The results of a worldwide survey published in 1999, clearly defined the differences that exist in cardiac care in developed vs. underdeveloped countries [1]. The survey showed that there are approximately 4,000 cardiac surgical centers in the world, with a striking mal-distribution of access. In North America, each center serves approximately 120,000 people. In Europe and Australia, each cardiac surgery center serves a population of 1 million people. In Asia, there is one center for every 16 million people, while in Africa the amount is one to 33 million people. This mal-distribution has a significant impact on the number of operations performed in these countries.

The average number of cases performed in North America, Australia, and Europe per million people, and possibly the ideal number, is 860. The average number of cardiac operations performed for every million population in South America, the Russian Federation, Asia, and Africa is approximately 60. Based on these figures, it is possible to calculate that 4.5 billion people (93%) living outside North America, Australia, and Europe have no access to cardiac surgery. (Figure 1)

It is entirely reasonable, therefore, to consider these areas the “less privileged parts of the World”. This general pattern also applies to Pediatric Cardiac Surgery.
The fact that modern cardiac surgery is not available to people in the most impoverished nations of the world is indeed no great surprise. Poor access to cardiac surgery is just one of the problems generated by sheer poverty and inequality in the developing world where, in general, cardiac surgery is not a priority, and cannot be performed because of lack of money or infrastructure [2,3]. For the most part, the minorities that can afford an operation in private or travel abroad have no problems.

Bureaucratic indifference and the concept of issues being a world apart are damaging. In the future, it will be important that physicians take an active role in political, economic and social aspects of the society in order to defend the interests of those suffering around the globe. The time has come when physicians have to decide whether they will continue to be a part of the problem, or whether they will be part of the solution.

Although this essay focuses on the situation in the emergent countries, “the less privileged parts of the world” can exist anywhere, and are not necessarily due to economic constraints. Lack of diversity due to social, intellectual, educational, and professional inbreeding, the latter representing cultural stagnation, can easily be responsible for the lack of scientific progress and development.

Most of my training in pediatric cardiac surgery was done in Argentina with some interruptions—one year in England, one year in Brazil and three months in New Zealand combined with multiple short visits to the United States. I eventually became Division Chief of the specialty in the most prestigious Department of Pediatric of the country.

Since I worked in South America, Europe, and most recently in the United States, differences in culture, resources and technology has had a significant impact in my practice and interactions with colleagues, patients and the public.

Social, Political and economic Considerations

Background

It is difficult to discuss this subject without bearing in mind some political and socioeconomic realities in these impoverished areas. Of children who die before the age of five, 98% are in the developing world. Of the millions who die prematurely of tuberculosis, malaria, measles, tetanus and whooping cough, all but a few thousand live in the underdeveloped world. There is no doubt that unhealthy countries are condemned to slow growth, and although ill health reinforces the poverty that kills the poor, nothing is as lethal as bad governance. [4] Needy countries often have corrupt or incompetent governments, and here is where most of the blame should be laid. The determination of leaders to improve their societies is frequently less significant than their strength of mind to maintain and expand their own power and privilege and foreign bank accounts.

The significant fall in mortality rates in North America and Europe in the last century was mainly due to improved nutrition and better public health arrangements such as safe drinking water, safe sewerage system, and regular waste disposal [4]. Yet, these advances are not generally available in the underdeveloped world as an indicator of the ongoing widening gap between resource-rich nations and poor countries. This is a disgrace for us all, and deserves special consideration from those planning and implementing global capitalism and the dream of universal economic growth. Otherwise, the world must share the responsibility for the early death of the poor and their children.

The leaders of the developing world have pointed out that their countries are behind in technology, destabilized by financial flows beyond their control, unable to achieve the prosperity promised to them, and their societies are devastated by disease. With few exceptions such as Australia, New Zealand, Canada, and Norway, most of the developing countries are commodity sellers and therefore exposed to the changes of market prices, sunk in a debt trap long after the need for debt relief is acknowledged.

Much of the poorer world is in turmoil, caught in a vicious cycle of disease, poverty, and political instability. Sound financial and scientific help from the rich nations is a vital investment, as are the economic benefits of integrating the Third World into the global economy that would lead to faster growth and far outweigh the cost. [5] The notion of cost-free leadership should be abandoned. It is necessary to pursue a course that is low in rhetoric and high in development.

International Community

The feel-good phrase INTERNATIONAL COMMUNITY is widely used when a collective will is needed to take action for the benefit of all countries and people. It is difficult to define it, and there is significant controversy about its real existence, with some saying that it is only fiction. For those who believe in the term “International Community”, it exists when: governments work together to establish an International Criminal Court for the prosecution of crimes against humanity; or when international aid flows to victims of natural disasters; or when countries contribute troops to
International Aid

International aid is available through different channels: international agencies, Governmental Foreign Assistance programs, Non-Governmental Organizations (NGOs), foundations, institutions, private philanthropists, private firms, etc. The members of the world’s leading foreign aid organizations constitute a near monopoly on the “commodity” of aid relative to the powerless poor. These international agencies (U.N. International Conference on Financing for Development, World Bank, U.S. Agency for International Development, International Monetary Fund, United Nations, and the Inter-American Development Bank) operate like a cartel: the cartel of good intentions. And like a cartel that thrives when customers have little possibility to complain or to find alternative suppliers, the foreign aid community forms a united front that allows them to diffuse blame among its members when economic conditions in developing countries do not improve according to plan. In the foreign aid business, customers—poor people in developing countries—have few chances to express their needs. At the same time, rich nations providing the funds have no clue about what those customers want or need. A complicated bureaucracy and the lack of market pressure from customers cannot reward efficient organizations and discipline unsuccessful ones, thus completing the vicious cycle [10]. There is a need for reforms introducing market mechanisms to reach goals with low cost and high benefits.

