy in distribution of cardiac surgery, capacity-building of experts is to be enhanced to ensure cardiac care for 24% of the world population living in South Asia.

## PERSPECTIVE

There is a prevailing global geographical discrepancy in the numerical distribution of cardiac surgery. The available expert human resources in South Asia are far less than the actual demand. A coordinated planning for capacity-building should be carried out with participation of all concerned to ensure adequate cardiac care for almost a quarter of the human population currently living in this part of the world.

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### Abbreviations and Acronyms

BACTA = Bangladesh Association of  
Cardiothoracic Anesthesia

CVD = cardiovascular disease

IACTS = Indian Association of Cardiovascular-  
Thoracic Surgeons

MCh = Master of Chirology

MS = Master of Surgery

OOP = out of pocket

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South Asia is a geopolitical, cultural, and historical region located in the south-central part of continental Asia (Figure 1). Starting in the north from the mountainous ranges of the Himalayas, it continues down the Indian peninsula toward the ocean. Afghanistan, Bangladesh, Bhutan, India, Nepal, The Maldives, Pakistan, and Sri Lanka are the 8 South Asian nations (Figure 2). These countries collectively possess an area of 5.1 million square miles and are inhabited by a large population of 1.8 billion. Thus only 2.96% of world's land area is inhabited by 23.9% of the world population.<sup>1</sup> This makes South Asia the most densely populated part of the world. Despite having a fertile soil pattern and a tolerant climate, the high burden of dense population and centuries of colonialism have put South Asia in a difficult situation of poverty and sufferings. South Asia is one of the most linguistically diverse areas in the world with 4 language families comprising more than 600 individual languages.<sup>2</sup> However, 2 centuries of British colonial rule have given English a special status in the region. English is also the medium of undergraduate and postgraduate medical studies in South Asia.

There remains a gross discrepancy in the distribution of the world's wealth. This includes various service sectors including health care facilities. Cardiovascular ailments are the most common cause of human suffering and are responsible for 179 million deaths annually, which accounts for 32% of all global deaths.<sup>3</sup> High-income countries have cardiovascular disease (CVD) death rates of approximately 38%. CVD deaths (28%) in low- and middle-income countries show a great range of variation starting from as high as 58% in Eastern Europe to as low as 10% in Sub-Saharan Africa. CVD is the largest cause of death in all of the developing regions apart from Sub-Saharan Africa. Even there it is the leading cause of death in those older than the age of 45 years.<sup>4</sup> So, heart diseases are major health concerns all over the world. Most of these CVD mortalities and morbidities are either preventable or reducible with adequate

