INCLUSIVE INNOVATIONS

Using Telemedicine to Treat Patients in Underserved Areas

Remote service delivery provides patients and doctors with access to specialists, greatly reducing the need for costly travel

HIGHLIGHTS

- Telemedicine is the remote delivery of healthcare services via information and communications technology (ICT) to diagnose, treat, and prevent disease and injury.
- It allows rural health practitioners to consult with city-based specialist doctors to provide diagnoses and treatment plans for rural patients, so patients don't have to travel.
- It also provides distance learning opportunities for local health workers.

Summary

Millions of people living in rural, remote areas must travel long distances, at enormous cost, just to receive a medical diagnosis. Telemedicine allows local healthcare providers to consult with specialists in towns and cities, allowing many patients to be treated locally.

Development Challenge

Millions of people in rural and remote areas lack access to even basic medical care. Patients who need specialized care must travel long distances, at enormous cost, just to receive a diagnosis. Being able to obtain medical care where they live could be life-changing for these people.

Business Model

Telemedicine is the remote delivery of healthcare services via ICT for the purpose of diagnosing, treating, and preventing disease and injury. It can extend healthcare to people who lack access to it because they live too far from a health facility or the facility lacks the necessary equipment or trained personnel. Telemedicine can also be used to train local healthcare workers and provide them with professional support.

Telemedicine is rarely a stand-alone business model. Especially in low-income settings, it tends to be a turnkey solution that is plugged into existing business models, such as chain clinics or hospitals, leveraging existing providers and structures and extending services to new areas.

Telemedicine is used by a healthcare professional as part of their interaction with a patient at a clinic or hospital. One form of telemedicine that uses wireless devices and cell phone technologies is mHealth, or mobile health. mHealth is usually used on consumer-facing devices. The use cases are thus slightly different; telemedicine is more established and can allow for more in-depth consultation since a healthcare professional is physically present. There is more possibility to prescribe medicines or perform examinations.

WORLD BANK GROUP

This series on Inclusive Innovations explores business models that improve the lives of those living in poverty. Editors are Elaine Tinsley and Natalia Agapitova. Written and researched by Endeva and Ashley Insight with additional contributions by Madhusmita Hazarika.

Components of the Model

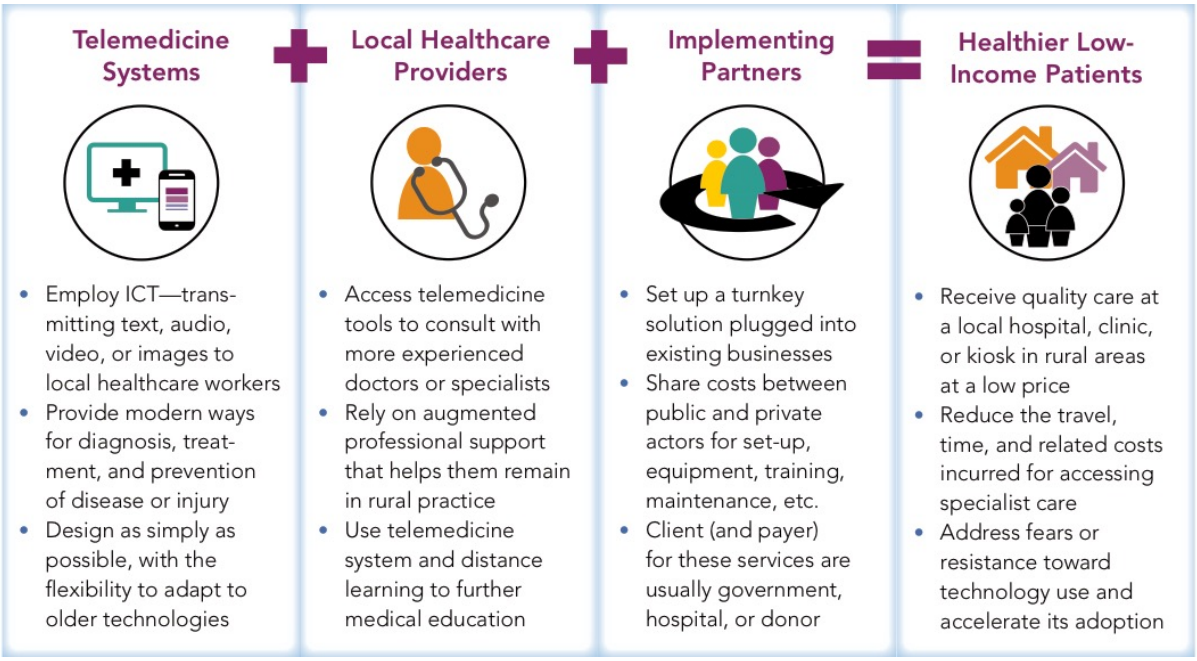
Telemedicine includes teleconsultations, videoconferencing, and remote patient monitoring (see Figure 1). Patients usually access telemedicine at a local hospital, clinic, pharmacy, or kiosk, where local healthcare workers consult with doctors or specialists on diagnosis and treatment options. Telemedicine facilitates access to expert healthcare for both patients and local healthcare workers in several ways:

- It provides healthcare workers at local hospitals, clinics, or pharmacies access to expert help from more experienced physicians or specialists.
- It offers reassurance to both local healthcare workers and patients.
- It reduces the travel time expense and stress associated with seeking specialist care.

It also encourages local healthcare workers to remain in rural areas, by augmenting professional support and allowing them to continue their professional development.

Telemedicine transmits information via text, audio, video, and still images to a range of specialists. Photographs of simple skin tumors can be transmitted to large hospitals for interpretation and consultation; X-rays can be sent off for a specialist opinion. Where a stable Internet connection exists, patients can videoconference with a healthcare professional or email information for analysis. Doctors can monitor blood pressure or glucose levels of a clinic's patients by looking at a computer screen.

Figure 1. Features of the telemedicine model that can improve health outcomes for rural poor



Cost Factors

Operating a telemedicine system involves purchasing the equipment needed to set up the system in the hospital, clinic, or pharmacy; maintaining the equipment; training the physicians and local healthcare workers on the technology; and compensating the physicians. Public and private actors usually share these costs.

Revenue Streams

Most telemedicine programs and services are subsidized by governments or international donors. A few social enterprises are trying to operate financially self-sustaining telemedicine services. Table 1 illustrates examples of services provided and costs.

Table 1. Fees charged by selected providers of telemedicine services

Company/country	Service provided	End-user costs
Apollo Healthcare (India)	Teleconsultations for hospital patients	Teleconsultations cost USD 20–30, borne entirely by the patient.
Narayana (India)	Teleconsultations and remote electrocardiogram (ECG) readings	Teleconsultations cost USD 30–50, borne entirely by private hospitals. ECG readings are free to users.
Telemedicine Africa (South Africa)	Complete telemedicine solutions for hospitals, including distance learning courses for staff	Patient payment for health services in South Africa is a flat USD 2 per consultation at public clinics; therefore the cost for the telemedicine equipment and services is borne by the hospital, not the end-user.

Financial Viability

The costs of telemedicine are often high in low-income countries, because of low awareness among both patients and local healthcare workers, low information technology literacy, and limited access to infrastructure and technology. Because hospitals are generally unable to cover all costs, most projects are at least partially funded by local governments or development partners.

Financial viability can be greatly impacted by external factors, such as poor Internet connectivity. The Opportune Breast Cancer Screening and Diagnosis Program (OBCSDP) was initiated in Mexico in 2006 to reduce breast cancer mortality in women between the ages of 50 and 69. The federal and state governments as well as nonprofit groups provided approximately USD 2.8 million to set up this telemedicine program in 11 states. The program originally aimed to become financially self-sustaining by 2012, but it found that poor Internet connectivity significantly reduced uptake. Diagnostic centers that were able to perform more than 150 screenings per day averaged less than 50. OBCSDP is working to acquire more reliable technology. In the meantime, doctors must place image scans on compact discs and use ground transportation to deliver them. Results can take up to three weeks to deliver. Mexico's government and nonprofit partners have remained supportive, but such delays and challenges often cause pledged program money dry up, putting the program at risk.

Some models could eventually be self-sustaining. VSee, created by a team at Stanford University, is a screen share app for iPad that allows five parties to video. The technology allows high-quality ultrasounds to be conducted with only USD 300–4,000 worth of equipment—a fraction of the price of an ultrasound machine (up to USD 30,000). VSee is currently funded by Salesforce and the National Science Foundation, but it is a model that could be profitable.

Partnerships

Successful telemedicine projects align the interests and resources of various stakeholders to create a solution that is tailored to the local market. These partners include private companies; governments and development partners; local clinics and pharmacies; and remotely located hospitals, doctors, and specialists.