Recipient country selection also seems to be a problem. There is no significant difference in democracy, public service delivery, rule of law, and corruption between those countries that received IMF and World Bank loans in 2001 and those that did not. It is not unusual to see aid-agency bureaucrats concentrating on high visibility projects with few concerned about their endurance beyond the ribbon-cutting ceremony [10,11].

During James Wolfensohn’s tenure as a President of the World Bank, a participatory New Development Framework—handing control over to poor countries, supporting their developing plans—was introduced because of the disappointing results of the structural adjustment based on conditionality. The results of the new approach were mixing. It was Good in Uganda and no so good in other countries, as demonstrated by the recent events in Chad where the program supported by the World Bank, that was supposed to oversee the use of oil wealth for the benefit of its poorest citizens, seems to be on the verge of collapse. Again, the Bank learned the same lesson. Good policies are useless without good government to implement them [12].

In medicine, the author’s profession, the first step to treatment is diagnosis. If one considers that poor countries have an illness, poverty, the first step should be to make a diagnosis of what is causing it in each of them in order to treat them individually. In general, international financial institutions have a tendency to prescribe the same treatment, without a growth diagnosis, that would allow identifying country-specific problems. Policies that work in some countries may not be effective in a different setting [13].

The New Partnership for Africa’s Development (NEPAD), officially adopted as a continent-wide initiative in July 2001, if properly implemented can mark the beginning of a new promising phase in the partnership and cooperation between Africa and the developing world. One of the most attractive features of this organization is the African Peer Review Mechanism—adopted in 2003—that require countries to commit to a process of sharing information and experiences aiming to good governance and prosperity.

The basic principles of NEPAD are:

1. The New Partnership for Africa’s Development (NEPAD) is a continent-wide initiative that seeks to improve governance and promote development in Africa.
2. It is based on the principles of partnership, good governance, ownership, and shared responsibility.
3. It aims to foster collaboration among African countries, as well as with the international community.
4. It recognizes the importance of local ownership and participation in decision-making processes.
5. It emphasizes the need for transparency, accountability, and sustainable development.
6. It seeks to address the root causes of poverty and inequality in Africa.
7. It aims to create a more inclusive and effective governance framework.
8. It recognizes the importance of capacity building and human resource development.
9. It seeks to promote economic growth and job creation.
10. It recognizes the importance of sustainable natural resource management and environmental protection.
11. It seeks to promote peace and security in Africa.
12. It recognizes the importance of regional integration and intra-African trade.
13. It seeks to address the impact of climate change and other global challenges.

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- Good governance as a basic requirement for peace, security and sustainable political and socio-economic development;
- African ownership and leadership, as well as broad and deep participation by all sectors of society;
- Anchor the development of Africa on its resources and resourcefulness of its people;
- Partnership between and amongst African peoples;
- Acceleration of regional and continental integration;
- Building the competitiveness of African countries and the continent;
- Forging a new international partnership that changes the unequal relationship between Africa and the developed world; and ensuring that all Partnerships with NEPAD are linked to the Millennium Development Goals and other agreed development goals and targets. www.nepad.org

Non-governmental organizations definitely help, but they are relatively small to make a significant difference considering the magnitude of the problem. Foundations and private philanthropists spread their wealth generously but cautiously in selective programs. Bill Gates, today’s pre-eminent philanthropist, has already handed over an unprecedented US$31 billion to the Bill and Melinda Gates Foundation, mostly to tackle the health problems of the world’s poor. [14] The Global Alliance for Vaccines and Immunization, a major Gates beneficiary, has delivered more than 180 million doses of vaccines since 2000, saving more than 100,000 lives. Eighty percent of the Foundation’s contributions to global health are funneled through public-private partnerships that bring together all the parties needed to sustain successful programs. [15]

A long-standing disagreement over whether decades of foreign aid have done any good has prompted economists to review their thinking. On average, foreign aid has failed to foster economic growth in recipient nations, except in special cases when governments implemented supportive policies, such as low budget deficits and openness to trade. [16] International donors should be reward those countries with visible success, measured by higher growth rates and more foreign investment, and use them as examples.

Most significantly, trade is far more important than aid for long-term development. Poor countries need to sell their labor-intensive manufactured goods, such as textiles and farm products, to rich countries. Yet high tariffs continue to obstruct their imports. [17] The World Bank notes that the average poor person confronts trade barriers roughly twice as high of those confronting the typical worker in an advanced country. [18] Farmers in poor countries have difficulty competing with heavily subsidized farmers in Europe and America, with their own markets distorted when food surpluses are dumped on them. Support to agricultural producers in advanced countries is five times higher than the total development assistance to poor countries. Rich countries preach free trade to the poor while lavishing over $300 billion a year on their own farmers. [19] A change in these policies, first through an agreement on agriculture between the United States and Europe—both of them adamant agricultural protectionists—and then between those two and everybody else, is indispensable for the implementation of a broader package of trade liberalization. [20] A limited trade deal has been reached in Hong Kong after developing countries approved a European Union offer to end farm export subsidies by 2013. www.news.bbc.co.uk, December 18, 2005.