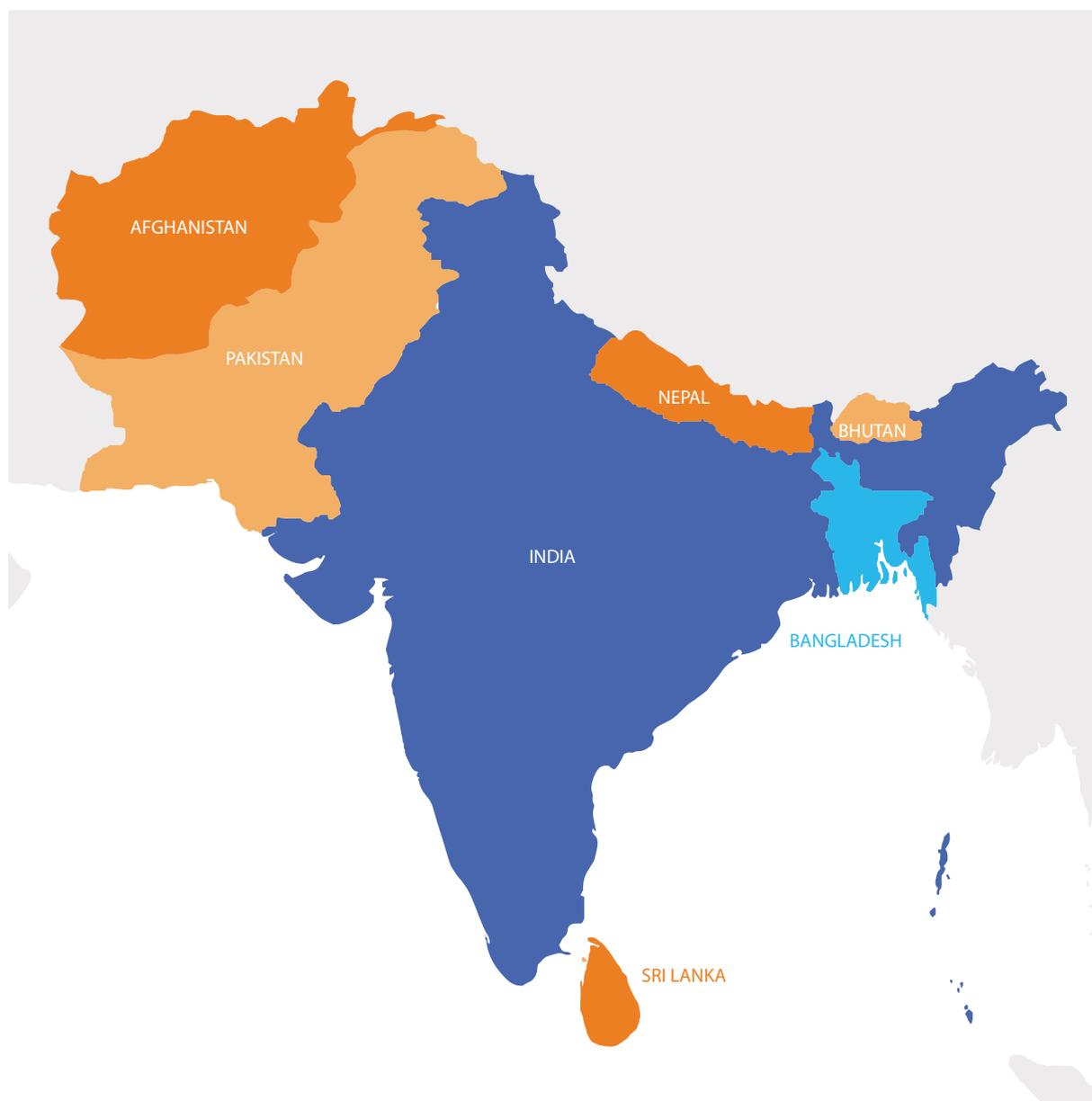
treatment. However, the treatment facilities available for CVD differ in terms of quality and quantity among different regions. There is a global commitment to reduce premature CVD by 25% by 2025.<sup>5</sup> All of the countries are committed to work towards that goal.

According to the World Bank Report (2019), 72.7% of current health expenditures in Bangladesh are out of pocket (OOP) spending, a figure much higher than the global average OOP spending of 18%. The OOP of neighboring South Asian countries are also much higher than the global figures. OOP health care spending of Afghanistan is at 79.3%, India 54.8%, Nepal 57.9%, Pakistan 54%, and Sri Lanka 45.6%. As a region South Asia has the highest percentage (56%) of OOP health care spending of the world. This South Asian aggregated OOP health care spending is even more than those of Sub-Saharan Africa (29.9%), least developed countries (50.6%), heavily indebted poor countries (41.2%), or fragile and conflicted affected situations (50.2%).<sup>6</sup>

There has not been much research work on health care spendings in South Asia. The average cost of a coronary artery bypass grafting operation or a single-stent percutaneous coronary intervention procedure in Bangladesh is higher than the per capita gross domestic product of Bangladesh. The scenario is similar in some other neighboring countries as well. These numbers are alarmingly contrasting, and inevitably large and unpredictable health payments because of severe cardiac ailments can expose households to a substantial financial risk and, at their most extreme, can result in poverty. Catastrophic health event expenditure is one of the major reasons for poverty in Bangladesh.<sup>7</sup> It is estimated that the poverty head count increased by 3.5% (5.1 million individuals) because of OOP health care payments.<sup>8</sup> This could mean immense financial burden on patients in Bangladesh because most patients have to rely on OOP expenditure. These all make the economic aspect an important matter of consideration in deciding the suitable treatment modality. The most challenging factor in ensuring proper cardiac care is providing a qualified human resource. The local medical educational institutions are to play a big role in capacity-building of the health care providers in cardiac surgery. The South Asian nations have some medical institutions serving this purpose. Although not adequate in numerical values, these institutions have played a significant role in providing human resources for providing cardiac care in this region.

