“I urge you to challenge this injustice, and to build a shared vision and strategy for global equity in essential surgical care. You can make the case that surgery is an indivisible, indispensable part of health care.”

Jim Yong Kim, President of the World Bank Group, to the Lancet Commission on Global Surgery, January 17, 2014
Teaching Case

1. Surgical care for low-income, rural populations: an alternative delivery model from Jan Swasthya Sahyog, India
   Kannan Sethuraman, Devanath Tirupati, Nakul Raykar and Prakash Awasthy

28. The Indus Hospital: Building Surgical Capacity in Pakistan
   Sarah Arququest, Julie Rosenberg, Rebecca Weintraub

37. NSQIP-Lite: Measuring Surgical Outcomes in Mozambique
   James W. Quinn of Case Study Consulting and others

47. Hôpital Universitaire de Mirebalais, Partners In Health in Haiti
   Robert S Kaplan, Bipin Mistry, Karla Bertrand

60. Surgery at AIC Kijabe Hospital in Rural Kenya
   Tiffany E Chao, Julie Rosenberg, Pratik Patel, Robert Rivirilo, and Rebecca Weintraub

70. Cases in Global Health delivery:
    Voluntary Medical Male Circumcision in Nyanza Province, Kenya
    Julie Rosenberg, Claire Cole, Maria May and Rebecca Weintraub

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Teaching Case

Surgical care for low-income, rural populations: an alternative delivery model from Jan Swasthya Sahyog, India

Kannan Sethuraman, Devanath Tirupati, Nakul Raykar and Prakash Awasthy. Jan Swasthya Sahyog Referral Centre, Ganiyari, Chhattisgarh, India

It was a late dusty evening in September 2014; Dr. Raman Kataria, specialist in general and pediatric surgery, was leaving the operating theatre after having completed an emergency operation on a three-day-old baby with a congenitally absent anal opening. This kind of case is routine at the Jan Swasthya Sahyog (JSS) Referral Centre at Ganiyari, where doctors perform a wide range of surgical procedures that include very complex procedures. What is more remarkable is the fact that a complex procedure like the one described above requiring two follow-up surgeries is offered at a very affordable, all-inclusive rate of 12,000 Indian Rupees (INR)—a charge that covers all the expenses relating to operative procedures, hospitalization and medication. This amount is even less than what would be charged in a government hospital where services are highly subsidized. For the past 14 years, JSS has been consistently providing high-quality care (including surgical care) in remote, inaccessible villages surrounding Ganiyari, where thousands of poor people find themselves stranded between an overburdened and dysfunctional public healthcare system and an unaffordable private healthcare system.

As he walked along the bustling corridors of Ganiyari Referral Centre where patients were waiting patiently, Dr. Kataria was quietly reflecting on key issues discussed in an important board meeting he had attended the previous evening. With the founding doctors starting to approach retirement, the question on everyone’s mind was who would carry on their legacy. The founders had worked hard to develop an efficient, high-quality, equitable health system—one that was dedicated to providing both preventive and curative services in the tribal and rural areas of the Bilaspur district of Chhattisgarh’s state in Central India. They knew that they needed to create the right incentives to attract good doctors to their mission, especially since so many in the new generation of doctors were attracted to the high-paying urban careers, not to rural hospitals like JSS. Additionally, the meeting brought into question the sustainability of JSS’s current business model. Given the limited ability of the villagers to pay for care and the high dependence of JSS on donations, it was a unanimous concern. Who would be the new leaders, and how would they make JSS more self-sufficient?

India: A snapshot of its demographics and healthcare outcome indicators

The Republic of India has a landmass of 3,166,414 square kilometers and is bordered by seven countries: Pakistan, Bhutan, China, Nepal, Myanmar, Bangladesh and Afghanistan. The southern half of India forms a triangular peninsula bounded on the east by the Bay of Bengal, on the west by the Arabian Sea and on the south by the Indian Ocean (see Figure 1 for a map of India).

According to the 2012 census, India remains the second most populous country in the world: its population of 1.236 billion has been estimated to reach 1.57 billion by 2050, making it the most populous country by 2024.

Figure 1: Map of India
Teaching Case

India’s population, growing at an annual rate of 1.7%, is projected by United Nations to overtake China as the most populous nation by 2028. After rapidly growing between 2004 and 2011, India’s GDP growth rates have slowed sharply in recent years to a more modest rate of 5.0% in 2013. While India has made significant strides in economic development over the past two decades since liberalization in 1992, it still remains a laggard in its performance on various health outcome indicators.

The World Health Organization (WHO) describes public health spending in India as “abysmally low in a country where about 26% of people living below poverty line are critically dependent on public health services and the range and complexities of health issues are substantial with the equal presence of both communicable and non-communicable diseases.”

According to the latest statistics from WHO (World Health Organization), total expenditure (public and private) on health as a percentage of the GDP has been relatively modest at 4.1% in 2012 and the share of public expenditure on health remains one of the lowest among low-and middle-income countries (LMIC) at 1.1% of the GDP. Even more worrying is the fact that in nominal terms, India’s healthcare expenditure has grown more slowly than the country’s GDP. The Indian healthcare sector is plagued by shortages of workforce and infrastructure: it has only one doctor per 1700 citizens—well below the WHO stipulated minimum ratio of 1:1000. Bed density in the country is 1-30 beds per 1000 people with public beds accounting for a meager 0-47 per 1000 which falls well short of the minimum guidelines of 3-5 beds per 1000 people stipulated by the WHO. Given these

### Table 1: India’s Basic Socioeconomic and Demographic Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Chhattisgarh</th>
<th>India</th>
</tr>
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<tbody>
<tr>
<td>Total population (in billions) (Census 2011)</td>
<td>0.0255</td>
<td>1.2101</td>
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<tr>
<td>Decadal Growth (%) (Census 2011)</td>
<td>22.59</td>
<td>17.64</td>
</tr>
<tr>
<td>Crude Birth Rate (SRS 2011)</td>
<td>24.9</td>
<td>21.8</td>
</tr>
<tr>
<td>Crude Death Rate (SRS 2011)</td>
<td>7.9</td>
<td>7.1</td>
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<td>Natural Growth Rate (SRS 2011)</td>
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<tr>
<td>Infant Mortality Rate (SRS 2011)</td>
<td>48</td>
<td>44</td>
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<tr>
<td>Maternal Mortality Rate (SRS 2007-09)</td>
<td>26.9</td>
<td>212</td>
</tr>
<tr>
<td>Total Fertility Rate (SRS 2011)</td>
<td>2.7</td>
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<tr>
<td>Sex Ratio (Census 2011)</td>
<td>992</td>
<td>940</td>
</tr>
<tr>
<td>Child Sex Ratio (Census 2011)</td>
<td>964</td>
<td>914</td>
</tr>
<tr>
<td>Schedule Caste population (in millions)</td>
<td>2.4</td>
<td>166</td>
</tr>
<tr>
<td>Schedule Tribe population (in millions)</td>
<td>6.6</td>
<td>84</td>
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<tr>
<td>Total Literacy Rate (%) (Census 2011)</td>
<td>71.04</td>
<td>74.04</td>
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<tr>
<td>Male Literacy Rate (%) (Census 2011)</td>
<td>81.45</td>
<td>82.14</td>
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<tr>
<td>Female Literacy Rate (%) (Census 2011)</td>
<td>60.59</td>
<td>65.46</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Values</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Human Development Index</td>
<td>135 out of 187 countries</td>
<td>2013</td>
</tr>
<tr>
<td>Population (thousands)</td>
<td>1.236.687</td>
<td>2012</td>
</tr>
<tr>
<td>Urban population</td>
<td>32%</td>
<td>2013</td>
</tr>
<tr>
<td>Drinking water coverage (% of rural population with access)</td>
<td>92%</td>
<td>2012</td>
</tr>
<tr>
<td>Poverty rate (% living under USD 1.25 per day)</td>
<td>21.9%</td>
<td>2012</td>
</tr>
<tr>
<td>GDP per capita in PPP (in current international dollars based on the 2011 ICP round)</td>
<td>$5138</td>
<td>2012</td>
</tr>
<tr>
<td>Literacy (total, female, male)</td>
<td>74.04%, 65.46%, 82.14%</td>
<td>2011</td>
</tr>
<tr>
<td>Rural literacy (total, female, male) in percentage</td>
<td>68.91%, 58.75%, 78.57%</td>
<td>2011</td>
</tr>
</tbody>
</table>

represents 69% of India’s total population, only 20% of this rural population, much of it below the poverty line, (857 million) followed by China (635 million). But while 1950, it still has the largest rural population in the world. Although India’s rural population has grown slowly since, Rural-Urban Divide in Health Status

goals (MDG) (see Table 5).

mortality rate (MMR) set in the Millennium Development

2015 targets for infant mortality rate (IMR) and maternal

(see Table 4b for comparison). Even more troubling is the

emerging economies, including Brazil, China and Russia

not only the developed economies but also the other

and life expectancy continue to lag behind the averages of

some of the LMICs, including Bangladesh and Sri Lanka

fact that India’s performance lags behind the averages of

Table 4a: Comparison of key health indicators for India versus LMIC economies

Table 4b: Comparison of key health indicators for India versus developed economies and emerging economies

limited resources, it is not surprising to see that India’s

health outcome indicators, such as infant mortality rate and

life expectancy continue to lag behind the averages of

not only the developed economies but also the other

emerging economies, including Brazil, China and Russia

(see Table 4a for comparison). Even more troubling is the

fact that India’s performance lags behind the averages of

some of the LMICs, including Bangladesh and Sri Lanka

(see Table 4b for comparison).

Moreover, it is expected that India will fail to achieve the

2015 targets for infant mortality rate (IMR) and maternal

mortality rate (MMR) set in the Millennium Development

goals (MDG) (see Table 5). For example, MDGs seek to

reduce the deaths of expectant mothers and newborns as

well as children under five by two thirds from 2000 to

2015. While Sri Lanka, China and Bangladesh have made

significant progress towards this MDG, India still

struggles. Nearly one-in-twenty children do not live to see

their first birthday and the under-5 mortality rate (USMR)—reported as 52 deaths per 1000 live births in

2013—remains well above the goal of 42 deaths per 1000

live births. Additionally, every 10 minutes, a woman in

India dies during childbirth, totaling to almost 45,000

deaths in 2013. The maternal mortality rate—178 deaths per

100,000 live births—also fails to meet the MDG target of

109 deaths per 100,000 live births.:

Rural-Urban Divide in Health Status

Although India’s rural population has grown slowly since

1950, it still has the largest rural population in the world

(857 million) followed by China (635 million). But while

this rural population, much of it below the poverty line,

represents 69% of India’s total population, only 20% of

India’s surgical workforce lives and works in rural India. The

issues in delivering meaningful health care to the

dispersed, isolated and impoverished populations living in

the rural areas of India are further compounded by

communication, transport, and climatic barriers so that,
not surprisingly, the latest census results in India reveal significant rural-urban differences in mortality indicators (see Table 6 and Appendix 2). Since its independence, India has had a goal to improve the health outcomes for its rural citizens, but the relatively small healthcare budget has proved insufficient for even the most basic services, let alone access to preventative, curative, and rehabilitative care. Disparities in access to affordable, high-quality care continue to pose daunting challenges to the Indian government and it will take a huge and persistent effort to accomplish better outcomes for its rural poor.

Jan Swasthya Sahyog, Ganiyari (JSS/People’s Health Support Group)

History
In the late 1990s, Raman Kataria was part of a highly selective cadre of physicians at the prestigious All India Institute of Medical Sciences (AIIMS) in New Delhi. A fully-trained pediatric surgeon, he had hit the faculty job-search jackpot—a position at the nation’s premier academic medical institution. But he passed up the opportunity to pursue his dream: “To start a health programme in villages that will give genuine healthcare to the poorest of poor and to start a hospital from which no patient will ever be turned down for their inability to pay for treatment and medicines.” Elaborating more on why they targeted rural India, he says: “Just as two Indias exist everywhere, especially in healthcare, we see a glaring difference in what is available for the rich versus that for the poor. On one hand, you have world class, state-of-the-art healthcare facilities available for the rich while there is little or no access to proper healthcare for the poor. We wanted to see greater equity in health care provision as well as in the health outcomes for people.” Yogesh Jain, another JSS co-founder, shares Dr. Kataria’s philosophy: “The battles against diseases will have to be fought and shall be won or lost in the vast varied expanse of rural India, the most marginalized area of all. The problem is that the foot soldiers are absent or poorly equipped with ammunition, supplies, communication system and backup. Where the need is highest, the support systems are the least adequate. If diseases and illnesses were due to deprivation, then as German anthropologist Rudolf Virchow once said, we as physicians have the responsibility to be the ‘natural attorneys of the poor’ and it is easy to see why we decided to tackle their social problems ourselves.”

Dr. Kataria further clarifies that it was particularly important for him to start an organization that provided comprehensive health services that included surgical care. “A health system cannot be considered a ‘health system’ without the provision of surgical services for common and yet life-threatening conditions. Consider something as ‘simple’ as getting pregnant. In the high-income world, this is largely a joyful moment, as it should be. Research studies have shown that at a population level—regardless of race, ethnicity or socioeconomic status—5–15% of pregnancies typically develop some sort of a complication requiring a caesarean delivery. Now imagine someone living in remote rural India, and being unable to access or afford surgical care. Getting pregnant can mean a potential death sentence. These issues transcend any one procedure or conditions. In populations without access to surgical services, you will see old men who die from urinary obstructive disease that could have been prevented with a prostatectomy, children and young adults die or face lifelong disability from easily treatable surgical conditions like appendicitis and open fractures, and working-age men remaining idle, unable to perform physical labor due to untreated hernias,” explained Dr. Kataria.

In 1996, their dream was realized. A small group, many of whom were classmates at AIIMS founded Jan Swasthya Sahyog (Translated: People’s Health Support Group). The core team consisted of 9 physicians (8 of
whom were couples) and a research scientist: Raman and his wife, Anju Kataria, Yogesh and Rachna Jain, Biswaroop and Madhuri Chatterjee, and Anurag and Madhavi Bhargava), Dr. Sathyamala (who was 9 years senior and was invaluable in her knowledge of patient needs), and Pramod Upadhyay (a research scientist) (see Figure 3 for a photo of the founders). “We decided to pool our energies and expertise in gynecology, pediatrics, epidemiology, medicine, surgery and microbiology to start JSS aimed to provide genuine health care to the rural poor,” said Dr. Kataria.

When asked whether they had considered teaming up with an NGO, Dr. Kataria jokingly responded that they engaged in what they internally termed as “NGO tourism”—scoping out places of the country that were notoriously deficient in healthcare delivery. “We had met with so many NGOs with whom we had explored the possibility of partnering. However, we ended up never quite feeling the match was right. Some were too laid-back with so many NGOs with whom we had explored the possibility of partnering. However, we ended up never quite feeling the match was right. Some were too laid-back about progress for our tastes, while others were too rich.”