- Private companies develop and implement telemedicine solutions.
- Service providers set up telemedicine systems for hospitals, providing monitors, Internet connections, technology suited to the environment, and training on how to use it. Telemedicine is therefore more of a B2B (business-to-business) than a B2C (business-to-consumer) operation.
- Governments and development partners provide funding, usually in the form of joint ventures by international donors and nonprofit organizations. Governments are also key to expanding rural access to broadband Internet connections, organizing national agencies for the development and promotion of telemedicine, and crafting policies that ensure an efficient and safe telemedicine experience for patients and healthcare providers. The Chinese government's National Health and Family Planning Commission of the People's Republic of

China (NHFPC) created guidelines on telemedicine in August 2014. They address how to actively promote the development of telemedicine services, clarify service items and ensure the quality and safety of telemedicine services, and protect the legitimate interests of both physicians and patients (Ferris and Lacktman 2014).

- Local clinics and pharmacies handle interactions between the telemedicine technology and the patient. They are trained to carry out parts of the consultation and send the doctor or specialist the necessary information.

Hospitals, doctors, and specialists provide expert advice, diagnoses, and treatment options to local healthcare staff. They may also provide continuing education and professional development of local staff.

Implementation: Delivering Value to the Poor

Awareness

Building awareness on the benefits and appropriate use of telemedicine is key to reducing resistance to the technology and accelerating its adoption among both healthcare workers and patients. Concerted advocacy on the benefits and the appropriate use of telemedicine can help address fears or resistance toward technology use and accelerate its adoption among both health professionals and patients.

Acceptance

Many local healthcare workers are unfamiliar or uncomfortable working with computers; they also fear that telemedicine may lead to job loss or a reduction in their bedside presence. To gain their acceptance, telemedicine programs must be designed as simply as possible. To allay anxiety about technology, Sanjeevani, an Indian company, integrates older technology, such as telephones and simple document scanners, with sophisticated video conferencing technology (Sood and Bhatia 2005). This helps bridge the gap in healthcare professionals' experience between old technologies and new, and has the added advantage of being a reliable alternative if Internet connections are slow or lost. The older technology also serves as a backup if the newer technology fails.

Availability

Given the scarcity of licensed doctors and specialists in many emerging and developing markets, telemedicine allows low-income patients access to highly professional care while potentially eliminating costs such as travel expenses for specialists and patient transfers. The level of service provision will often depend on the ICT infrastructure available. For example, there are two levels of development in rural India. Rural hospitals in larger rural cities, which have access to ISRO satellite network are able to get support from Apollo Telemedicine, Narayana Hrudayalaya, and other major hospitals.

In even more remote, rural areas, infrastructure is much more limited and large scale providers/ hospitals are not present, and therefore telemedicine may not be available. In response, mobile health clinics, such as those created by Apollo Hospitals, Philips, ISRO, and the Dhan Foundation as part of the Distance Healthcare Advancement Project (DISHA) project, enable access to medical care for individuals who are even more remote than existing clinics can handle. With the decreasing cost of mobile plans, and increased use of mobile phones, the health hotline (e.g., MeraDoctor) has emerged as an alternative solution for customers who do not want to travel long distances to clinics for relatively minor health questions.

Affordability

Telemedicine creates value for a healthcare system by providing more access to specialists at a minimum price (once the system is set up), providing modern ways of working with patients and

collecting data. It also allows healthcare providers to continue their education on a regular basis using distance learning—perhaps with bigger hospitals in the region or even international partners.

As a business model, service providers often set up a telemedicine system for a hospital. They can work with the hospital to remain within a certain budget and leverage existing technologies being used to ensure affordability. The main client (and payer) for these services are usually a government or a hospital. Services are provided in the form of a full telemedicine setup, which usually includes monitors, internet connections, technology suited to the environment, and some sort of training on how to use it. The end user (the patient) will rarely pay for the telemedicine services. They will most likely pay the price for a usual consultation regardless of whether it includes telemedicine or not. Therefore, telemedicine is much more of a B2B model than a B2C model.

Results and Cost-Effectiveness

Several programs have demonstrated results. Narayana's hospital and healthcare network in India connects 850 centers from around the world to its premier facility in Bangalore. Its cardiologists remotely review 600–700 ECGs a day.

MeraDoctor, a remote consultation service in India that uses WhatsApp and telephones, has provided more than 55,000 consultations on more than 400 ailments to its estimated 500,000 customers in rural areas of India. It has reduced the need for repeat visits to traditional doctors for simple medical conditions and helped quickly resolve questions. By avoiding overmedication, MeraDoctor also saves patients money on medicine.

