School of International and Public Affairs
Case Consortium @ Columbia
Columbia University

SIPA-15-0008.0

Telemedicine & eDoctors

Executive Summary

The United States leads the world in per capita health care spending, yet is ranked last among advanced industrialized nations in general population health.[1] The passage of "Obamacare" in 2010 began to change this landscape, by offering incentives to insurance companies and private medical groups to begin to act more like classic public health oriented organizations, and focus on primary care and prevention.

This comparative case study explores two innovative primary care programs in Brazil and India. In Brazil, we explore the development of Rio's *Clinicas de Familia*: low-cost, technology-supported, and community-based clinics. In India, we examine an innovative program to use telemedicine for primary care in rural areas. The case includes original interviews with Emme Deland, director of strategy for New York Presbyterian hospital; Under Secretary of Health in Rio de Janeiro Betina Durovni; President of Apollo Telemedicine Networking Foundation Dr. Krishnan Ganapathy; and Columbia faculty experts Professor Kavita Sivaramakrishnan and Professor Michael Sparer.

This case contains the following elements (same model as "Digital India").

a) Video Intro and Discussions – Available Online

b) Written Case Study (This Document)

c) Annex A – Original Documents

d) Annex B – Interviewee Bios and Interview Transcripts (Not Needed for Core Case, Presented for Research Purposes)

[1] Melissa Hellmann, "U.S. Health Care Ranked Worst in the Developed World," *Time*, June 16, 2014.

This case was written by Ted Smalley Bowen and Adam Stepan for the Picker Center for Executive Education at Columbia's School of International and Public Affairs (SIPA). Additional case research by Nora Johnson, Renu Pokharna, Arijit Malik and Sharmistha Maheshwari. The faculty sponsor was Professor William B. Eimicke.

Primary Care in the US

For decades, the US healthcare system had been characterized by extremes—it led the world in innovation and advanced care, yet trailed most of its peers in prevention and classic public health spending. In 2013, it spent 17.4 percent of GDP on healthcare, yet only 2.6 percent of that went to classic public health measures.[2]

Private non-profit and for-profit health providers played a leading role in the US system. US research facilities, manufacturers of medical equipment and pharmaceutical companies—many for-profit—drove much of global innovation in areas such as stem cell research, biochemical genetics and gastroenterology. A study by The Commonwealth Fund found that over 56 percent of Americans obtained health insurance from private providers.[3]

Yet despite the dominance of private players, public funds accounted for over 48 percent of total US healthcare spending. Public monies, however, were often spent inefficiently. Due to its fragmented nature with myriad private providers, the US system had little opportunity to realize the cost savings of larger integrated systems, and especially the savings of preventive care. Professor Michael Sparer of Columbia University's Mailman School of Public Health was an expert in health policy and management. He notes:

> For much of the last 50-100 years here in the United States, we've had a very siloed healthcare system. The hospital has been one piece of the silo, the doctor another, the lab another, the nursing home another… If a hospital is acting completely on its own, its incentive is going to be to encourage and increase its own revenues, and not to work collaboratively with the rest of the system.[4]

Obamacare. A recognition of weaknesses in the US healthcare system motivated many provisions of the 2010 Patient Protection and Affordable Care Act (ACA), commonly know as Obamacare. Two fundamental principles underlay ACA. One mandated that all individuals and businesses have an approved level of health insurance. Any business or an individual without health insurance would pay a penalty. Secondly, the federal government would completely or partially pay for the now-compulsory health insurance for 34 million uninsured Americans. The act also imposed comprehensive new regulations on the healthcare insurance industry.

Essentially, Obamacare consolidated the health insurance industry by creating a competitive marketplace for insurance providers. The consolidation allowed more affordable insurance rates. As Emme Deland, director of strategy at New York Presbyterian Hospital observes:

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[2] U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics *Health, United States, 2014*, DHHS Publication No. 2015-1232, May 2015.

[3] Karen Davis, Kristof Stremikis, Cathy Schoen, and David Squires, *Mirror, Mirror on the Wall, 2014 Update: How the U.S. Health Care System Compares Internationally,* The Commonwealth Fund, June 2014.

[4] Adam Stepan's interview with Prof. Michael Sparer in New York City. All further quotes from Sparer, unless otherwise attributed, are from this interview.