Why Bilaspur district in Chhattisgarh state?
“After an exhaustive search, in 1997, we had come to Bilaspur (then a part of the State of Madhya Pradesh and now belonging to the newly formed Chhattisgarh state) for a meeting. A chief administrative member of the ruling government in Madhya Pradesh, Mr. Harsh Mander, IAS, having heard of our aspirations, invited us to visit some of the surrounding villages near Ganiyari,” says Dr. Kataria. “While we knew the state of rural healthcare was rather unsatisfactory in large parts of India, we were quick to realize that it was virtually non-existent in Bilaspur district. Boasting a large tribal population, this region was underserved in terms of healthcare and community health services, which was reflected in the poor health indicators of the district.”1,14

“The tribals and dalits in the Bilaspur area were plagued with poverty and malnutrition,” continues Dr. Kataria. “The median body mass index (BMI) of the local women was 18.4 indicated that over half of them were undernourished according to the WHO’s minimum threshold BMI (18.5). Tribals and backward castes had even lower BMIs. Over half (57%) of the children under age five were malnourished, and over a fifth (22%) of them were severely malnourished. As many as 110 infants died in every 1000 births. In addition to malnutrition, malaria, water-borne diseases, tuberculosis, and leprosy were widely prevalent. Evidence from Bilaspur had suggested that extremely high levels of morbidity in both infectious diseases and non-infectious diseases were prevalent among Bilaspur’s poor. After several visits to its rural areas by our core team members between 1997 and 1999, observing the scores of villagers reeling under poverty and suffering a heavy burden of diseases, we were convinced this to be the ideal place to launch our work. We wanted to make healthcare for these villagers available, accessible and affordable.” He continued, “We were looking for some form of local people’s support, which we found through a fledgling literacy programme, ran by Praful Chandel. We felt such a programme would enable us to link health and education.”

**JSS’s mission, vision, values and strategy**
Articulating their vision and strategy, Dr. Yogesh Jain of JSS said: “We were quite clear from the outset that we wanted to contribute to the health, happiness and wellbeing of the rural people (see Exhibit 1 for a statement reflecting their mission, vision and values). We were interested in looking at the ‘whys’ and ‘hows’ of illness, the socioeconomic angle to ill health and, finally, the political issues involved in the rural healthcare field. Hence, we chose a three-pronged approach as our strategy to achieve our objectives which involved: (i) Doing everything possible to contain costs without compromising on quality of care and at the same time, making care available and accessible (ii) Encouraging a scientific enquiry approach to problem-solving and facilitating learning, and lastly, (iii) use force multipliers such as training, research and advocacy to amplify our effort to improve the healthcare outcomes of the rural citizens.”

**External support and early days**
Dr. Kataria shared details of how they generated external support for their initiative: “While fundraising has been a yearly problem for JSS, getting grants has not been the...
biggest hurdle. In the beginning, we received generous amounts from friends in Germany (INR 270,000) and from a grant through the Department of Science and Technology (INR 450,000 for 3 years). But it wasn’t enough. On the day we secured a grant of INR 2,700,000 from the Ministry of Health (MOH) in 1999, most of us put in our papers at our home institutions. The next year, we received a much-needed donation (INR 1,200,000), this time from the Sir Dorabji Tata trust; they would continue to be a valued supporter over the years. We also received generous support through grants from Oxfam, Netherlands, from fellow AIIMS alumni who live in the U.S. and from another organization of Indian professionals in the U.S. called Association for India’s Development (AID).”

Continuing about their early days, Dr. Kataria reminisced: “When we first go to the future site for JSS, it was an old, abandoned irrigation colony lying unused for over 20 years. Nonetheless, with a 30-year lease (just INR 10,000 per month) through the government, it was ours. There were about 5 brick buildings—one of them with any doors or roofs—that had been used by cattle, gamblers, and drunks. Immediately it struck us that this could be the ward and the OR and the OPD. With some renovation work arranged by our friends, we started our first OPD day. The clinic site is in Ganiyari village—20 kilometers from Bilaspur—and on our first day at work, not even a single patient turned up. The second day was no different. Then on the third day, we had our first patient. Then the numbers steadily increased by the day and before long, we were inundated with work.”

The transformation was not an easy one. Dr. Kataria and his team had to struggle to address issues on three fronts simultaneously to make this happen. First, most of the people in the area in the region did not know about the clinic; those who did know had no idea of what to expect and how much the service would cost. They had to encourage people to seek care, and make them aware that the new clinic was available and affordable. Second, the facilities were primitive, and the basic infrastructure had to be created; this was challenging, despite the fact that funding issues were resolved relatively easily. And finally, making healthcare affordable meant cutting costs and creating innovative alternatives to standard practices without compromising quality.

**Strengthening access to care for the poor**

**Strategies to enhance referrals into the hospital**

Explains Dr. Kataria, “There is a common misperception among the medical establishment that patients take too long to decide to seek care. We are quick to attribute their reluctance to seek care on ignorance about modern medical care and faith in traditional beliefs about health and traditional healers. Seldom discussed is the basic inability of our health facility infrastructure to reach the poor. First, facilities are few and far between. Patients typically need to travel long distances to reach these facilities. Second, the costs of undertaking such a journey—both in lost wages and in transportation—are enormous. Lastly, impoverished communities have years of collective experience that teaches them that even if they reach such a facility, there is no guarantee that they will receive timely or effective treatment. Rural facilities are generally underfunded, understaffed and may have precious little to offer.”

In light of this, the JSS leadership decided to tackle the issues relating to access and availability head-on with a robust community outreach component of its health services. Dr. Anurag Bhargava, another cofounder of JSS, elaborated: “Our main idea was to work on two to three levels. We not only wanted to run a hospital which would provide low-cost, good, quality curative care of a fairly wide and comprehensive nature, but we also wanted to work with village communities and bring about lasting changes in their health status. In a system of public healthcare in a village, we need to have village-level health workers and not doctors alone. And the potential of these health workers must be to deliver not only curative care but also look at other aspects of health.”

Their approach revolved around a three-tiered approach: (i) The first level focused on offering preventive and curative services in tribal villages through the training of village health workers (VHWs) elected by their respective villages. (ii) The second level of service is offered through the Village Health Centers where outreach clinics are held on a weekly basis. (iii) Finally, outpatient clinics are held at the Ganiyari clinic three times every week. In addition, the clinic had facilities for treating in-patients and surgeries for a range of ailments.

Asked whether this three tiered approach was aimed at replacing the government’s existing 3-tiered referral system (see more on Indian Government’s rural health initiatives in Appendix 2), Dr. Yogesh Jain was quick to clarify: “Very clearly, right from the outset, our intention was never to replace the public health system, but rather to strengthen it through technical inputs along with being a watchdog too. Our relationship with the state, especially with the public health system, has been a dynamic one of mutual support. They have been wary that they have to perform well or else we might raise a few uncomfortable questions. At another level, they have asked us periodically for technical assistance in running their programmes more effectively and for training their personnel in skills relating to malaria control, cancer screening, and child nutrition.”

**JSS Village Health Workers—First tier of the community health program by JSS**

JSS provides preventative and curative services through their training of VHWs who are elected by the villagers. In 2001, JSS initiated a community health program in a cluster of 8 villages that has now spread to more than 70 tribal villages in three clusters in the Kota and Lormi
blocks of Bilaspur district. These villages are located in forests or at the forest-fringe with many of them lacking access to all weather roads.

More than 110 VHWs have been trained under the Village Health Programme. “Our biggest challenge was to evolve a comprehensive community health programme with the participation of local villagers,” says Dr. Rachana Jain, another founding doctor associated with JSS. The training of VHWs continues to play a vital role in their quest for providing low-cost and effective health care. The trained VHWs provide rational first contact care using 20 different kinds of medicines, supported by referral advice when required. Other researchers have also reported the successful use of village or community health workers in other parts of the world and how they can play a critical role in care provision and in case identification, prompting appropriate referral to care centers.

On the question of qualifications, selection process and the decision to only use women as health workers, Dr. Kataria was forthright in his determination: “These women were selected after open discussions with the village communities. By training women as VHWs, we took care of two sections of the population: women and children. If we had not done that, we would have the situation of many women with problems opting to not go to male health workers for some of their needs. We also found children to be more comfortable with women. We saw this as a way to empower the village women. Although literate candidates are preferred, we did not make literacy a criterion for training these village health workers. We firmly believe that the poorest women who may be uneducated should not be excluded for that reason. To give you a fair picture, out of the 110 VHWs we have, more than half are not literate to start with. Our decision to only use women as health workers, Dr. Kataria said about the initiative: “Since more than 70% of the deliveries are still at home, we recognize the importance of training traditional birth attendants. In the tribal villages, still there are ill-informed practices such as starving the mother for six days after delivery or waiting for the placenta to be delivered first before cutting the cord (which can jeopardize the health of both mother and baby). It has been gratifying to see significant changes in their practices after taking our training.”

The TBAs are also taught to tackle a few emergencies, the most common one being the management of post-partum haemorrhage, by applying uterine compression. Talking of their training program’s effectiveness, he recounted an episode recollected by Milki Bai and Jaymati, two of their TBAs from Atariya village: “Rajeshwari, the Sarpanch22 of our village delivered a baby boy and after delivery, she started bleeding and it would not stop, and she was feeling faint and cold. We remembered our training: we compressed the uterus with one hand fisted in the vagina and another on her abdomen. We held it like that for 15 minutes, and the bleeding stopped. She recovered after that and is fine now. This was something we would not have been able to manage a year ago.”

**JSS Village Health Centers—Second Tier**

At the second level, since 2000, JSS has been running weekly mobile outreach clinics in three village health centers located at Shivrtarai, Semariya and Bamhni villages, each 50 to 75 kilometers away to the north and northwest of Bilaspur town. Each village health center is typically served by a doctor who visits the mobile clinic with a nurse, a laboratory technician and a pharmacy assistant. A doctor would typically attend to 30 to 75 patients during each visit, depending on the season. The clinics serve around 50 forest and forest-fringe villages each in a radius of up to 15–20 kilometers. A distinctive feature of the clinic is that they provide basic laboratory services including malaria and sputum microscopy, helping to provide more rational and effective treatment. The lab is well-equipped to do basic biochemistry, hematology and microscopy of all body fluids, as well as take culture samples
The village health center at Bamhni is manned by two trained senior health workers (SHWs) round the clock which makes access to quality health care feasible for patients with limited mobility (for instance, the elderly and women with young children). As the JSS report says, “The main tasks of the middle level health worker (SHWs fall in this cadre) include diagnosis of common illnesses including emergencies, management of these common emergencies and deciding about referral of those that she/he cannot manage.”

The outreach clinic at Shivtarai, a forest-fringe village about 43 kilometers to the northwest of Bilaspur town, has been running since March 2000. More than 1954 consultations have been offered at this clinic as of 2013. The clinic at Semariya village (42 kilometers to the north of Bilaspur town) has been in operation since July 2000. With the generous support of the locals, the site has been upgraded and more than 3456 consultations have been conducted at this site. At the third clinic at Bamhni village, 70 kilometers to the north of Bilaspur town in the Achanakmaar Game Sanctuary, more than 13048 consultations have been rendered since it began its operation despite the fact that it is difficult to reach the clinic by vehicles. Their unparalleled commitment and dedication to serving remote villages is well-reflected from the fact that they never shied away from their task to reach Bamhni sub-center despite being forced to cross a river in spate.

JSS Community health center at Ganiyari (the JSS hospital)—Third Tier

From its humble beginnings, the JSS community health center at Ganiyari has grown substantially. Today it is a well-equipped, self-sufficient hospital with an outpatient service, an inpatient ward, an operating theatre complex, a low-cost pharmacy, a radiology unit and a laboratory that is equipped to perform even sophisticated tests and cultures. Over the years, it has provided service to more than 100000 patients.

Responding to a question about their catchment area, Dr. Sushil Patil, physician-administrator at JSS says: “We draw our patients from more than 1200 villages/towns of the district and beyond. Typically, 40% of every OPD (80–100 patients per day) come from the state of Madhya Pradesh. These patients tend to be the most sick. Patients also come from the states of Orissa and the full breadth of Chhattisgarh. Over the years, we have acquired a great reputation for providing low-cost, effective care. Patients place a lot of trust in our ability to cure their illnesses and are equally impressed at the quality and affordability of the care we offer. They not only come from faraway places but are willing to wait any amount of time to avail our services.”

Asked about alternative healthcare facilities in the region, Dr. Patil mournfully lamented: “The quality of the public health system in this region has been dismal. Patients typically are reluctant to seek care in the government hospitals, as they are known for poor patient care and poor inter-departmental coordination. Particularly, if a patient needs a medication, blood transfusion or a medical clearance for surgery, there is little help that they get from the system. In addition to all these, they are plagued by excessive absenteeism.”

Others are equally critical of the poor quality of public health systems: “The rush of patients on any given day at the JSS is not merely an indication of the quality of care, it is also a testament to the lack of anything comparable in the region. There is a government primary health center (PHC) in Ganiyari itself, not far from JSS. But typical of PHCs the country over, it rarely has any doctors, let alone patients, and its appearance of dingy neglect hardly inspires confidence.”

Challenges in setting up a surgical hospital in rural Ganiyari

Physical Infrastructure

Buildings & Space

On the choice of their building design, Dr. Kataria said: “Based on our conversations with the community prior to establishing JSS, it was very clear to the core team that the clinic and its facilities had to be something that was welcoming and allowed the average villager to feel comfortable approaching us to receive his or her healthcare. We chose the brick-based structures with thatched roof design given their similarity to other structures in the area as well as their cost-effectiveness in terms of construction and maintenance.”

Electricity

Mr. Paramanand, chief administrative officer, shared how they tackled the issue relating to electricity: “In the late 1990s, most of rural India, just like much of the low-resource locations elsewhere, was not electrified. Ganiyari was a typical Indian village that had little existing infrastructure with very poor overall electrification. Luckily power lines already ran through the general vicinity of our site and the local state electricity board was helpful in providing electrical connection for JSS. But it (the electricity) was highly unpredictable. We had frequent outages to the point that the actual availability in a day could be less than a combined total of 8 hours. Over the years, we tackled this issue of power outages through a transformer that was donated to us. Over time, we have also purchased two generators which also act as backups to provide uninterrupted power supply to our OTs and for other emergency uses.”

