

HEALTHCARE

Innovation and Development in Indian Healthcare

This research into the Indian healthcare market will provide a broader understanding of the changing demographic in India and its affect on the current healthcare infrastructure. This report will focus on providing an overview of that infrastructure as well as identifying major organizations and companies that are working to improve it. This report will also provide research on technological advancements in preventative and curative medical systems that are either in use, under development, or could be applied to the India market.

PK4 Technologies

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Introduction

Liberalization and social changes coupled with a surplus of bright minds has led to an economic revolution in India. Multi-sector growth and rapid urbanization have increased the number of successful businesses and opened the gateway to a brighter future. In fact, in the decade which is to follow, India is poised to become the world's fastest growing economy. However, India has many obstacles to overcome on the road to success; none more prevalent than the looming issue of healthcare. As is, the healthcare infrastructure in India is simply unsustainable and demands change. Unfortunately due to the wide socio-economic gap, the majority of economic growth has left much of India worse off. This report will serve to summarize the issues facing India and provide examples of technological change and innovation in healthcare implementation that can potentially improve if not solve the problem of medical accessibility to the entire population.



Summary

Statistical Information

According to the United States Central Intelligence Agency (CIA) India's current population is estimated to be 1,173,108,018 people. This makes India the second largest population in the World behind China's estimated 1,330,141,295 people, and ahead of the United States, which comes in third place at only 310,232,863 people. The CIA estimates the rate of population growth to be approximately 1.376% as of 2010 compared to only 0.49% annual population growth in China ("CIA July 2010.") This means that by 2030 India will have surpassed China as the world's most populous country, and will reach a population of 1.4 billion people by 2050 ("PricewaterhouseCoopers LLP 2007.")

This rapid population increase in India is due to several factors, including but not limited to, a decrease in the infant mortality rate, increased vaccination at birth, and increased life expectancy. As a result the growing elderly population in India will place a large burden on India's Healthcare infrastructure, with estimates that by 2025 nearly 189 million Indians will be over age 60 ("PricewaterhouseCoopers LLP 2007.")



Top Five Countries by Pop.

1. China
1,330,141,295
2. India
1,173,108,018
3. United States
310,232,863
4. Indonesia
242,968,342
5. Brazil
201,103,330

Statistics

- Population Growth Rate:
1.376%
- Birth Rate (births/1000 pop):
21.34 births
- Avg. Life Expectancy:
66.46 years
- Median Age:
25.9 years
- Pop. Infected with AIDS/HIV:
2.4 million (2007)
- Percentage AIDS/HIV in pop:
0.3% (2007)

Source: "CIA World Factbook 2010"

A Growing Market

Pricewaterhouse Coopers (PwC) estimated that as of 2007 the total value of the Indian healthcare sector was greater than \$34 billion. This was approximately equivalent to 6% of total GDP at the time. However, very little of this growing market can be attributed to the public sector. In fact, it is estimated that 80% of the total annual healthcare spending in India is through the private sector (*"PricewaterhouseCoopers LLP 2007."*)

Statistics show that private sector healthcare accounted for 82% of India's \$30.5 billion expenditure on healthcare in 2003. A 2007 PwC estimate states that private firms are thought to provide 60% of all out patient care, 70% of all hospitals, and 40% of all in-patient care and beds in India (*"PricewaterhouseCoopers LLP 2007."*)

Another key sector of growth in India is that of pharmaceutical development. Huge strides are being made in the Indian pharmaceutical sector. Pharmaceutical sales were reported to have increased 17.5% in the 2005-06 fiscal year to \$7.3 billion (*"PricewaterhouseCoopers LLP 2007."*)

A Changing Demographic

The growing middle class is progressively becoming wealthier and has more disposable income to spend on healthcare. More than 150 million Indians are earning an income of over \$1000 annually and the per capita income as of 2005 reached record highs of \$620. Rising incomes have led to an increase in ability of middle class Indian's to afford western healthcare benefits; however as of 2007 only 50 million Indians were estimated to be able to afford these services, a market 20% smaller than that of the United Kingdom who's population is a mere 61.3 million (*"PricewaterhouseCoopers LLP 2007."*)

This increase in the middle class's purchasing power has also had many negative effects. Most notably, India has seen an increase in lifestyle diseases, such as diabetes, heart disease, hypertension, and various forms of cancer. This emergence of lifestyle diseases can be attributed to changing nutritional habits, tobacco usage, work environment, and lack of physical exercise. Modernization and more liberal lifestyles are taking a toll on many Indians, causing further need for medical development and healthcare accessibility (*"PricewaterhouseCoopers LLP 2007."*)