### METHODS

Surgeons in general are not famous for proper record-keeping. This is more so in South Asia, where data collection and management have always been a problem. The data related to cardiac surgery was difficult to collect and compile. However, the academic records are better maintained compared with the clinical data. Information was sought in terms of the list of centers, the number of operations, surgeons, anesthetists, and perfusionists as well as ongoing academic activities.



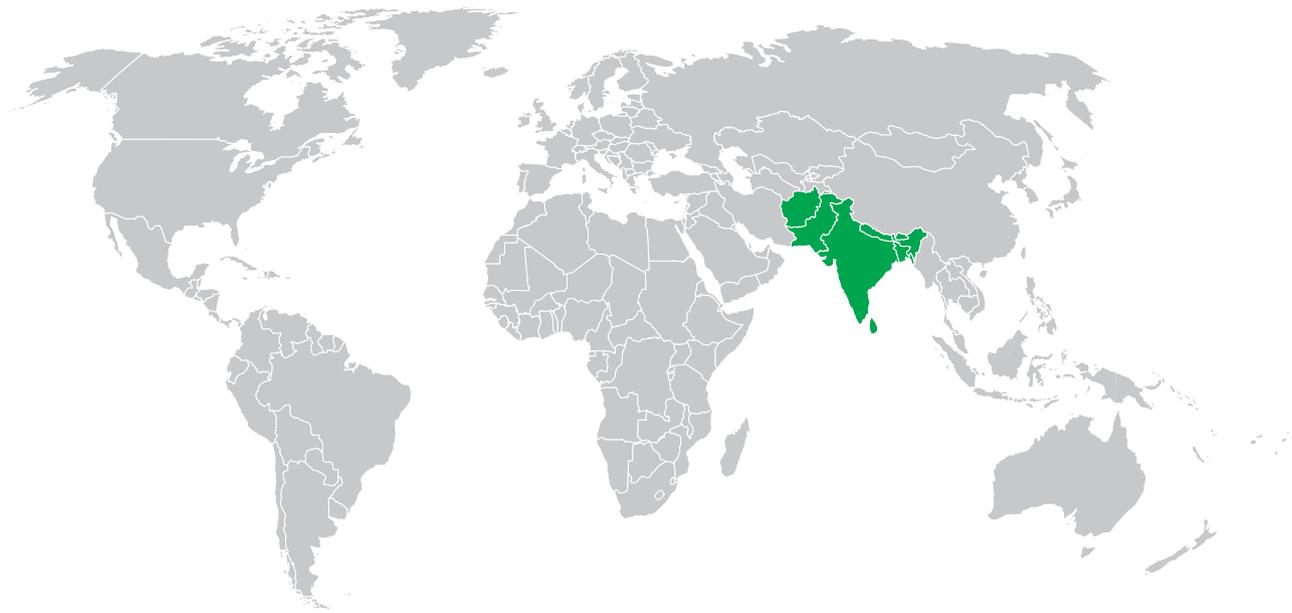
**FIGURE 1.** South Asia at a glance.

The corresponding author personally visited all of the South Asian countries except Afghanistan and contacted the eminent surgeons in person or by mail. The office bearers of the associations of cardiac surgeons, cardiologists, and cardiac anesthetists were also contacted. Among the South Asian nations, Indian cardiothoracic surgeons have their well coordinated organization, “Indian Association of Cardiovascular-Thoracic Surgeons” (IACS). The IACS was contacted through emails, phone calls, and personal visits during their annual conferences in search of the relevant information. In addition, 11 individual Indian cardiothoracic surgeons from different regions of the country had also been contacted to request the data in their possession. The selection of surgeons was purposive, on the basis of earlier acquaintance with the corresponding author.

The organizations of the cardiothoracic surgeons from the other South Asian nations are either not so well organized or totally nonexistent. Available organizations had also been contacted, but better information came from the individual surgeons of the countries concerned. The Pakistan

Association of Cardiothoracic Surgeons is the organization of the cardiothoracic surgeons of Pakistan. In addition, 4 individual cardiac surgeons were also contacted on the basis of previous contacts and acquaintance with the authors. Most of the senior Nepalese cardiothoracic surgeons were educated and trained in Bangladesh. Four such surgeons in Nepal were contacted in search of information. These surgeons provided useful information regarding the situation in Nepal.