Water

The team did not face significant challenges with respect to water sources, given that Ganiyari used to be a rural irrigation colony. Mr. Paramanand continued: “Today, our internal needs are met with the water from two borewells on campus; the waster is stored in an overhead
water tank that can hold up to 100,000 litres. We purify water before use in three different ways: (i) Big reverse osmosis (RO) filter donated by one of the leading RO filter manufacturers is used to purify water for autoclave purposes, (ii) at various water dispensers, ultra-violet (UV) filters are deployed for purification and finally (iii) UV drum is used for cleaning at other places including the community center. We also check regularly (3–4 times a year) for its potability and if found unsafe, we deploy chlorine-based purification.

**Medications, Supplies and Supply Chains**

When asked about the availability of medications and other supplies, Dr. Kataria said: “Luckily, since Bilaspur has several pharmaceutical warehouses, it is a distribution hub to the hospitals and clinics in the area, including ours. So we have not had many problems with getting generic versions of drugs and supplies. We have also been able to purchase medications and supplies at relatively lower prices, thanks to the bargaining power that our alma mater All India Institute of Medical Sciences (AIIMS) enjoys”(See Table 8 for comparison of JSS’s low-cost generic drugs with market rates). Mr Paramanand added: “Within the larger purchase agreement negotiated by AIIMS, JSS is able to procure supplies on an as-needed basis. Although, as chief administrative officer, I am authorized to decide on minor purchases, larger purchasing decisions are typically made by a purchasing committee comprised of clinical (includes all four remaining founding physicians) and administrative staff at JSS. Such a systematic procurement system has enabled us to streamline costs without compromising clinical needs.”

**Equipment, Maintenance and Donations**

Maintenance of medical equipment always poses severe challenges in low-resource settings. Talking about this issue, Dr. Kataria said: “Very few equipment manufacturers are located in rural areas, and the few biomedical equipment technicians who reside near Ganiyari are always on high demand. Many times we make purchasing decisions not based on the quality of the equipment, but rather on our ability to service and maintain the equipment.”

Recollecting an interesting episode, Dr. Kataria shared: “When we had to purchase our first generator, we had a choice between a relatively inferior local unit and a superior unit from overseas. In the end, we went with the local make largely because we knew it could be maintained by the local technician. It is important to recognize that all equipment will fail, and it’s a matter of having the resources to fix it and move on.”

Also Dr. Kataria points out that in private hospitals in the neighborhood such as the SRC hospital, a common workaround in tackling reliability issues is to have redundancy in supplies and equipment. Although it adds cost, in most cases the redundancy is justified. He notes that for laparoscopic and gastroscopy equipment, for example, it might take months for a defective component to be sent to Delhi for diagnostics, repair and eventual return to Bilaspur.

Given its NGO status and the positive coverage it has received for its commitment to the rural poor, JSS has been fortunate, Dr. Kataria notes, in attracting the attention of philanthropists. Some philanthropists have been interested in donating equipment, but Dr. Kataria notes that it’s problematic if the donation is based on what the donors are able to give, as oppose to what the hospital actually needs. He notes that the donation of expensive, fancy equipment that cannot be repaired and maintained locally is like receiving an expensive Italian sports car to drive in the middle of the desert. “Without a mechanic or a fuel station, it’ll quickly end up as an expensive piece of machinery rusting and gathering dust.”

**Sterilization**

On the topic of sterilization, Dr. Kataria says: “The ability to sterilize reusables is critical for surgical care. Although in rural environments, this can be achieved at relatively low cost using some basic instrumentation, we have opted to invest in industrial healthcare-grade sterilization machines at our hospital. We didn’t want to take any chances with respect to safety of our patients. Also, these machines have ensured safety in our extensive reuse of test tubes and sterilizable glass syringes.”

**Ancillary Services**

**Laboratories**

JSS has invested in basic laboratory equipment on-site, and has established relationships with a laboratory in Bilaspur that provides diagnostics at reduced rates. Basic chemistries, coagulation profiles, blood counts, blood typing and cross-matching can be performed on-site. The lead time involved for send-out tests can vary between a couple days to weeks.

**Blood Bank**

JSS has been at the forefront of advocating for improved blood banking facilities in low-resource areas. It is estimated that over 99% of blood banks in India exist in urban centers, leaving less than 1% of blood banks for the rural citizens. The closest blood banks to JSS are in Bilaspur, and the time necessary to obtain blood in the case of an emergency can span up to several hours. Recent changes to the law have allowed centers like JSS to serve as blood storage facilities, so blood collected elsewhere can be stored in coolers at JSS. This has reduced the delay in provision of necessary life-saving transfusions. However, as Dr. Kataria points out, they are in perpetual shortage both on-site and at the source blood bank. For this reason, they sometimes use tranexamic acid, which has been proven to reduce the need for blood during surgical procedures.
Pathology
Currently they have no pathology services available on site and all diagnostic pathology specimens are sent to a laboratory in Bilaspur for formal reading.

Radiology
X-ray machines and ultrasound equipment are available on site. More complex imaging consisting of CT scans and MRI are only available in Bilaspur. There is no staff radiologist, so films are read by the clinicians on-site. More specialized reads (for example echocardiography) are obtained through clinician networks generated by the founders. For example, a cardiologist at Mayo Clinic Jacksonville (an AIIMS colleague of Drs Kataria and Jain), trained a nurse to operate ultrasound equipment for the purposes of echocardiography. The images are sent electronically to the cardiologist who is able to provide reads remotely.

Waste management
Paramanand was proud to point out that JSS manages its medical and clinical wastes as per the state government regulation through its tie up with Envirocare, a private waste management firm. Waste from medical, laboratory and pharmaceutical practices are collected at the source and properly classified and stored in different colored bins and kept in a designated waste storage building before they are fortnightly collected by Envirocare for disposal.

Ambulances
JSS owns 5 ambulances: they were gifts from various donors over the years. On average, the ambulance service receives 2-3 emergency calls a week and the ambulances are also used to transfer patients to local doctors/hospitals if they need to be referred.

Overall facility capabilities
There are three inpatient wards at JSS. The original ward had 15 beds that mostly served the post-operative patients recovering from general, gynecological, pediatric or ENT surgery. Since August 2009, they have opened a new ward consisting of an additional 15 beds and since 2010, there is also another ward fully dedicated to tuberculosis patients with the total bed capacity going up to 70. The operation theatre complex includes 2 major operation theatres and a labor room.

Staff on duty as of September 2014
The surgical team at JSS consists of Dr. Raman Kataria, Dr. Rachna Jain and another obstetrician. Dr. Kataria is a pediatric surgeon turned generalist; he takes care of obstetric and gynecological procedures along with basic orthopedic procedures. Dr. Jain is an obstetrician and gynecologist, who handles basic general surgery and is capable of providing a laparotomy if necessary. The other obstetrician on staff is available largely for emergency caesarean deliveries. An external orthopedic surgeon provides his services on a pro-bono basis once weekly, as does an urologist who provides endo-urologic services. Both are located in and work at the district hospital in Bilaspur. “There is no such thing as a specialist in rural surgery,” explains Dr. Kataria. “We don’t want to be paralyzed by our specialized training. You must be a multi-specialist, trained in and capable of providing pretty much everything. If you are not trained in something, we recommend training yourself through experience. When faced with a situation where a patient is either going to die or suffer a chronic condition because timely service is unavailable or unaffordable, it is better to try our best to salvage the situation even if we are not the best-trained to deliver that service. Over the years, each and every one of us have become very good at what we practice and this de-specialization of doctors has made us more versatile in handling diverse situations with limited resources.”

The medical team at JSS is headed by Dr. Yogesh Jain, a pediatrician by training, and consists of a team of three retired staff physicians who volunteer their services and are available part-time, providing a range of services from general medicine to pulmonology. The organization consistently has 4-5 junior physicians, who are generally in the midst of training (basic or advanced) or have completed training. Turnover is high, as these individuals usually use the JSS high-volume experience as additional training to further their careers. To date, JSS has had a few surgical trainees spend 3–9 months on site, with very few showing the commitment to stay for the long haul.

The nursing situation is equally challenging. It is difficult to attract skilled nurses to a rural area where the pay is low. There is little incentive to sacrifice a job in an urban area, which may be less disruptive to their personal lives and family situations. Because of the nursing shortage, we train local volunteers who are on-the-job to assist with nursing duties. To address this issue, in 2010, JSS initiated a state-approved nurse-training program to which they reserve a large proportion of the seats to candidates belonging to the local community areas in the region. “We find that individuals with ties to the community, who have grown up in these areas, are much more likely to stay at JSS even with the prospects of higher-paying jobs elsewhere in the cities,” says Sumesh who runs the basic training course for the nurses.

Service Provision to the Poor
JSS has been so successful with its outreach efforts and positive word-of-mouth, that over 500 patients line up to be seen every week; they come from over 3000 remote villages within a radius of 200 kilometers from Ganiyari. About 20% of these patients are triaged to a surgical consultation for a potential surgical issue and JSS hospital has performed over 25,000 surgical procedures since inception; over 1500 of them were performed in
Since it opened its doors, JSS has cared for more than 270,000 patients; about 44% were from backward castes, 35% Dalits, and 14% Tribals. By 2014, the sub-centers had cared for about 75,000 patients and the VHWs had cared for about 26,000 patients; over 72% were Tribals, 19% backward castes, and 7% Dalits.

It costs only 10 INR (less than $0.20 USD) to register at JSS, and half of that if you are pregnant or a child under the age of 6. There is no separate fee for an initial consultation or repeat consultations during the first week; after that, each consultation costs just 5 INR.

The median expenditure for an illness for its complete evaluation, laboratory investigation and drug needs for an entire month costs the patient a meager 110 INR. Many surgical procedures are provided through the RSBY scheme, so a surgical hospitalization, which can be a catastrophic financial expense, costs nothing to patients if they are unable to afford it.

Emergency patients may skip the registration process and go directly to the OPD.”

He adds: “New registration typically happens the evening before the OPD (Saturday, Tuesday, and Thursday evenings). You may have noticed the luggage patients have kept along the corridor to indicate their position in their line. Based on their position in the waiting line, they are given a token for OPD appointment that may not necessarily be on the following day. Typically if a patient comes to register on a Tuesday, he or she will probably get a token for a Friday’s OPD. While patients are in line, our staff members will go through and make sure that any patients with acute issues are moved out of the line for quick assessment.”

Since patients travel from far away, they frequently stay on campus grounds or in the dharamshala for a few days before their turn comes. JSS provides shared kitchen areas where patient families are permitted to

### Exhibit 2: List showing various conditions for which surgeries are performed at Ganiyari

| Abdominal                     | Urinary stones, gastro-intestinal perforation, gallstones, appendicitis, hernia, hydrocele, hemorrhoids, fistula-in-ano, intestinal obstruction, cancer of the colon and rectum, hydatid cyst. |
| Gynecological and Obstetric issues | Cancer of the uterus, uterine cervix and breast, ovarian cyst, dysfunctional uterine bleeding, cystocele, rectocele, vesico-vaginal fistula, caesarean section. |
| Chest and ENT                 | Empyema thoraxis, thyroid adenoma, mixed parotid tumor |
| Skin and connective tissues   | Necrotising fasciitis, pyomyositis, post-burn contractures, squamous cell carcinoma, abscesses, fractures. |
| Congenital and pediatric      | Cleft lip and palate, tracheo-esophageal fistula, clubfoot, hydrocephalus, Hirschprung disease, congenital pyloric stenosis, posterior urethral valves, stricture of the urethra, Wilms’s tumor, necrotizing enterocolitis, hypospadias, undescended testes. |

### Exhibit 3: Key milestones at JSS

- **January 1998**: Appropriate technology development work
- **March 1998**: Decision to work in rural Bilaspur
- **May 1999**: Setting up base
- **January 2000**: Community program initiation
- **February 3, 2000**: Clinic starting at Ganiyari
- **May 2001**: Operationalization of the operation theatre and 10 bed ward inauguration
- **June 2003**: Opening of the sub-center and the community health programme for the 75 villages in the Achanakmaar tiger reserve and surrounding areas
- **August 2004**: Mitanin—hamlet based health worker programme, based on ideas from many organizations including JSS
- **September 2005**: Training workshop for rural physicians and surgeons of Bilaspur district
- **January 2006**: Commission of new operating theatre services
- **March 2006**: Workshop on hunger and health at Ganiyari
- **2007**: People from over 2500 villages coming for their health problems to Ganiyari including 3 districts of Madhya Pradesh
- **February 2009**: Multi-stakeholder workshop at Ganiyari on management and control of falciparum malaria Ganiyari
- **February 2009**: Blood storage center commissioned at Ganiyari
- **February 2010**: Inpatient bed strength raised to 70
- **February 2011**: ANM training school for adivasis and Dalit girls
- **March 2012**: Skype classes and telemedicine start
- **January 2013**: GNM training school started
- **March 2013**: Workshop at Ganiyari on rational use of investigations in a low resource setup
- **January 2014**: DNB programme in family medicine started
cook their own meals. They also have the option to buy subsidized meals from the JSS canteen.

At the time of registration, every patient is given an identification card with a registration number. JSS maintains the medical records of all its patients; patients need only bring their identification card to each visit. JSS is currently in the process of converting their paper records into electronic versions, but in the meantime, the paper records are color-coded to indicate gender, diagnosis, age (green for children, yellow for women, white for men), and participation in community services (pink for those in the intensive village programme).

**Triaging**

After registration and when it is their turn, the patients go to a screener, a position typically served by a JSS Senior Health Worker. The screener, being well-trained in categorizing the patients by their ailments, triages the patients efficiently and sends them to the appropriate physician. For instance, patients with a medical problem will be sent to Rooms 1, 2 or 6; diabetes cases are sent to Room 6; surgical cases are sent to Room 3.

Dr. Kataria also noted that they strive to achieve same-day treatment for their patients. Asked to elaborate more on this, he said: “Even if it stretches the system, we wanted to have a single-day service provision. From consultation to investigation to treatment, we strive to finish as much within a day as possible.”

**Mechanics of Surgical Care Delivery**

Surgical conditions presented at Ganiyari are diverse (see Exhibit 2 for a range of conditions for which surgeries are performed at the JSS hospital at Ganiyari and Figure 5 for the surgical delivery scheduling process). Patients requiring surgery, upon their arrival in Room 3, will be seen by a junior doctor who will provide them with a checkup including a physical exam. After the examination, the doctor will decide whether to send the patients for lab tests and further investigations if necessary. All laboratory, imaging and ancillary services are conducted on site, after which, Dr. Kataria, the senior surgeon, makes a decision about the patient’s surgery.

Surgery for a given patient is scheduled based on a multitude of factors, including wait time (depending on the surgery backlog), illness severity, and the distance the
patient travelled. Typical wait time is about 2 weeks but it can be as long as 1.5 to 2 months, depending on the above-mentioned factors.

Patients who underwent minor procedures under local anesthesia are typically sent home after the procedure. Regional anesthesia patients remain at the hospital for 24 hours, and general anesthesia patients stay about 7–10 days. Women who have caesarean deliveries usually stay for 4 days.