The India Left Behind

Although India's recent economic growth is causing widespread urbanization in cities across the country, the majority of the population is being left behind. It is estimated that as of 2004, India's population had 27.5 percent of the population living below the National Poverty Line, with an estimated 300 million Indian's living on less than one US dollar a day (*"Emerging Market Report: Health in India 2007."*) As of 2007 this percentage has decreased to 25 percent of the population living below the poverty line according to the CIA (*"CIA World Factbook."*) Although the effects of forward progress can be seen, the pace of progress has been all too lethargic.

Addressing the issue of rural health services is a key factor for overall growth in India's healthcare sector. The issue is namely the lack of access. Those living in rural areas have little to no access to modern allopathic medicine and are forced to rely on ancient practices of Ayurvedic medicine, Unani, acupuncture, etc. Statistical Information collected in 2007 by researchers from Price Waterhouse Coopers Ltd. has shown that nearly $\frac{3}{4}$ of the population are currently living in rural areas, over 700 million people (*"PricewaterhouseCoopers LLP 2007."*) The World Health Organization (WHO) estimates that as of 2004 the total number of physicians in India amounted to about 650,000 (*"WHO."*) According to Price Waterhouse Coopers, of that population of Physicians, only 3% live in rural areas (*"PricewaterhouseCoopers LLP 2007."*)

In recent years, urbanization and new city developments have brought an increasing number of people in to the cities and urban areas. According to the Urban Health Resource Center (UHRC) the amount of people living in urban areas in India will reach 534 million by 2026. Much of this urban development has led to an increasing population in urban slums as well. UHRC estimates that there are nearly 100 million people living in slums, nearly $\frac{1}{3}$ of India's urban population. This number is estimated to double to 200 million by 2020. Tragically most slums are known for poor hygiene, overcrowding, lack of sanitation, and little to no civic service. (*"UHRC"*)

Although improvements in health services have nearly eliminated ailments such as leprosy, poliomyelitis, and neonatal tetanus; there has been an increase in other degenerative and infectious diseases. Viruses that had once been under control have experienced resurgence in recent year as well. Viruses such as tuberculosis, viral hepatitis, pneumonia, malaria and dengue fever have returned, and in some cases developed resistances to pharmaceutical treatment (*"Indian Brand Equity Foundation."*)

This resurgence is likely due to an the increasing social disparity in India which has lead to sub-standard housing, inadequate water supply, abysmal sewage and waste management systems, and a deteriorating public health infrastructure.

The India Left Behind Continued

Tragically India's healthcare infrastructure has not kept pace with India's overall economic growth. In general Public Hospitals, which account for 2/3 of India's hospitals, are inefficient, inadequately managed, feebly staffed, and have insufficient and poorly maintained medical equipment while providing only basic care (*"The Economist."*) (Exceptions include: All India Institute of Medical Studies (AIIMS))

India currently has half the amount of community health centers that it requires failing to meet the set goal of 74,150 centers per million population. Principle funding for public healthcare is the responsibility of the individual state governments which bare about 80% of the financial responsibility (*"The Economist."*)

This has lead to poorly funded public health sectors across India, including 11 states that do not even have pharmaceutical testing laboratories. Of those states that do have laboratories, about half are improperly staffed and/or ill equipped (*"The Economist."*)

The Indian Government launched a seven year plan (2005-2012) in April of 2005 for the National Rural Health Mission. The focus was placed on eighteen particular states which include; Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Himachal Pradesh, Jharkhand, Jammu and Kashmir, Manipur, Mizoram, Meghalaya, Madhya Pradesh, Nagaland, Orissa, Rajasthan, Sikkim, Tripura, Uttaranchal and Uttar Pradesh (*"National Informatics Centre."*) The plan thus far has shown some promise and as this report will demonstrate, technological improvements are greatly adding to the efficiency of rural health centers.



