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Presidential address: Changing boundaries

James L. Cox, MD

During the past year, two pioneers in cardiac surgery died—Dr René Favaloro of Buenos Aires, Argentina, and Dr Will Sealy of Duke University. Dr Favaloro was the father of coronary bypass surgery and Dr Sealy was the father of cardiac arrhythmia surgery. It is rare that a specialty loses two giants of their magnitude in the span of only a few months. I would like to dedicate this presidential address to both of them.

History has taught us that the best way to prepare for the future is to study and understand the lessons of the past. The first time I traveled through Europe several years ago, I was struck by how close together the medieval castle ruins seemed to be now that most of the forests have been cleared away. Once, invisible boundaries surrounded each of those castles, boundaries that were defended to the death. But those boundaries eventually dissolved because technology ultimately made the castles themselves obsolete and then the boundaries became meaningless.

Today's geographical boundaries are also becoming the victims of technology and will be progressively less important to our future. Our economy is now global, air travel has shrunk the size of our world, and the Internet is demanding one international language. In fact, we now sit astride what I believe to be the next major "redefinition of boundaries" that will dominate our cultural, financial, educational, and sociological development during the next millennium. Yet, as all these global trends are evolving, the educational disparity between wealthy and poor countries is actually increasing in magnitude. H. G. Wells once said, "Human history becomes more and more a race between education and catastrophe." Wells never dreamed that the relatively simple society of his day would look like ours today.

A few months ago, Nebraska Senator Bob Kerry, a winner of the Congressional Medal of Honor in Vietnam, said that the expanding gap between the wealthy and the poor in our society represents the single greatest threat to our free-standing democracy. Largely because he is a visionary who perhaps understands, better than most, the major changes that loom in our future, he forfeited his secure seat in the United States Senate earlier this year. To most thoracic surgeons, it is incomprehensible that a person would voluntarily give up a seat in the United States Senate. Yet, an unusual number of our nation's best leaders on both sides of the aisle have done so in recent years—men such as Democrats Bob Kerry, Sam Nunn, and Daniel Patrick Moynihan and Republicans Paul Laxalt, Warren Rudman, and Jack Danforth.

What do these great American political leaders foresee that those of us cocooned in the world of medicine seem to be missing? I believe that they understand, better than their colleagues do, and certainly far better than we do, that the old paradigm for dealing with both national and international social and political problems will

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Address for reprints: James L. Cox, MD, President, The World Heart Foundation, 1828 L St, NW, Suite 1100, Washington, DC 20036-5104.

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not work in the future and that the time has come to develop a new paradigm that will work. I also believe that we are at precisely the same point in time in the specialty of thoracic surgery.

As thoracic surgeons, representing only 0.001% of the population, there is little we can do about the evolving socioeconomic gap among countries. However, this disparity is not only financial and political, it also involves health care. Again, as thoracic surgeons, we have neither the numbers nor the resources to effect a significant change in the overall well-being of entire populations. However, we can make a difference in those persons who have the very diseases that we are so adept at treating.

The Problem

In 1999, Professor Felix Unger,¹ a member of The American Association for Thoracic Surgery from Salzburg, Austria, published the results of a remarkable worldwide survey that clearly defined the magnitude of the differences that exist in cardiac care in developed versus underdeveloped countries. The survey determined that there are approximately 4000 cardiac surgical centers in the world, but as you might expect, they are hardly distributed in an even fashion.

Each cardiac surgery center in North America serves approximately 120,000 people or a small city approximately the size of Durham, North Carolina. In Europe and Australia, each cardiac surgery center serves a population of approximately 1 million people, or a larger city roughly the size of Columbus, Ohio. In Asia, there is one cardiac surgery center for every 16 million people or one for a city the size of Los Angeles and the surrounding counties. In Africa, each cardiac surgery center serves approximately 33 million people. This paucity of cardiac surgical centers translates into a gross deficiency in the actual number of cardiac cases that are performed in these countries.