Surgical Innovations

The approach at JSS for surgical procedures aligns with its overall mission to provide affordable health care. Their focus in surgical procedures has been on minimizing costs by providing frill-free, basic care without compromising quality at any stage of care. To meet this goal, JSS adapts strategies that have been proven to be successful at other institutions, and works to find innovative alternatives when necessary. To contain costs, general anesthesia is only used when it is essential, and the OR, while fully-equipped, is basic. The three basic procedures described below illustrate the approach at JSS and illustrate the impact of these initiatives on cost reductions.

Inguinal herniorraphy using mosquito net mesh

Inguinal hernia repair is one of the most frequently performed surgical procedures in the world. Although hernias are common conditions that affect men and women of all ages, they are much more common among older men and infants. Men have a 27% lifetime risk for developing inguinal hernia, while women only have a 3% lifetime risk. It is estimated that more than 20 million inguinal hernia repairs are performed annually worldwide.

Inguinal hernia refers to the weakening of the abdominal wall in the groin area and a “herniation” of abdominal cavity contents into or through the inguinal canal. As a result, the patient experiences a bulge in the groin often accompanied by pain. The severity can range from minor inconvenience to debilitating pain. Rarely, the abdominal contents that slide into the hernia defect can obstruct or twist on themselves (strangulation), which can be life-threatening.

Sharing his insights about the acuteness of the problem in tribal areas near Bilaspur, Dr. Kataria said: “In tribal areas of Bilaspur, there are many untreated inguinal hernia cases, and patients often develop large inguinoscrotal herniation as a result of delayed presentation. We have encountered emergency situations where fatalities are not that uncommon.”

Inguinal hernias are generally repaired with an incision to the groin, separation of the abdominal wall layers and placement of a prosthetic mesh to bridge the hernia gap. This is known as the tension-free hernia repair since it replaced the earlier approach of simply buttressing a repair performed under tension. In India, polypropylene mesh cost about INR 1500. Although the use of such expensive synthetic mesh is universal in high-income settings, it is cost-prohibitive in poorly-resourced rural communities.

Dr. Kataria elaborated on some of their innovations to tackle the affordability issue: “Although our repair procedure is surgically identical to that performed in high-income settings, there are some notable exceptions. Firstly, we prefer spinal anesthesia to general anesthesia. We have replaced pre-packaged, disposable nylon sutures with simple nylon fishing wire, which costs 10 INR and it

<table>
<thead>
<tr>
<th>Name of Drug</th>
<th>Price at JSS in INR</th>
<th>Price of alternative in local market (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albendazole 400 mg</td>
<td>1.50</td>
<td>9-12</td>
</tr>
<tr>
<td>Amlodipine 5 mg</td>
<td>0.40</td>
<td>1.50-6.00</td>
</tr>
<tr>
<td>Cephalexin 500 mg</td>
<td>4.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Azithromycin 250 mg (1 tablet)</td>
<td>8.50 (Zithrin, FDC)</td>
<td>39.14 (Vicon, Pfizer)</td>
</tr>
<tr>
<td>Levofloxacin 500 mg (1 tablet)</td>
<td>6.80 per tablet Levoflox (Cipla)</td>
<td>95.00 per tablet (Tavanic, Aventis)</td>
</tr>
<tr>
<td>Ramipril 5 mg (1 tablet)</td>
<td>5.50 per tablet (Sclerace, Novartis)</td>
<td>9.70 (Cardace, Aventis)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Rural (per 1000 population)</th>
<th>Urban (per 1,000 population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude death rate</td>
<td>7.6</td>
<td>5.6</td>
</tr>
<tr>
<td>Infant mortality rate (IMR)</td>
<td>46</td>
<td>28.0</td>
</tr>
<tr>
<td>Neonatal mortality rate</td>
<td>33</td>
<td>16.0</td>
</tr>
<tr>
<td>Post neo-natal mortality rate</td>
<td>14.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Under-five mortality rate</td>
<td>58</td>
<td>32.0</td>
</tr>
</tbody>
</table>


Table 7: Rural-Urban Divide in Health outcomes in India in 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2003</th>
<th>2005</th>
<th>2009</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant mortality (deaths per 1000)</td>
<td>119</td>
<td>86</td>
<td>61</td>
<td>29</td>
<td>22.45</td>
</tr>
<tr>
<td>Perinatal mortality (deaths per 1000)</td>
<td>67</td>
<td>65</td>
<td>44</td>
<td>21</td>
<td>30.38</td>
</tr>
<tr>
<td>Under 5 mortality rate</td>
<td>145</td>
<td>110</td>
<td>77</td>
<td>44</td>
<td>40.95</td>
</tr>
<tr>
<td>Malaria: Annual parasitic index</td>
<td>32</td>
<td>20</td>
<td>13</td>
<td>7</td>
<td>4.1</td>
</tr>
<tr>
<td>Crude death rate</td>
<td>14</td>
<td>10</td>
<td>8.5</td>
<td>5</td>
<td>7.69</td>
</tr>
</tbody>
</table>

*This figure is for the period April 2013–March 2014.

Table 8: Price differentials in drugs

<table>
<thead>
<tr>
<th>Category of Staff</th>
<th>Monthly salary (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors</td>
<td>40,000–45,000</td>
</tr>
<tr>
<td>Anesthetist</td>
<td>40,000</td>
</tr>
<tr>
<td>Nurses</td>
<td>5000</td>
</tr>
<tr>
<td>Senior nurse</td>
<td>6000–10,000</td>
</tr>
<tr>
<td>Graduate nurse</td>
<td>10,000+</td>
</tr>
<tr>
<td>Paramedical staff</td>
<td>5000–7000</td>
</tr>
<tr>
<td>OT Assistant</td>
<td>10,000+</td>
</tr>
<tr>
<td>Lab Technician (Senior)</td>
<td>10,000</td>
</tr>
<tr>
<td>Lab Technician (Junior)</td>
<td>5000</td>
</tr>
<tr>
<td>Minimum salary</td>
<td>5000</td>
</tr>
</tbody>
</table>

Table 10: Representative Salary Structure at JSS
**Teaching Case**

**Table 11: Summary of costs for performing hernia repair at JSS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (INR)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal 2 ml lox</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Spinal needle for injection (23 gauge)</td>
<td>70</td>
<td>Reused with autoclave</td>
</tr>
<tr>
<td>2-0 catgut suture</td>
<td>48</td>
<td>Vs. INR 150 for vicryl—to tie the sac</td>
</tr>
<tr>
<td>Simple nylon</td>
<td>1</td>
<td>Simple nylon INR 10 for 10 patients</td>
</tr>
<tr>
<td>Mosquito mesh†</td>
<td>5</td>
<td>Vs. INR 1500 for monofilament mesh</td>
</tr>
<tr>
<td>Dressing material</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Silk reel</td>
<td>12</td>
<td>INR 250 for 20 cases; 12.5 rupees/case</td>
</tr>
<tr>
<td>Gloves 2 pairs</td>
<td>12</td>
<td>INR 6 per pair</td>
</tr>
<tr>
<td>Antibiotics given (pre-op)</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

**Table 12: Summary of Costs for performing laparotomy at JSS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (INR)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal 4 ml lox</td>
<td>16</td>
<td>75% are done with spinal anaesthesia</td>
</tr>
<tr>
<td>Spinal needle for injection (23 Gauge)</td>
<td>70</td>
<td>Reused with autoclave, it is made of steel</td>
</tr>
<tr>
<td>2-0 catgut sutures</td>
<td>94</td>
<td>INR 47 per strip</td>
</tr>
<tr>
<td>2-0 silk sutures</td>
<td>140</td>
<td>INR 70 per strip</td>
</tr>
<tr>
<td>Dressing material</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Gloves 2 pairs</td>
<td>12</td>
<td>INR 6 per pair</td>
</tr>
</tbody>
</table>

Around 32–36 hernia cases are operated per month at JSS. Surgeries are scheduled in advance and surgeries usually have an average waiting periods of about a month. Surgery is typically done 3 days a week. Dr. Raman Kataria and Dr. Rachna Jain perform the hernia operation. †Mosquito mesh is autoclaved.

Mosquito nets (5 INR) are cut into the appropriate sizes and then autoclaved for use as the prosthetic mesh instead of the more expensive, pre-packaged synthetic meshes (1500 INR); the mosquito nets is a good value for money. Although we have not conducted randomized clinical trials comparing the two approaches, there are other studies done elsewhere that have confirmed their effectiveness and safety. (See Table 11 for the net impact of these initiatives on cost of providing surgery.

**The Laparotomy**

Laparotomy, also known as abdominal exploration, is an important basic procedure that is required in treating a variety of urgent or emergent conditions, including vascular emergency (ruptured aneurysm), occluded blood supply to abdominal organs (mesenteric ischemia), and any perforation of gastrointestinal tract (from an infectious ulcer like H Pylori), the small intestine (typhoid infection, for example) or large intestine (diverticulitis or cancer). Usually it is an emergent procedure done to explore the abdomen for intra-abdominal catastrophe.

Though repair of the potentially catastrophic findings upon entering the abdomen requires high-level surgical expertise, the laparotomy procedure itself—defined as the surgeon gaining entry into the abdomen—is not particularly resource-intensive. It requires only bales for the incision and sutures or electrocautery to stop bleeding and to close. Generally, there is no implant of foreign material (other than sutures). However, the procedure does have an ill-defined cost component that is a function of the problems discovered during the procedure. For example, the time and materials (sutures, grafts) required for intestinal or vascular repair can be extensive.

Here again, Dr. Kataria explained how JSS was able to contain costs: “In contrast to general anaesthesia that is typically used in high-income settings, we prefer to administer spinal anaesthesia (with general anaesthesia only when necessary). In addition, the surgeons at JSS make concerted effort to minimize the number of sutures and disposables consumed during the surgery through a variety of ways. For instance, if a tear in the intestine requires repair, it may require anywhere between 1 and 20 suture ties (insertion needle, extraction needle, and tying of the suture ends) to repair the defect. In high-income settings, many surgeons use a fully prepackaged suture for each tie in order to save time through the rapid tie of the suture. At JSS, we use the same suture for at least 7 ties, and use the suture until it is very short on the cut end. It is slower, but more efficient.” (See Table 12 for a summary of the cost of surgery at JSS compared to the cost of surgery elsewhere)

**The Caesarean Delivery**

At JSS, Caesarean deliveries are performed by surgeons and obstetricians using the standard procedures in line with the latest surgical techniques. A single double needle absorbable suture is used for the uterine closure,
a simple nylon suture constructed of the locally-sourced nylon (described in the hernia repair section) is used for fascial closure and a silk suture is used for intra-operative hemostasis.

Continuing on the earlier discussion about their cost-cutting initiatives Dr. Kataria explained: “The caesarean delivery is a well-established procedure all over the world and our procedure is very similar to how it is done in high-income settings except for major differences in cost arising primarily due to labor and materials savings.” (See Table 13 for a comparison of our costs to standard costs incurred elsewhere.)

Improvements in Healthcare Indicators
The tireless efforts of the doctors, paramedics and other staff at JSS have led to significant gains in various health care indicators for the project area. From 2000 to 2013 (Table 9), we saw a truly remarkable drop in infant mortality rate (IMR); it plunged down from a high of 119 deaths per 1000 live births in 2000 to 22-45 in 2013–14. The result is even more remarkable when we consider the fact that the rest of Chhattisgarh is still suffering a much higher IMR: 59 deaths per 1000 live births in 2013. Equally impressive results have been achieved in under-5 mortality rates (U5MR): it was reduced from 145 deaths per 1000 live births in 2000 to 40-95 deaths per 1000 live births in 2013–14. The malaria incidence rates have also significantly fallen from a high of 33 deaths per 1000 people in 2000 to 4-1 deaths per 1000 people in 2013–14.

The birthweight of newborns has significantly improved in this period. More than 84% of newborn babies had a birthweight exceeding 2.5 kg. Efforts to prevent malaria in pregnant women have significantly contributed to this result.

Financial Viability of JSS: Costs & Revenues
The commitment of JSS to providing high-quality healthcare cost effectively is reflected in almost all of its activities, including wage and salary structure, minimization of waste and costs, and pricing policies, and the actual care delivery. As described earlier in the context of surgical procedures, significant effort and attention has been devoted to minimizing the cost of services by using alternative, less-expensive materials.

JSS’s salary structure also captures the organization’s philosophy to foster an equitable society (see Table 10). The salaries for all staff, including that of medical professionals, are well below their counterparts in other hospitals. The informal understanding is that doctors at JSS draw no more than 25% of market rates for similarly qualified doctors. JSS also encourages and supports the policy of giving employment to both spouses as it helps to enhance the household income of married couples. In addition to the salaries, an extra 300 INR are also paid per child to all employees up to a maximum of two children. Further, as can be seen from the table, the senior management at JSS has strived hard to keep the ratio of the highest to the lowest salary at between 8 and 10 and to not exceed 10.

The impact of cost reduction efforts in delivery of surgical procedures is reflected partially in the posted prices of JSS. Representative data on costs and prices are provided in Tables 11–13 for the three procedures described earlier. The tables also present reference prices for similar procedures (See Annexure 2 for prices at SRC for equivalent procedures) that can be used as a benchmark for comparison. The reference prices denote the prices charged by SRC, a private hospital in the region and rates approved under the Rashtriya Swasthya Bima Yojana (RSBY) scheme, a government-sponsored insurance scheme that targets those who are poor or below the poverty line.

It should also be noted that while JSS announces standard prices for each procedure, patients are treated based on need, irrespective of their ability to pay. As a result, only a fraction of the patients pay the full price and several are treated at no charge. In addition to revenue collected from the patients, JSS also receives payments from the RSBY administrator for patients enrolled in the insurance scheme. In any case, revenue from the patients (including payments from the RSBY scheme) is not adequate to cover the full costs of running the facility and JSS depends on contributions from philanthropists and charitable organizations for its survival. The details of expenses and revenues received by JSS from various sources are summarized in Table 14.