> Obamacare is moving us to significant consolidation and mergers, and those consolidations and mergers are happening across all the stakeholders, so hospitals are forming integrated delivery systems, physicians are merging and many of them are becoming employees of integrated delivery systems, laboratories are consolidating, insurance companies are starting to consolidate under the guise of needing to think about taking care of populations and not just individual episodes of illness.[5]

Obamacare also put in place incentives to increase primary care. It encouraged Medicare and Medicaid patients to obtain primary and preventive care services by eliminating co-insurance, deductibles and co-payments for approved preventive services and tests that helped detect disease early.[6] Another Commonwealth Fund report, *How the Affordable Care Act Will Strengthen the Nation's Primary Care Foundation*, identified three key incentives.[7] These were:

- a 10 percent bonus to clinicians who participated in the Medicare program. Beginning in 2011, the bonus was available to primary care physicians, nurse practitioners, and physician assistants who spent 60+ percent of work hours providing office visits, nursing facility visits, and home visits. The measure was intended to prompt primary care providers to take on more patients.

- a temporary increase in reimbursement for primary care physicians treating Medicaid beneficiaries.

- promotion of patient-centered medical home (PCMH) models of care. PCMH provided a stable relationship with a personal source of primary care, and allowed patients to receive well-organized health services emphasizing prevention and chronic disease management.

Brazil—Public Health Overview

Against the backdrop of the ongoing US debate on primary care, Brazil provided an encouraging example of what public health could accomplish. While the country also had a tradition of private hospitals and insurance—and many institutional ties to US medical schools—Brazil focused on public health and prevention. Only 26 percent of the population held private insurance, while 62 percent received service from a comprehensive primary care system known as *Estratégia Saúde da Família*, or the Family Health Strategy (FHS).

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5 Adam Stepan's interview with Emme Deland in New York City. All further quotes from Deland, unless otherwise attributed, are from this interview.

6 Federal programs Medicare and Medicaid, created in 1965 through amendments to the Social Security Act, provided health insurance and assistance with health care costs for elderly and low-income Americans, respectively.

7 Karen Davis, Melinda Abrams, and Kristof Stremikis. "How the Affordable Care Act Will Strengthen the Nation's Primary Care Foundation," *Journal of General Internal Medicine* 26.10 (2011): 1201–1203, July 9, 2015.

Brazil had long been a leader in "tropical medicine" and public health initiatives, exemplified by the establishment of the Oswald Cruz Foundation in 1900. Under the administration of President Juscelino Kubitschek, Brazil in 1956 began a nationwide initative to eradicate endemic rural diseases such as malaria and yellow fever. Working alongside the Global Malaria Eradication Program of the World Health Organization (WHO), the government implemented a malaria eradication campaign. The campaign marked the start of the largest public health endeavor undertaken in Brazil and underscored the linkage of economic development with improvements in public health.

In the 1990s, Brazil took a leading international role in the battle against AIDS. In 1996 it became the first developing nation to provide free anti-retroviral drugs (ARVs), including protease inhibitors. The effort was exhaustive; by 2003, 100 percent of all registered AIDS cases had received free anti-retroviral treatment. The success of Brazil's AIDS effort proved wrong those who had argued that ARVs were too expensive, and that adherence to the drug regime would be poor. A 2004 study of 322 outpatient services in Brazil found an impressive participation rate of 75 percent.

Primary care. Meanwhile, a new 1988 constitution declared health care to be a universal human right. It laid the foundation for the development of a public health system known as the *Sistema Único de Saúde* (SUS), funded by federal, state and local governments. As a result, publicly financed health services and most common medications were accessible free of charge to all citizens—including those enrolled in private health plans.[8] The SUS reform was driven by a decentralization process that gave municipalities responsibility over health service management, while states oversaw health-related legislation and provided financial assistance. Federal healthcare authority transferred to state and municipal levels, while decision-making and implementation frameworks were expanded to include a greater number and diversity of stakeholders.[9]

In an attempt to move away from a traditional hospital-centered, curative-care model, SUS developed a comprehensive primary care system known as *Estratégia Saúde da Família*, or Family Health Strategy (FHS).[10] Implemented at the national level in 1994, this innovative, proactive approach relied on teams of interdisciplinary health professionals who intervened directly at the community/family level. Primarily targeting low-income populations, FHS teams operated out of onsite *Clínicas da Família*, or family clinics, serving specific geographic areas.