**Debt Relief**

Programs designated to relief debt, as advocated by policy makers, some economists, activists, and the public to improve health care, education, employment, and development in highly indebted poor countries have produced mixed results. This kind of help has often been granted to corrupt governments with proven track records of misusing aid. Furthermore, debt relief under the World Bank and IMF requires, among other considerations, that countries prepare Poverty Reduction Strategy Papers. The World Bank’s handbook with guidelines to prepare such documents has more than 1,000 pages. Due to the lack of qualified policy makers and managers, it is a challenge for the poor countries to comply with such a request. To complicate the situation even more, there are often disagreements between the international lending organizations and the borrowers regarding the conditions to qualify for debt relief. [21]

Military expenditure in Africa has been increasing in recent years according to the Stockholm International Peace Research Institute. Several of the African nations identified by this organization as increasingly big military spenders, have received debt relief under the World Bank and International Monetary Fund’s Highly Indebted Poor Countries Initiative (HIPC Initiative). Interestingly, the Enhanced HIPC Initiative agreed to by the lending nations in 1999, has no guidelines for limiting military spending in countries seeking debt relief, and as is all too obvious, debt relief can free significant cash to be used to buy arms. [22]

In July 2005, the Group of eight (G8) industrialized countries at a meeting in Gleneagles, Scotland, agreed to cancel the debt of 18 developing nations. www.bbc.co.uk.

**Pediatric Cardiac Surgery with Limited Resources**

I find it important to include Professor Marc De Leval description of the nature of cardiac surgery, to help the reader to understand the context of complexity combined with limited resources:
"Cardiac surgery is a high technology system in which performance and outcomes depend on complex individual and organizational factors and their interactions. In these complex socio-technical systems, human factors research has been a major contributor to safety and reliability enhancement. Like in any complex system that involves a large number of individuals; human errors are possible and can carry major consequences. Detection is the first step in error handling. The surgeon's knowledge of the strategies to correct a problem and communication with the rest of the team, are important prerequisites to effective compensation for negative outcomes." [23]

Pediatric cardiac surgery has been available for many years in several developing countries, thanks to the hard work and creative adaptation of individuals who were able to stretch the limits of their abilities in spite of the restricted resources. Limited resources were a constant problem forcing us to focus on short-term creativity and adaptability. A great deal of energy in the form of leadership and negotiations was used to insist that people surpass themselves and continue to work hard for low pay.

Leadership, patience, perseverance, dedication, and the capacity to adapt to adversity, have been the keys to success. Our sense of mission, commitment, enormous enthusiasm, dedication and clear objectives, supplemented the insufficient support of the institution that never fully met our needs.

More than 2,500 children had surgery during my tenure in Argentina.

Some important contributions such as the evolution of the Fontan procedure, the arterial switch operation, the better understanding of the anatomy and surgery of Fallot's tetralogy with absent infundibular septum, and early extubation after pediatric cardiac surgery, came from these parts of the world.

Because of the escalating cost of cardiac surgery, and the lack of money, most of these centers have simplified the cardiac surgery process, implementing an ingenious multi-principle adaptive work the KISS approach (Keep It Simple and Safe) to help more patients with the available funds, equipment, and manpower. [24] Using the elements of this approach, which eventually became a policy, we were able to make a significant impact on pediatric cardiac surgery in Argentina, as well as in other Latin American countries, whose surgeons adopted it.

Additional considerations are the allocation of the scarce resources to patients who are most likely to benefit from cardiac surgical procedures, and avoiding those with a low expectation for a satisfactory outcome. [24]

The important features of the KISS approach are as follows:

1. Using anesthesia, perfusion, and surgical techniques that facilitate early extubation of the Trachea. A previous extensive experience with this technique in Argentina encouraged us to evaluate its impact in a completely different environment. A retrospective review was done of all hospital records for 1,000 consecutive patients who underwent surgery for congenital heart disease between April 1993 and January 2001 at our institution in the United States of America. Extubation occurred within 6 hours following surgery in 80.2% of patients, and was achieved for 73% in the operating room. It was also possible for complex anomalies, being achieved in 91% of those undergoing correction of Fallot's tetralogy, and 88% of Fontan procedures. There were no deaths related to early extubation. Preoperative intubation was a risk factor for postoperative ventilation. As expected, the patients requiring ventilation after surgery were younger, smaller, and more critically ill than those who met the criteria for early extubation. The benefits include simplified postoperative care and, when combined with clinical practice guidelines, also result in a significant reduction in the cost of cardiac surgery. It is important to emphasize that extubation in the operating room saves on respiratory therapy, and the costs of equipment, by avoiding ventilator-related charges in the intensive care unit. [25]

2. Minimizing monitoring and the involvement of ancillary services whenever a careful bedside clinical evaluation is able to provide enough information, with the nursing staff taking an active participation to achieve this goal.

3. Economizing in hardware and disposables by using locally produced ventilators, heart-lung machines, oxygenators, devices, cannulas, sutures, patches, and so on. Brazil is an excellent example of a country that, despite its large population, and significant socioeconomic problems, addressed access to cardiac surgery in the early 1960s. It started under the leadership of Professor E. J. Zerbini, who established a center of excellence in São Paulo that trained a large number of cardiologists and surgeons who spread all over the country. The center evolved and became the Heart Institute of the University of Sâo Paulo Medical School one of the largest in the world. Currently, cardiac surgery of good quality is available in every major city in Brazil, and more than 50,000 operations are performed per year. Developing a medical industry that gradually that will eventually replace imports was a priority from the very beginning. Presently, 82% of the medical equipment is locally made with a total market of US $2.4 billion. [26]

4. Reducing invasive investigations with the majority of patients undergoing surgery without
cardiac catheterization with echocardiographic diagnosis.