Looking to the future—Key challenges and possible options
At the board meeting on the previous evening, the team discussed several challenges that JSS faces in the future.
Reflecting on the accomplishments of JSS since its inception, Dr. Kataria was pleased that more than 200,000 poor and needy patients have been treated during this period, irrespective of their ability to pay. However, he also realized that with a population of 25.5 million in Chhattisgarh alone, most of whom were poor and below the poverty line, this was a drop in the ocean. The problem was severe resource constraints and limitations in infrastructural facilities. First, with patient revenues covering only a small percentage of total annual expenditure, JSS was heavily dependent on external sources in the form of donations and grants to remain solvent. While some of the grants were tied to specific activities and had long-term commitments, reliance on grants made JSS financially vulnerable. In the past, several initiatives had been suggested and discussed to assure more stability, but there was no concrete follow-up action. In the meeting that Dr. Kataria attended the previous day, the executive committee members revisited the details of some of these initiatives and the details of their discussions on pros and cons of each as follows:

i Establishment of a corpus: With its demonstrated commitment and dedication to the cause of providing affordable healthcare for the poor, JSS has developed an enviable reputation and credibility, not only locally but also nationally and beyond. Thus today it has the potential to leverage this reputation and seek funds from the corporate houses for establishing a corpus. Such a corpus has the advantage of freeing the organization from day-to-day funding worries and would help focus on its core mission. Second, access to a corpus would enable better long-term planning, particularly for creation of suitable facilities. The recently enacted legislation requiring corporates to spend 2% of their profits on CSR activities is also likely to be helpful in implementing this initiative. Critics of this option worry that seeking funds from corporations who do not share the same values as that of JSS may limit the scope of the activities they wish to pursue.

ii Increasing posted prices of JSS’s services: It was argued in the past that a small to moderate increase in posted prices would enable JSS to increase patient revenues without compromising its mission. The suggestion was motivated by the recognition that a good number of patients could afford to pay a higher fee, but did not do so because of the posted price. Further, it was argued that the posted prices were well below those at comparable facilities—lower than the government-approved rates for RSBY and less than a fraction of the rates charged by SRC in the same district. It was also pointed out that in any case needy patients were always treated and never turned away because of their inability to pay, and any proposed change in posted prices would not affect them.

iii Encouraging RSBY patients to avail of JSS’s services: Clearly, RSBY approved rates were higher than the posted prices of JSS, so increasing the number of RSBY patients where payment was assured under the insurance program, JSS’s finances would improve marginally from the increased revenues. However, JSS has resisted following-up on this initiative because of the fear that it might encourage patients to seek unnecessary treatments.

iv Changing the patient mix: Given the diversity of patient population with varying ability to pay, there was a suggestion that JSS should offer two or three classes of peripheral (non-core) services and charge patients accordingly, thereby effectively deriving benefits of cross subsidy from one patient group to the other. The practices followed in nearby SRC and other private hospitals indicate that, if marketed well, such a strategy could be effective in boosting overall revenues. However, Dr. Kataria has consistently opposed this as it would dilute the focus of JSS. There was also a concern that creating such “class” distinctions among patients has the danger of driving away the poor patients.

While funding issues and the ability to remain solvent were important, Dr. Kataria was more concerned about the persistent shortage of qualified and trained medical professionals that was severely limiting the number of patients able to be treated. In part, the problem was due to the low level of wages offered and the unattractive lifestyle in rural India. As a result, only the most dedicated and committed individuals chose to come and serve in JSS. While modest increases in salaries may ease the problem a little, it was clear that JSS would never be able to attract professionals on the basis of salary. Rather the complex environment and diversity of case mix at JSS offered a rich

<table>
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<tr>
<th>Year</th>
<th>2011—12</th>
<th>2012—13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receipts from Activities</td>
<td>14,774,719</td>
<td>16,180,397</td>
</tr>
<tr>
<td>(Mainly patient services)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donations</td>
<td>2,086,012</td>
<td>1,406,214</td>
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<tr>
<td>Grants received</td>
<td>33,343,337</td>
<td>53,367,666</td>
</tr>
<tr>
<td>Other incomes (Through interest)</td>
<td>6,805,016</td>
<td>6,679,722</td>
</tr>
<tr>
<td>Total Income</td>
<td>INR 57,009,084</td>
<td>INR 77,631,999</td>
</tr>
</tbody>
</table>

Table 14: Income and Expenditure at JSS
opportunity for training professionals that could be leveraged to provide a steady stream of qualified people that could help JSS deliver service to more patients. The key step in this initiative would involve JSS being recognized as a qualified place for imparting advanced training and certification for professionals such as doctors and nurses. Such recognition would help bring qualified people for additional training and require them to spend a specified period, usually a few months to as long as two years. In return for the training and certification, such professionals would be available to serve JSS and enhance the capacity of the facility to deliver more services. The downside of the scheme was that JSS would have to devote some of its precious resources towards training. And, Dr. Kataria was not sure that the people coming in for certifications were committed to caring for JSS’s core patient group.
He was also worried about the complete absence of second level of leadership at JSS. The organization still depended on Dr. Kataria and the founders for all major decisions and while there had been several junior doctors who had spent extended period of time at JSS, to date no one had emerged at the next level to take the organization further.

Contributors
KS, DT, NR and PA led the writing of the paper and did the analysis. NR and PA made the site visits, conducted interviews and collected data. JM and NR read earlier versions of the report and provided valuable feedback. All members of the India case group contributed ideas for the report, reviewed the report, and agreed on the final version.

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Prakash Awayshty (Doctoral candidate, Indian Institute of Management, Bangalore); Rowan Gillesy (Globality Fellow, Harvard Medical School); John Meara (Plastic Surgeon in chief, Harvard Medical School); Nakul Raykar (Paul Farmer Global Surgery doctoral candidate, Harvard Medical School); Nobhojit Roy (Visiting professor for public health, Tata Institute of Social Science); Kannan Sethuraman (Associate Professor, Melbourne Business School, University of Melbourne, Australia); Devanath Tirupati (Airbus Chair Professor, Indian Institute of Management, Bangalore, India)

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Footnotes
1 The exchange rate on 27th December, 2014: 1 US $ = 63.68 Indian Rupees (INR).
3 Chhattisgarh, the 26th state of India, was founded on 1 November 2007. http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.
6 “India has just one doctor for every 1,700 people.” Indian Express, 22nd September 2013.
11 Source: http://www.bioline.org.br/requests1009.
12 Photos from JSS hospital are provided in Appendix 1.
13 It was classified as a backward district in terms of its socioeconomic development, ranking 9th in the Human development indicators out of the 16 districts of the state.
14 Despite constitutional safeguards, the interests of the locals remain marginalized and the state continues to face a higher rate of poverty, illiteracy, infant and maternal mortality and malnutrition when compared to the average Indian population (see Tables 2 and 3 for comparative statistics based on 2011 census).
15 Dalits represent a class of people in India who are considered as untouchables under the Indian caste systems.
16 A phrase used in India to denote submitting resignation papers.
17 This quote was obtained from Jan Swasthya Sahyog website.
18 This quote was obtained from Jan Swasthya Sahyog website.
19 This quote was obtained from Jan Swasthya Sahyog website.
20 This quote was obtained from Jan Swasthya Sahyog website.
23 Sarpanch is a Hindi term for elected head of a village level institution.
25 Sarpanch is a Hindi term for elected head of a village level institution.
27 Despite constitutional safeguards, the interests of the locals remain marginalized and the state continues to face a higher rate of poverty, illiteracy, infant and maternal mortality and malnutrition when compared to the average Indian population (see Tables 2 and 3 for comparative statistics based on 2011 census).
28 Hindi word for free dormitory.
29 Caesarean deliveries are generally performed with a transverse skin incision in the lower abdomen. The subcutaneous tissues can be bluntly dissected with the surgeon’s fingers or with the aid of a scalpel, and includes the subcutaneous fascia, the thick fibrous tissue that forms the core of the abdominal wall strength known as the fascia, the rectus muscle layer, and the peritoneum, a layer of tissue that lines the abdominal cavity. Once the uterus is exposed, it is opened in a low transverse or low vertical incision. The classical approach, now rarely used in the high-income world and avoided at JSS because of a high rate of uterine rupture, involved a high vertical incision that extended into the upper portions of the uterus. Unfortunately, in some parts of the low-resource world — it is impossible to know exactly how often — the classical approach is still used. Once the fetus is delivered, the most important aspects of closure involve suturing the uterus in two layers and the fascial closure involve suturing the uterus in two layers and the fascial. The peritoneum, a layer of tissue that lines the abdominal cavity. Once the uterus is exposed, it is opened in a low transverse or low vertical incision. The classical approach, now rarely used in the high-income world and avoided at JSS because of a high rate of uterine rupture, involved a high vertical incision that extended into the upper portions of the uterus. Unfortunately, in some parts of the low-resource world — it is impossible to know exactly how often — the classical approach is still used. Once the fetus is delivered, the most important aspects of closure involve suturing the uterus in two layers and the fascial layer described above. The evidence is less strong for closure of the subcutaneous tissue prior to skin re-approximation of the skin.
30 A brief description about RSBY is provided for interested readers in Appendix 3.
31 A brief description about RSBY is provided for interested readers in Appendix 3.
Appendix 1: Photos from JSS

Patients line up to be seen in the outpatient clinic at the JSS Hospital in Ganiyari. Given that patients frequently travel days to be seen and cannot afford lodging, patients stay on the JSS campus, reserving their spot in line for the outpatient clinic by placing their belongings on a numbered spot on the ledge. The line can extend to 300 patients prior to each outpatient clinic day.

Waiting position number 12 is marked on the ledge for the outpatient clinic visit. Patients will place belongings, physically sit and/or sleep there, or tie a piece of clothing to the area to reserve their spot in line. JSS staff comb the line multiple times per day to identify patients who have acute issues that require more immediate attention.
The head nurse at the JSS Hospital in Ganiyari, Nurse Kutti (foreground), helps screen patients by collecting basic information from the patient about their medical complaint or condition, helping to triage patients for medical or surgical consultation. Patients who are identified as having a potential surgical condition will see Dr. Raman Kataria in OPD Consultation Room #3. Upwards of 60 patients in each session will be referred to Dr. Kataria.

Dr. Raman Kataria discusses the plan of care with a patient in OPD Room #3, the room reserved for surgical consultation. In the foreground, JSS staff continue efforts to organize the flow of as many as 300 patients to see the appropriate clinician, get the necessary diagnostic tests, obtain a diagnosis, treatment plan and appropriate medications from the pharmacy prior to the end of their visit. One way that JSS minimizes cost the patient is by striving to provide all needs on a single visit without need for repeated follow-up.
A diagram details the process by which JSS staff process and keep track of up to 300 patients in each outpatient clinic day, from registration to pharmacy.

One of two operating rooms at the JSS Hospital
While many of the components are older than those found in the high-resource setting, these are functional and easy to maintain and replace. Large windows provide much natural light, allowing less electricity usage during times of energy conservation.
Blood samples are processed in the JSS laboratory. JSS uses reusable, sterilizable glass test tubes instead of the disposable variety that are ubiquitous in most healthcare settings in the high-resource world.

JSS had to purchase a blood cooler and storage unit in order to keep blood on reserve for emergency usage. Ideally, JSS would be able to have its own blood bank on-site, but the costs of maintaining a certified, government-approved blood bank standard are prohibitive.
Teaching Case

Nurses tend to patients in the inpatient ward in the JSS Hospital in Ganiyari. An area behind a brick wall divider, not pictured, serves as the intensive care unit, where nursing staffing ratios are 1:2 with up to six patients and continuous heart rate and blood pressure monitoring is possible.

A nurse tends to a surgical patient at the JSS Hospital in Ganiyari. An area behind a brick. JSS has established a nursing training program, which is now certified by the state and provides a source of nursing workforce to itself and to other institutions in the region. Training nurses locally has helped with retention.
Teaching Case

Dr Raman Kataria, left, rounds on the surgical post-operative patients in-between his daily load of operative cases. A visiting physician, right, from Massachusetts, USA presents the overnight issues and status update. The supporting physician workforce at JSS consists largely of rotating physicians at various stages of training in India or abroad.

The JSS team has established a process by which disposable gloves that have been only minimally soiled are collected, washed, disinfected and then packaged for non-sterile re-use.
Appendix 2: Health system evolution in Rural India

India's rural healthcare system owes its origin to the philosophy expressed in the Government of India's 1946 Report on the Health Survey and Development Committee, often referred to as the Bhore Committee Report; later strengthened through the Alma Ata declaration in 1978. Driven by its mission to provide all its citizens access to primary care, irrespective of their individual socio-economic status, the Indian Government developed a three-tiered referral system based on predetermined population norms (see Table 6). It consists of sub-centers (SCs), primary health centers (PHCs), and community health centers (CHCs).

At the lowest level, SCs are the first point of contact for patients, and serve to provide basic medical care, health education and strategies for disease prevention. Each SC is manned by at least one auxiliary nurse midwife (a female health worker) and one male multipurpose worker. One health assistant (female) typically supervises six sub-centers. As per the figures provided by the India's Union Ministry of Health and Family Welfare (UMHFW), there were 148,124 sub-centers functioning in March, 2011—about 12% lower than the prescribed number as per government norms.

PHCs often serve as the first contact point between the rural populace and a health professional. They are designed to provide integrated curative and preventive healthcare to the rural population. A PHC, which acts as a referral unit for six sub-centers, is typically manned by a medical officer who is supported by 14 paramedical and other staff. It is typically equipped with 4–6 beds for inpatient care. As of March, 2011, there were 23,887 PHCs functioning, yet representing a 16% shortfall when compared with the norms for PHCs.

The highest tier in this structure is the CHC, which is usually manned by a surgeon, a physician, a gynecologist, and a pediatrician along with 21 paramedical and support staff. They are equipped with 30 in-door beds, OR, X-ray unit, labor room and lab facilities and they act as the referral unit for 4 PHC’s. As of March, 2011, there are 3,346 CHCs, which are only half as many as recommended.

Rural healthcare in India is characterized by a huge mismatch between supply and demand for health professionals. Although the posts of health workers at various levels are sanctioned, many of them are unoccupied due to shortage of applicants for these posts. Qualified and registered doctors are rarely ready to work in remote rural and tribal areas that lack social infrastructure and where the residents have no ability to pay for the services. A recent report highlights the acute shortfall: there is only one doctor per 1,700 citizens in India; this falls short of the WHO stipulated minimum ratio of 1:1000. To meet the shortfall, India would need about 300,000 more doctors by 2020—110,000 for sub-centers, 50,000 for PHCs, 80,000 for CHCs and another 50,000 for medical college hospitals. Hence, rural residents are unable to receive treatment for basic ailments due to a shortage of facilities as well as qualified personnel. The private sector is expanding to fill in the unmet need but their services are unaffordable to the rural poor. As a result, universal access to good quality healthcare, envisaged almost 70 years ago by Sir Joseph William Bhore, still remains elusive.

The Government of India launched a 7-year (2005–12) National Rural Health Mission (NRHM) in April 2005 to focus on providing an improved quality of life for rural populace with a special focus on 18 states which have weak public health indicators and weak infrastructure. In spite of such policies to bridge the gap in access to healthcare between rural and urban population, there still remains a huge deficit in health outcomes for the rural citizens in India. Further commercialization of health care services that has taken place in the last 20 years has limited access to affordable, high-quality essential health care.