All residents in a clinic's community qualified for care. The clinics served as patient entry points into the health system and strove to integrate medical care with health promotion, prevention, and public health initiatives. Each clinic was equipped with a simple laboratory, a vaccination and minor procedures room, x-ray and ultrasound capacity, a pharmacy, and a dental care suite (since 2004). In addition to medical capacity, the clinics offered the community health-

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[8] James Macinko and Matthew Harris, "Brazil's Family Health Strategy—Delivering Community-Based Primary Care in a Universal Health System," *New England Journal of Medicine,* 372:2177-2181, June 4, 2015.

[9] Pain et al., "The Brazilian Health System." *Lancet,* May 21, 2011.

[10] The FHS was originally called the Family Health Program (FHP) but was later renamed Family Health Strategy.

related resources, such as outdoor gyms, and programs, including smoking cessation, nutrition, family planning, exercise, and community therapy groups.

Each FHS team, responsible for some 1,000 households, comprised six to eight full-time community health workers plus a nurse technician, a nurse, and a physician. The teams provided health counseling and prevention, and monitored recoveries. The community health workers were vital, each assigned around 150 households within the clinic's catchment area, and they lived locally. The health workers visited each household at least once a month to collect individual and household-level data. These visits provided basic clinical care, promoted health activities and identified health problems early.

The pace of FHS expansion was impressive. In 1998, about 2,000 teams of 60,000 community health agents provided services to 7 million people (4 percent of the Brazilian population). By 2015, 39,000 teams of 265,000 community health agents, plus 30,000 oral health teams, served 120 million people (62 percent of the population).[11] In addition, several studies showed that FHS expansion resulted in children's health improvements, including a significant reduction in infant mortality due to diarrhea and respiratory infections. Among adults, FHS was linked to a reduction in cardiovascular and cerebrovascular mortality, large reductions in hospitalization rates for ambulatory care and reduced rates of complications from some chronic conditions such as diabetes.[12]

Rio. Despite the successful adoption of FHS in smaller municipalities, FHS services in Rio de Janeiro remained limited. With a population of 6.3 million, Rio was the second largest city in Brazil, with the second largest municipal GDP in the country. Despite significant economic growth in the 2000s, the city suffered from marked social and economic inequality, with 19 percent of population living in *favelas* (slums).[13] In addition, Rio had an aging population; 70 percent of its residents were ages 35-65, with a growing life expectancy likely to skew those numbers further.

In 2001, only 23 family health teams existed within the municipality, increasing to just 57 by 2005, covering just 3.3 percent of the population.[14] The slow adoption rate had several likely causes. Historically, Rio benefited from a well-developed hospital and outpatient service network, including federal, state, municipal, and privately managed facilities. In addition to emergency, inpatient and specialist care, hospitals provided basic care through their outpatient departments and emergency rooms. This resulted in long lines, overcrowded waiting rooms, costly expenditures and overworked staff. In addition, hospitals lacked preventive services and integrated care.

In 2008, facing increasing health care costs and an aging population, the Rio government conducted a study to evaluate the health system's overall condition. The study found that 82 percent of the city's total health budget was spent on hospitals and that 85 percent of hospital patients received primary care. In addition, 75 percent of treated patients suffered from chronic

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11 "Historico de Cobertura Da Saude Da Familia."

12 Macinko and Harris, "Brazil's Family Health Strategy."

13 Instituto Brasileiro de Geografia e Estatística, Census 2010, Accessed at www.ibge.gov.br/

14 Cavalini et al., "Contracting for Primary Health Care in Brazil." February 18, 2016

diseases; all this while Family Health Service was available to only 3.5 percent of the population.[15] It was clear that a shift was needed from hospital to primary care.

In 2009, a newly elected city government launched what it called the *Saude Presente* (Everyday Health) initiative to expand FHS coverage throughout the city. Previously, public sector procurement and HR rigidities had led to problems in hiring and retaining professionals to work in the FHS. Rio health officials therefore decided to give up direct FHS management and contract instead with privately-owned and managed, nonprofit, social organizations (OS) to deliver primary healthcare services through the family clinics. The OS model, inspired in part by São Paulo's successful experience in the hospital sector, was seen as a flexible, efficient and autonomous solution.[16]

The same year, the city partnered with nonprofits in Rio de Janeiro's FIRJAN network to implement health management software that would help monitor disease outbreaks and their location, population displacement, and the number of available medical professionals, beds and equipment. Rio Under Secretary of Health Dr. Betina Durovni notes that "we had a system that was centered in the hospital, very expensive, very inefficient, and our indicators were bad, so we were spending a lot of money and we didn't get the results."[17]

The private-public partnership (PPP) model initially met with significant resistance from professional and public interest groups and finally passed under two conditions: the city could contract with OSs only for primary care, and OSs could provide care only in new facilities (e.g. they could not take over existing family health clinics or older basic care units). In addition, OSs would be subject to public audit by the *Tribunal de Contas* and ministerial oversight.

