Delivering Care
Where It’s Needed

The rural village of Chepkemel in western Kenya sits near Lake Victoria and the border of Uganda. The residents rise early, leaving their mud-and-grass homes to tend fields of maize, sweet potatoes, beans and other crops. But Silas, a 41-year-old community health worker, rises earlier. Carrying a blood pressure monitor, his phone, data collection forms and a stack of educational pamphlets, he makes house calls before breakfast.

Four years ago, he noticed signs of hypertension—high blood pressure—in his neighbor Gladys, a 57-year-old mother of eight. He referred her to a doctor and she began taking medication. Today, her pressure is under control, one of many such success stories. By improving access to diagnostics and treatment, Silas and many others are improving the health of communities in many low- and middle-income countries.

The need is all too real. Death and disability from cardiovascular and related diseases have risen sharply in developing countries in recent years, fueled by a complex array of causes, from dietary changes and increased tobacco use to indoor air pollution. Four fifths of the world’s chronic illnesses now occur in countries classified as low- or middle-income by the World Bank. The World Health Organization (WHO) estimates that collectively, heart attack, stroke, diabetes and other related diseases will kill 28 million people in Africa over the next decade—far outpacing deaths from malnutrition, starvation, childbirth complications and infectious diseases. In 2005, cardiovascular disease was responsible for twice as many deaths as HIV, malaria and tuberculosis combined.
Implement Policies to Promote Cardiovascular Health

Improve Access to CVD Diagnostics, Medicines and Technologies
Doctors and nurses conducting ward rounds in Kenya’s new Cardiac Care Unit, which officially opened in June 2013 in Eldoret.

already severely strained. The National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke was established in 2010, and although a preexisting cancer component is now active, other programs are yet to roll out nationwide.

The system also faces a severe shortage of skilled health workers, especially in remote rural areas. India doesn’t meet WHO’s recommended minimum of 23 doctors, nurses and midwives per 10,000 people, averaging just 19. But there is also an extreme shortage of both general practitioners and specialists—just 6.5 doctors per 10,000 people versus the global average of 14.2, with only a quarter practicing in the rural areas that are home to three quarters of all Indians. Most doctors prefer to work in the larger clinics and hospitals that are concentrated in the cities.

Public health expertise is also in short supply, as India did not invest in schools of public health until very recently. As a result, health care policies were not adequately informed by research. The design, delivery and evaluation of health programs fell short, failing to meet the country’s health needs. To bridge the gap, the Public Health Foundation of India (PHFI) was launched in 2006 with initial funding from the government of India, the Bill & Melinda Gates Foundation and private donors. While launching the foundation, Mammoth Singh, India’s prime minister, noted the importance of public health in India’s development. “Ours is a demographically young country,” he said. “The largest growing demographic segment in India over the next two decades lies between 15 and 59 years. This provides a wide window of opportunity to enhance national growth, provided we can productively deploy this vast human resource.”

In collaboration with premiere research universities in Europe and the United States and a range of public-private partnerships, PHFI has forged a model for addressing national health crises, one that Singh said, “can help blend the commitment of government with the operational efficiency of not-for-profit private groups.”

One focus point is education. Five Indian institutes of public health now offer epidemiology, health promotion, research methodology and other on-campus and distance learning programs. Since 2008, these institutes have graduated some 1,500 public health professionals; another 17,000 have received shorter-term training.

In another initiative, PHFI is researching the effectiveness of India’s current cardiovascular disease care efforts in partnership with Emory University and the London School of Hygiene & Tropical Medicine. These investigations include the role of lesser-trained health care workers in diagnosing and treating chronic disease and the efficacy of innovative mobile phone technology to transmit health data.

Other research is examining the impact of policy changes such as new, higher taxes on cigarettes. With more than 120 million smokers and nearly a third of the country using tobacco in low- and middle-income countries worldwide.

Limited access to therapies for common conditions like high blood pressure exacerbates the problem. Funding and infrastructure is often lacking. Governments and relief organizations have, understandably, invested more heavily in treating infectious diseases and acute illnesses. But a striking lack of rural doctors and poor health care coverage are just two examples of the hurdles facing countries that are struggling to cope with cardiovascular conditions.

This growing burden of disease, coupled with inadequate care in these regions, led the U.S. Institute of Medicine’s Committee on Preventing the Global Epidemic of Cardiovascular Disease to list the need for improved access to cardiovascular diagnostics, medicines and technology among its recommendations back in 2010. Many efforts to provide cardiovascular services in developing countries are now underway, the most successful of which involve strong collaboration among not-for-profit organizations, governments and private companies.

**IMPROVING PUBLIC HEALTH IN INDIA**

Coronary heart disease is reaching epidemic levels in India. The younger population is particularly hard hit, due in part to undiagnosed high blood pressure, increased smoking and inefficiencies in the health care system that leave these and other risk factors unmanaged. News of a 30-year-old who has suffered a heart attack is no longer a shocking event. About 25 percent of 30- to 39-year-olds die of heart ailments; among those under 64, that number jumps to 40 percent.

