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Viewpoint

The Past and Future of Heart Institutes: Having Moved Beyond the One-Trick Pony

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*Division of Cardiology, San Francisco General Hospital, and the Department of Medicine, University of California, San Francisco, San Francisco, California, USA**He's a one-trick pony**One trick is all that horse can do**He does one trick only**It's the principle source of his revenue¹*

Cardiology became relevant as a clinical entity soon after the middle of the 20th century. Although hypertension and valvular heart disease were common, life-threatening, and hardly treatable, in developed countries, coronary artery disease was a raging epidemic that had not yet peaked. The discovery of coronary arteriography in 1958 by Mason Sones, the successes of coronary bypass surgery beginning a decade later, and the spread of coronary care units throughout the 1960s laid the groundwork for successful treatment of coronary disease.^{2,3}

During this era, heart institutes appeared in several major cities including Montreal, Ottawa, Houston, and Sao Paulo. The driving force behind the creation of these institutes was usually 1 charismatic individual, most often a cardiac surgeon. Cardiac surgery was in its infancy then, and outcomes were demonstrably better in high-volume centres where pre- and postoperative care could be optimized and tailored to this new category of patient. Patient selection criteria and cardiac anaesthesia were not well developed, and drugs such as aspirin and β -blockers were not yet in widespread use, yet cardiac surgery, particularly coronary bypass, flourished because of pent up demand.

The advent of coronary angioplasty led to a repetition of this cycle. In the beginning, angioplasty was limited to programs in which emergency cardiac surgery was available. The larger volumes of patients at heart institutes facilitated the emergence of interventional “superstars,” analogous to the cardiac surgeons of the preceding generation. When emergency percutaneous coronary intervention (PCI) became the

preferred treatment for myocardial infarction, large centres were able to provide this service on a 24-hour, 7-day per week basis, and smaller centres with fewer interventional cardiologists and limited resources struggled to keep up.

The rise of cardiac electrophysiology in the past 2 decades has also favoured heart institutes. Success rates for ablation procedures are operator-dependent, and electrophysiologists with large volumes who work in a group with several others are likely to be more successful than a lone electrophysiologist with small volumes working in a general hospital.

During their adolescence, heart institutes tended to be focused on coronary bypass surgery, but the pony has learned new tricks: PCI, electrophysiology, prevention, cardiac rehabilitation, heart failure management, and clinical research. Heart institutes are large enough to support specialized niche clinics such as for adults with congenital heart disease, cardiac disease in HIV patients, and special cardiology problems in women.

Advantages of the Heart Institute Model

By concentrating resources and expertise in one place, heart institutes were able to provide better and more cost-effective care. Taking cardiologists out of the Department of Medicine and cardiac surgeons out of the Department of Surgery, and putting them together, with cardiac anaesthesiologists and cardiac radiologists, seemed like such an obviously good thing, especially by those involved. Patients with coronary disease were much younger then compared with now, and had fewer concomitant diseases, and thus less need for a phalanx of consultants from other specialties.

The financial success of heart institutes varied depending on the medical system of the country in which they were situated. In the United States, heart institutes that were well managed and had large patient volumes for expensive procedures could generate high revenues. The fame of the institute and its surgeons drew patients from far away, and procedural volumes increased further. Some of the profits were plowed back into improvements in infrastructure and ancillary services, such that the gap between the heart institute and the cardiovascular services of a regular hospital widened.

In countries in which governments controlled reimbursement for medical services, heart institutes succeeded also, but through somewhat different mechanisms. Governments

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generally allowed heart institutes to grow and thrive because they provided services that were cost-effective and popular with the public. Supporting a prestigious heart institute was almost always good politics.

The large volumes of cardiac patients concentrated in heart institutes provided a fruitful milieu for clinical research. Beginning in the 1970s, large clinical trials in cardiology established an evidence-based foundation for our current practices, and greatly ameliorated patient outcomes. Some heart institutes and heart institute-like programs (Montreal, Cleveland, Duke, Rotterdam) embraced this type of research, and others remained mainly clinically focused. Some of these research-oriented programs have developed the expertise and infrastructure to manage large, global trials.

Some heart institutes have become adept at cultivating philanthropy. Raising money for a heart institute might be easier than raising money for a general hospital. Almost everyone has a family member or friend touched by heart disease, and the documented successes of cardiovascular medicine might inspire donations.