As might be expected, the highest incidence is in North America, where 1222 cardiac surgery cases are performed per million population (Figure 1). The next highest rates are in Australia with 786 cases per million and in Europe with 569 cases per million. The *mean* number of cardiac cases per million population internationally is 169 cases per million. This means, of course, that cardiac surgery in the remainder of the world is performed far less frequently than in North America, Australia, and Europe. Indeed, the numbers decrease to 147 in South America, 37 in the Russian Federation, 25 in Asia, and 18 in Africa.

Since no consensus exists on exactly how many cardiac surgical procedures should be performed per million population, it would be wrong to assume that the large number of cardiac procedures performed in North America is necessarily the optimal number. Indeed, many think that number is too high. Therefore, in an effort to be more realistic, one might take the average number of cases performed in North

America, Australia, and Europe per million population and assume that to be the optimal number of heart operations that should be performed for every million persons. That average is 860 cases. Thus, in an optimal environment where every patient who needs a heart operation can actually get one, there will be 860 cases performed for every million population.

The average number of heart operations performed per million population in South America, the Russian Federation, Asia, and Africa is about 60. Comparing these two numbers allows us to determine how many people in these latter areas have need of an operation but cannot get that operation. That calculation leads to an astonishing figure. Of all the people living in South America, Russia, Asia, and Africa who actually need a cardiac operation, 93% cannot get that operation! Stated in a slightly different way, of all the people in the world living outside North America, Australia, and Europe, 93% have no access to cardiac surgery!

As thoracic surgeons, we must recognize that we as a specialty have failed the international community, and we should place the task of correcting that failure at the top of our agenda. As American thoracic surgeons, perhaps our first obligation is to our own here in the United States. However, it is virtually impossible to find a person in this country who really needs a cardiac surgical procedure and cannot get one, so that our efforts should rightly be in the areas where that is clearly not the case.

The fact that people in the most impoverished nations of the world have no real access to modern cardiac surgery is certainly no great revelation. One knows intuitively that cardiac surgery cannot be performed in most of those countries because of the lack of money or infrastructure to support it. It is also clear that, all things considered, such nations have problems that far exceed their need for a mitral valve repair or closure of an atrial septal defect. However, we are not sociologists, economists, or political scientists; we are thoracic surgeons, and as such, we have an obligation to address those problems that we do know how to fix.

Approximately 4.5 billion people in the world have no access to cardiac surgery. One reason is that the political situation in a number of countries precludes significant assistance from abroad. Another reason is that cardiac surgery is expensive and the primary problem in many countries is the lack of money. The international thoracic surgical community is certainly not indifferent to the plight of other nations. In fact, I have encountered overwhelming enthusiasm from cardiac surgeons in the more affluent countries who want to become involved in a program to improve the world's access to cardiac surgery but who have no idea how to do so. It would appear that the major impediment to overcoming the problem is that we simply do not know how to distribute our services in an efficient and effective manner.

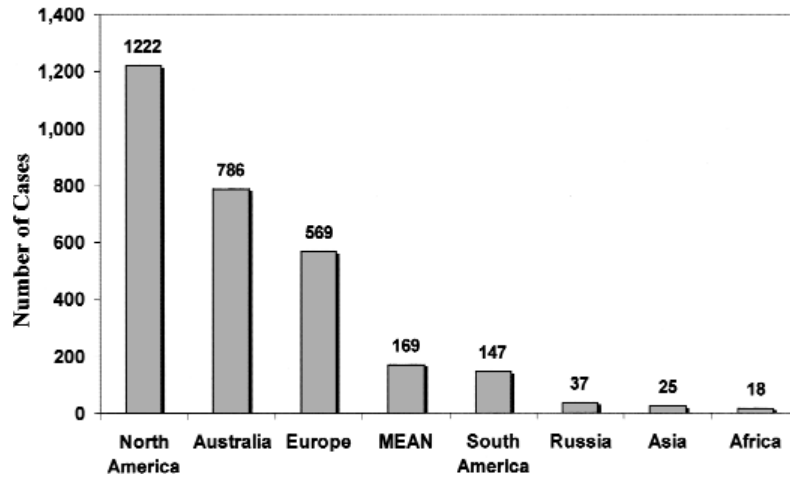


Figure 1. The number of cardiac surgical procedures performed on an annual basis globally. (Reproduced from Unger F. Worldwide survey on cardiac interventions 1995. *Cor Europaeum*. 1999;7:128-46; with permission of Springer-Verlag.)