Source: "Better Lives"

Improvements in Insurance

The lack of insurance in India is one of the most significant disparities of all. Only 11% of the population has any form of health insurance coverage, which is mostly provided by the government run General Insurance Provider (GIC). In 2004 and 2005, only 1% of the population was covered by private insurance companies (*"PricewaterhouseCoopers LLP 2007."*)

In order to alleviate some of this disparity the Indian government attempted to enact its first Medical Insurance scheme in the 1996-1997 budget to be marketed by the four subsidiaries under the GIC. The plan covered ages 5-70 for expenses 30 days prior to hospitalization and 60 days after for an annual fee of \$122. The catch was that the scheme was based on reimbursement, thus a holder of the insurance would still have to pay his medical fees up front and then file to be reimbursed after the fact. Unfortunately this did not work for the target market middle-class and lower middle-class, because they would have to pay the expenses out of pocket (*"PricewaterhouseCoopers LLP 2007."*)

In the 2001-2002 fiscal year the average Indian household's total healthcare expenditures were estimated at 98.4% out of pocket expenditure. Due to the amount of out of pocket expenses, the poor are forced to take loans and borrow money. The WHO estimates that 20 million Indians fall below the poverty line due to indebtedness caused by Healthcare needs (*"WHO."*)

One of the most successful government enacted plans was put in place by the state of Karnataka under a Public-Private partnership know as the Yeshasvini Medical Insurance Scheme (2002.) Heading this program was Dr. Devi Prasad Shetty and the Narayana Hrudayalaya Hospital. For a premium of only Rs. 60 annually a farmer in Karnataka is covered for any major surgical operations including those related to pre-existing conditions. Approximately 50,000 farmers enrolled within the first year. (*Khanna, Rangan, and Manocaran*)



Structure

Urban Healthcare

To accommodate increasing incomes in the growing middle class, private health providers have begun to fill the demand for proper care. The Apollo Group, which started out in 1983 as a mere 150-bed Hospital in Chennai, now boasts over 50 hospitals across India with more than 8500 beds. Apollo is Asia's largest healthcare provider, with as many as 80 hospitals spread across the continent. The Apollo group functions by way of several different subsidiaries that geographically cover most of India. Those groups are Apollo Hospitals, Apollo Clinics, Apollo Pharmacy, Apollo Life, The Cradle, and Apollo Munich Health Insurance. Through these subsidiaries the Apollo group can diversify its services, offering anything from primary rural healthcare to tertiary care for Indians and medical tourists (*"Apollo Hospitals."*)

Another strong competitor in the private sector is Fortis. Fortis Hospital currently operates 39 hospitals with over 5000 beds across India. In December of 2009 Fortis added to its bed count when it acquired India's fifth largest pharmaceuticals and healthcare provider, Wockhardt hospitals. Alone Wockhardt Hospitals currently operates 7 hospitals in cities around India, and are looking to expand rapidly. (*"Economic Times- India Times"*) Both Fortis and Wockhardt are currently working on at least two new hospitals each, all of which will have around 400 beds (*"Wockhardt Hospitals."*)

A different approach, adopted by Columbia Asia Hospital, is to focus their service on a community level, locating their hospitals outside city centers and closer to where the people live. This hospital also places important emphasis on technological improvement "there are more computers in our community hospitals than there are inpatient beds" (*"Columbia-Asia"*) boasts Chairman Rick Evans. He says that hospitals of the future will be smaller and more restricted to space, thus they must be more efficient to achieve the maximum effect. Technology at Columbia-Asia plays an invaluable role; linking the entire system through a common software operating system for "seamless record-keeping, diagnostics and billing" (*"Columbia-Asia."*) Every waiting room is also equipped with a plasma screen that lets waiting patients know their place in line as well as an estimated waiting time (*"Columbia-Asia."*)

Rural and Semi-Rural Healthcare

The first line of defense in rural areas throughout India is the public health sector's government run Primary Health Centre (PHC.) Each PHC provides the primary source of healthcare to over 100,000 people from around 100 surrounding villages. They typically have around 4-6 beds and are operated by a medical officer, at least one female assistant, a block extension educator, a compounder, a driver, and a laboratory technician. The most recently available information provided by the government is that as of September 2005, India had exactly 23,236 of these centers. These facilities are all equipped with a Jeep and the necessary equipment to carry out only small and basic surgeries (*"National Informatics Centre."*)

A non-government organization known as the Smile Foundation has started a revolutionary program of mobile hospitals. "Smiles on Wheels," are a series of mobile healthcare vans that operate in a 25 km radius around their location point. These vans are normally located in an area where there is no PHC or the population is too great for the PHC to handle. Each mobile hospital provides preventative, promotive, and curative medical aid and advice to approximately 2-3 villages a day. The vans make their way through their designated villages and/or slums using a systematic process to reach everyone. Each van has a highly equipped medical station and is operated by specialized doctors, nurses and a medical staff (*"Smile Foundation."*)