Footnotes
2 Figures from Chapter 11, Health Infrastructure in rural India and India’s health workforce by Garg
3 “India has just one doctor for every 1,700 people,” The Indian Express”, 22nd September, 2013.
Appendix 3: The Rashtriya Swasthya Bima Yojana (RSBY, translated as National Health Insurance Programme) Scheme

According to a 2010 estimate from the World Bank, 32.7% of India’s population falls below the international poverty line of $1.25 a day on purchasing power parity basis. By 2007, with a mere 15% of India’s population being covered by a pre-paid insurance scheme, research\(^1\) had confirmed that illness shocks were proving to be catastrophic for those who were either below poverty line or were just above it. Also, insured citizens comprised mostly of urban government employees and rich households (WHO 2008). The Government of India, recognizing the need to protect the poor from such financial catastrophe, launched the landmark micro-insurance initiative called the Rashtriya Swasthya Bima Yojana (RSBY) in April 2008 as a way of providing affordable health insurance. The scheme aimed to provide hospitalization coverage for most diseases for more than 60 million households designated as “below poverty line” (BPL) over the five years (2008 to 2013). By January 2011, the RSBY had been rolled out in over 400 districts in 26 states, and in the first two years, the initiative had covered more than 18 million households with almost 55 million individuals.

Eligible households were able to enroll by paying only 30 INR (less than $0.50 USD) as a registration fee, and 75% of the premium was paid by the Central Government with the rest being taken care of by the respective state governments. The enrolled beneficiaries were able to visit any ICF for in-patient care for any of the approximately 700 surgical or medical procedures. The government had fixed the rates at the participating hospitals for these procedures. Preexisting conditions are covered from day one and there is no age limit specified for receiving the benefits. Coverage is extended to five members of the family including the head of household, spouse and up to three dependents. A registered household was covered for a maximum annual sum of 30000 INR (about $667 USD) of inpatient care. The OPD facilities, however, were not covered under this scheme, but OPD consultations were free. However, beyond consultation, if the patient incurred any expenditure that did not lead to hospitalization, the costs were not covered by this scheme.

Not everyone has been praising this initiative with critics\(^3\) highlighting problems with RSBY, such as: (i) No support for outpatient care is provided under this scheme which the critics say may lead to excessive indebtedness among the poor, (ii) On the one hand, people covered by this scheme are undergoing all kinds of procedures that they may not actually need and on the other hand, many people who are in need are left out of the RSBY.

Footnotes
Appendix 4: Shri Ram Care Hospital in Bilaspur, Chhattisgarh (SRC)

Growing up in Bilaspur and observing the plight of the poor who were stranded between a very low-quality, overburdened public health system and a highly variable quality and often unaffordable private health system, Dr Amit Soni was determined to establish a hospital that provided best health care at affordable cost to the middle and low-income citizens—he intended using profits generated from full fee paying patients to subsidize care for those who could not afford it.

After medical school, Dr Soni pursued training in surgery at the Bhabha Atomic Research Centre Hospital in Mumbai, followed by a fellowship in minimally invasive surgery at Sir Gangaram Hospital, New Delhi. Upon his return to Bilaspur in 2008, after a short stint with Indian Railways for three years, he founded the Shri Ram Care Hospital (SRC) in 2011 with funding provided from their family business.

SRC is a 75-bed multi-specialty hospital providing a range of medical and surgical services that include emergency services, ICU management, advanced laparoscopic and onco-surgeries, chemotherapy, upper gastro intestinal (UGI) endoscopy and colonoscopy. The hospital specializes in dialysis services that include both hemodialysis and peritoneal dialysis. SRC is well-equipped with modern facilities including two advanced operating theatres, digital X-ray machine, and fully advanced automatic pathology services. A more detailed list of services provided and the facilities available is presented in tables at the end of this Appendix.

Today, SRC treats about 100 to 150 OPD patients daily and performs about 10 to 12 surgeries. In addition, the hospital handles 40 to 50 pregnancies and caesarean deliveries per month. The physician team at SRC is headed by Dr. Amit Soni and his wife, Dr. Natasha Soni, a pediatrician by training. There are three other surgeons on their payroll that include an orthopedic surgeon, an urologist and a general surgeon. The medical staff consists of 10 permanent doctors, 31 visiting doctors and more than 40 nurses. In contrast to JSS, SRC has been more successful in attracting medical professionals due to a combination of factors. First, SRC offers relatively competitive salaries (see data presented towards the end of this annexure). Second, Bilaspur is a growing town that offers a lifestyle that is closer to that found in other urban centers. And third, the local medical college in Bilaspur provides SRC access to fresh graduates looking for their first jobs. Most of these graduates consider working at a highly professional and demanding environment such as the one SRC provided as a valuable experience to further their career prospects.

In keeping with its mission of providing affordable healthcare to low- and middle-income citizens, cost reduction is one of the major focus areas at SRC and practices to curb costs are similar to those followed at JSS. However, there are some important differences. First, the facilities at the hospital are more upscale, consistent with the target population. Similarly, the pricing policy of SRC reflects the higher levels of affordability of the middle class population. While the hospital is committed to providing care to the needy patients, the majority of the poor patients (low-income and below the poverty line) are enrolled in government-sponsored insurance schemes (MSBY) for those above the poverty line and RSBY for those below the poverty line. Taken together with its pricing and the standard rates approved by the government under its insurance scheme, the need for subsidy for the needy patients is somewhat modest and the hospital has been making modest profits since its inception. A representative pricing chart and some details of SRC’s financial performance can be found in the tables below.

Footnotes
1 There was a mega-budget hospital (Apollo) in Bilaspur that was known to offer high-quality but prohibitively expensive surgical care.
2 Dr Soni was son of a successful local, wealthy industrialist.
3 Govt. of Chhattisgarh, in their drive to improve the affordability, availability and accessibility of quality health care to every citizen of the state, has initiated Rashtriya Swasthaya Bima Yojana (RSBY) for the unorganized workers and Mukhyamantri Swasthaya Bima Yojana (MSBY) to provide protection to every uncovered household against the risk of health spending leading to poverty. The scheme is designed to provide health insurance coverage up to INR 30,000 to all the left out families not covered under Rashtriya Swasthaya Bima Yojana.
II. Facilities at SRC

- 75-bed hospital
- 45 general ward beds
- 12 air-conditioned private ward beds
- 12 ICU beds
- 6 dialysis beds
- 5 haemodialysis machines, peritoneal dialysis
- 24/7 trauma Unit (ICU-backup)
- Ventilators, infusion pump, defibrillator
- 2 advanced operating theatres
- Digital X-ray machine
- Ultra sonography/ 2D Echo/ ECG/TMT
- Labour room
- 24/7 medical shop
- 2 ambulances

Nurses
INR 10,000-12,000

Lab assistants
INR 15,000

Junior doctors
INR 30,000

MD
INR 80,000-90,000

Doctors
INR 300,000

III. Salary structure at SRC (per month in INR)

Income and Expenditure at SRC 2012-13

Income in INR
Sales of Services
INR 48,863,710.00
Other Income
INR 1,435,953.00
Total Income
INR 50,279,663.00

Expenditure in INR
Purchase Accounts
INR 14,482,521.00
Administrative Expenses
INR 25,394,656.85
Financial Expenses
INR 1,030,541.00
Depreciation
INR 5,676,575.00
Total Expenditure
INR 46,384,291.85
Profit
INR 3,895,369.15

V. Cost of 3 Index Surgeries at SRC

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<th>Component</th>
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<td>Spinal Needle</td>
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<td>Skin Stapler</td>
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<td>Sterilized Gloves</td>
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<td>OT assistant</td>
<td>3</td>
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<td>Circulator</td>
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<td>30</td>
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<td>INR 22,000</td>
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“Working in the government medical system, most of my energy was being misdirected, and life is too short. So I said, ‘Let’s build a hospital where our energies are better utilized.’”

Dr. Abdul Bari Khan, CEO of Indus Hospital

The Indus Hospital opened in Karachi, Pakistan in 2007 with a mission of providing exceptional, high-quality surgical care at no cost to the city’s poor residents.

Dr. Abdul Bari Khan, after a long career as a cardiac surgeon in a public sector hospital, had tired of wrestling with government bureaucracy and the slow pace of change. He and his cofounders, also surgeons and an anesthesiologist, had witnessed the immense unmet burden of surgical disease and seen the barrier surgical costs created. They felt they could make a large impact by providing free, high quality surgical care with philanthropic support.

Most people believed that free care would only be available for a year before Indus would be forced to collect fees to keep quality operations going. Seven years later, in 2014, the hospital was still providing free care, maintaining its quality, and caring for 1000 patients daily. Bed occupancy ran at 91%, and there was a two-year wait for some elective procedures. The government had approached Indus about partnering for scale up. Bari had to figure out what it would take to scale up the quality care and whether the partnership would be workable.

Overview of Pakistan

The Islamic Republic of Pakistan in South Asia (see Exhibit 1 for map of Pakistan) is divided into five provinces: the Khyber Pakhtunkhwa, Punjab, Sindh, Baluchistan, and Gilgit Baltistan. The modern state of Pakistan developed in 1947 following independence from British rule and sub partitioning from the Indian subcontinent. Relations between Pakistan, primarily Muslim, and India, primarily Hindu, remained tense, and border disputes led to Pakistan-Indian wars. Modern-day Bangladesh seceded from Pakistan in 1971 with Indian support. Pakistan’s government underwent alternating periods of civilian and military rule, marked by high levels of corruption, inefficiency, and instability, and Pakistan’s internal political disputes led to low levels of foreign investment and underdevelopment.

Pakistan in 2014 was a lower-middle-income country marked by high rates of poverty (see Exhibit 2 for basic demographic statistics). It was the seventh most populous country in the world. Two-thirds of people lived in rural areas, which tended to be dominated by a few wealthy landlords. The nation lagged behind other South Asian countries in terms of education and health outcomes. The government and non-governmental organizations (NGOs) have made efforts to improve health care, but challenges remain in providing equitable access to medical services.

List of Abbreviations

- DOTS: directly observed therapy short course
- GDP: gross domestic product
- ICU: intensive care unit
- IRD: Interactive Research and Development
- MDR-TB: multi-drug resistant tuberculosis
- MOH: Ministry of Health
- PPP: purchasing power parity
- TB: tuberculosis
- USD: United States’ dollars
countries in nutrition, literacy, gender equity, and access to health facilities. In 2009 only half of the 19 million primary school-aged children were enrolled in school.\(^7\) With over 23.5 million people in the metro area, Karachi is the largest city and national economic hub. In the late 2000s, the main economic drivers were services (54-5%), agriculture (20%), and industry (23-6%).\(^3\) Between 2001 and 2007, Pakistan’s economy grew robustly and poverty decreased. In 2007 the onset of a global economic crisis coupled with the fallout from domestic political disruptions slowed economic growth. Sharp oil and food price increases exacerbated the economic downturn.\(^1\)

Health in Pakistan

In the twenty-first century, Pakistan faced a double burden—high rates of infectious diseases and the increasing prevalence of noncommunicable diseases (see Exhibit 3 for top 10 causes of mortality and morbidity).\(^5\) The country also had high birth rates and infant and maternal mortality rates (see Exhibit 4 for more health indicators). Less than one-third of pregnant women received regular antenatal care, and 40% gave birth at health facilities.\(^7\) Pakistan lacked universal vaccination coverage\(^9\) and more than 25% of children—mostly in rural areas—were chronically malnourished and lacked safe water and household sanitation.\(^7\)

Like in many low- and middle-income countries, access to and affordability of surgical care in Pakistan was hard to attain for the majority of people. Patients from rural areas traveled long distances to seek surgical care, incurring a financial burden even if free surgical care was available.\(^7\) One study found that people in urban areas were nearly twice as likely to receive an abdominal operation as compared to those living in rural areas, regardless of economic status.\(^8\) Prices for surgical care far exceeded what the average Pakistani could afford. For example, an uncomplicated hernia repair cost between USD 211 and USD 740 while the minimum monthly wage in 2013 was USD 97.\(^7\) Data on the quality of surgical care in Pakistan were practically non-existent.\(^7\) Given the lack of regulation in the health care sector combined with the population’s low literacy and education levels, many patients were unable to compare quality between facilities or understand what they were purchasing; despite this, patients often sold personal assets or took loans from family and friends to pay for care.\(^1\)

Health Care Workforce

Pakistan had a health care workforce shortage, especially among nurses. The majority of health services and personnel were in urban areas. Private traditional healers were the main source of care in rural areas.\(^7\) The government paid physicians about USD 350–USD 400 per month. Private sector doctors could earn up to four times as much.\(^7\) About 20% of new Pakistani medical graduates emigrated annually to seek higher salaries.\(^7\)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN Human Development Index ranking</td>
<td>146 (out of 187)</td>
</tr>
<tr>
<td>Population</td>
<td>182 million</td>
</tr>
<tr>
<td>Urban population (%)</td>
<td>38</td>
</tr>
<tr>
<td>Drinking water coverage (%)</td>
<td>91</td>
</tr>
<tr>
<td>Poverty rate (% living under USD 1.25 per day)</td>
<td>21.0</td>
</tr>
<tr>
<td>Gini index</td>
<td>30.0</td>
</tr>
<tr>
<td>GDP per capita in PPP (international dollars)</td>
<td>2,741</td>
</tr>
<tr>
<td>GDP per capita (constant 2000 USD)</td>
<td>806</td>
</tr>
<tr>
<td>Literacy (men/women/youth, %)</td>
<td>67/42/71</td>
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</table>


Exhibit 2: Basic Socioeconomic and Demographic Indicators

<table>
<thead>
<tr>
<th>Rank</th>
<th>Mortality</th>
<th>Morbidity/Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diarrhea</td>
<td>Hypertension</td>
</tr>
<tr>
<td>2</td>
<td>Childhood lower respiratory infection</td>
<td>Injuries</td>
</tr>
<tr>
<td>3</td>
<td>Tuberculosis</td>
<td>Eye diseases</td>
</tr>
<tr>
<td>4</td>
<td>Rheumatic heart disease</td>
<td>Malnutrition</td>
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<tr>
<td>5</td>
<td>Chronic liver disease</td>
<td>Birth diseases</td>
</tr>
<tr>
<td>6</td>
<td>Congenital malformations</td>
<td>Congenital malformations</td>
</tr>
<tr>
<td>7</td>
<td>Birth diseases</td>
<td>Dental diseases</td>
</tr>
<tr>
<td>8</td>
<td>Ischemic heart disease</td>
<td>Ischemic heart disease</td>
</tr>
<tr>
<td>9</td>
<td>Child septicemia</td>
<td>Anemia (in women)</td>
</tr>
<tr>
<td>10</td>
<td>Other respiratory diseases</td>
<td>Mental retardation</td>
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</table>