Disadvantages of the Heart Institute Model

Removing Cardiology from a Department of Medicine often leaves a gaping hole. Cardiology accounts for up to half of the patients in Medicine, and Cardiology usually generates revenue that supports less procedure-intensive subspecialties such as endocrinology and neurology. In cities and medical schools with large, successful heart institutes, Divisions of Cardiology might suffer. They might lack the high level of personnel and resources that tend to be found in heart institutes.

Medical education might also suffer. Trainees in a general hospital might lack sufficient exposure to cardiovascular diseases, and trainees in a heart institute might learn to ignore the noncardiovascular problems of their patients. Leave the uncontrolled diabetes to someone else; let's just fix the heart.

On the balance, heart institutes provide the opportunity to reorganize clinical training around the specific population with cardiovascular disease. The care of these patients has evolved to the point at which the traditional categories of medicine, surgery, and radiology are anachronistic. Hopefully, the day will come when cardiovascular specialists all receive basic training before subspecializing in revascularization, imaging, electrophysiology, adult congenital heart disease, preventive cardiology, or other specific niches such as women's cardiology. A barrier to this obviously beneficial advance is that medical education tends to be controlled by the traditional departments of Medicine, Surgery, and Radiology.

Heart Institute Within a General Hospital

In many places intermediate solutions have evolved, between the extremes of a freestanding cardiovascular institute at one end and cardiovascular care integrated within a general hospital at the other. For example, the Mazankowski Alberta Heart Institute, which began receiving patients in 2008, was built as an addition to the University of Alberta Hospital in Edmonton.⁴ The Libin Cardiovascular Institute of Alberta in Calgary combines cardiovascular care, basic and translational

research, and education into 1 entity but at multiple nearly contiguous geographic sites.⁵ The Netherlands Heart Institute is a research collaboration among the 8 cardiology departments in the Netherlands, without a clinical care component.⁶

Intermediate approaches such as these have the potential to yield the advantages of a heart institute model while avoiding the disadvantages. How well different approaches function in reality might depend less on the physical and administrative structure and more on other factors, such as the local culture and the people involved. That different models have evolved in different circumstances should be viewed as a positive development, one that validates the basic concept of a heart institute.

Most freestanding heart institutes do not include pediatric cardiology because a large number of ancillary children's services would be required to support relatively few patients. Yet, having pediatric cardiology within a heart institute provides a seamless transition to later life care for children with heart disease. A heart institute closely associated with a general hospital with a pediatrics department, or with a children's hospital, would be better able to provide pediatric cardiology services.

Heart Institute as a Marketing Label

*I was walking down the street
When I thought I heard this voice say
Say, ain't we walking down the same street together
On the very same day
I said hey Senorita that's astute
I said why don't we get together
And call ourselves an institute¹*

The success of heart institutes has spawned imitators, especially in the United States. A small cardiology group with a freestanding catheterization laboratory might name themselves a heart institute to attract patients and donations. The cardiology division of a general hospital might also adopt this title without having any of the attributes of a heart institute. There are probably hundreds of "heart institutes" in the United States, but only a handful of them meet my arbitrary criteria and can be considered a true heart institute.

According to my arbitrary definition, a heart institute should provide the whole gamut of cardiovascular services and have large patient volumes. Ideally, it should excel at clinical care and have outcome statistics well above the mean. It should attract complex cases and have the expertise to deal with them successfully. Ideally, it should provide excellent postgraduate medical education and have a commitment to clinical research.

Studies that compare the quality of care in heart institutes with that provided in general hospitals have not been done. However, hospitalized patients treated by cardiologists compared with noncardiologists are more likely to receive evidence-based care^{7,8} and have better outcomes.⁷ In a study from Beijing, cardiac-specialized hospitals compared with nonspecialized ones had less delay in time to PCI for patients who presented with ST-elevation myocardial infarction.⁹ If

Table 1. Changes in the CCU, Montreal Heart Institute, 1986-2003

	1986	2003
Admissions per year, n	937	1577
Length of stay, days	7.5	3.5
Mortality, in CCU	9%	1.5%
Mean age, years	58.4	63.4
Instrumentation*	38%	8.1%
Swan Ganz catheter	8.1%	0.7%
Coronary angiography	50%	81%

CCU, coronary care unit.

* Arterial line, central venous pressure catheter, temporary pacemaker, Swan Ganz catheter, or intra-aortic balloon pump.

Data from Awaida et al.¹⁰

heart institutes do not provide a superior level of evidence-based care, it jeopardizes their raison-d'être.