Contracts between OSs and Rio were standardized; the OS would manage, maintain and staff a defined set of health services. Contracts were for two years, renewable based on achieving 80 percent of the stipulated goals and objectives. The contract offered two methods of payment: 1) fixed payments, calculated by the number of family health and/or oral health teams and an estimate of the resources required to cover the Portfolio of Basic Services; and 2) variable payments based on performance in three sets of indicators.

One critical feature of the OS model was simplified hiring, and the flexibility to pay differentiated and higher salaries. For example, doctors were allowed to earn more than twice as much as public officials, nurses up to 36 percent more, and dentists up to 65 percent more. Nurse technicians, however, received 36 percent less. Higher salaries for more qualified positions facilitated clinic expansion.[18]

The *Saúde Presente* initiative resulted in significant expansion of Rio de Janeiro's FHS program, from eight percent of the population in 2008 to 41 percent in 2013. In addition, from 2009–2013 the city built 85 new Family Health Clinics and converted 49 Basic Health Units to

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15 Secretaria Municipal de Saude do Rio de Janeiro Powerpoint presentation

16 Sao Paolo was Brazil's most populous city and the country's financial center.

17 Stepan interview with Dr. Betina Durovni in Rio de Janeiro. All further quotes from Bettina, unless otherwise attributed, are from this interview.

18 Cavalini et al., "Contracting for Primary Health Care in Brazil." February 18, 2016

family clinics.[19] With the expansion came a significant increase in Rio's health spending. A World Bank Study found that from 2006-2012, spending more than doubled in real terms with a significant shift in spending to primary care.[20] Before 2010, Rio's spending on primary care was less than half the national average, but it tripled by 2015, when it constituted a third of total health spending per capita.

The World Bank study also found that in comparison to 2007, the municipality had seen a near doubling of primary care consultations, a large increase in chronic disease patients under active care, and a reduction in avoidable hospital admissions from diabetes and associated complications. However, there was only a modest increase in the percentage of pregnant women with seven or more prenatal consultations (see World Bank table below).[21] Other issues remained, primarily related to information collection, data cost tracking mechanisms and performance measures. In addition, the city had yet to find a way to properly align incentives for OS performance and compensation for health workers, which varied between different OSs and different geographic areas.

Technology in clinics. In 2006, Brazil made electronic medical records mandatory by law. One of the characteristics of Rio's new primary care clinics was their use of technology to connect the relatively basic clinics with more sophisticated units in Rio's hospital system. As Dr. Durovni points out:

> It's not simple… You need lights, technology, you need sophisticated technology, you need very good information. We work with electronic arts, we need rapid diagnostic tools… We need to have good technology in primary care.

Columbia's Professor Sparer notes that, increasingly, IT technology supports the work of local health care providers. He says:

> The phrase used to be, "All politics is local." There's no doubt healthcare is local, too. However, in order for local to be truly effective, need those local community healthcare workers to have access to digital technologies that can provide evidence, that can provide health promotion, that can provide expertise, that can provide specialties that they don't have. The digital advances in healthcare are there, in large part, to support and to expand and to supplement the services that get provided locally.

Public Health in India

Public health in India offered both contrasts and parallels with the US system. As in the US, private hospital and insurance groups played an important role, often providing public health solutions. That said, India invested dramatically less in healthcare, both public and private funds.

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[19] Ibid.

[20] Ibid.

[21] Ibid.

Whereas the US in 2013 invested 17 percent of GDP, or US$9,146 per person, India spent only four percent, or US$61 per capita on health care.[22]

In the face of this health investment shortfall, the Indian government turned instead to the public-private partnership model. That included experiments in the delivery of primary care via telemedicine. Rajiv Lall, executive chairman of the Infrastructure Development Finance Company (IDFC), notes:

> The mission of a private hospital, and the mission of a private physician, to a large extent, is to maximize their own income, to maximize their own utility. To maximize their own efficiency. It takes the public sector to say, how are we going to translate that private system into a system that could also provide a public good for the whole population, for the whole community? It takes a public system regulating that private system. It takes a public system financing that private system. Both India and the United States may have and do have delivery systems that are largely private, but both of them rely on public financing to finance a lot of that private delivery system.[23]