There is a need to strengthen the evidence of telemedicine programs by standardizing reporting on outcomes, cost-effectiveness versus traditional healthcare delivery, and increased coverage to remote areas (Khanal and others 2015). A standard reporting toolkit would not only provide stronger evidence of impact, it would also enable governments, international donor agencies, and investors a means of assessing the potential of telemedicine.

Scale and Reach

Telemedicine extends the reach of existing health facilities and providers by increasing access to healthcare for end-users. In higher-income countries, with good infrastructure, institutions, and awareness, telemedicine is reaching millions of people. Narayana Health has treated 54,000 patients through its ECG networks, examining approximately 450–500 ECGs a day. The Naranaya Health network connects 130 centers via teleconsultation, including 53 in Sub-Saharan Africa. Naranaya Health which boasts the largest telemedicine network in the world, had 800 telemedicine centres in India and another 100 centres spread across 60 countries.

The Indian Space Research Organization (ISRO) connects 22 specialty hospitals, such as Narayana Hrudayalaya, which focuses on cardiac care, with 78 rural and remote hospitals across India through its geostationary satellites. ISRO has provided more than 25,000 patients with teleconsultation and treatment. Narayan Hrudayalya reports that it treated 17,400 patients using telemedicine connectivity in various parts of India, mainly rural areas, between 1999 and 2005. Other telemedicine programs have reached only a much more modest scale, largely because of weak Internet connectivity.

Improving Outcomes

Telemedicine provides people in poor communities with access to specialized care not available in their own communities, in many cases obviating the need for them to travel. It facilitates cross-site and intercountry collaboration, providing healthcare professionals with access to otherwise unavailable specialist advice.

Telemedicine is also a good way to train local healthcare workers remotely (House and others 1987). World Health Partners, an Indian NGO, has expanded its telemedicine network in Uttar Pradesh to

include approximately 1,200 "Sky Care Workers" and 120 entrepreneur-run centers, which it has branded "Sky Health Centers" (Knowledge at Wharton 2012). Sky Care Workers are trained to diagnosis patients, perform symptom-based treatments, use teleconsultations, and make referrals to Sky Health Centers.

Cost-Effectiveness

Telemedicine is more of a cost-saving mechanism than a money-making mechanism for a health business model. Telemedicine helps save costs by offering many more services to a hospital or clinic's patients without in-house specialists or the need for transfers to other facilities that can be time-consuming and costly. It is also a way for hospitals and clinics to modernize their services, and to provide their staff with ongoing learning from hospitals in the region, country, or even internationally. This further education via videoconference is critical, especially for rural practitioners to keep abreast of the latest in medicinal practice.

At the patient level, telemedicine provides patients access to services previously not available—and allows them to save money on specialist consultations. Apollo Hospitals charges USD 20–30 for a teleconsultation, and estimates the total cost of a traditional consultation at approximately USD 100. Research showed that only 25 out of 100 patients needed to physically see a specialist after a telemedicine consultation. The other 75 people were saved a referral to a specialist.

Scaling Up

Challenges

Telemedicine has enormous potential, but it faces significant barriers to adoption in low- and middle income markets, for a variety of reasons:

- *Lack of infrastructure, particularly broadband*: Broadband networks that can transmit videos are still limited in many areas, including in China, India, Indonesia, the Philippines, and Vietnam. Access is growing, however. It will lead to increased acceptance of telecommunication as a tool for health.
- *Low awareness of benefits*: Some patients, particularly older patients, are hesitant about the new technology. Many hospitals and clinics perceive that telemedicine solutions are too expensive to implement.
- *Lack of or dependency on public support*: Telemedicine solutions tend to be government-funded, at least in their early phases. If funds dry up and there is no alternative business model, the system becomes unsustainable.
- *Lack of regulation and legislation*: No international framework on telemedicine exists; there is little consensus or understanding on what constitutes a high-quality telemedicine service or attempts to develop standards. Standardization of both hardware and software, as well as guidelines for practice, would help program managers overcome interoperability, portability, and security issues (WHO 2010).
- *Legal liability issues*: Some medical practitioners may be reluctant to practice telemedicine for fear of medical indemnity issues.
- *Privacy concerns*: To address concerns about privacy, nonprofit organizations such as the Center for Connected Health are working to make Skype compliant with medical codes relating to privacy so that doctors can communicate over it without breaching doctor-patient confidentiality. While Skype's encryption methods are strong, overall it does not appear to meet HIPAA (Health Insurance Portability and Accountability Act) compliance standards. Organizations that use the software to communicate with patients over the Internet should be aware of the risks involved and consider using other video conferencing platforms instead.