5. Using funds from the adult cardiac surgery service to finance the expenses of pediatric cardiac operations in indigents.

Our work with limited resources at the Italian Hospital in Argentina attracted the attention of Dr. John W. Kirklin and Dr. Eugene Blackstone, from the University of Alabama in Birmingham in the 1980s. They retrospectively reviewed 1,250 operations undertaken over the period 1978 through 1985 using multivariate analysis, and the inferences of that study were:

- Simple methods imposed by limited resources allowed generally good results in patients treated surgically.
- In the environment of the study, many patients must have died before presenting for surgical treatment. For example, 10 of 15 patients with total anomalous pulmonary venous connection presented at age 6 months or older, but 14 of 15 survived. Currently, public pediatric cardiac surgery centers in Argentina have up to one-year waiting list.
- Young age at operation was an incremental risk factor.
- A number of preliminary operations were deemed necessary in infants.
- More sophisticated methods are required for obtaining excellent results in infants.
- Simple methods are often sufficient for standard operations for congenital heart disease in children.

Movement of Cardiac Surgery to the Very Young

In the late 1980s and early 1990s, a new and difficult to neutralize adaptive challenge appeared, the movement of surgery for congenital heart disease to the very young became a powerful international trend—globalization is not a recent occurrence. Two individuals were primarily the innovators and the driving force, namely Sir Brian Barratt-Boyes in New Zealand and Aldo Castañeda at the Boston Children's Hospital. The advantages of early repair are well known and multiple. [27]

Neonate and Infants: a word of Caution

Neonates and infants have a limited physiologic reserve, have cardiac lesions with a complex pathophysiology that often require technically demanding procedures, and are prone to complications and/or sequelae related to cardiopulmonary bypass. Although the accuracy and quality of the surgical procedure are the most important determinant of survival after surgery, neonates and infants, in addition to early diagnosis, capabilities for transportation, and pre-operative resuscitation, require expensive sophisticated support, expertise, manpower, and technology.

In some developing countries, well-trained and skillful surgeons, while being able to generate excellent results in children, have difficulties reproducing the same kind of outcomes with neonates and infants. As expected, increasing costs, the lack of sufficient resources and the widening technology gap with the rich countries all have an important impact on cardiac surgery. Because individual medical leadership alone is not enough to solve this problem neonatal cardiac surgery will linger last in most developing countries. I am mindful of the danger of being unjust to people who make choices in conditions of uncertainty and circumstances over which they often had little control. It will require leadership at the level of the national government—someone in the business of changing minds—and the help of civil society to adjust values and priorities addressing social exclusion and the need to overhaul the health care.

International Cooperation

Because the world faces many formidable problems, we cannot expect to solve the mal-distribution and poor access to cardiac surgery through the regular channels for international aid. Currently, there are numerous groups around the world involved with structured international projects, but without coordination among them. In humanitarian medicine, there is room for cooperation rather than competition, because the people in need outnumber those able to provide assistance. Unfortunately, there are not humanitarian solutions for humanitarian problems. Answers that are more comprehensive are needed, in which humanitarianism would play only a part.

At my former institution, in a combined effort with the Michigan and Ohio Chapter for “Healing the Children”, 162 children from 19 countries around the world underwent cardiac surgery free of charge. Physicians from many specialties, dentists, and nurses donate their services. The hospital, social workers, laboratories, X-ray facilities, pharmacies, physical therapists, teachers, translators and others similarly donate their professional services. Airline personnel donate their time, and use their travel passes to escort the children from their home countries and then back. Healing the Children chapters across the country bring children to cities in their area and assign each child to a volunteer host family who will provide room, board—and love—for the duration of the child’s stay in the United States. www.htcmichiganohio.org
There are a limited number of programs involved in bringing patients to affluent countries for free cardiac surgery. More typically, the majority of donor programs focus on developing an on-going relationship with a host program. This relationship involves visiting teams, teaching, training, collaborative research, and donation of equipment. Basically, this "twinning process" results in a transfer of knowledge, ideas and skills to other people. It is important to identify places, "fertile sites", with receptive individuals where good work is being done, to avoid squandering energy and resources. A visiting team usually includes: surgeon, anesthesiologist, cardiologist, perfusionist, interventional cardiologist and nurse.

This approach will be most effective when local governments; doctors and hospitals have a genuine learning interest. Eventually the host program becomes autonomous, with the donor program assuming a consultant role. [28]

Another approach to the problem is building a new regional center, but this is not always feasible. Nevertheless, there are some examples that deserve mentioning:

Vien Tim - Heart Institute was erected in Ho Chi Minh by the Alain Carpentier Foundation. More than 11,000 operations have been performed by local and visiting surgeons since its opening in 1990, most of them for congenital and valvular disease.

Le Centre Cardiovasculaire de Phnom Penh in cambodia was build by Chaine de l’Espoir. Surgery has been completed for 1350 patients with congenital and valvular disease (800 surgeries: non-paying, indigent children) since the opening in 2001—229 in 2004. More than 100 local permanent staff has been trained. International Surgical missions involve 10-12 volunteers’ teams per year.

The Pediatric Cardiac Unit in Guatemala City is a joint venture of the Aldo Castañeda Foundation, the government of Guatemala, and donations from abroad. The aim of the Unit is to:

1) Provide optimal care for the Guatemalan children with congenital heart disease

2) Train additional members of the local team. Initially Castañeda was the only surgeon. Since then, two young surgeons were trained and they are currently operating independently, doing about 75% of all cases.