Colonial legacy. During colonial times, the British Raj developed a national system of health care, but the focus was mostly on preventing infectious diseases. Most hospitals providing public care were non-profit charities, a tradition that continued into the 21st century. Following independence, the government of Prime Minister Jawaharlal Nehru had bold plans for improving public healthcare, but budget constraints limited their implementation. Under the Indian constitution, healthcare was not a right. As a result, there were very few primary care physicians, and there was a greater emphasis on curative (treatment) rather than preventative healthcare. As Columbia Professor Kavita Sivaramakrishnan notes:

> Building trust in the kinds of services that telemedicine [can] offer is critical because people haven't been used to these kinds of services. So if you only offer curative care, which a lot of I think big medical specialty hospitals have, then people tend to feel that prevention hasn't been important, and that it's not really helping them to change their lifestyle or to prevent falling ill. So I think its really important for all of these services to offer both, to offer health advocacy, to offer certain kinds of public health information and to focus on prevention as much as the curative kind of services that they offer.

While India's public healthcare system presented massive problems, important private players emerged to fill the gaps. Many groups modeled themselves on major US private groups,

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22 World Bank health expenditure figures, total spending as a percentage of GDP, see: http://data.worldbank.org/indicator/SH.XPD.TOTL.ZS); and per capita, see: http://data.worldbank.org/indicator/SH.XPD.PCAP).

23 Adam Stepan interview with Dr. Rajiv Lall. All further quotes from Lall, unless otherwise attributed, are from this interview.

and included physicians and medical administrators trained in US private hospitals. With India's market opening of the 1990s and the increased purchasing power of India's new middle class, more Indians were seeking private health care. As IDFC's Lall notes,

> The moment they could afford it, they very happily turned to the delivery of private healthcare, which previously was not possible. So on the back of the growing purchasing power of the Indian middle class, you also began to see, in addition to the pharma industry development, the development of private, secondary and tertiary care in the form of private hospitals and clinics around the country. And they have come to serve that segment of the community in India that can afford the pretty high cost of those services.

Apollo Group. The Apollo Group was India's market leader, and typical of many private Indian healthcare players. The for-profit corporate hospital chain was the third largest provider in the world and the largest in Asia. Apollo, which employed 70,000, had treated more than 38 million patients in its 57 hospitals. One of the most aggressive in the telemedicine field, Apollo Hospitals was India's oldest and largest private hospital company. Apollo had entered the telemedicine business in 1999, providing long-distance care, health education, postoperative follow-up, and disease management through a non-profit foundation and a separate business unit formed in 2010. By 2014, the company had held roughly 90,000 telemedicine sessions over 15 years.

In late 2013, Apollo signed a contract with the government that took it into new territory—a public-private partnership. Apollo undertook to add telemedicine to the services offered by government-sponsored Common Services Centers (CSC), which already brought a wide array of government and private services to rural and underserved areas.[24] The partnership had the potential to increase Apollo's business exponentially and to bring unprecedented access to healthcare to the countryside. But it also carried considerable financial and reputational risk for Apollo and, to a degree, for the government.

Typically, Apollo focused on providing services to the top of the Indian pyramid and to rich international patients. Offering advanced medical procedures at a fraction of the cost of hospitals in the West, Apollo hospitals did not rely solely upon wealthy Indians, but tried to attract well-to-do patients from across Asia and elsewhere.

Telemedicine as charity. But the Apollo group also followed the British colonial, and later Indian, tradition of providing public health as a charity. In 1999, it began offering telemedicine *pro bono.* The leader of Apollo's telemedicine operations was neurosurgeon Dr. Krishnan Ganapathy. The initiative began first under Apollo's non-profit arm, called the Apollo Telemedicine Networking Foundation, and was conducted with the Indian Space Research Organization. Ganapathy explains:

> Bill Clinton, then-president of the United States, formally commissioned the world's first very small aperture terminal (VSAT) satellite-enabled

[24] Created as part of the 2006 National e-Governance Plan (NeGP), the CSC program was launched under the auspices of the federal Department of Information and Technology.