Surgical teams from virtually every developed country in the world travel to developing countries from Mozambique to Vietnam. As commendable as such efforts are, I believe that we can improve on their efficiency by establishing a more structured global approach to this world-wide problem. For example, in most cases in which surgical teams travel abroad to perform cardiac surgery in underdeveloped countries, the surgical teams are present at those remote sites for no more than 1 week per year. This approach of volunteer teams “parachuting” into remote sites to operate for a week and then leaving creates serious problems with such things as follow-up care and equipment maintenance, not to mention the fact that it only scratches the surface of the problem. Nevertheless, in the absence of a better system, this one has had to suffice. However, if we are to solve this problem, we will need more than good intentions and hard work. Above all, we will need good planning and organization. In my opinion, the only plan that will work requires the problem to be approached in a multidimensional fashion, taking maximum advantage of contemporary communications technology and educational techniques.

Tackling the Problem

The educational activities of our specialty already provide excellent opportunities for most of the world’s cardiothoracic surgeons to stay abreast of new developments. The annual meetings, scientific journals, local educational courses, and textbooks are the result of enormous expenditures of energy by many different people. I believe that the recent introduction of the CTSNet will ultimately prove to be one of the most important developments of our era. I was heartened to learn recently that plans are being developed to extend the National Adult Cardiac Surgery Database beyond

the boundaries of the United States to include the surgical results in other countries as well. This is an important step in the right direction.

As important and effective as these efforts are in maintaining the standards of excellence in developed countries, they do not effectively address the lack of cardiac surgical care in underdeveloped countries. Such a problem requires both strategic and tactical thinking and planning. For example, it is clear that without the active support of government and quasi-government organizations such as the Agency for International Development, the World Bank, the International Monetary Fund, and perhaps even the United Nations, this effort is likely to fail. It is equally clear that the leaders in our specialty must assume their leadership mantles in this effort or else those who are not leaders will quickly lose interest. In addition, surgeons who are not usually thought of as leaders in our specialty also have the opportunity and the obligation to contribute. In many cases, these surgeons, most of whom are in private practice, are superb technical surgeons who do not often have the chance to teach others their skills. Without the assistance of this large group of surgeons, it will be virtually impossible to reach our goals internationally.

It is also preferable that our specialty organizations participate in this effort to make cardiac surgery more available to the world’s population. I believe that this is a role for the AATS. The ultimate objective of these efforts is education, and the AATS has been at the forefront of education since the beginning of our specialty. Of course, the ultimate success of these efforts will depend on how much money can be funneled into the project, but that, in turn, will depend on how well organized we are and on how much effort we are willing to expend ourselves.

The recruitment of government support and the re-energizing of our surgical leaders and our organizations are strategic initiatives. Although they represent the infrastructure that is necessary for ultimate success, they will fail without the creation and implementation of a feasible and effective tactical plan. The approach should revolve around efforts to increase local surgeons' accessibility to established experts in the field of cardiac surgery and to improve the training and expertise of those local surgeons and their teams. If successful with this approach, we will ultimately put ourselves out of business. In the meantime, we must establish a delivery system that serves the clinical needs within a certain sphere of influence—a sphere of influence that should not necessarily be defined by the boundaries of a country.

At the mid-winter meeting of the Council of the AATS held in Washington, DC, in December, 2000, I proposed that the AATS create an "Encyclopedia of Cardiothoracic Surgery" to be placed on the Internet with hyperlinks to appropriate coronary arteriograms, echocardiograms, computed tomographic scans, and magnetic resonance imaging scans. This encyclopedia would be a free reference source modeled after, and compatible with, the Thoracic Surgery Curriculum that was developed a few years ago by the Thoracic Surgery Director's Association. I hope the AATS leadership of the future will pursue this idea. It would mean that for the first time, essentially all contemporary knowledge in our specialty would be available to every member of our specialty in the world.