3) Create a referral center for complex cases from Central America. After retiring from the Boston Children’s Hospital, Dr. Castañeda has managed despite many limitations, to lead a local team that has operated on more than 1,000 patients, including neonates, with complex lesions. [29]

The Shanghai Children’s Medical Center is the result of a productive joint venture that started back in 1983, involving Project Hope, the Children’s Hospital Boston, the Children’s Hospital of Philadelphia, and the Chinese government. The Cardiac program espoused the basic philosophy of Project Hope, which is "train the trainer". The teams that traveled to Shanghai every 6 months over the past 17 years were sent to target subspecialty areas within the children’s hospital where particular instruction was required. The American team educated their Chinese peers, and these individuals subsequently become the instructors for the local staff. In addition to intramural training of staff performed by Project Hope teams, an exchange fellowship program has enabled numerous physicians and nurses to spend time particularly at Children’s Hospital Boston. The Shanghai Children’s Medical Center is an example of what can be accomplished through collaborative educational efforts. It is one of the largest congenital heart programs in the world where 1,500 open-heart procedures were performed in 2002. [30]

Heart Institute in Aracaju, Sergipe, Brazil: I have made regular visits to Brazil’s northeast—Recife, Natal, Belem, Fortaleza, Maceio and Aracaju—for the last 20 years to lecture and to perform surgical demonstrations. I facilitated the donation of a significant amount of equipment that helped improve cardiac care in this large and populated region. I became the Honorary Medical Director of a recently opened heart institute in Aracaju, which offers modern facilities to the population, including the underserved. This was an effort by a group of physicians, disappointed with the situation at the public hospital where the lack of resources was affecting the quality of patient care, and resulted in a daily struggle.

Professional organizations, such as the American Association for Thoracic Surgery, the Society of Thoracic Surgery, and the European Association for Cardio-Thoracic Surgery, can be extremely helpful. They could by coordinating the efforts, and taking maximum advantage of contemporary technology in communications and educational techniques for fostering the transfer of knowledge, skills, and ideas of its members for the benefit of patients in lesser-developed countries. The Eastern European Committee of the European Association for Cardio-Thoracic Surgery, initiated in 1995, has helped to alleviate educational needs in that part of the world, and continues to flourish. During these years the Committee has granted 106 fellowships, 12 in pediatric cardiac surgery, sponsored 49 team excursions, disbursed 32 professorial grants, and facilitated the attendance of 76 young surgeons to special courses and symposia. The International Heart School, located in Bergamo, Italy, under the leadership of Professor L. Parenzan, has provided important support to the fellowship program. The
Where do we get the necessary surgical teams for the direct delivery of surgical care and for the training of local surgeons and their ancillary personnel? In the fall of 2001, the American Association for Thoracic Surgery (AATS) mailed a questionnaire to its membership prepared by the World Heart Foundation. This questionnaire was designed to gauge the level of interest among the membership of the AATS in providing their surgical services to underdeveloped countries. Of approximately 1,000 questionnaires mailed, over 200 responses were received, 182 of which were positive. A databank was established at the AATS offices in Manchester, MA for use in arranging future “operating schedules” in underdeveloped regions. The AATS has recently agreed to request the leadership of both the Society of Thoracic Surgeons (STS) and the European Association of Thoracic Surgeons (EACTS) to mail the same questionnaire to their respective memberships. The STS has a membership of over 4,500 surgeons and the EACTS's membership is over 3,000. Since the AATS membership is only 550 and the combined membership of the STS and EACTS is over 7,000, a significant increase in the number of volunteer teams as a result of these questionnaires is anticipated. www.world-heart.org

Non-Governmental Organizations: Together with other members of civil society, are full participants in international life, and play an increasingly active and effective role in promoting the interests and priorities of the underserved.

The World Heart Foundation and affiliated NGOs: The World Heart Foundation (WHF) is a non-profit organization that was founded on May 1999 in Washington DC. Its purpose is to improve the delivery of cardiothoracic surgical care to developing countries and particularly to the children suffering from congenital heart diseases. The organization serves as a hub for the interaction of its affiliate’s non-governmental organizations that are engaged in addressing the population of the world that has no access to cardiac surgery. The Humanitarian Cardiac Surgery Project Directory of the WHF provides information of the worldwide ongoing-long-term projects of its affiliates.

The World Heart Foundation is currently implementing a six years Cardiothoracic Surgery Residency Program in China, modeled after the new American and Canadian program. Four residents began their training recently under the direction of Dr. Thomas Pezzella. It is hoped that this program will be used as a model and adopted by other centers in China. www.world-heart.org.

In addition, the WHF has produced 6 Continuing Medical Education programs for surgeons of developing countries, one of which was held in Paris. Ten Professors of Surgery from Eastern Europe and 17 surgeons from Africa were brought in free of charge, providing their housing and meals while in Paris.

“While I have been pleased with these types of activities, I have not been pleased with our ability to coordinate the work of our Affiliates. We are trying to institute a Quality Control system and an “international operating schedule” for our Affiliates, a warehouse of equipment, etc. with marginal results. In addition, our efforts to establish Regional Surgical Hubs have met with mixed results. We have also had a very difficult time raising money for the benefit of foreign children, though one of our Affiliates, Heart to Heart has recently received a major grant to help with their work in Russia.”

Personal communication. James Cox MD, Chief Executive Officer and President of the World Heart Foundation.