The Bangladesh Association of Cardiothoracic Anesthesia (BACTA) is the association of the cardiothoracic anesthesiologists of Bangladesh. It gathers information from its members regarding the number and type of cardiac operations performed. They compile the collected data and present at their annual conference before finally publishing in their journal. Because the anesthetists have no direct conflict of interest in these numerical values, the data collected by them is usually authentic and reliable. That is why the most accurate figures of the number of cardiac operations are available from Bangladesh among the South Asian nations.



**FIGURE 2.** South Asia on the world map.

In this article, the major source of information from Sri Lanka was the industry people. Manufacturers and traders of oxygenators, valves, and other items often maintain excellent databases of their own. These could be good sources of information. However, this information is often available in truncated form and might be biased because of their commercial interest. The major manufacturers and traders were requested to provide the available information from their database. In some cases, they provided important pieces of information as for Sri Lanka, whereas in some other cases they supplied valuable missing links. The websites of concerned academic institutions and various degree-awarding bodies were also examined.

All of the information from various sources was compared and cross-checked. Because of the diverse origin and format, these had to be carefully validated and compiled.

## RESULTS

Because of poor record-keeping and incomplete database, the actual number of cardiac surgeries in South Asia is hard to determine. Ironically, the most reliable figures often come from the anesthetists, the manufacturers, and the merchandisers. The number of cardiac operations collectively performed in the South Asian countries was estimated to be between 250,000 and 300,000 as of 2019, the last year before the COVID-19 pandemic. So, with more than 6 times the US population, the South Asian nations are combined performing less than half of the annual number of cardiac operations in the United States. India performs the highest number of cardiac operations in the region with an estimated number of approximately 200,000 cases. Unfortunately, there is no well maintained database covering the different regions of India. In their 2008 annual conference IACTS claimed that the annual number of cardiac operations then had been between 70,000 and 80,000 in 174 Indian centers nationwide. Despite repeated requests, IACTS could not provide any recent data. In personal

communications, the IACTS Secretary provided an estimated figure of 200,000 cases in 2018. Analyzing the information from various sources, we concluded that 200,000 could be accepted as a reasonable number for India for 2019.

Because of smaller population size and fewer centers, estimation is comparatively easier for the other South Asian nations. Pakistan performed an estimated 28,000 cases in 49 centers in 2019. Most Pakistani centers are in Karachi, Lahore, and a few other major cities. That makes data compilation relatively easier. The most precise data were available from Bangladesh because the anesthetists' association BACTA collected the numbers from each center and then compiled those yielding the accurate numbers. A total number of 12,926 operations were performed by 28 different centers in Bangladesh in 2019. From the data provided by BACTA, it is also known that 67% of the operation in Bangladesh in 2019 were coronary artery bypass graftings, whereas valvular cases were 12%, congenital 20% and others constituted 1% (Figure 3). A detailed breakdown of operation figures is not available from other South Asian countries. Sri Lanka and Nepal performed approximately 6500 and 2800 operations, respectively.

When the country population is taken into consideration as the 2017 numbers shown in Table 1, Sri Lanka had the best figures at 265 operations per million population followed by India (113), Pakistan (108), Nepal (69), and Bangladesh (69). These numbers are far less than those of the Western world. These figures indicate that the required number of surgeries are not being performed. There is an apparent lack of surgeons and other relevant human resources like nurses, perfusionists, and technicians. There

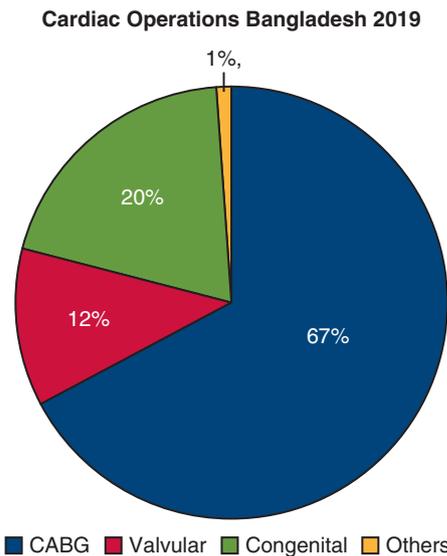


FIGURE 3. Cardiac operations in Bangladesh 2019 according to type.

should be efforts toward more capacity-building of the cardiac surgeons to meet the growing demand of operations.