Role of Government and Public Policy

The government can address the challenges facing telemedicine in many ways:

- *Improving infrastructure*: Government can help increase broadband access, especially in rural areas not served by private sector telecommunications companies.
- *Institutionalizing telemedicine*: Countries can establish national agencies for the development and promotion of telemedicine and its applications. To spur governments to do so, promoters must present policymakers with evidence of the extent of its benefits, as the Nigerian Telemedicine Development Alliance (NTDA), a web-based advocacy group, has done.
- *Adopting legislation*: Legislation is crucial to protect electronic personal and health-related data and ensure that patients can access and control their own health records. Special actions are needed to protect children from harm on the Internet. Laws that require insurance companies to officially recognize telemedicine and reimburse doctors for its use can be beneficial to telemedicine adoption.
- *Providing funding*: Governments and international donors are the main providers of funds for telemedicine projects in most developing countries. They may provide seed capital for setting up the project, compensating the physicians for their time, or raising awareness. Most funding comes from multiple institutions.
- *Building awareness*: Public sector actors can help promote telemedicine by identifying and analyzing telemedicine usage and policies worldwide.

Table 2. Selected providers of telemedicine services

Company	Country	Description
Apollo Hospitals Group	India	Provides camera over ICU beds that can be remotely switched on. Consultants can use this facility to make additional virtual visits 24/7 and remotely re-evaluate the patient. Family can also visit their loved ones from home in this way.
Aravind Eye Care Systems	India	Provides eye care through Internet-based information technology (via high-speed wireless videoconferencing) that allows patients in rural areas to be remotely diagnosed by ophthalmologists at the base hospital.
CISCO Brazil and Federal University of Sergipe	Brazil	Provides pediatric care as well as continuing education programs to state health professionals.
Doct-hers-in the-House	Pakistan, but aimed at Middle East and North Africa in the long term	Uses technology to connect female doctors who cannot access the workplace to rural areas without doctors.
Mashavu Networked Healthcare Solutions	Kenya, Tanzania	Uploads to the Internet basic medical information collected by trained operators at kiosk stations. Upon receiving the information, local doctors provide recommendations and indicate whether the patient needs to travel to a hospital or clinic. Public health officials can use the Information to evaluate trends or possible epidemics. This is a social enterprise venture of students at Pennsylvania State University.
Merck	Ghana, Kenya, Uganda	Provides e-diagnostic and consultation clinics at Kenyatta National Hospital in Nairobi and Machakos Hospital. The clinics allow patients and healthcare providers in remote areas to interact with specialists at Kenyatta Hospital using IP and video conferencing.
Narayana Health	India	Pioneered concept of telemedicine in India, in collaboration with the Indian Space Research Organization (ISRO).
PLDT-Smart Foundation	Philippines	Cisco HealthPresence solutions combine network, mobile, cloud, and video technologies to link medical providers with patients and colleagues in underserved communities.
Telemedicine Africa	South Africa	For-profit company offers telemedicine solutions, including training, implementation, and consulting services to the Department of Health and other health service delivery partners.

University of Bamako/Société Malienne d'Imagerie Médicale	Mali	IKON Project, a tele-radiology project developed by three medical students at the University of Bamako, allows healthcare professionals to send and receive medical information over the Internet.

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PROFILE: Telemedicine Africa

Providing remote healthcare in South Africa through a virtual consultation center

Challenge

Rural health care in South Africa is poor. Lacking specialists, rural hospitals rely on transport to larger medical institutions, which may also lack the needed equipment and personnel. Telemedicine can link facilities to bring specialist opinions to rural patients' bedsides. The technology can obviate the need to transport patients to more sophisticated facilities, a practice that is expensive, complicated, and onerous for both patients and their families.

Innovation

Founded in 2008, Telemedicine Africa (www.telemedafrica.co.za) is a for-profit company that provides training, implementation, and ongoing consulting services over the Internet. In Limpopo, South Africa's poorest province, it works with 14 regional hospitals, covering the entire province. The company operates a virtual telemedicine consultation center that makes specialists and general practitioners available to patients across Limpopo. The center is linked to patients through a variety of partners, including rural clinics, village hospitals, and provincial hospitals; mining clinics; schools; and correctional facilities.