International Children’s Heart Foundation (IHF) is a non-profit organization based in Memphis, Tennessee dedicated to helping children with congenital or acquired heart disease in developing countries throughout the world. The organization mission is to bring the knowledge to care for children with congenital heart disease to places were it is most needed. In a 125 missions ~2,500 children had surgery in 18 countries upon request. Once a request for a mission trip is received, a site assessment questionnaire is sent to the requesting entity. Site assessment visits are not performed except in special situations. The site assessment questionnaire includes questions concerning hospital infrastructure, hardware, disposables, personnel and current status of the pediatric cardiac service. The decision to fulfill a request is based upon the answers to the questionnaire and the ability to raise funds to cover the team’s expenses. Bosnia, Nicaragua, Nigeria, Dominican Republic, and Palestine are not functional in between trips.

The overall early survival rate was 90.3%; there was a significant difference in early survival between the first five years versus the second five years—84.6% Vs 93.6% ; P< 0.001.

How much does it cost to do heart surgery on a child? The average cost per child was US$ 2,327 versus ~US$ 21,000 in the United States. There are many factors that go into the cost, the country, hotel charges, airline fares, the amount of medical supplies and equipment that has been donated vs. the amount that would have to be purchased, and the size of the medical team.

As an example, going to Nicaragua usually costs around $18,000, assuming the medical supplies are donated, which they often are. During a two week trip the medical team typically operates on between 15 - 20 children. The cost per surgery is US$ 900 - $ 1,125, considering expenses only.
Peru about US$ 30,000/trip, Pakistan about the same as Peru (this is because the Pakistani's cover the hotel and food, otherwise it would be about US$ 50,000); China about US 35,000/trip (they also cover food and hotel, otherwise it would be about US$ 45,000). The cost of the materials necessary to perform all peri-operative care is shared between the host institution and/or the local governmental agencies. The host institution provides nursing, physician and support staff to augment the ICHF volunteers. The inviting institutions, local governmental agencies or the ICHF support team expenses for travel, housing, food, visas and local transportation.

How often are surgical trips made? This year, there have been trips every month and that will continue through the end of this year.

Are the medical volunteers compensated? The medical volunteers are just that, volunteers. Usually they schedule trips on their vacations and in some cases the medical institutions they are affiliated with allow them to take time off for humanitarian efforts. The airfare, food and lodging in country are provided to the volunteers. Many volunteers return from a trip feeling, they have been "compensated" with an overwhelming feeling of having done something very important and meaningful.

A number of the programs such as Ukraine, Peru (National Heart Institute), Nanjing Children's Hospital, Beijing Children's Hospital, and Belgrade have flourished with ICHF assistance. Ukraine requires visits every 3-4 years. Belgrade, they need help with complex newborns. Some however, have failed miserably, like Croatia, Uzbekistan and these failures are all secondary to internal house politics.

The ICHF is a 501c3 charitable organization in the United States and because of this status is able to solicit and receive donations of products and funds from several sources.

Equipment donations include monitors, ventilators, syringe pumps, bypass machines, heater coolers, echo machines and electrocardiogram machines from other institutions, US and European companies. Disposables are expensive involving hundreds of thousands of dollars yearly.

Through a unique relationship, FEDEX provides free shipping when volunteers are sending supplies and ship donations to the mission's sites free of charge.

Education at all levels is an important component of the program—nurses, surgeons, perfusionists, cardiologists, intensivists, respiratory therapists, cath techs and echo techs. A team of intensivists and nurses was sent to Minsk, to educate their local counterparts without the huge patient load that happens when the surgical team is there. Locals are incorporated into the delivery of care in such a way that at some point during the visitors are serving as advisors not deliverers in the operating room, intensive care unit and the catheterization laboratory. William M. Novick. Founder and Medical Director. Personal communication. www.babyheart.org

Children’s Heart Link (CHL), for over thirty-six years the organization has been dedicated to the prevention and treatment of children’s heart disease in developing countries. It started during the Vietnam War when Vietnamese children and from other countries with heart disease were brought to Minnesota for treatment—CHL served the cardiac surgery needs of 643 children from 23 countries over the first twenty years.

In the 90’ CHL changed its approach. Instead of bringing children to the United Stated for treatment, the organization decided to assist existing programs to improve the quality and quantity of their services. From 1988-2005 CHL has participated in 39 missions to 19 countries and is currently active at 10 sites in seven countries—China, India, Ukraine, Kenya, South Africa, Malaysia, Ecuador. Over 1500 patients have been directly assisted through cardiac treatment and CHL involvement.

With regard to the average cost of a mission, it depends on the following three variables: size of volunteer team, the location of partner site (some countries/cities are more expensive to get to and/or live in than others), and what resources do the partner site brings to the table. With that said, an average mission hovers between US$ 25,000 to $ 30,000.

Children’s Heart Link work/partner with established/active cardiac programs with a commitment to pediatric charity care (these hospitals are therefore operational year round). Sites must be committed to tracking and measuring outcomes; have local/provincial governmental support; committed to CHL principles and partnership; and have a potential to become a regional cardiac center.

Although CHL has facilitated procurement of equipment and transfer to partner sites in the past, we find that local sourcing of equipment (and its associated maintenance warranties) and supplies is the most sustainable approach to building capacity.