> village [charity] hospital [in] Aragonda, which happens to be the birthplace of the founder chairman of the Apollo Group, Dr. Prathap Reddy. The Indian space research organization was looking [to use its expensive] space technology for something which would benefit the public and it looked that this was a perfect combination, deploying VSAT satellite technology for healthcare. Satellite technology is now receding and today we use internet protocol, replacing ISDN lines which bridged the gap for the first couple of years.[25]

Dr. Reddy recalls the rationale for adopting telemedicine:

> Our limitation was that we could not establish hospitals everywhere. Through telemedicine, the remote areas could be covered, so people in villages and in mountains and tribal areas could get an opportunity to get the benefit of the experts that we have in our hospitals.[26]

Technology. The period from 2000, when Apollo began offering distance medical consultations, until 2013 saw dramatic advances in the technology of telemedicine. With the development of the Internet, services emerged combining the features of electronic medical records (such as those used universally in Brazil) with the consultations that voice and video connections allowed. Telemedicine was more than a simple Skype video-call between patients and doctors. For example, the Germany-based BodyTel had developed Bluetooth wireless sensors that measured glucose levels, blood pressure and weight, and uploaded the data to a secure web server. Once uploaded, doctors and patients could view, monitor, and provide treatment through the web.

Enter the CSC's. The emergence in 2007 of the Common Service Centers dramatically changed the landscape. In turning to telemedicine to improve access to healthcare, India was near the leading edge of a global trend. Improvements in automation and telecommunications made it possible to offer affordable primary and secondary care in communities that lacked basic medical resources. However, poor rural infrastructure, uncertain business and staffing models, data insecurity, mistrust of "virtual" doctors' visits, high rates of illiteracy, linguistic diversity, and lack of regulation or common standards all threatened to limit telemedicine's reach

Regulation was a key consideration. Lall notes that "a lot of private sector participation started happening in sectors that involved delivering public services to the community, whether healthcare, toll roads, electricity, these are all public goods that require some form of regulation. But now you have a private sector that is delivering or started delivering these kinds of services, and the private sector by definition is motivated by profit. So to adjudicate the interests of the public and the private you need a very, very strong regulatory infrastructure in place and a sophisticated regulator." He continues:

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[25] Billy Shebar's interview with Dr. Krishnan Ganapathy in Chennai, India, on December 4, 2014. All further quotes from Ganapathy, unless otherwise attributed, are from this interview.

[26] Billy Shebar's interview with Dr. Prathap Reddy in Chennai, India, on December 4, 2014. All further quotes from Reddy, unless otherwise attributed, are from this interview.

> You need a very sophisticated bureaucracy that understands how to frame and conduct the bidding and the contracting that is required in these kinds of spaces. So in a public/private partnership in a hospital, the risks and responsibilities between the public and the private have to be allocated and designed in a very sophisticated manner.

Telemedicine as Business

Still, as the technology improved and business opportunities increased, Apollo looked to capitalize on telemedicine. In 2010, the company established a separate business unit, Apollo Tele-Health Services, with Ganapathy as medical director. However, recalls Ganapathy, "I told Dr. Reddy I can't run a profit and loss center, I know nothing about it. I am a clinician, not a businessman or a hospital administrator."[27] To complement Ganapathy, Apollo made business manager Vikram Thaploo CEO. Despite his added administrative responsibilities, Ganapathy continued to see patients virtually via video session, and maintained a steady schedule of online health education lectures.

Over the next few years, Apollo Tele-Health bolstered existing business lines like tele-radiology. It also built new markets, working, for instance, with real estate developers to locate telemedicine centers in large apartment complexes. The increasing bottom line pressures created some tensions within Apollo, for example between patient care and billing, but no more than in other departments, recounts Ganapathy.[28] By 2014, Apollo Tele-Health operated 135 telemedicine centers across India and in more than a dozen other countries (including Iraq and Afghanistan).

The economics of telemedicine were a challenge from the start, and CSC executives and Apollo managers haggled over the details. While some Indian hospitals offered free telemedicine services to rural communities as philanthropy and/or marketing, the envisioned PPP planned to charge. CSC administrators wanted rates that low-income villagers could afford, whereas Apollo had to find a way to pay its physicians and induce the Village Level Entrepreneurs (VLEs) who operated the CSCs to add the service. What's more, the fees were not set in stone. Dinesh Kumar Tyagi, CEO of CSC e-Governance Services India Limited, the special purpose vehicle designated by the Indian Department of Information Technology to set up and support the CSCs, explains:

> If 100 [rupees] is paid by a large number of citizens, the [fee] may be increased to 150 or 200, but if it is not paid and not many people are willing, it has to be reduced. So it is up to the market.

In the end, Apollo-CSC agreed to charge each patient 100 rupees ($1.60) for primary care consultations and 900 rupees ($14.40) for specialties like neurology and cardiology.[29] The fees were to be split between Apollo (40 percent), the VLE (40 percent), and the government (20 percent).