Telemedicine Africa sets up a virtual telehealth center for each partner, providing telemedicine and videoconferencing equipment as well as an administrator and a technician, who assist local healthcare workers with the use of the equipment. Assistance is available to any partner site once it purchases the equipment and is connected to the virtual telemedicine consultation center. South Africans are covered by a health insurance under which they pay USD 2 per consultation. They pay no extra charge for the telemedicine consult, which is paid for by the government. Telemedicine Africa also provides assessment for tele-surveillance (the use of data collection tools to gather information) in 14 other African countries and coordinates telemedicine training for local staff.

Impact

The system provides rural residents and prisoners with access to good-quality care that would otherwise be unavailable and saves millions of dollars on travel and transport. It also improves training of healthcare personnel. Telemedicine Africa is having an impact in other ways as well. It helped the Southern African Development Community (SADC) prepare a regional report on human trafficking by allowing its facilities to be used to interview victims, police officers, social workers, and victim protection activists. Its technology can also be used to track outbreaks and other important health-related trends.

Scaling Up

Several factors account for Telemedicine Africa's success. Patients are more at ease and accepting of the use of telemedicine than they once were. It has tapped relevant contact points for rural South Africans, such as schools, mining clinics and prisons.

However, key challenges to scaling include the slow rate of technology adoption; weak Internet connectivity, especially in rural areas; and limited funding as most telemedicine programs are funded by governments or donors. Still, there are strong potential clients in remote areas, such as mining companies and prisons, that could also benefit from telemedicine services.

PROFILE: Narayana Hospital

Connecting patients to cardiac specialists in India and Africa

Challenge

For 70 percent of the Indian rural population, the patient-physician ratio is a mere 0.39 per 1000 people—compared to the country average of 0.7 per 1000 (World Bank World Development Indictors). The leading causes of death in India are ischemic heart disease, chronic obstructive pulmonary disease, and stroke, accounting for 30 percent of all deaths. And while access to primary care physicians is limited, access to specialists, such as cardiologists, is nearly impossible. As a result, rural patients are unable to receive the specialty care they need in a timely fashion, and often cannot afford the expenses that result from travel to urban areas, overnight stays, and expensive tests.

Innovation

Narayana Hrudayalaya (www.narayanahealth.org) recognized early on that slow medical response time, lack of availability of specialty care, and the stark urban-rural divide in terms of healthcare access and follow-up have made it all but impossible to get cardiac consultations in rural areas. In 2001, Narayana pioneered the concept of telemedicine in the country. The main telemedicine services Narayana provides are a Trans-telephonic Electrocardiogram (Tele-ECG) and a Tele-consultation. The interpretation of ECG tracings is an example of a process that is well suited to telemedicine. While an ECG is a simple test to perform, it takes significant amounts of training to interpret the tracing. Local healthcare providers can easily perform the ECG and send the tracings in bundles to those trained to interpret them. Narayana receives data from 600–700 ECGs per day, responding to each in under a minute.

The ECG is provided for free to the patient by implementing cost-saving methods such as accepting donations, relying on digital X-rays rather than more expensive films, and reducing inventory and processing times using comprehensive hospital management software, as well as increasing patient volume to maximize use of infrastructure and reach economies of scale. Narayana also provides tele-consultations at cost. Narayana charges according to the patient's ability to pay, and it cross-subsidizes its services for the poor—with approximately 60 percent of treatments provided below cost or for free. Narayana also provides medical education training via its telemedicine channels for doctors in other parts of India, Africa, or elsewhere in the world.

Impact

Today, Narayana's telemedicine program, one of the world's largest, connects 850 centers across the world to its specialty hospitals, providing low-income patients in rural areas access to quality cardiac care. The impact of providing access to ECG far exceeds its costs. Early detection of acute myocardial infarction or other abnormalities using ECGs, and transmission of information to a physician can accelerate management of the patient considerably. Even patients with pre-existing coronary artery disease and chronic heart failure can be managed more safely and effectively with regular telemedicine consultations, giving them ongoing access to follow-up care.

Scaling Up

Of its 850 centers, 53 are in sub-Saharan Africa. Narayana benefits from large economies of scale that allow it to cross-subsidize its patients. Taking ECG tracings can become an extremely standardized process, making it easier to work cost effectively. Moreover, prior to free software such as Skype being commercially available, telemedicine consisted of expensive customized medical software integrated with computer hardware along with the diagnostics instruments at each location, which was much more expensive to implement and upkeep. Skype is now the primary means of connecting doctors and patients, reducing costs.