Education has been the primary method that the organization utilizes to promote capacity enhancing
efforts, providing more than 3,500 educational opportunities as a result of conferences at our partner sites and more than 100 off-site training sessions. The organization receives funding from private sources, individuals and donors—no governmental funding. Elizabeth Bickel. President. Personal Communication. www.childrensheartlink

**La Chaîne de l’Espoir** is a humanitarian organization founded in 1988 by Alain Deloche, to combat the injustices in the geographic availability of medical treatment. Since its creation, La Chaîne de l’Espoir, has brought together physicians, surgeons, nurses, host families, sponsors, donors, artists and financial partners dedicated to providing necessary medical care to disadvantaged children. The organization is active in over 20 countries, especially in Asia, Africa, and the Middle East. [www.chaine-espoir.asso.fr](http://www.chaine-espoir.asso.fr). It has several sister organizations:

**Chain of Hope–UK**, Founded in 1995 under the leadership of Magdi Yacoub, a heart surgeon of world repute, this British affiliate cares for and operates on children with heart defects from around the world and brings them to be operated on in the UK. Chain of Hope also has regular surgical and teaching missions in Mozambique, Egypt, and Jamaica. [www.chainofhope.org](http://www.chainofhope.org)

**Surgeons of Hope Foundation Inc.** is a US registered non-profit organization, that complement the work of Chaîne de l’Espoir in Cambodia and the Maputo Heart Institute in Mozambique, whose purpose is to bring sustainable surgical and medical care to indigent children in developing countries. [www.surgeonsofhope.org](http://www.surgeonsofhope.org)

**Coeur pour Tous (Hearts for All)** is a humanitarian organization founded in 1988 and based in Geneva, Switzerland, with the objectives of promoting pediatric cardiology and cardiac surgery in developing countries, to give children with congenital cardiac anomalies the chance to return to a normal life.

Their teams make 12 missions per year that involve visits to Georgia, Lebanon, Serbia, Mauritius, Mozambique, Morocco, Eritrea and recently in Cyprus. Approximately 250 patients with congenital and acquired valvular heart disease have surgery in these countries as well as the University Hospital in Geneva. The approximated cost is US$ 15,000 per mission (25 to 30 cases) for those countries where the participation of the whole team is required. For the remaining countries where there are already some trained people, it is possible to reduce the cost to a level varying between 7,000 and US$10,000. The usual components of the group in terms of human resources are the cardiac surgeon, anesthesiologist, intensivist, perfusionist and two intensive care nurses. The number of participants varies according to the training level of our local counterparts.

Every year, Coeur pour Tous allocates 6 scholarships to a cardiac surgeon, anesthesiologist, intensivist, nurse, perfusionist and pediatric cardiologist for their training in their respective areas at the University Hospital of Geneva, the duration of the training fluctuating from 6 months to 2 years.

In January 2006 the first valve repair academy was organized and the intention is to repeat these web lab-training courses 4 times a year to familiarize cardiac surgeons from developing countries with valve repair techniques. In addition, during each mission training courses and lectures are arranged for our local counterparts in their respective areas.

The usual components of the teams in terms of human resources are the cardiac surgeon, anesthesiologist, intensivist, perfusionist and 2 intensive care nurses. The number of participants varies according to the training level of our local counterparts. Afksendyios Kalangos MD. President. Personal Communication. [www.coeurpourtous.ch](http://www.coeurpourtous.ch)

**Palestine Children Relief Fund**: Congenital heart disease is a serious problem facing thousands of Arab children in the West Bank, Gaza Strip and Iraq. Unfortunately for these children, there is no local pediatric cardiac surgery center. This organization arrange free care abroad for children from the Middle East, ship medical equipment / supplies, sent 61 surgical missions to the region that provided open-heart surgery to ~1000 children. The objective of the “Healing Hearts” campaign launched in 1998 is to provide surgery training the personnel and helping to build a pediatric cardiac surgery program that eventually become capable of treating children with heart disease locally. Currently, missions can be done with only a surgeon at an average cost of $US 7,000 thanks to the training of the local staff. Steve Sosebee. President and Chief Executive Officer. Personal Communication. [www.pcrf.net](http://www.pcrf.net)

**Pediatric cardiac surgery at Santiago Children’s Hospital, Dominican Republic**, is dedicated to providing pediatric cardiac surgery care for the poor children of the Cibao Region of the Dominican Republic. Since the start in 2004, 112 patients underwent surgery and 46 interventional cardiology procedures performed by several visiting teams. Local personnel are undergoing training with the purpose to establish an independent program. Carlos Troconis MD. Surgeon in Charge. Personal communication.

**Engineering World Health** is a charitable engineering organization that began in 2001, dedicated to the improvement of conditions in hospitals of developing nations with a unique multi-step process that
Begin with an assessment conducted by our specially trained engineers. While working alongside hospital administrators, the engineer evaluates how the needs of the hospital can best be met. Next, Engineering World Health assembles a container of refurbished medical equipment and donated supplies to meet the hospital's needs. Shipping the container to the hospital is far from the end of EWH's involvement. Once the parts have arrived, EWH volunteer engineers return to the hospital to install the equipment and train the hospital's staff in its use and maintenance. They will also repair broken equipment and train staff in the skills needed for future improvements.