Another major contributor to Rural Health care is the Apollo Clinic. There are 60 clinics operating in various states across India as accredited franchisees for the Apollo brand name. Typically these clinics are located in an area that is not already managed by a PHC or in an area which needs particular assistance due to population size. Each clinic offers diagnostic and preventative services, consultation, and a 24-hour pharmacy (*"Apollo Clinic."*)

A different approach has been taken by the Urban Health Resources Center (UHRC) who provides technical assistance to government bodies to assist the urban poor living in slums throughout Indian cities. Their goal is to focus their efforts on the urban poverty and help government organizations to educate while offering preventative and curative medical services. The UHRC works to bring together volunteers and to create awareness about urban poverty (*"UHRC."*)

Medical Tourism

India's growth in the private healthcare sector coupled with the purchasing power of the Indian Rupee has led to the availability of low cost medical treatment. This development has led to foreign tourist seeking inexpensive quality care in India, or what is known as Medical Tourism. Simply typing "Medical Tourism in India" into a Google search turns up over 2 million results. As of 2006 the market for Medical tourism was estimated at \$350 million with the potential to become a \$2 billion industry by 2012. An estimated 180,000 medical tourists were treated in Indian facilities in 2004 with a projected increase of 25-30% annual growth. The industry has the potential to bring in 1 million medical tourists annually, adding an approximate \$5 billion to the economy (*"PricewaterhouseCoopers LLP 2007."*)

An Ideal model of what India has to offer these Medical Tourists is the Medanta Medicity. Medanta is located in Gurgaon and is the life work of Dr. Naresh Trehan. The Medicity was founded with the vision to bring the highest standards of medical care to India. The facilities are located on a 43 acre plot of land, which includes a research center as well as a medical and nursing school. It offers 1250 beds as well as 350 critical care beds and 45 operation theaters that cater to over 20 specialty surgeries. These specialty practices are housed within Medanta's 6 centers of excellence, dedicated to providing the best care available in their fields (*"Medanta; the Medicity."*)

Another Important part of the Medical tourism industry is Sahara Medical. Sahara is a private organization with ties to over 2500 quality name hospitals across India. Sahara coordinates medical tourist's treatment with thousands of state of the art facilities and top physicians. The list of partnering Hospitals include; Sahara Hospital, Artemis Hospital, Fortis Hospital, Medanta Medicity, Columbia-Asia Hospital, Max Hospital, Wockhardt Hospital, Apollo Hospitals, KIMS Hospital, Global Hospital, Apollo Victor Hospital, Paras Hospital, Sitaram-bharatiya Hospital, Moolchand Hospital, and the Narayana Hospital. All of these hospitals are specifically designed and built to specialize in tertiary care for both Indians and Medical tourist alike (*"Sahara Medical."*)

Medical Tourism Continued

The Apollo group, the largest Healthcare provider outside the United States, provides high quality hospitals situated throughout India as well as a franchisee known as the Apollo Victor Hospital. The Apollo Victor Hospital is located in Goa, and is the first high quality tertiary care center of its kind in that area. The Apollo Victor's goal is to set the bar for the standards of tertiary care provided in India. This 150 bed Hospital is equipped with the latest in medical equipment, featuring its Siemens Cath Lab, the first of its kind in India. This Hospital also features 40 fully equipped critical care beds featuring advanced critical care and life saving equipment (*"Apollo Hospitals."*)

Cost comparison for selected surgeries

SURGERY	U.S.	INDIA	THAILAND	SINGAPORE
Heart bypass	\$130,000	\$10,000	\$11,000	\$18,500
Heart valve replacement	\$160,000	\$9,000	\$10,000	\$12,500
Angioplasty	\$57,000	\$11,000	\$13,000	\$13,000
Hip replacement	\$43,000	\$9,000	\$12,000	\$12,000
Hysterectomy	\$20,000	\$3,000	\$4,500	\$6,000
Knee replacement	\$40,000	\$8,500	\$10,000	\$13,000
Spinal fusion	\$62,000	\$5,500	\$7,000	\$9,000

SOURCE: American Medical Association

TRIBUNE GRAPHIC

Source: "Quick Cost Comparison"