Ted Bowen's interview with Dr. Ganapathy on December 4, 2014 in Chennai. All further quotes from Ganapathy, unless otherwise attributed, are from this interview.

[28] For example, doctors might be inclined to consider a follow-up video consult as part of the original appointment and not bill for it, while the business staff might consider it a billable service.

[29] Although a for-profit chain, Apollo was required by the government to provide free or subsidized care to low-income patients who visited its hospitals.

Apollo's profit depended on volume. At the 100 rupee rate, notes Ganapathy, "[40 rupees] is a small margin, but if you get 10 to 20 patients per day times 10,000 kiosks, it adds up… We certainly expect to recover all the expenses which we incur."[30]

The government wanted companies like Apollo to bolster infrastructure and services, banking on advances in computing and communications technology to improve access to healthcare for the poorest segment of the population. Apollo wanted to scale up its telemedicine business to generate ancillary sales and was hoping that state-subsidized insurance would cover telemedicine. A venture like the Apollo-CSC partnership had the potential to boost public health in underserved areas and reduce the financial burdens on individual patients, says Ganapathy:

> I am not for a moment saying we can do complex surgical procedures through telemedicine, certainly not. But I can definitely reduce the number of people who today are unnecessarily traveling at great expense and time to the big cities of India. Unfortunately, the commonest cause of what is called rural indebtedness in India is healthcare. People [are] losing their entire savings.[31]

Dr. Ganapathy's group faced several major questions. Could a for-profit company with its shareholder obligations deliver telemedicine to poor rural communities, make a profit and serve a mission? Could the VLEs operating the CSCs provide the technical support and personal touch required to run virtual doctors' offices?

In its brief time in the field, Apollo Hospitals had made significant progress. Apollo executive Samuel David had succeeded in recruiting a number of the untrained local medical providers, sometimes labeled "quacks," who competed for villagers' limited funds to provide referrals on commission. He was pushing more lucrative 900-rupee specialty services and had struck some separate deals to establish telemedicine services within NGO-run clinics. He also mined his extensive experience as an AIDS counselor and social worker, helping villagers understand who qualified for which government services. Still, even the comparatively low 100-rupee fee was too high for some. A telemedicine session could also result in costly prescriptions, tests and/or visits to specialists.[32]

Limits and potential. Beyond the economics of reaching rural communities there were infrastructure problems. Intermittent electricity supply and balky Web connections, along with the occasional software glitches proved challenging. Dr. Ganapathy notes that bandwidth/audio-visual problems prevented him from making a clinical diagnosis in about five percent of his virtual cases. But Apollo offered a technical support group in Hyderabad. David also had to deal with the sometimes-challenging task of training VLEs. Apollo also encountered resistance from villages who expected medical appointments to be face-to-face.

But Dr. Ganapathy vouched for the telemedical consultation. For 80 percent of patients, he claimed to be able to make a reasonable differential diagnosis, weighing the likelihood of possible

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30 Billy Shebar's telephone interview with Dr. Ganapathy on October 29, 2014.

31 Billy Shebar's interview with Dr. Ganapathy on December 4, 2014 in Chennai.

32 Ted Bowen's interview with Samuel David on December 7, 2014 in Tiruvannamalai.

causes for a given condition, based on the patient's description of symptoms. In only 10 percent of cases did he feel the need to examine the patient physically, while only 5-10 percent required further, in-person examination. He argues:

> You do not have to physically touch a patient to make a clinical diagnosis. I have personally done about 1,400 neurological tele-consultations over the last 14 years, and I've never found a single instance where a wrong diagnosis was made. I can ask the patient to put out his tongue, to close his eyes, to touch the tip of his nose, to do whatever I normally ask a neurological patient to do in a face-to-face encounter. Similarly, my cardiologist does not have to place the stethoscope on the chest of the patient, we teach patients to place the stethoscope on their own chest. Today we have Bluetooth-enabled stethoscopes… The respiratory sounds which a physician normally hears through a stethoscope inside his ears can be transmitted through the internet.[33]

With patients' permission, videos of consultations could be archived and reviewed later, giving doctors multiple opportunities to detect medical clues. "I honestly feel that a [videotaped] remote examination is actually better than a face-to- face encounter, because it gives me an opportunity to [catch] any mistakes which I may have made in a face-to-face encounter," adds Ganapathy.