However, EWH has found that a visit from engineers when the equipment first arrives is not enough. Items get broken in shipment, staff forgets how to use the equipment, and occasionally a hospital requires an unanticipated special part to use the equipment. That's why EWH returns a third time to the hospital. During the third visit, any additional parts not shipped with the original delivery are installed and the training is reinforced, preserving the hospital's capabilities for years to come. Engineering World Health has bloomed into a national organization with chapters at schools around the country. Since the announced partnership with Duke University in 2004, EWH has continued to expand and create new initiatives, including the Cure Program and the Design for the Developing World class being taught currently at Duke. CUREs is a nonprofit business plan competition that works with student teams from across Duke University to develop innovative, simple, inexpensive medical devices that meet the needs of people in developing countries. EWH frequently accompany organizations like International Children's Heart Foundation and Children's Heart Link on their missions to help them keep their equipment running. There are approximately 50 trips going this year to about 10 countries. Dr. Robert Malkin. Founder. Personal communication. www.ewh.org

Domestic Philanthropic Endeavors
Philanthropy in the developing countries is suboptimal and has no solid tradition. Latin America, predominantly catholic, the world’s most unequal region is a good example of relatively modest but increasing philanthropic efforts with many opportunities for leadership. Philanthropy can also add to the total sum of efforts necessary to rescue the education systems. [32]

Culture and/or interpretation of the concept of philanthropy may be responsible for weak philanthropic efforts. In the United States philanthropy is mainly the donation of money for a good cause. In other parts of the world where money is scarce, people donate their time and skills to help other persons without expecting personal benefits.

Lack of tax incentives and tax evasion also has a negative impact on philanthropy and charitable donations. Even when tax incentives are available, deductions are only possible for the minority that pays taxes. In addition, lack of trust and accountability are powerful deterrents.

Not everybody is poor in the emerging countries. There are often people with enough education and resources to organize and participate in local philanthropic efforts, to help their own “have not”. The philanthropic leadership will come once the elites have the opportunity to cross the physical and psychological barriers that make it difficult to get to know the poor, recognizing them as fellow citizens. Philanthropy can also add to the total sum of efforts necessary to rescue the education systems.

The Great Orchestra of Christmas Charity Foundation, a Polish non-governmental and non-profit organization, focused in children, is a good example of how the population can contribute to improve the quality of the health care. Since its establishment in 1993 the foundation has supported 13 major projects in public hospitals in the country providing US$ 44 million in financial assistance—US$ 9,864,293 in 2005—to equip different pediatric subspecialties, including cardiac surgery.
www.wosp.org.pl [33]

The Importance of Education and Research in Developing Countries
Education should be part of basic human rights. Overall, the education system is inadequate and crying out for reorganization. The best long-term way to improve the lot of the poorest is better primary schooling, particularly in girls, with an emphasis on improving quality rather than quantity. Higher education should focus on producing well-trained individuals equipped to be a factor of change. Although education does contribute to the human capital of each individual, additional spending on education produces few benefits when it is not accompanied by major socioeconomic reforms. More education does not necessarily mean more growth, as presumed by most politicians and economists. [34]

When compared to their counterparts in the developed world, young people in the developing countries are 100 times less likely to enter a scientific career. Nevertheless, science and technology can be the answer to their countries’ problems. Despite the obvious limitations imposed by the lack of knowledge and scarcity of resources, the importance of research in those areas must not be underestimated. The potential advantages of research under these circumstances are to:

1. Develop local expertise
2. Provide opportunities for talented people.
3. Determine the size of the problem in cooperation with all concerned locally.
4. Generate specific answers for local problems (neglected diseases).
5. Implement a strategy of Science leading to technology, and thence to health and wealth.
6. Enhance dignity.
7. Participate and contribute to global knowledge.

Examples of this approach are the joint research projects on endomyocardial fibrosis in Mozambique, and on Chagas Cardiomyopathy in Honduras, in which the Chain of Hope, the Harefield Research Foundation, and the Imperial College, London, are involved. [35]

### Conclusion
- “The less privileged parts of the world” can exist anywhere, and are not necessarily due to economic constraints. Cultural stagnation can easily be responsible for the lack of scientific progress and development. Realize this could be your problem!
- Listing the problems may be easy; finding solutions is not. Principle-policy gap: initially, people tend to agree on principles but when the trade-off—cost for the different individuals or special interests of the groups involved—becomes evident many initiatives do not eventually become policies.
- Because the dilemma is complex, only fundamental changes in the world’s architecture and economy can solve it. It is unlikely to see these changes materialize in the near future. If development were easy, everyone would have already developed.
- There are no humanitarian solutions for humanitarian problems. Palliation is possible with a multidimensional approach involving donors and professionals.
- It is important to identify places, ‘fertile sites’, where people are doing good work, and help them through the concept of a twinning program working with institutions rather than governments.
- Success should be rewarded by donors and used as an example.
- National and International professional organizations can help by coordinating the efforts, and taking maximum advantage of contemporary technology for communications and educational techniques.
- Developing countries should do as rich countries do, and not necessarily, as they say. (P. Krugman). Rich countries have the resources to pay for their own mistakes!
- The intellectual, cultural, and moral benefits of education for individuals and society are undeniable. Thoughtlessly unlimited expansion does not necessarily result in economic growth.

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CV of the author
- Medical Doctor Degree National University of the Litoral; Rosario School of Medicine Rosario (Argentina);
- Doctorate in Medicine (Thesis Presented) National University of Rosario School of Medicine Rosario (Argentina);
- Certified Cardiovascular Surgeon. Argentine College of Cardiovascular Surgeons. Buenos Aires (Argentina);
- Board of Trustees Member. The International Heart School. Bergamo, Italy. April 2004- Present.
- Board of Directors Member. Global Medical Relief Program (philanthropic organization). Chicago, IL. USA. (www.Globemed.org); July 2000- Present.
- Associated member, Society of Surgery of Rosario, Argentina.
- Active member. Society of Cardiology of Rosario, Argentina.
- Member. Society of Pneumonology of Rosario, Argentina.
- Honorary Member. Brazilian Society of Cardiovascular Surgery. March 17, 2004
- Honorary Member. Rosario Society of Cardiology, Argentinean Federation of Cardiology. August 20, 2004

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