The economic consequences are severe. Stents implanted after a heart attack cost about $3,000 whereas coronary bypass surgery runs between $1,500 and $5,000. These costs are prohibitive even for a mid-level employee (who earns about $10,000 to $12,000 a year). One study found that about 70 percent of Indians who suffer severe cardiac events face catastrophic expenses. Half are forced to sell property, and almost that many lose income. Most health care expenses in India—nearly three quarters—are paid out of pocket. Some companies offer widows compassionate employment when one of their workers dies, but that salary is usually too low to sustain a family. However, the economic impacts radiate further: WHO estimates that India will lose $237 billion between 2005 and 2015 due to heart disease and diabetes.

India’s health care system has been slow to adapt and is...
in some form, the institute has given its use special attention. Among the younger population, smoking poses the greatest heart attack risk. The Indian government recently raised cigarette taxes to 18 percent, but far more people smoke bidis, which are far cheaper. And with a social stigma against females smoking, women tend to chew tobacco instead. PHFI is pushing to raise taxes on these products, too, with those revenues targeted for universal health care coverage. The organization is also working with law enforcement to ensure that India’s formidable antitobacco measures are enforced—laws banning sales to minors and smoking in public places, and another requiring public service announcement screenings in movie theaters that detail tobacco’s health hazards.

PHFI is also bringing technology to the frontlines of cardiovascular care. Rural health care workers are now inputting patient data into electronic tablets—blood pressure readings, blood sugar levels, blood test results, electrocardiogram readings and more—and then uploading that data to a primary care physician or a cardiologist so that problems can be addressed quickly. While the tablets cost the government $400 each, a diagnostic test costs an individual just $2.

PROVIDING COMPREHENSIVE CARDIOVASCULAR CARE IN KENYA

Because heart disease is considered a wealth country problem, its rise in low- and middle-income nations is often believed to exclusively reflect the lifestyle changes of an expanding middle class. The rate of cardiovascular disease in rural western Kenya contradicts that notion. Most people work the land and make about $800 a year, yet stroke and heart disease rank in the top 10 causes of death nationwide. One in 10 people have high blood pressure; this high incidence may be due to both traditional causes, such as high salt intake, as well as more endemic causes, including indoor air pollution from burning wood or animal dung for cook fires. By 2025, this burden is expected to skyrocket globally: 75 percent of all hypertension cases worldwide will be in low- and middle-income countries.

Accessibility to diagnostics and treatment has been a major challenge. In Chepkemel, Silas’s village, a clinician visits once a month. Much of their time is spent treating patients with acute illnesses, so the likelihood of early detection of heart problems—before costly complications ensue—is slim. For example, if hypertension is diagnosed early, medication needed to control it costs under $2 per month, while treatment for later-stage hypertension in more sophisticated medical facilities costs an unaffordable $10 per month; local farmers earn $1 to $2 per day. Left untreated, a debilitating stroke could make it impossible to ever work again, hospitalization is extremely
costly—and a stroke could prove deadly.

In 2001, an international consortium of universities formed an organization to address the health care needs faced by the 3.5 million people living in western Kenya. The Academic Model Providing Access to Healthcare (AMPATH) partnership teamed Kenya’s Moi University and Moi Teaching and Referral Hospital with U.S. medical schools, including Indiana, Brown and Duke universities, among others, initially to implement a comprehensive care program for patients with HIV/AIDS. More recently, AMPATH expanded its clinical scope to include the most common cardiovascular and related diseases: stroke, hypertension, heart failure, diabetes and rheumatic heart disease. By twinning implementation and delivery of care with a robust research program, the organization was designated a Center of Excellence to Combat Chronic Diseases by the U.S. National Heart, Lung and Blood Institute in 2009.

AMPATH collaborates with Kenya’s Ministry of Health to work with community health workers like Silas, who are schooled in data collection and trained to monitor blood sugar, measure blood pressure and conduct other diagnostic testing. They are then dispatched to make door-to-door visits in their own communities. Villagers are comfortable sharing personal information with them, people who are their neighbors, making it a very effective program. Now, the entire adult population in this area is being monitored for hypertension and other cardiovascular issues.

But screening does not guarantee treatment. Access to even the most common medications in some places is difficult, if not impossible. The nearest government-run pharmacy may be far away, and though medicines are affordable, they are often out of stock. AMPATH is now helping communities create small pharmacies inside local health clinics; if patients have transportation problems or government supplies run out, they can purchase medications nearby for just a little more than what they’d spend at the government-run outlets. A new service supervises patients taking blood-thinning medications: By using devices that provide instantaneous test results, dosing can be adjusted immediately and individualized pillboxes could help promote adherence to treatment.

Although no existing records quantify exactly how prevalent chronic disease is in western Kenya, the numbers of people streaming through AMPATH’s cardiovascular outpatient unit hints at the magnitude of the problem. The center has enrolled 4,000 patients, including 800 children; its inpatient cardiac care unit has treated more than 300 critically ill patients since opening in February 2013.