Innovation

A New Formula for Health Care

Founded by Dr. Devi Prasad Shetty, the Narayana Hrudayalaya Hospital is one of the most advanced and revolutionary hospitals in the world. Described by the Wall Street Journal as the “Henry Ford of Heart Surgery,” (Anand) Dr. Shetty sees Healthcare in a very different and yet what seems to be far more productive and cost effective way. The flagship Narayana Hrudayalaya Hospital in Bangalore has 1,000 beds and 42 cardiac surgeons, performing an unmatched 3,174 cardiac bypass surgeries in 2008. In comparison the average US hospital has around 160 beds, and a leader in cardiac surgery like the Cleveland Clinic only performed 1,367 cardiac bypass surgeries in that same year (Khanna, Rangan and Manocaran.) Dr. Shetty was quoted by the Wall Street journal saying “Japanese companies reinvented the process of making cars. That's what we're doing in health care” (Anand.)

“What health care needs is process innovation, not product innovation.”

-Dr. Devi Prasad Shetty

Source: (Anand)

Next door to the Narayana Hrudayalaya Hospital is a 1,400-bed Cancer Hospital as well as a 300-bed Eye Hospital, all part of what Dr. Shetty sees as “Health Cities.” The plan is for multiple of these so called Health Cities to be erected across India, providing inexpensive quality healthcare to everyone from poor rural farmers to medical tourists. Currently four of these Health Cities are being built by the group, with the intention of having over 30,000 available beds by 2015, which would make it India’s largest private Healthcare provider. (Anand)



Telemedicine

The most significant developments in Indian healthcare are being produced by the growth in telemedicine. This is of particular importance because of the lack of rural health services and health practitioners. As mentioned before only 3% of physicians live in rural areas and only 25% live in semi urban areas (*"PricewaterhouseCoopers LLP 2007."*) Telemedicine allows doctors to attend to multiple patients all across the country or even the world without ever leaving their hospital. A doctor can diagnose a patient, prescribe medication and treatment, or simply educate a patient on a particular issue without having the patient leave their village. The development of telemedicine is therefore crucial in order to spread health services to the majority of the population.

A key development in telemedicine for India is a prototype mobile phone health monitoring system. The development is being headed by a partnership between a team of engineers at Loughborough University and Indian experts in the field of telemedicine. Their project is to create a revolutionary and unique system that would monitor health through a mobile phone. This innovative mobile phone, first unveiled in 2005, transmits a patient's vital signs such as blood pressure, blood glucose, oxygen saturation, and even electrocardiogram (ECG) heart signals to a hospital or clinic anywhere in the world. The two engineers responsible for the development, Professor Bryan Woodward and Fadlee Rasid of Loughborough University in the UK, were recently awarded a grant by the UK-India Education and Research Initiative (UKIERI) for further development of the mobile phone health monitoring device (*"Loughborough University News and Events."*)

The Loughborough team has joined forces with London's Kingston University, the Institute of Technology Delhi (IIT Delhi), the Aligarh Muslim University, and the All India Institute of Medical Science with the goal of miniaturizing the system to make it more portable and yet more powerful. The team will plan to develop the system so that it can also be used to monitor patients suffering from chronic conditions, and relay information back to their doctor or hospital. The article in 2007 by Loughborough University reported that "clinical trials of the system will take place in the UK and India over the next three years." Thus far, no new information has been posted by the University on the topic (*"Loughborough University News and Events."*)

Telemedicine Continued

India's largest healthcare provider, Apollo Hospitals has just recently announced an alliance with technology giant Cisco to "transform health care through information and communications technology (ICT.)" (*Economic Times- India Times 10 May 2010.*) The first phase of this initiative is to leverage ICT to transform the current operations of Apollo Hospitals and Apollo Group subsidiaries, as well as provide a growth platform for the Cisco Health-Presence Extended Reach technology program. The Second phase will involve the development of ICT Standards for healthcare to transform the medicine in India. The third and final phase will be to leverage ICT as the solution for changing all medical practice in India, Asia-Pacific, and emerging countries. As a first step to approaching this action-plan, Apollo has deployed hundreds of Cisco Health-Presence Extended Reach solutions across both Specialty hospitals and remote clinics. The Extended Reach solution will help to provide specialty care accessibility to people anywhere in the country. Professor Ganapathy, President of the Apollo Telemedicine Networking Foundation and President Elect of the Telemedicine Society of India announce to the Times of India "anyone, anytime, anywhere will be our slogan" (*Economic Times- India Times 10 May 2010.*)