Exhibit 3: Top 10 Causes of Mortality and Morbidity in Pakistan, 2000

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>Average life expectancy at birth (total/female/male)</td>
<td>66.4/67.3/65.6</td>
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<tr>
<td>Maternal mortality ratio (per 100,000 live births)</td>
<td>170</td>
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<tr>
<td>Under-five mortality rate (per 1000 live births)</td>
<td>86</td>
</tr>
<tr>
<td>Infant mortality rate (per 1000 live births)</td>
<td>69</td>
</tr>
<tr>
<td>Vaccination rates (% of DTP3 coverage)</td>
<td>72</td>
</tr>
<tr>
<td>Undernourished (%)</td>
<td>19.9</td>
</tr>
<tr>
<td>Adult (15–49 years) HIV prevalence %</td>
<td>0.1</td>
</tr>
<tr>
<td>HIV antiretroviral therapy coverage (%)</td>
<td>14</td>
</tr>
<tr>
<td>Tuberculosis prevalence (per 100,000)</td>
<td>376</td>
</tr>
<tr>
<td>DOTS coverage (%)</td>
<td>100</td>
</tr>
<tr>
<td>Malaria cases (per 1,000)</td>
<td>1.9</td>
</tr>
<tr>
<td>Expenditure on health as % of GDP expenditure</td>
<td>2.68</td>
</tr>
<tr>
<td>Government spending on health as % of total government spending</td>
<td>4.7</td>
</tr>
<tr>
<td>Government health spending as % of total health spending</td>
<td>36.9</td>
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<tr>
<td>Total health expenditure per capita (international dollar rate)</td>
<td>77.3</td>
</tr>
<tr>
<td>Physician density (per 10,000)</td>
<td>8.3</td>
</tr>
<tr>
<td>Nursing and midwifery density (per 10,000)</td>
<td>5.7</td>
</tr>
<tr>
<td>Number of hospital beds (per 10,000)</td>
<td>6</td>
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</tbody>
</table>


Exhibit 4: Health System and Epidemiologic Indicators
Public Health System

Pakistan inherited a centralized health care system from the British. The Ministry of Health (MOH) was responsible for providing free health services, including hospital care, to all citizens.\(^\text{11}\) Ineffective implementation led to wasted resources and poor morale among civil servants described as “institutional malaise.”\(^\text{12, 13}\) Starting in 2001, the government decentralized planning and administrative powers to address criticism about the failing system.\(^\text{14}\)

Most of Pakistan’s public health care infrastructure was created in the 1970s. Village basic health units were the first level of care and were understaffed and poorly equipped. The next level of care, rural health centers, had 30-member staffs led by medical officers to serve 50,000 to 100,000 people. The centers often were open only three to five hours of the scheduled 24–7 coverage. They offered X-ray, basic laboratory test, and minor surgery facilities. Municipal-level hospitals typically had 40 to 60 beds and offered secondary services, including obstetrics, pediatrics, and general surgery to a catchment area of 100,000 to 300,000 people. District hospitals had about 100 beds and offered acute care and emergency services to one to two million people. Major cities had state-run tertiary teaching hospitals that offered subspecialty care (see Exhibits 5a and 5b for numbers of public and private health care facilities).\(^\text{15}\)

Surveys showed less than 30% of people used government health care services.\(^\text{16}\) While public-sector health services were supposed to be free, patients often had to pay user fees and buy their own drugs and supplies.\(^\text{17}\) Additionally, there were widespread accusations of corruption\(^\text{18}\) and care quality was not monitored systematically.\(^\text{19}\) As a former Pakistan Medical Association president explained, “A majority of the basic and rural health units in the country are nonfunctional mainly because of the very low priority status the government accords to public health. In a country where the government is unable to provide clean drinking water, it’s difficult to talk of quality health care.”\(^\text{20}\)

Private partnerships to boost health services were increasingly common throughout Pakistan.\(^\text{21}\) The Civil Hospital, a 1900-bed tertiary teaching hospital in central Karachi, for example, relied substantially on private-sector support. Much of the 100-year-old crumbling structure had dim, dirty hallways, crowded wards, broken and outdated equipment, and an overworked, underpaid staff, but eight units privately managed and funded were strikingly clean, organized, and well stocked with modern, functioning equipment.

The Private Health Sector

Pakistan’s private health care sector—including traditional healers, for-profit clinics, high-tech specialty hospitals, and not-for-profit clinics and hospitals—accounted for at least 70% of health care services in the country among the poor and wealthy alike.\(^\text{22, 23}\) About 90% of private health care was funded through individual out-of-pocket payments.\(^\text{24}\) The cost of care often pushed the poor deeper into poverty.\(^\text{25}\) Most Pakistanis did not have insurance.\(^\text{26}\)

Charity Medical Care

At least 1800 NGOs provided free or subsidized health care services in Pakistan.\(^\text{27}\) Zakat, Muslim obligatory charity, and donations from wealthy Pakistanis financed numerous charity hospitals. Funding channeled through the Ministry of Zakat and a similar government department called Bait-Ul-Maal accounted for 0.32% of formal health financing in 2008.\(^\text{28}\) Like most of the private sector, charity hospitals received minimal government oversight.

Typically, charity hospitals provided curative services for acute medical problems for a single medical condition or specialty. With a few exceptions, charity hospitals did not have reputations for providing high quality, state-of-the-art care. Over time, many charity hospitals closed or began charging patient fees to cover expenses.

The Indus Hospital

The Indus Hospital was a nonprofit, private charity hospital that opened in July 2007 to serve a catchment area of about 2.5 million people. The hospital was located in Korangi, a Karachi neighborhood where multi-generational families crammed into small flats stacked unevenly along the unpaved, narrow streets. The five-story, 150-bed Indus Hospital was one of the tallest buildings for miles. Indus’ 20-acre campus also included a walk-in filter clinic, an open-air TB clinic, a pharmacy,
and a nursing school. The hospital ground floor included a reception area, a patient welfare office, a 10-bed emergency department, six outpatient clinic rooms, areas for X-ray, ultrasound, and blood drawing, and a blood bank. The first floor housed four operating theaters, a six-bed intensive care unit (ICU), a six-bed cardiac care unit, a cardiac catheterization lab, and an endoscopy suite. The second floor included a 10-bed dialysis center and a 41-bed men’s inpatient ward. The 37-bed women’s ward and a 27-bed pediatric ward were on the third floor. The fourth floor had the central laboratory, a biosafety level-three lab for highly infectious materials, conference rooms, administrative offices, and the Indus Hospital Research Center staff.

Background
In 2005, medical school colleagues—surgeons Dr. Bari, Dr. Zafar Zaidi, and Dr. Akhtar Aziz and anesthesiologist Dr. Muhammad Chinoy—who had studied together in the 1980s at Civil Hospital in Karachi, reunited. They had all trained in the United States and United Kingdom before returning to Pakistan to build successful practices. Driven by a philosophy that all patients had a right to high-quality care, regardless of ability to pay, the group conceived of a surgical facility that would provide free, high-quality surgical care to Karachi’s poor. “I was very clear from day one that the hospital had to be free,” Bari worked for free for the first six months. They successfully attracted the financial support from a Pakistani industrialist provided seed funding of USD 2 million for the operating rooms. Another USD 3 million was raised to support the initial construction.

Two years after the initial conception, Indus hospital saw its first patient in 2007. The founding physicians worked for free for the first six months.

Planning and Building
Indus invested in the design and building of a comprehensive, custom-built electronic medical information system that linked all hospital operations. Staff signed into the medical information system with a biometric scan of their hands, and all hospital activity was tracked on a single system. This early commitment to electronic data systems proved essential to supporting the hospital’s operations, quality monitoring and scalability. It also proved to be good public relations; the media called Indus “Pakistan’s first paperless hospital.”

Indus leaders never created a detailed, written strategic growth plan (see Exhibit 7 for Indus Hospital patient volume over time). They decided what services to add based on whether the services fit their broad vision, funding and staffing were available, and there was sufficient operational capacity. The hospital’s initial services reflected the founding physicians’ specialties: cardiac, orthopedic, and urological surgery supported by anesthesiology. The hospital focused on expensive procedures that patients would not be able to pay for out of pocket. Indus did not offer obstetric and gynecological services, fearing an overwhelming demand. The hospital added pediatric and adult general surgery and nephrology after recruiting specialists.

With donor funding, the hospital opened a 10-bed dialysis center, recruited a gastrointestinal specialist, opened an endoscopy suite, and offered ophthalmology services. Indus also provided comprehensive tuberculosis (TB) treatment, including second-line drugs for treating multi-drug resistant TB (MDR-TB).
and a high-tech laboratory for diagnosing MDR-TB. One leader explained, “The non-surgical teams developed in the initial phase as a means of providing care for surgical patients—for example if a diabetic was undergoing a hip replacement, the comorbid condition needed to be dealt with. Over time, they have become strong departments in their own right.”

While donors offered funding for mental health services, a neurology department, and expensive diagnostic machines, such as CT and PET scanners, the leaders declined. Bari explained, “We want to grow fast to meet the needs of the community, but we have to balance growth with our commitment to quality.”

### Patient Services

The first 300 patients to arrive at the outpatient “filter” clinic each day received tokens guaranteeing an appointment that day. Patients began lining up as early as 5 a.m. While they waited, clinic staff announced the services the hospital did not offer, including maternal care, so patients needing those services would seek care elsewhere. After checking in, patients often waited up to six hours to be assessed by a doctor.

The outpatient clinic doctors included young medical officers and pediatricians. Their job was to determine which patients could be treated in the clinic and which needed more specialized diagnosis or treatment. Training the medical officers to make high quality referrals to the surgeons based on effective outpatient workups was an ongoing challenge when patient volume was so high. Nine medical officers each saw about 30 to 40 patients per day in the filter clinic.

Patients could be admitted to the hospital from the outpatient filter clinic, hospital consultant, or emergency department. New patients received a unique patient identification number connected to their address or mobile phone number, an electronic medical record, and a white card listing their name, age, and patient ID number. This card became their passport within the hospital.

All patient tests, such as X-rays, blood analyses, or urine cultures, were ordered electronically and performed at the Indus laboratory. Doctors and nurses rounded with mobile computers and entered patient information directly into the electronic system. This real-time tracking allowed physicians to receive results instantly via cellphone text message. Legal consent forms, surgical checklists, outpatient prescriptions, and patient discharge summaries were the only paper forms.

All care within the hospital was provided at no cost to all patients. Zaidi emphasized that there were “no cash counters in Indus Hospital.” Patients did have to purchase outpatient prescriptions at local drug shops.

Some patients, particularly those who had traveled from far away and did not receive an appointment, complained about the long waits in the filter clinic. When the hospital was full, which was often, patients had to go to another free hospital and wait again. Many patients reported being grateful for the free care and fair processes through which it was provided (see Exhibit 8 for patient profiles).

### Hospital Volume

Without any formal marketing campaigns, patient volume increased rapidly, particularly in the emergency...
department and outpatient clinics. In roughly eight years, Indus had seen more than 1 million patients in the clinics and emergency department, and provided nearly 4 million diagnostic tests.

The exponential growth in emergency department patients in particular overwhelmed the hospital. Doctors in the 24-hour, 10-bed emergency department saw more than 400 patients per day. The waiting area overflowed into the main corridor. Commonly, patients came via a charity ambulance or private rickshaw after dog bites or motor vehicle accidents; or they arrived with other maladies caused by the poor local standard of living. To maximize flow through its emergency department and operating rooms, Indus hired part-time orthopedic surgeons to operate on trauma cases in the evenings after the elective cases finished.

Of the 40,012 inpatients Indus treated free of cost between 2007 and 2012, 33,606 (84%) received surgical procedures. Surgical procedures increased five-fold from 1,838 in 2007–2008 to 9,478 in 2011–2012. Bed occupancy increased to 91% from 65% over the same period. The growth in patient demand exceeded the hospital’s delivery capacity. The waiting times for elective joint replacement surgery extended to two and a half years; for cardiac angiography, the wait was two weeks.

The lack of available beds for pre-operative and post-operative patients led to underutilization of the operating theater, catheterization lab, and other hospital resources. In an effort to maximize use of these areas, the hospital tried to lower the average length of stay by increasing outpatient procedures.

Quality
Indus leaders reminded their board of directors and other stakeholders that the quality of the care set them apart from other charity hospitals. The chief anesthesiologist had his bypass surgery at Indus, and Bari’s mother-in-law had a pacemaker insertion at Indus. Tracking overall quality remained an ongoing struggle.

While Indus collected significant data with its electronic system on volume, costs, and efficiency, drawing conclusions on patient health outcomes was more challenging and required significant research capacity. Indus lacked data on long-term patient health outcomes, challenging and required significant research capacity. Conclusions on patient health outcomes was more system on volume, costs, and efficiency, drawing

Hospital Staffing
Initially, Indus paid employees less than market rate, relying on the hospital’s mission to attract staff.
Leadership realized that recruiting and retaining qualified staff was the hospital’s main growth-limiting factor. Indus raised nearly all staff salaries in 2010 after surveying the local market. Annual raises continued and proved beneficial in retaining and recruiting staff, although staff retention and recruitment, especially for surgeons, remained a persistent challenge. In 2013, staff received average raises of 8.5%, and in 2014, 9.5%.

In 2014, Indus employed 996 staff, of which 50 were surgeons and 40 surgical and anesthesia residents. About 26% of the 2013–2014 payroll of USD 4.9 million went toward surgeons. General surgeons and internists received close to market rate (monthly salary for a general surgeon was about USD 2120). Indus could not match market rate for specialists. Indus looked for specialists with “an innate desire to help those who cannot help themselves,” Dr. Zaidi said. Indus also provided clinicians case diversity they may not see in private practice, which was intellectually attractive to many. To supplement their incomes, Indus encouraged physicians to participate in research grants and allowed them to work in private practice after 5 p.m.

Mansoor Khan was one physician who left a busy private orthopedic surgery practice to work at Indus. A month’s salary at Indus was equivalent to what he earned previously performing just four knee replacements, eight hours of work. At Indus, he sometimes saw 40 patients per day. When feeling discouraged, he focused on his impact. “If you salvage one breadwinner,” he said, “you look after the welfare of a dozen people.”

Hospital administrators allowed Dr. Khan to perform a newer hip replacement technique—hip resurfacing—on select younger patients even though it cost four times as much as the old technology. He believed the cost was worth it: “If you do a traditional hip replacement in a young person whose joint was destroyed in a car accident or by TB and they go back to pushing a fruit cart or laying bricks and sleeping on the floor among 20 people and using a toilet in the ground, that joint is only going to last a couple of years.”

News that a charity hospital performed the procedure shocked the Karachi medical community and made local headlines. Dr. Khan called this a “halo procedure” because it attracted the attention of current and future donors. He also believed the hospital’s adoption of newer technologies also attracted trainees.