Competition. Apollo was not alone in the telemedicine space, but it was the only commercial player. The Indian Space Research Organization (ISRO) telemedicine network, for example, connected 384 general and 60 specialty hospitals to more than 300 rural sites, district hospitals and medical college hospitals. It also supported 18 mobile telemedicine units. By 2014, the space agency had reached more than 250,000 patients. India also ran a program through the Ministry of Health and Family Welfare; the central government funded states' efforts to establish a National Rural Telemedicine Network to deliver primary care to rural and underserved areas. However, it was still in the planning stages (despite launching in 2007).

To all appearances, Apollo had an open playing field. In late 2014, it notched another public sector deal, this time with the government of the mountainous northern state of Himachal Pradesh. Rural Connect would provide specialty and emergency consultations via satellite to remote, high-altitude villages. The deal had taken the better part of eight months to negotiate. Himachal Pradesh had already invested in telemedicine but had little to show for it, so Apollo fielded numerous questions about the quality of communication links, protocols for emergency situation, training and other issues. According to Assistant Vice President of Program Development Prem Anand, Apollo landed the contract largely because it could demonstrate an end-to-end telemedicine system of hardware, software and networking and suggest performance metrics and an auditing scheme. Anand notes:

> Tele-emergency's never been done before, anywhere in the world, to my knowledge. That contract is pretty big for us. The pilot is going to be in

[33] Billy Shebar's interview with Dr. Ganapathy on December 4, 2014 in Chennai.

> two hospitals, but it could translate into a [500 million rupee/$8 million] mandate for us, where we make money, we create a name for the promoters of all of this work, and we do good for society.[34]

But on December 23, 2014, the Modi government threw a spanner in the works: it announced a drastic 20-percent reduction in the already-strained budget for public hospitals and clinics. The announced cuts and the fiscal reality they reflected also cast doubt on the Modi government's ambitious universal healthcare initiative, slated to provide free diagnostic tests, drugs and insurance. While Apollo's telemedicine services did not rely directly on funds from New Delhi, the cuts threatened to constrain its public sector partners, the CSCs. It was hard to predict what telemedicine in India would look like in five years.

Telemedicine and Primary Care in US

In the US, the sorts of experiments that Brazil and India had undertaken were beginning to find a receptive audience. Telemedicine had become an established tool for a broad range of services. It extended medical access to rural and underserved populations (such as inner city residents), and offered convenient in-home check-ups and follow-ups for more affluent patients. After the Patient Protection and Affordable Care Act (ACA) added to the rolls of the insured, some healthcare and insurance companies as well as employers looked to telemedicine to help contain costs and expand services while saving on trips to the doctor and ER visits.

The ACA contained a number of provisions that could result in expanded coverage for telemedicine under US government health insurance programs Medicare and Medicaid —for example, such in-patient services as remote monitoring of patients by specialists not available at a particular hospital. The landmark healthcare legislation authorized the use of tele-health links in the review and approval process for home health services, durable medical equipment and medication. The ACA also penalized hospitals with a chronically high readmission rate by reducing Medicare reimbursements. Monitoring and follow-ups via telemedicine offered a way to avoid the penalties and improve patient outcomes.

But there were hurdles to broader US acceptance of telemedicine. Doctors needed to be licensed in the states where they practiced, dramatically reducing the geographic scope of telemedicine.[35] Moreover, only 22 states mandated that telemedicine be compensated at the same rate as in-person appointments, meaning less income for doctors.

New York City's Columbia Presbyterian Hospital, for example, had long offered telemedicine consultations to inner city diabetes patients, but was ineligible for reimbursement. Moreover, there was no national standard of care (the quality of care in a given locale). Congress had discussed loosening medical licensure requirements to ease the adoption of telemedicine, but as of 2014 the American Medical Association and state medical boards had blocked such a change. As Columbia's Professor Sparer notes:

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[34] Ted Bowen's interview with Prem Anand in Chennai, India, on December 4, 2014. All further quotes from Anand, unless otherwise attributed, are from this interview.

[35] By contrast, doctors licensed in one European Union country could practice telemedicine with patients throughout the EU.

The healthcare system in the United States is transforming dramatically. The healthcare system in 2025 is going to look very different from the healthcare system in 2015. In 2025, Apple and CVS could be among the two biggest healthcare providers in the United States. In 2025, instead of hundreds of hospitals around the country, we could have four, five, six big hospital systems. In 2025, there could be community health workers dominating the care delivery system in a way that doesn't even exist today. We cannot, today, predict where we're going to be in 10 years. What I can tell you for sure is, the healthcare system in the United States is going to look very different in 10 years than it does today.