Table 2 shows the number of cardiac surgeons in the South Asian countries. India has the highest number of cardiac surgeons. This is simply the reflection of the biggest population of India in the region. Sri Lanka has the best population:surgeon ratio with 863,000 people for each cardiac surgeon. Pakistan, India, Bangladesh, and Nepal follow them in ascending order of population per cardiac surgeon. However, these figures might often be confusing on the basis of how a cardiac surgeon is defined. A surgeon may be included mere by holding a degree in the relevant subject or may be counted only if he or she can perform cardiac operations independently or by a combination of both. Whatever the definition, one thing is clear that the population:surgeon ratio is much worse than that of the West. Thanks to a steady flow of production of cardiac surgeons, there is a 20% to 30% increment in the number of cardiac surgeons in these countries between 2017 and 2022. The growth in the number of cardiac operations was not as per expectation in 2020 and 2021 because of the COVID-19 pandemic. Many scheduled operations had to be cancelled or deferred because of

TABLE 1. Comparative estimated figures of the South Asian countries 2017

Country	Approximate number of operation	Population in million	Number of operations per million population
India	150,000	1324	113.3
Pakistan	21,000	193	108.8
Bangladesh	11,121	162	68.6
Sri Lanka	5500	20.7	265.7
Nepal	2000	28.9	69.2

TABLE 2. Cardiac surgeons in the South Asian countries 2017

Country	Population in million	Approximate number of surgeons	Population per surgeons (in thousands)
India	1324	700	1891
Pakistan	193	110	1755
Bangladesh	162	85	1905
Sri Lanka	20.7	24	863
Nepal	28.9	15	1927

lockdowns, restrictions, patient reluctance, or redeployment of cardiac anesthetists to COVID intensive care units. All of these had a negative effect on the number of cardiac surgeries in South Asia just like in the rest of the world. However, the number of cardiac surgeons has continued to grow because academic activities were relatively less hampered.

Most of the South Asian cardiac surgeons these days are home-grown. India, Pakistan, Bangladesh, Sri Lanka, and Nepal have their own education and training systems for the cardiovascular and thoracic surgeons. Specialized education and training in cardiothoracic surgery began here in the 1960s. India is the pioneer in the region to commence specialized education and training programs for cardiothoracic surgery. Christian Medical College in Vellore, India, became the first institution in South Asia to introduce a specialized course in thoracic surgery. In March 1960, 3 candidates of Christian Medical College in Vellore, India, appeared in the Master of Surgery (Thoracic Surgery) examination at the University of Madras.<sup>1</sup> India now offers the Master of Chirology (MCh) degree mostly in the government institutions and Diploma National Board mainly in the private institutions. MCh students have to complete a 3-year Master of Surgery (MS; General Surgery) course before enrollment in the MCh (Cardiothoracic Surgery) course. The total duration of the MCh course is usually 6 years. Pakistan offers the MCh degree by the universities. In addition, Fellowship of the College of Physicians and Surgeons in Cardiac Surgery is awarded by the Pakistan College of Physicians and Surgeons.

In Bangladesh Master of Surgery (Cardiovascular Thoracic Surgery) degree offered by the universities is the main postgraduation degree in cardiac surgery. This course was introduced by the National Institute of Cardiovascular Diseases, Dhaka, Bangladesh, in the late 1980s. Recently Fellows of the College of Physicians and Surgeons program run by the Bangladesh College of Physicians and Surgeons also have a small presence. In Nepal, the MCh degree in Cardiovascular and Thoracic Surgery is awarded by the Teaching Hospital at Kathmandu.