Center for Development and Advanced Computing

An interesting development in India, Sehat Saathi is a program oriented towards rural healthcare monitoring. The rural telemedicine system is under development by the Media Lab Asia research hub at IIT Kanpur. The project was first launched in Kanpur and provides front end patient contact with a suitably trained non-medical professional operating in under directions from a back-end composed of doctors, pathologist and other health care professionals for diagnosis and treatment. (Singh) The front end takes down information from a patient in a rural area and that information is stored and transferred at the back-end where a Doctor can make a diagnosis and prescribe a treatment (Murthy.) The system uses a mobile health care unit known as an Infothela. The Infothela is designed to exchange information “on the go” through fax, internet, phone, etc. The design is a mobile care unit similar to a pedal rickshaw for use in rural villages in order to provide access to the poor (“Kanpur-Lucknow Labs- Media Labs Asia IIT Kanpur.”) Little information has been published on the “Infothela” within the last 5 years.



Source: "Infothela"

CDAC Continued

The Center for Development and Advanced Computing (CDAC) in Bangalore, Karnataka began development in 2005 of a “Mobile Based Primary Health Care Management System” for deployment in PHCs. The program will encompass software made for a patient database system, patient-doctor interaction, and medical data acquisition (e.g. blood pressure, electrocardiogram images, vital signs, etc.) The project will encompass a web-based management system for primary care, integration with SMS text-messaging, web applications, 3G/4G software, and an interface available in multiple regional languages. Taking into account the rapid penetration of mobile phones into the rural Indian market, the program will work to develop a Wireless Application Protocol (WAP) web gateway for integration with General Packet Radio Service (GPRS)/3G systems in order to be used on any mobile device (“CDAC.”)

Another development in the works by the CDAC is ONCONET. The project, which has been supported by the Department of Information Technology (DIT), is for the development of a “web based Medical Image Processing solution for capture, storage, transmission and processing of medical images from the biomedical equipments and implementing a comprehensive telemedicine network for ACI-Adayar Cancer Institute (W.I.A), Chennai and Seven nodal centres at different places of Tamil Nadu, Andhra Pradesh and Andaman island” (“CDAC.”) Current design and development of Telemedicine software is being undertaken by the CDAC Thiruvananthapuram. The software is meant to be a comprehensive system that provides a platform for an integrated telemedicine solution with collaborative tools to facilitate communication between Doctors at their respective specialty hospitals, and patients in a rural hospital/clinic (“CDAC.”)

In total the CDAC is currently developing 8 similar projects focused on telemedicine and oncology. The three discussed above encompass the scope of the other five projects; however these five developments show merit in their specified focuses on particular medical fields and/or regions. The eight projects are titled as follows: Medical Image Analyzer for Cervical Cancer, ONCONET Tamil Nadu, Rural Telemedicine, Mobile Tele-Oncology, Data Management System (DMS) for Oncology, NRHM-Rural Telemedicine, Rural Health Management Information System, and the Development of Knowledge Management System for Healthcare Services (“CDAC.”)

Mitanins

Mitanins across Chhattisgarh have had a tremendous impact in the supply of preventative and informative knowledge to members of their local communities. The program, first started in 2001 under the development of the State Health Resource Centre (SHRC,) is an attempt to bring better preventative and curative health practices to underserved rural areas of Chhattisgarh. Mitanins are local women who are chosen to become health activists for their community. Mitanins chosen serve their local hamlet, made up of approximately 40-60 households. The decision was made to have the women who were chosen watch over their respective hamlets as opposed to an entire village for several reasons. The first reason was to try to avoid having the Mitanin feel awkward about entering the house of a lower or higher caste, because in most cases Hamlets are more homogenous communities. The second reason was to lessen the work load of each Mitanin, in order to not impose on her personal life. By 2004 the SHRC had a Mitanin in every single one of Chhattisgarh's 54,000 hamlets. One role of the Mitanin is to refer patients with more complicated symptoms to the local PHC, a role that when the program first started began to force PHCs to open on time, and doctors to meet their job requirements. Since the start of the Mitanin program PHCs have been force to be prepared with adequate supplies of medicine and available for service during their scheduled hours. As a matter of fact, 500 of Chhattisgarh's 717 PHCs are now open 24x7. The efforts of the Mitanins have brought new information and practices to rural villages, particularly in the field of child birth. Since the program started the infant mortality rate has decreased from 95 deaths for every 1000 births in 2000, to 44 deaths for every 1000 births in 2009. (*"Economic Times- India Times" 1-3*)