The Changing Face of Cardiovascular Disease

Cardiology patients have changed over the past 50 years. Rheumatic heart disease has almost disappeared in developed countries. Myocardial infarction has evolved from what was usually a catastrophic event with ST-elevation, ventricular arrhythmias, pericarditis, and acute heart failure, to what now is more likely to be just a troponin "leak" with few consequences. Most infarctions no longer exhibit ST-elevation. The prevalence of chronic heart failure is growing steadily. Patients are older and are burdened with comorbidities: diabetes, chronic kidney disease, cerebrovascular disease, peripheral arterial disease, and perhaps dementia. We have many more treatment options now, but need clinical wisdom to know when to use them.

These changes are to a large extent the consequences of our success. In Table 1 the changes that occurred in the coronary care unit at the Montreal Heart Institute between 1986 and 2003 are shown.¹⁰ Despite an increase in the average age from 58.4 to 63.4 years, length of stay decreased from 7.5 to 3.5 days, and mortality decreased from 9% to 1.5%. More than 80% of patients received coronary angiography in 2003, compared with 50% in 1986, and the use of, or need for, cardiac pacing and a Swan Ganz catheter decreased markedly.

When coronary angioplasty was introduced, the discoverer stressed that this innovation would be applicable to a small minority of coronary patients. Since then, the use of PCI has grown dramatically and has displaced a large proportion of coronary bypass surgery. In place of worse-than-useless anti-arrhythmic drugs, implantable defibrillators now do prevent sudden cardiac death in susceptible individuals. Prevention has evolved from aspirin and a β -blocker to the combination of an angiotensin-converting enzyme inhibitor, a potent statin, and more potent antiplatelet and antithrombotic drugs, with the expectation that recurrent events can be reduced by up to 80%.

Age-adjusted rates of heart disease and stroke have decreased steadily in Europe and North America, but are increasing in Asia, fueled by improving economic conditions that have created an epidemic of obesity and diabetes. Worldwide, 382,000,000 people now have diabetes, and this number is expected to increase to 592,000,000 by 2035.¹¹ The total cost of treating diabetes in 2013 was estimated to be 548 billion US dollars,¹¹ even though 175,000,000 cases

were undiagnosed.¹¹ Fully 80% of people with diabetes live in low- or middle-income countries, where most of the projected increase in diabetes is expected to occur. These countries lack the financial and health care resources to cope with the oncoming epidemic of diabetes, coronary disease, and stroke.

Heart disease has also migrated down the socioeconomic ladder in wealthy countries. The stereotype of the businessman experiencing a heart attack while hurrying through an airport should be replaced by that of an older, unemployed woman suffering a stroke because she could not afford to pay for her blood pressure drugs.

Whether a heart institute is the best place for today's patient with cardiovascular disease is an open question. A heart institute within a general hospital would provide access to noncardiovascular services, whereas a freestanding institute would need to develop expertise in these areas. Indeed, to ensure high quality care, a contemporary heart institute must have a broad-based faculty, including cardiologists with specialized training in critical care, geriatric cardiology, vascular medicine, diabetes, and renal disease.

Future Role of Heart Institutes: A Global Mission

Heart institutes have been blessed with an array of resources, and thus have an obligation not just to provide a high level of care to patients, but perhaps also to attempt to improve conditions outside their walls. The shift in coronary disease and stroke from developed to developing countries has created an imbalance, with most of the resources in the former and most of the unmet needs in the latter.

In poor countries, most patients with coronary and cerebrovascular disease are not taking medications for secondary prevention. For example, in the Prospective Urban Rural Epidemiology (PURE) study, use of antiplatelet drugs, β -blockers, angiotensin-converting enzyme inhibitors, or angiotensin receptor blockers and statins was 62%, 40%, 49.8%, and 66.5%, respectively, in high-income countries and 8.8%, 9.7%, 5.2%, and 3.3%, respectively, in low-income countries.¹²

The model of cardiovascular care used in developed countries is far too costly for these circumstances. The development of a polypill for secondary prevention has the potential to extend treatment to millions of currently untreated patients and to reduce their risk by up to 80%; however, several barriers limit widespread implementation of a polypill strategy, including physician reluctance, lack of interest from pharmaceutical companies, and regulatory hurdles.¹³ Overcoming these barriers will require expertise and resources that are unavailable in poor countries. Heart institutes and other organizations involved in cardiovascular trials can provide these resources. Collaboration with medical leaders, pharmaceutical companies, and government health care agencies in poor countries will be necessary to bring this treatment to the millions in need.

