Foreword. In this article, Dr. Ashmeg of the King Fahad Armed Forces Hospital in Jeddah and Dr. Abdullah of the Prince Sultan Cardiac Center, Riyadh, at the request of the Board of Directors of the Saudi Heart Association (SHA), have provided relevant information and analysis backing the Kingdom of Saudi Arabia's requirements for adult cardiologists, pediatric cardiologists, and cardiac surgeons, as well as the need for cardiac centers to facilitate the delivery of comprehensive and optimum cardiac care for the population. This report concentrated on the need for physicians and cardiac centers. The requirements for qualified nurses and medical technologists in the field of cardiovascular medicine was not covered.

The information provided in this working paper and the recommendations made have been discussed by the Board of Directors of the SHA, and have been accepted as reflecting the general views of the SHA.

In this regard, the SHA is publishing this paper to draw the attention of policy makers at the ministerial level and in other government agencies to the desirable number of physicians required for the delivery of comprehensive cardiac care in the Kingdom. The availability of adequate numbers of qualified physicians and cardiac centers, as well as their proper distribution in the Kingdom, are of the utmost importance.

It is our hope that the information provided in this working paper will be of relevance to health planners in the Kingdom of Saudi Arabia in their endeavor to provide comprehensive and optimum cardiac care for the population. (Mansour Al-Nozha, FRCP, President, Saudi Heart Association.)

1) Cardiovascular diseases remain a major cause of death and morbidity in the Saudi population.
2) Reduction of the risk factors is feasible.
3) Outside of Riyadh (the capital), the provision of cardiological services is wholly inadequate.
4) Treatment of arrhythmias, pediatric cardiac services, heart transplant services and research, all need major development in the Kingdom of Saudi Arabia.

We reviewed the task force recommendations of the American College of Cardiology and the Royal College of Physicians in the United Kingdom, and applied modifications of their proposals to meet the demography and population distribution within the Kingdom.

There are differences and similarities between the Kingdom and the two reference countries:

Differences
1. The relatively small population of 16.9 million in the Kingdom (12.3 millions indigenous, and 4.6 million expatriate; the 1993 census) is...
concentrated principally in two densely populated areas (Riyadh, and Jeddah with Mecca). The rest of the population is centered in smaller towns and rural areas.

2. There is still a relatively high incidence of rheumatic heart disease in the Kingdom compared to Western countries.

3. The birth rate is relatively high in Saudi Arabia at 35.9/1,000 population.

4. There is a lack of sufficient and accurate statistics in the field of disease distribution in Saudi Arabia.

5. There is a lack of proper cardiology training programs, especially for internists and general practitioners in Saudi Arabia.

**Similarities**

1) Availability of up-to-date, sophisticated cardiac technology.
2) Good transportation system for patients who live away from cardiac centers.
3) Increasing incidence of ischemic heart disease.
4) Similar incidence of congenital heart disease.
5) Medical teleconference with satellite systems to assist in diagnosis and management.

Heart disease is the most important cause of premature death and an important cause of morbidity in patients of all ages. Staffing requirements to meet the needs of the entire field of cardiac diseases in the Kingdom - adult and pediatric cardiology and cardiac surgery - is far from adequate at the present time.

**Definition**

The consultant cardiologist is a physician who spends ~ 80% of his/her time in cardiology, including academic sessions. Office practice loads vary for cardiologists, but they see an average of about 200 patients per month.

**Exercise Test**

Exercise tests are performed by 44% of internists, 18% of family physicians, and by 10% of general practitioners.

**Adult Cardiology Staffing**

For each 250,000 population in the West, two adult cardiologists are recommended. Using the same criteria, around 65 adult cardiologists would be needed to cover the Kingdom's total population. However, 42.4% of the population in Saudi Arabia are below the age of 14 years, and the expatriate community is predominantly young and male, and their numbers are decreasing. Therefore, a more realistic figure for adult cardiologists at this time would be around 55. In addition, there should be 10 to 15 senior registrars in training at any one time, ready to fill the vacant consultant positions arising from retirement, departure from the Kingdom, etc. An average of three years' training period is recommended for a senior registrar in adult cardiology.

Cardiology Centers can be divided into regional (major), and peripheral (district). A major center is one with full investigating facilities plus cardiac surgery. Regional centers can provide staff to visit district clinics. When a district clinic needs 7 sessions of cardiology visits each week, then it justifies the appointment of a permanent cardiologist.

The number of non-invasive cardiologists should be equal to or more than the number of invasive cardiologists.

Using the Kingdom's population distribution (1992 census) as a base, the following is suggested:

**Adult Cardiology**

- Riyadh needs 4 major cardiac centers (present census is 3.25 million according to figures released by the Higher Council for Development of Riyadh City)
- Jeddah needs 3 major cardiac centers. Abha and Dammam (350,000 people each) need 1 cardiac center each.
- One cardiac catheterization laboratory with 2 cardiologists is needed in each of the following cities: Tabouk, Madina, Taif, Gizan, Al-Gassim, and Haf Al-Batin.
- Hospitals with about 100 beds need an internist with interest in cardiology for basic cardiac services, e.g., exercise ECG, echocardiography, thrombolytic therapy.

**Cardiac Surgery Staffing**

One cardiac surgeon is required for every two adult cardiologists, therefore, about 30 cardiac surgeons are required. Each cardiac surgeon should perform between ISO to 200 open heart operations per year. Every group of two cardiac surgeons will require the support of two registrars, plus a senior registrar. The senior registrar's training should be 3 years on average, including one year abroad in a
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major cardiac center. At present, there are about 26 cardiac surgeons in nine centers in the Kingdom, performing less than 3,000 operations per year (ideally 10,000 operations per year should be performed in the Kingdom of Saudi Arabia).

Pediatric Cardiology Staffing

Based on the recommendations of the American Academy of Pediatrics, 4 pediatric cardiac centers should be available for a population that generates over 30,000 live births per year. In Saudi Arabia, the live birth rate is 35,900/million population, which equates to around 607,000 live births/year. Applying the American Academy of Pediatrics' recommendations means that about 20 pediatric cardiology centers would be required for the Kingdom, which is an impractically high figure. However, with 42.4% of the population below the age of 14 years, the number of live births will continue to increase when this young population enters the child-bearing age.

The recommendations for the number of consultants depend on the number of clinics that are needed, and the number of clinics depends upon the population distribution.

There are only two pediatric cardiology centers in the Kingdom at this time, both of them in Riyadh. These two centers will be sufficient for Riyadh and the Central region. Another two centers are needed for the Western region, and three more centers should be sufficient to serve the South, North and Eastern regions with one center for each region. These 7 centers can cover the rest of the country by providing staff for peripheral clinics. Patients from outlying areas can be transported to the centers by ambulance or medevac aircraft.

Each center requires between 2 to 4 pediatric cardiologists and two pediatric cardiac surgeons capable of performing the complete range of pediatric cardiac surgery to maintain 24-hour and year-round cover.

Seven centers will be needed to provide services for children with heart disease. Around 25 pediatric cardiologists and 14 pediatric cardiac surgeons will be required. The Kingdom is far below the target numbers in this field at the present time.

As a solution, we suggest that pediatric cardiology and pediatric cardiac surgery training should be well-planned, with a period of four to six years of extensive training in Riyadh centers and abroad.

The need for subspecialties, such as fetal cardiologists and electrophysiologists, has not yet been addressed.

References