In a recent Indian report, it was shown that a big portion of the seats available for cardiovascular surgery remained vacant indicating a lack of interest among the new

generation of surgeons.<sup>9</sup> A nationwide survey was conducted in India covering only the cardiothoracic residents in training. One hundred forty-five residents participated in the survey; 128 male and 17 female. Forty-seven percent of the residents said that they were satisfied with their training, 23% were dissatisfied, whereas 34% chose to remain neutral. Eighty-one percent of the respondents claimed that they barely get leisure time whereas the remaining 19% claimed they get adequate leisure time. Seventy-five percent of the respondents had a negative outlook to their future, 87% agreed that they are not confident of independent practice at the end of their training, and regrettably 41% were unhappy with their decision of taking up cardiac surgery.<sup>10</sup> The findings of this survey appear quite alarming for the future of cardiac surgery in India. Similar trends are also observed elsewhere in South Asia.

Despite postgraduate education and training systems prevailing in 5 South Asian countries, the available number of cardiac surgeons and relevant human resources are far less than the actual demand. To meet the surgical requirements of 1.8 billion people of the region, many more trained surgeons are needed. In the earlier days, the developed countries provided technical and logistic aid encouraging the human resource development in cardiac surgery. This support was crucial in the capacity-building during the initial phase of cardiac surgery in South Asia. A Japanese team of cardiologists, cardiac surgeons, anesthetists, perfusionists, nurses, and technicians came to Bangladesh in the early 1980s and stayed there for years to support capacity-building of their Bangladeshi counterparts. American and French teams helped human resource development in Nepal.<sup>1</sup> A French team provided support in Afghanistan. South Asian nations also had cooperation among themselves. Some Indian surgeons and institutions have provided training for Bangladeshi and Nepalese surgeons. Most of the senior Nepalese surgeons were educated and trained in Bangladesh.

The prevailing numerical discrepancy in global geographical distribution of cardiovascular surgeries is not a healthy affair for anybody. We live in the same world. The COVID-19 pandemic has brought some serious philosophical realization. If we must live in a global village in terms of trade and commerce, we must do more so for ensuring health care. Moreover, health care expense of any individual procedure is far less in the developing world than that in the West. There might be various innovative ways and means of expediting the human resource development in cardiac surgery. The expert individuals and institutions of the developed world might play a vital role in this regard.

There seems to be a recent trend of having vacant positions in education and training positions in cardiovascular surgery. This apparent lack of interest among the new generation of surgeons in South Asia is a matter of great

concern. Another important issue is ensuring adequate matching of various types of man power. Some centers in south Asia are lagging because of the scarcity of a particular type of experts, most notably the anesthetists and perfusionists. To combat this problem, developmental equilibrium among various types of workforces should be maintained. Proper planning and perfect execution are very important in this regard to ensure adequate functioning of a just number of centers for providing cardiac care for millions of people living in South Asia and beyond.

## CONCLUSIONS

Cardiac Surgery has a poor numerical presence in South Asia as compared to that in the Western world. This reflects the global geographical discrepancy in the numeric distribution of cardiac operations. Five South Asian countries have their own education and training programs for cardiac surgery. The prevailing systems of postgraduate education and training in cardiac surgery of India, Pakistan, Bangladesh, Sri Lanka, and Nepal are helping these countries to deliver service for the common people, although the numbers are nowhere near adequate. Most of the cardiac, vascular, and thoracic surgeons of the South Asian countries are home-grown and trained. The recent trend of the available positions in cardiovascular surgery remaining vacant with an apparent lack of interest among the new generation of surgeons in South Asia is a matter of great concern. Despite having postgraduate education and training systems, the number of cardiac surgeons and relevant human resources are far less than the actual demand. Appropriate coordinated planning should be implemented to ensure proper cardiac care of almost a quarter of the human population currently living in this part of the world.

## Limitation

This study was conducted by collecting information from various diverse sources. There might be discrepancy and lack of uniformity in the definitions and measurements. The practice of record-keeping is poor in South Asia particularly by clinicians and surgeons. Estimated figures have been cited on some occasions, which might not reflect the actual figures.