Historically, heart institutes have provided training to physicians from other countries, including basic cardiology, subspecialty training, and training in research. This tradition should continue, but perhaps with an emphasis on physicians from developing countries, where future needs will be greatest.

We should be training physicians not only to treat patients with cardiovascular disease, but also to manage an epidemic.

Heart institutes with global programs have used different approaches. The University of Ottawa Heart Institute has a 5-year agreement to mentor the development of the cardiac program in the rapidly growing Chinese city of Qingdao.¹⁴ The Cleveland Clinic is opening a hospital with a large cardiovascular department in Abu Dhabi, in the Emirates. Several prestigious medical centres have established cooperative research agreements with medical schools in other countries, and some of these programs have languished or failed. To be successful, both partners must have a long-term commitment, sufficient resources must be allocated, and the plan must be realistic.

Future Role of Heart Institutes: Local and National Opportunities

Innovations that reduce the cost of cardiovascular care without sacrificing quality will be of interest to wealthy countries, not just poor ones. Heart institutes might provide an optimal environment to test such innovations, and then promote the successful ones within their communities. Heart institutes should be involved across the continuum from clinical research to guideline development to performance assessment.

Heart institutes should contribute to the development of cardiovascular health care policy for their entire community. Influencing government policies to promote a healthy lifestyle could do more to reduce the burden of cardiovascular disease than pouring resources into more late-stage interventions. Government initiatives that have reduced tobacco consumption, including educational campaigns, limiting smoking in public places, and higher cigarette taxes, have been an extremely cost-effective way to reduce cardiovascular disease.¹⁵

Heart institutes should lobby for legislation that improves cardiovascular health across the whole population, including everything from better labelling of food products to more bicycle paths. It could be argued that such an approach goes far beyond our obligation as physicians; however, we should be advocates for our patients, present and future, and preventing cardiovascular events is so much better than treating them.

Optimizing the Structure of the Heart Institute

It would be astonishing if the current administrative structures of most heart institutes, developed long ago mainly for clinical purposes, were optimal for their current and future challenges. A heart institute that lives mainly within its walls, like a medieval castle, will have a limited effect in the modern world. In fact, many of the problems in cardiovascular medicine can be attributed to discontinuities among components of the medical system.

Dzau et al. have discussed how an Academic Health Science System can act as an integrator to bridge the gaps in the continuum from medical discovery through translation to clinical research to guideline development and adoption to global health.¹⁶ Duke Medicine is attempting to do this through the establishment of the Duke Translational Medicine Institute and the Duke Global Health Institute.¹⁶ The Duke Translational Medicine Institute consists of 4

organizations: the Duke Translational Research Institute, which focuses on translating early discoveries into clinical applications, the Duke Clinical Research Unit, which undertakes biological proof-of-concept studies with advanced genomic and imaging technologies, the Duke Clinical Research Institute, for clinical trials and registries, and the Duke Center for Community Research.¹⁶ Such an elaborate and expensive structure will not be appropriate for every heart institute, yet it demonstrates a comprehensive solution to the problems of discontinuities.

The recognition that many countries are experiencing the same explosive growth of cardiovascular risk factors, mainly obesity, diabetes, and lack of physical activity, has stimulated a search for global solutions.¹⁷ Yet despite similarities, important differences among countries are obvious. The term “glocalization” originated in business and refers to the adaptation of a product or service to a specific locality or culture¹⁸; an example of glocalization would be McDonald’s developing a kimchi burger for the Korean market.

Glocalization might be an important component of programs to improve cardiovascular care worldwide. As examples, a culturally specific strategy is necessary to reduce the extremely high rate of obesity and diabetes in Saudi women, who are discouraged from exercising by religious authorities. Heavy air pollution is a major cardiovascular risk factor in several large cities in China, and controlling it requires a political solution; urging individuals to breathe less does not help. In India, 75% of the population lives in rural areas without access to even basic health care. In response, a start-up company plans a network of 2000 rural 30-bed modular hospitals in which uniform treatment protocols will cover 42 common conditions, and telemedicine will provide expertise and help control costs.¹⁹

In 1996, Brown and Goldstein, who had won a Nobel Prize for identifying the low-density lipoprotein cholesterol receptor, predicted that coronary heart disease as a major public health problem might well disappear early in the coming century.²⁰ Fourteen years into the century, we can clearly see that this isn’t going to happen. Coronary disease will shift geographically, and its features will continue to mutate, but unfortunately it isn’t going away any time soon. And heart institutes won’t either, if they adapt successfully to the changing landscape.

Disclosures

The author has no conflicts of interest to disclose.

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