One problem in developing countries is that surgeons simply do not have the financial means to travel to international courses such as this one to learn about the latest surgical techniques. Of course, they can read about them in our journals, but frequently they cannot afford the journals either. However, with very little effort, we can televise many of our operative clinics and other types of educational courses into these countries. These conferences are much more effective if presented live. To broadcast them live and still during reasonable hours, the world can be conveniently divided into 3 broadcast time zones: Western, Central, and Eastern. Live clinics and conferences broadcast from the Western zone would be transmitted via satellite to numerous countries and cities throughout the Western Hemisphere where surgeons are capable of paying a registration fee for the course. The same signal could then be broadcast into those countries in the Western Hemisphere where surgeons are not able to afford the registration fee. Since the goal is to transmit the conferences live, similar conferences would emanate from the Central broadcast zone and the Eastern zone.

Another feature is to provide weekly Internet video conferences to all available sources within each broadcast time zone. These conferences would feature two prominent sur-

geons each week from each respective zone who would present state-of-the-art information on a given topic followed by questions submitted via the Internet from surgeons anywhere within that zone. Each conference would last 2 to 3 hours and would be held at the same time each week. For example, every surgeon in an entire zone would know that the video conference would start at, say, 3:00 PM every Tuesday afternoon and that they would have the ability to interact directly with the world's experts on whatever topic was on the schedule for that week. The two experts would change each week so that no surgeon would be asked to do this more than two to three times a year, ideally, only once a year. The schedules would be posted well in advance on that particular Web site, as well as in the major cardiothoracic surgery journals of the world (free of charge).

An elective consultation service should be established on the Internet to provide expert consultation to any surgeon in the world. E-mails from surgeons in developing countries could be sent to a specific Web address published in every issue of our major journals. The E-mail could be received at a triage center equipped with off-the-shelf software capable of forwarding 90% of the messages to the appropriate surgical team. Most of these queries could be handled by the surgeon's staff of nurses and/or physician assistants, because they frequently relate to perioperative care and nontechnical issues rather than to the specific surgical technique itself.

Another project is to organize existing surgical teams, plus even more new teams, into an efficient and effective delivery system for cardiac surgery. The basic premise is that rather than having a surgical team in every country for 1 or 2 weeks a year, we will establish regional surgical hubs and move the patients within that region to the surgical hubs. By consolidating the surgical services to one site, the multiple surgical teams can operate at a single site where adequate equipment and personnel can be maintained throughout the year.

Obviously, an important part of this effort is the selection of an appropriate site for the regional surgical hub. There are basically 4 groups of countries in terms of the organization of our efforts. Some countries such as those in North America, Western Europe, and Australia do not need our services. In other countries, it is not feasible for us to attempt these efforts either for political reasons or because of active military conflicts. Some countries are so large and complex that, at least initially, it would be futile for us to try to change anything as complex as health care delivery systems. However, despite these exemptions, we are still left with more than 100 countries in which our efforts could have a tremendous impact.

For a variety of reasons, the plan of the World Heart Foundation is to begin in Central America. Presently, every Central American country has at least one surgical team

traveling to it each year, albeit with the inherent limitations previously mentioned with this uncoordinated “parachute” approach. Fortunately, one of the world’s greatest pediatric cardiac surgeons, Aldo Castaneda, now lives in Guatemala and has recently established a new pediatric cardiac surgery clinic there. In this case, there is obviously no need for a host of pediatric cardiac surgeons to rotate through Dr Castaneda’s clinic. Rather, there is an urgent need to train the ancillary personnel better and to secure funding for many of them who now work on a part-time basis. In addition, our efforts should be directed at serving the adult population in Central America. Rather than have multiple teams travel to all of these countries, the patients in each of those countries would be brought to the center in Guatemala. Dr Castaneda’s team would perform the pediatric cases and multiple visiting teams would perform the adult cases.

Another surgical hub should be established to serve the needs of the northern tier of South American countries and the Caribbean. Present plans call for the development of a center in Barbados that will serve those two areas. Again, the idea is to transport the patients from surrounding countries to Barbados rather than trying to travel to each country individually with various surgical teams.