Source: "Women Empowerment"

National Rural Health Mission

Along the same lines as the Mitanins, the NRHM's special program to address primary healthcare in rural villages utilizes a trained female "activist" who is native to the community. These women are formally known as an Accredited Social Health Activists or ASHAs. The purpose of the ASHA is to be a local resource in villages of 1000 people or less for guidance and basic treatment of health related issues. The program is operational in 10 states, and in 2005-2006 the NRHM recruited 120,000 ASHAs to be trained and oriented for the job. Females chosen for the program are expected to remain permanently in their village. The training process is 23 days split in to 5 sessions which provide a thorough education in basic healthcare to give the women the tools to aid their fellow villagers in practicing preventative and curative care. After the ASHA has been working in the field for 6 months she will be desensitized to the issue of AIDS/HIV and taught to counsel on the subject as well as give referrals. After the first 6 months she will also be taught in the proper care of a new-born child. ASHA's will participate in several mandatory monthly meetings with different groups of which include the local Primary Health Center (PHC,) other ASHAs, and other groups such as Anganwadi Worker (AWW) and the Auxiliary Nurse Midwives (ANM). At present this has not been developed as a telemedicine or tele-health related program, and the ASHA is given no means of communicating critical information to local PHC's or hospitals in real-time ("ASHA Accredited Social Health Activist.")



Source: "ASHA Training Camp in MP"

Village Health Champions

A branch of CARE Hospitals called the CARE Foundation has deployed a program for primary healthcare in rural villages known as Village Health Champions (VHC.) The model has been piloted in the Yavatmal district in the Vidarbha region of Maharashtra for a three year test of the model's feasibility. The model is composed of trained local female workers equipped with handheld devices that provide them with direct access to doctors at the hub clinic or hospital. This gives the doctors at the clinic the ability to interact with patients in rural villages through the VHC who inputs important medical information into the handheld device. The data from the handheld device becomes instantly assessable by the doctor or hospital. If an issue is found with a patient that needs professional medical treatment they are referred to the closest clinic or hospital, in this case the CARE Arogya Clinic. The handheld devices in the hands of a VHC, gives doctors the ability to diagnose and treat an illness without the doctor's physical presence. It also allows the doctor to judge the severity of an illness to plan for future action. (*"Center for Insurance and Risk Management Blog"*)



Source: "CARE Hospitals"



Source: "Village Health Champions (VHCs)."