## Webcast

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### Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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**Key Words:** discrepancy in distribution, cardiovascular surgeries, human resource development, South Asia

### Discussion

#### Presenter: Dr Nazmul Hosain

**Dr Zachary Enumah** (Baltimore, Md). Hey. Good morning, and thanks so much for that talk, Dr Hosain. Two things. One, I want to commend you on first is just the choice of your topic. If we think about the WHO building blocks for health systems, we can focus on physical infrastructure, we can focus on equipment, but also focusing on human resources in the health care workforce is important. And then I think your humility is also appreciated in your methods because it's no small feat to physically do what you did in terms of carrying out this study. One quick question is on the slide and the point you made about some seats going unfilled. I'm wondering if you can comment or share what you think is the underlying reason? Because we

could, for example, increase the number of seats for trainees. But if people are dissatisfied with training where seats are already going unfilled, then clearly, that also will not help curb the burden or this disparity in terms of the health care workforce. Thanks again.



**Dr Nazmul Hosain** (Dhaka, Bangladesh). Thank you. Thanks for your question. This is an alarming situation because we already have a scarcity of surgeons in recruitment, and then some of the seats remain vacant. One of the reasons is that, after completion of studies, cardiac surgery takes a long time to build a career. You'd have to work for a long time to develop. It's true for any part of the world, but in the South Asia, where most of the countries are low-, middle-income countries, it becomes very difficult for the surgeons to pursue their career in this subject. They prefer other easy access. That is one reason. But at the same time, partly in our part of the world, cardiac surgery is losing the charisma it once had. Once upon a time, it was a very lucrative subject for the surgeons. But for various social and economic reasons, there has been a change, but it has to be changed again. We need more surgeons.

**Unknown Speaker 1.** Thank you, Dr Hosain, for doing this very important survey research. I'm a general thoracic surgeon in Chapel Hill, North Carolina, and I partner with Kamuzu Central Hospital in Lilongwe, Malawi. As emerging countries develop further, there'll be increasing need to treat thoracic oncologic conditions. I see the CMC [inaudible] where I was actually a visiting student many years ago has a degree program, but what do you see is the future in dedicated training to thoracic surgery in the South Asia region? Will there be regionalized training programs, or will cardiac surgeons further subspecialize? What's your vision?

**Dr Hosain.** Thank you. When we were trained, my degree was cardiovascular and thoracic surgery, so the trend was they'd train us all 3, cardiac, thoracic, and vascular, and after you obtain your degree, you choose which way you move. But these days, they have designated special courses for thoracic surgery separately, and they're even starting courses for vascular surgeries as well. So right now, as I have mentioned, there is no uniformity among the nations in South Asia, the countries vary regarding the condition of the cardiac, thoracic, and vascular surgery courses being offered. But there is a trend to train the thoracic surgeons separately, as a separate entity.

**Unknown Speaker 1.** I'd like to suggest an opportunity for the society to participate in those thoracic surgical courses and specializations.

**Dr Hosain.** Yes, of course. I believe that is the primary reason for presenting this paper, although I focused on cardiac. But yes, it is true for thoracic as well. And one thing I

d like to mention, that when I moved to my current city, Chittagong, in 2009, there was not a single cardiac surgery center, and not a single cardiac case was being performed. And, at that time, with 4 million population, Chittagong was designated as the biggest city of the world with no cardiac surgery facilities. So, I'm happy to announce that at least we got rid of that undignified title. Now we are no longer the biggest city without any cardiac surgery facilities. But well, there is a lot more we can do. I've been running these exchange programs. We had friends from the West, from Turkey, from India, visitors from various countries beyond borders. I'm ready and willing to do that in future. So, anybody, who want to do some exchange programs in South Asia, please feel free to contact me.

**Unknown Speaker 2.** Yeah. Dr Hosain, very briefly. Excellent presentation. I had a question. For countries who don't have training programs, maybe in South

America or other regions of the world, what kind of suggestions or insights do you have into how they can avoid maybe the pitfalls of open seating spots in these programs or even just in early development?

**Dr Hosain.** Good question. From our experience, I can tell that in Bangladesh, we started cardiothoracic surgical training programs in the 1980s and at that time, a Japanese team organized by the Japanese International Cooperation Agency came. They sent their team of cardiac surgeons, cardiologists, anesthetists, and had run approximately a 2-year-long exchange program, and that really changed the scenario. So, from zero cardiac surgery in 1980s, now we are performing more than 12,000 (cases every year). That's not adequate. But that helped a lot. So, I think the regional countries, who have interest and common cultural basis (with South America), can be of great help for you.