These traveling surgical teams come from all over North and South America. The advanced scheduling of these visiting teams is similar to running a busy elective operating schedule, although in this case the surgical team will have to travel a bit farther to get to the operating room. Most of these teams, however, are experienced in traveling to Central America and other places to perform volunteer surgery. A major difference with our approach is that when they arrive, they will find an optimal place to operate and they will not have to provide their own equipment.

While we in the Western Hemisphere are working to solve the cardiac surgery needs here, our colleagues in Europe and Asia will be doing the same in their respective areas of the world. Current plans call for starting either in the Balkans or in the non-Balkan portions of Central Europe. Surgical teams from Europe will be expected to serve the needs of this particular regional hub. Similar programs are envisioned for Africa, Asia, and the Far East.

Even with this improved system for delivering cardiac care to developing countries, we can never hope to meet the world’s need for cardiac surgery solely with this approach. Certainly, this plan is more efficient and cost-effective than the non-system that currently exists, but traveling surgical teams alone will not solve the problem on a long-term basis. The solution lies in using these surgical hubs as training sites for surgeons in the surrounding countries. In addition to learning surgical techniques, other surgical team members could learn anesthesiology techniques, the principles of perfusion, and postoperative nursing care from experienced

teams. A part of this training program will also include several international training sites, where surgeons have already agreed to cooperate in this venture. Ultimately, developing technologies will be used to link each of the regional and international training sites with sophisticated methods for assisting surgeons remotely by means of robotics. Most of the efforts using robotic systems today are directed at making surgery less invasive. However, I believe that the greatest promise of robotic systems is not in minimally invasive surgery but rather in the possibility of having experienced cardiac surgeons assisting inexperienced cardiac surgeons from remote sites.

The operative clinics, the video conferences, and the training programs all contribute to our first tactical goal of improving the education and surgical expertise of local cardiac surgeons. The consultation services, surgical hubs, and remote robotic surgery of the future all contribute to the second tactical goal of increasing local surgeons’ accessibility to leading international cardiac surgeons. Together, these two tactical goals will lead to improved cardiac surgery services to developing countries.

In summary, my challenge to the specialty of thoracic surgery is to address the deficiency of cardiac surgical care access worldwide. My suggestion is that we develop an online encyclopedia of cardiothoracic surgery, televise world-wide live operative clinics and educational courses, present weekly world-wide Internet video conferences, systematically train cardiac surgeons from developing countries at regional and international centers, provide continuous online world-wide consultation services, organize a seamless rotation of operative teams into developing countries, and ultimately use robotic techniques to assist surgeons in developing countries from remote sites. As mentioned, if we are fortunate enough to accomplish our goals, we will eventually put ourselves out of business.

The question is whether or not we have the courage to tackle these problems. If we do not, I am afraid that we stand in danger of forgetting why we became thoracic surgeons in the first place. We all take pride in the fact that there has never been a more talented or highly selected group of people in any profession than in our specialty of thoracic surgery. We were born into an unforgiving social structure that uniformly condemned failure and rewarded only success. We were forged in the furnace of academic competition more mentally, psychologically, and physically brutal than any other group. We have spent our lives in the most stressful, serious, and complex profession in the world, and we have thrived in it. People far more accomplished than we are respect us simply for what we do, without even knowing exactly what it is that we do, and there are no boundaries to that respect. It is universal and extends across all social and geographical boundaries. No other group of

people in the world can claim such a wonderful position in life or a more rewarding job!

But precisely because of our unique talents and our place in the world's social spectrum, we have obligations that only we are capable of addressing. We cannot continue to boast about the number of cases we do, as if increased volumes somehow bestow increased virtue, when we alone have the ability to add 75 years onto the lives of millions of children and yet choose not to do so. We have an obligation as uniquely talented individuals to change the boundaries of

our thinking, the boundaries of our influence, and the boundaries of our efforts. As thoracic surgeons, we are not meant to bend history itself, but we can work to change a small portion of events within our own sphere, and in the total of all those acts will be written the history of our generation of surgeons.

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