The organization is also a leader in the use of health information technology to improve care of patients in a low-income country setting, from electronic health record systems and computerized data collection to portable automated blood pressure machines and glucose testing kits. The hope is to empower community health workers to provide more effective care. Researchers are now evaluating the role of mobile devices; smartphone technology could be harnessed to prescribe medication and monitor patients in rural areas.

THE PACEMAKER RECYCLING MOVEMENT

A stark example of the inequity in cardiovascular treatment across the world is in the area of lifesaving implantable cardiac devices: pacemakers and cardioverter-defibrillators (ICDs) that are used to treat dangerously slow or fast heart rhythms. The need for such devices is increasing in developing countries for multiple reasons. In Latin America, a bite from the triatomine bug often infects the victim with the Trypanosoma cruzi parasite. The resulting condition, Chagas disease, scars heart tissue, which may cause “heart block” or heart failure. The need for implantable devices is also on the rise from increasing numbers of smokers and people who suffer from high blood pressure or diabetes.

But they cost a small fortune, making them prohibitively expensive for people living in low- and middle- income countries. The price of a pacemaker runs between $2,500 and $3,000, while defibrillators cost an order of magnitude more, anywhere from $20,000 to $40,000. A 2009 survey quantifying the yearly global use of pacemakers reported 767 implantations annually per million people in the United States versus only five per million in Bangladesh. About a million people may be dying every year due to lack of access to pacemakers. Some foreign manufacturers have reduced the price to $800 per unit, which is still far more than the average annual income in many parts of the world. Although some donate their product widely through organizations like Heartbeat International, it’s not nearly enough for everyone in need.

Recycling these devices is an obvious, if bureaucratically thorny, solution. While brand-new pacemakers and ICDs are expensive, previously used pacemakers can be harvested from deceased patients—they’re always removed prior to cremation, and they can be sterilized and reused at a fraction of the original cost. Given that pacemakers generally last 10 years or more and roughly 40 percent of patients die within four years of receiving them, a significant fraction have enough remaining...
battery life to be potentially reusable. Three quarters of pacemakers removed for medical reasons will continue working for another five years. Some heart patients request removal of the device in a living will; studies have found that family members and funeral directors are more likely to donate the device if there is a system in place to do so.

One organization that is attempting to build such a system is My Heart Your Heart, which studies and facilitates pacemaker and ICD reuse. It was founded in 2010 by physicians from the University of Michigan Cardiovascular Center in collaboration with the Michigan Funeral Directors Association, World Medical Relief, a nonprofit that helps people with medical and pharmaceutical needs in developing nations; and a company that recycles the metallic by-products of the cremation process, Implant Recycling, LLC. The group has already stockpiled more than 12,000 previously implanted devices and is working with Pace4Life in the United Kingdom to collect pacemakers and ICDs in Europe.

The numbers are promising, but in order to build a successful large-scale recycling program, a few obstacles must be overcome. Chief among them are U.S. Food and Drug Administration regulations that categorize pacemakers and ICDs as “single-use,” which means that those intending to reprocess them for reuse would need to comply with the same handling and product standards as the original manufacturer. These standards may be difficult to achieve by charities involved in device reuse, even though current reprocessing protocols have been shown to be safe.

Safety is the primary concern with “adulterated” products. Manufacturers cannot be held accountable for any malfunction during their second incarnation. The potential risks extend beyond the devices themselves: A worry is that reimplantation could, in theory, transmit infection from the donor to the recipient.

Numerous small cohort studies carried out over the last several decades suggest that the infection risk is really quite small. Recent research in Nicaragua, Mexico and India has found a low incidence of complications, on par with those in brand-new devices. Although these small case studies are promising, My Heart Your Heart is poised to conduct a large prospective multicenter study to determine the clinical efficacy and safety of pacemaker reuse.

In the meantime, many obstacles remain before cardiac pacemaker and ICD reuse can become mainstream and recycling remains, for the moment, more of a concept than a reality. To safely reuse devices on a large scale, rigorous and transparent protocols will be needed to carefully collect, evaluate and reprocess pacemakers in the U.S.—with careful oversight. Collaborations between medical facilities, the funeral industry and nonprofit funders will also be necessary in low- and middle-income countries.

Cardiovascular disease can no longer be stereotyped as a “rich world” disease. With nearly 30 percent of deaths in low- and middle-income countries now attributed to coronary heart disease, stroke and other related ailments, these nations need the infrastructure to cope. Poverty, too few doctors and other systemic issues thwart early detection, which allows costly and debilitating complications to arise. However, rising necessity sparks novel strategies that will ensure access to diagnostics, medications and technology.

Gradually these innovations are creating a new landscape. It is visible when a sugarcane grower in Andhra Pradesh, in southern India, pays $2 for a 33-point diagnostic test or when a funeral home director inquires about pacemaker donations. And it is transforming the hillsides of western Kenya, as Chepkenel’s residents emerge from their homes asking when Silas will arrive.

The economic consequences are severe.

[In India] stents implanted after a heart attack cost about $3,000 whereas coronary bypass surgery runs between $1,500 and $5,000.

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