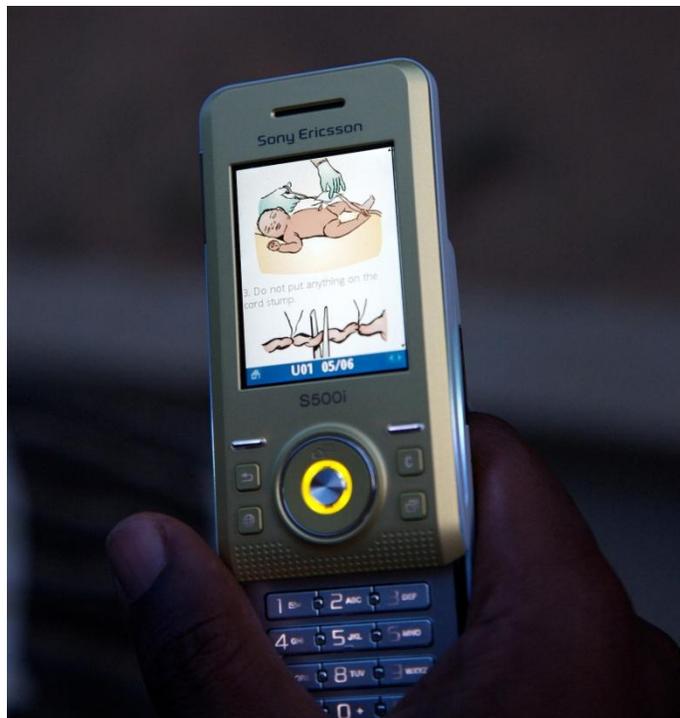
Global Developments in Telemedicine

Another significant development in telemedicine is a program in South Africa known as the Dokoza System. The system was developed as a health monitoring system that uses SMS and mobile phone technology for medical information management, doctor-patient communication, and transaction processes. The system is based off simple SMS text-messaging and can therefore operate off of any SIM-card on any network without any additional applications or software. The back-end of the Dokoza system is “extensively rules based” making it easy for health care workers with little technical knowledge to operate the system. The back-end is also easily integrated into all current hospital systems, computers, laptops, PDA, and any Smartphone as well as being able to integrate messages and transmissions into fax and email. A patient’s information is managed by what is called a Patient Management Clinician (PMC) who is not the treating health worker but rather the person in charge of designing and monitoring the system. The main purpose of this system was to be used in the treatment and prevention of AIDS/HIV and TB with particular emphasis on monitoring a patient and creating awareness through education. The program will charge Government Agencies no upfront costs in the implementation stage and will only ask the cost of text messaging services. Therefore, the client will be the Government Agency and the patient’s health alerts, medicine compliance reminders, appointment reminders, notification for receipt of blood test results and so on will be free of any extra charges. (*Komna*)

A similar resource used in Africa is a non-profit organization founded in 2007 known as “Text to Change.” The program is fairly simple, mobile users receive SMS text-messages with quizzes related to health. They answer the questions by simply replying with the answer number of their choice (e.g. 1, 2, 3.) The Text to Change (TTC) service is free of charge. If a person gets an answer wrong they will receive a text with the correct answer and more information. If they answer it correctly, they are given a new question and become eligible to win prizes like phone credit, t-shirts, mobile phones, or health products. They use the slogan “don’t guess the answers, learn the truth.” The program is specifically targeting the African youth in an effort to make them aware of the dangers of unprotected sex and teach them to live health conscious lifestyles. In addition, the SMS texts send encouraging messages to users to visit TTC partners like clinics or testing centers. This has resulted in a major increase in the number visits to these clinics and test centers and an increase in medical awareness (“*Text to Change.*”)

Global Developments in Telemedicine Continued

In Brazil, a project is underway that will bring modern medicine and connectivity to 30,000 people living in 175 rural villages in the Amazon. This project is headed by Ericsson, one of the world's largest technology companies and Vivo, Brazil's largest mobile provider. One application of the project will be to deploy a mobile survey tool used to monitor environmental impact and assess a quality of life index. In addition it will provide patient diagnosis and communication within a community (*"Ericsson Press Release."*) "We will create a learning network through the use of mobile devices to build local educational setup and to also exchange information" says Roberto Lima, President and CEO of VIVO Mobile in Brazil (*"Ericsson Press Release."*)



Source: "M-Health "

Development of Tele-practice in Pharmaceuticals

All of the major hospitals and healthcare providers listed above under Urban Healthcare provide pharmaceutical services. Of those Fortis is the Largest Pharmaceutical producer in India. However, the infrastructure of the domestic pharmaceutical sector is highly fragmented with 70% of the market being controlled by over 10,000 different firms (*"PricewaterhouseCoopers LLP 2007."*) This fragmentation in the pharmaceutical sector presents an opportunity for development of new systems of operation that can cut through the chaos.

One possible solution to escape the calamity is a form of telemedicine for use in pharmaceutical distribution and sales. According to an article written in the online Medical Journal "Marketing Health," Pharmaceutical Sales Representatives (PSR) can improve their productivity through the use of a mobile device application. A general synopsis of what the article proposes is a real-time link between a Doctor, a PSR, and a patient. For example, a patient arrives at the doctor's office and the doctor does an examination. Once the doctor diagnoses the Patient and records the information on his computer the data is stored on a server accessible by the PSR who is alerted when the server is updated. The PSR is given the clients information and immediately contacts the client to remind them of the prescription and dosage that they need to pick up. Once the patient has the prescribed medication the PSR will send reminders of when the medication should be taken, a reply to this message would signify that the patient has complied. When the patient goes back to the clinic or hospital for a follow-up visit, the doctor will be able to know if the patient had missed any of the dosages. This is just one way in which this type of system could assist a PSR (Amit.)



Conclusion

Although India's current infrastructure is weak and out of sync with western standards, the development's in telemedicine exhibit promise for growth and improvement. The market is quickly picking up steam, putting India in a position to grow both economically and socially. Improvements in medical accessibility that enable doctors to reach the rural population of India are game changers in today's world. Telemedicine is simply a model made for India. A national embrace of modern technological improvements in healthcare has the potential to lead the country in bridging its socio-economic divide and help establish India as a seat of power in the world of tomorrow.



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