### Training Programs

All Indus staff underwent training on standard operating procedures. The hospital developed a training program specifically for nurses. The best nurses were promoted to managers and instructors who trained and monitored the rest of the nursing staff. New nursing applicants had to pass two assessments before being hired on a conditional basis. These protocols were a starting point for quality and cost controls, a manager said, but the hospital still had much work to do. It was working toward developing ways to assess care quality and hold clinicians accountable.

In 2009 Indus received approval from the College of Physicians and Surgeons of Pakistan to train medical residents and accepted two residents each in urology, orthopedics, general surgery, anesthesiology, and infectious diseases in 2010. Family medicine was added in fiscal year 2013–2014 in hopes of improving outpatient care. Leaders planned to build a medical school, nursing school, and paramedical training schools. They were also considering adding health informatics and a public health school. The goal was to receive government funding for these schools.

Indus’ senior leaders wanted to identify rising stars and cultivate their commitment to the hospital philosophy. Bari said. “Our responsibility at Indus is to make a good system and develop future leaders to run it.”

### Research

Interactive Research and Development (IRD), a not-for-profit organization that secured international grants to carry out global health research in Pakistan, gained office space on the fourth floor of Indus Hospital. IRD and Indus partnered to create the Indus Hospital Research Center and carry out research on the local burden of disease and other projects, particularly around MDR-TB and childhood pneumonia. IRD was self-sufficient bringing in research funding. This research, in turn, influenced the hospitals’ future plans and priority areas, including the expanded TB program and added pediatric wing. Zaidi commented on how the research expanded the clinicians’ mindset: “My surgeon’s perspective expanded from considering how one hospital could make a difference not just for individual patients but also potentially impact the health of an entire community.”

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<tr>
<td>Inpatient</td>
<td>546,687</td>
<td>1,815,853</td>
<td>3,046,296</td>
<td>2,443,622</td>
<td>1,492,841</td>
<td>9,344,939</td>
</tr>
<tr>
<td>Outpatient</td>
<td>483,120</td>
<td>1,460,774</td>
<td>1,701,160</td>
<td>1,757,976</td>
<td>1,757,976</td>
<td>5,403,031</td>
</tr>
<tr>
<td>Total</td>
<td>1,029,807</td>
<td>3,276,626</td>
<td>4,747,456</td>
<td>4,201,598</td>
<td>3,249,817</td>
<td>13,754,970</td>
</tr>
<tr>
<td>% of total value of services rendered by Zakat</td>
<td>30</td>
<td>41</td>
<td>42</td>
<td>40</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>% of total inpatient expenses financed by Zakat</td>
<td>46</td>
<td>64</td>
<td>69</td>
<td>74</td>
<td>76</td>
<td></td>
</tr>
</tbody>
</table>

Source: The Indus Hospital.
In fiscal year 2013–2014, Indus provided about USD 10.5 million in free medical care, roughly five times the value of services provided in its first year of operations (see Exhibit 9 for more on the value of care provided over time). Ninety-eight percent of all donations were locally generated. Zakat comprised 34% of all donations, followed by 24% of unrestricted funds, and in-kind donations (24%), buildings (12%), grants (5%), and return on investments (1%). Overall, donations received between 2007 and 2012 totaled USD 26.6 million and had increased seven-fold, with Zakat increasing 12-fold.

Using the electronic records system, Bari could review the pages of expenses for each patient, including medications, consumables, and clinicians’ time. Each item was traceable back to the person who ordered and administered it. The hospital provided detailed accounting to major donors to demonstrate that their money was used accordingly. No patient ever saw a bill. The 35% of patients who were not Muslim or made more than the income limit for Zakat eligibility still received free care financed by the hospital’s general donation fund.

As the hospital’s service volume and operating budget grew, Bari requested line-by-line expense reporting. The finance team developed a system for determining actual costs for roughly 600 procedures based on invoices and time and motion analysis that tracked staff and equipment utilization for each procedure (see Exhibits 10a and 10b for a detailed summary of costs). As the hospital’s volume increased, the unit cost for nearly all procedures decreased. This detailed accounting allowed for accurate future budgeting.

### Future Challenges

Ample donor funding had supported the hospital’s rapid growth, including its operating budget that had increased 27-fold by 2014. Bari and the hospital’s other cofounders planned to add 650 beds to the 150-bed Karachi campus and add new surgical departments. In 2014, zoning and planning for Indus Hospital’s expansion were complete.
Phase one, construction of the additional 650-bed facility, was to be completed in 2018. All funds for phase one had been secured. Phase two plans included expanding total inpatient beds to 1,500 and day care beds for short surgical procedures, chemotherapy, and endoscopic procedures to 250 by 2024. By 2024, they dreamed of an Indus Health Service Network with a primary, secondary, and tertiary care footprint in all provinces through government partnerships.

As Bari said:

> When we started Indus Hospital, within one year we were approached by the government to explore possibilities of partnership. We did not have the capacity then and the government was not ready to meet the conditions we laid down (which were to give us complete operational control) … Five years in, we have the brand and the credibility. They are asking us to manage public sector hospitals on our terms.

The Indus leaders were unsure if their success could be translated into a national program and integrated into the government system. What aspects of their model were scalable in partnership with the government?

**Acknowledgments**

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**Footnotes**

A Polio remained endemic in four countries: Afghanistan, India, Pakistan, and Nigeria.

B Family members made generous donations to the hospital following these services in lieu of paying an actual bill.

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9. APP. Minimum wage raised to Rs10,000. no additional tax on Rs2.5 million income. The Express Tribune with the International New York Times. June 23, 2011.


NSQIP-Lite: Measuring Surgical Outcomes in Mozambique

On a Tuesday morning in the fall of 2014, the Medical Education Partnership Initiative (MEPI) Working Group assembled at an oval table in a conference room at the offices of Universidade Eduardo Mondlane (UEM) in Maputo, Mozambique. The fan overhead provided a welcome breeze against the early-morning humidity. The group was preparing to review the most recent findings from its much-anticipated NSQIP-Lite research. NSQIP-Lite is a shorter version of the National Surgical Quality Improvement Program (NSQIP), a program widely used in United States hospitals to measure risk-adjusted surgical outcomes and to improve the quality of surgical care. Conversation was light and collegial as the participants greeted one another. Through their commitment to a shared vision, the team members, who hailed from Mondlane University, University of California, San Diego School of Medicine (UCSD), and Mozambique’s Ministry of Health, had developed not only professional ties during the preceeding years, but also close personal bonds. Their aim was to define surgical needs in rural areas of Mozambique and, ultimately, improve surgical delivery.

The team took a few moments to reflect on how far the work had advanced over the past 36 months. Prior to initiating the NSQIP-Lite program, which sought to establish a ‘risk-adjusted’ approach to monitoring surgical outcomes in Mozambique, work of this kind was uncommon in the developing world. To advance its surgical outcomes research, the MEPI Working Group selected three pilot hospitals in geographically dispersed regions of Mozambique. The group systematically gathered approximately 1,000 patient records, data it believed necessary to better understand and predict surgical outcomes.

A simple example represented, on a basic level, the reasoning behind risk-adjustment. Dr. John Rose, a UCSD surgery resident, offered a hypothetical, “If my 88 year-old grandmother with heart failure and pneumonia goes to a hospital and has her appendix taken out, she is very different from my 12 year-old nephew who [had his appendix removed and] is otherwise completely healthy.” Without risk adjustment, statements relating to morbidity and/or mortality of these two patients would carry very little statistical weight or comparable clinical information. “Mortality statistics alone do not allow us to make conclusions about what’s really happening in health care,” Dr. Rose said.

A number of technical research questions had animated the minds of the MEPI Working Group throughout the preceding months; a great deal of time, thought, and care had gone into developing and implementing optimal research protocols. However, with 1,000 patient records now gathered, a set of related administrative and strategic issues began to come into focus. The group considered how it could make the best use of the data to advance its goal of improving surgical delivery in Mozambique.

For months, the team had been discussing potential applications of the data. Some advocated for a focus on Quality of Care improvements at the pilot sites, while others suggested applying generalizable strategies and system-related improvements, generally called Implementation Science, across the country. Still others wondered whether, and to what extent, the new data might be beneficial to bolster fundraising efforts. Would organizations such as the Gates Foundation or World Health Organization (WHO) be interested in these findings?

The MEPI Working Group: Profiles and Perspectives

Composed of closely-affiliated and committed researchers, the MEPI Working Group was deeply collegial. Individual members tended to be self-effacing, habitually sharing credit or deflecting attention from any one individual’s contributions to the group. However, the MEPI Working Group did see its research as foundational to the broader surgery research efforts in Mozambique, in other African countries, and around the world.

Four key actors constituted the core of the MEPI Working Group:
Teaching Case

Dr. Emilia V. Noormahomed
Educated in Spain and holding both an MD and PhD in parasitology, Dr. Noormahomed acknowledged that she “understands a little bit about surgery.” As the MEPI Principal Investigator (PI), she oversaw not only research related to NSQIP-Lite, but also other Mozambique-focused research streams for which UEM had received $11 million in funding from the U.S. government.

A former UEM dean, Dr. Noormahomed commented, “Apart from infectious disease, I have a special interest in medical education.” She was instrumental in deepening the relationships with researchers from UCSD, which grew, as she said, “from a previous small research project” to “thinking about other ways of cooperating,” and culminated in the MEPI partnership.

One of Dr. Noormahomed’s chief priorities was to ensure the sustainability of the group’s work. She explained, “even after a program or initiative is complete, we have to find ways of sustaining it into the future.” To that end, Dr. Noormahomed and her counterparts in other African countries created a “Council of Principal Investigators” representing public health leaders in Sub-Saharan Africa. They met every six months to discuss and advance ways to reach the elusive goal of creating sustainable health care systems within their respective countries.

Dr. Stephen W. Bickler
A professor of surgery and pediatrics at UCSD, Dr. Bickler had made many trips to Africa during his career, including working in The Gambia as a pediatric surgeon for 2 1/2 years. An experienced researcher, Dr. Bickler was involved with MEPI from the start. He oversaw the research fellows carrying out work in Mozambique, including Dr. Rose. As a “senior person at UCSD,” Dr. Bickler looked to “provide opportunities” and guidance to other researchers. He believed that it was important to allow appropriate freedom to learn through experience and meet the many inevitable challenges that global research presented, “My job [in overseeing Dr. Rose and other research fellows] is to sit back and watch things a little bit, okay, which can be frustrating. But one of the things I learned as a pediatric surgeon working in The Gambia was how much you learn from kind of struggling sometimes.”

Dr. Bickler was passionate about advancing awareness, status, and funding relating to global surgery. He commented, “You look at the NGOs in Mozambique, you look at the level of funding provided. For HIV, the budget is over $200 million a year. And what does surgery get? Nada. I hope it's going to change. I've spent a good part of my career trying to collect data and make logical arguments that surgery actually needs to be better represented, and I was fortunate to be put in charge of the Global Burden of Disease part of the Disease Control Priorities (DCP3). And when you do all of the analysis, the burden turns out to be about one-and-a-half times the burden relating to tuberculosis, HIV, and malaria. It's massive, just massive.”

Dr. John Rose
A UCSD surgery resident, Dr. Rose noted that his relationship with Dr. Bickler at UCSD and an interest in “public health, or population health research” drew him to the work in Mozambique. Work on the NSQIP-Lite research involved periodic visits from his home in California to pilot sites in Mozambique approximately every two to three months. Dr. Rose noted that his site visits, lasting 3-4 months each, involved “getting things to the next step of implementation” and then “taking a step back and letting people on site go on their own for a while.”

Dr. Rose, age 34, maintained a strong belief that once a rigorous approach to capturing risk-adjusted outcomes was implemented in Mozambique, the implications for patient health and well-being would be substantial. In keeping with the expectations for young surgeons conducting important research in the field, he expected to publish papers about the MEPI research through traditional academic outlets.

Dr. Rose, who learned Portuguese to prepare for his role, spent much of his time during implementation of the project working closely with site data on his encrypted laptop, bringing innovative ideas to surgeons and staff at the pilot sites, educating stakeholders about the goals and progress of the project, and connecting with other MEPI Working Group members to make mid-stream course corrections.

Dr. Carlos Funzamo
An epidemiologist by training, Dr. Funzamo provided a direct link to the Mozambique Ministry of Health, where he had worked for 14 years. Dr. Funzamo attended most pilot site visits with Dr. Rose, often providing introductions to key stakeholders, helping with logistics and travel, and serving as a sounding board to advance the work of MEPI.

Dr. Funzamo saw the Ministry of Health as “very open in terms of new proposals—they want to improve our health system.” He acknowledged the inherent lack of funding available for new projects, while remaining optimistic about the effect NSQIP-Lite would have. “This is very exciting, something new,” he said, “We’ve never conducted such a study in Mozambique.” He indicated that the results of the study “might help us come up with new policy” and placed importance on “understanding the real figures” and “finding out something that we don’t know yet.” One specific aspiration Dr. Funzamo mentioned in connection with the MEPI research was to increase the number of qualified surgeons serving Mozambique.
Country Context: Mozambique Past and Present

“It is necessary to know what happened in this country during the colonial time, the war, and the time just after independence,” said Dr. Fernando Vaz, “if you are to understand anything about our present experience.” In addition to being an active surgeon in Mozambique for 25 years, Dr. Vaz also served as director of Central Hospital of Maputo for 10 years. He was the Mininster of Health in the 1980s and 1990s.

War for independence began in September 1964 and ended more than a decade later, when full independence from Portugal was achieved in 1975. The transition to life as an independent state was anything but smooth. The country encountered a number of barriers to proper development, including “large-scale emigration, economic dependence on South Africa, severe drought, and a prolonged civil war.” The civil war, which spanned from 1975 to 1992, succeeded in separating people from each other, while also impairing critical economic development and compromising the country’s basic infrastructure. A U.N.-negotiated peace agreement between the Frelimo and Renamo warring factions ended the war.

By the conclusion of Mozambique’s civil war, the vast majority of educated professionals, including physicians, had left for Portugal. For those who remained, a commitment to rebuild Mozambique out of the ashes of war became paramount. “It was about a dream to create a new country out of ruin,” Dr. Vaz explained. “It would be very easy to look back now and feel bad that I could have fled to Portugal and had a ‘perfect life’ without all this war-torn stuff,” he said. “But even now I don’t look back and regret it.”

Meeting the Demand for Surgical Care: The Shortage of Surgeons

The history of depleted human resources in Mozambique extends far beyond the twentieth century. Dr. Peter Bendix, Fogarty Clinical Research Fellow at Dartmouth-Hitchcock Medical Center, offered the following summary:

There are structural issues in Mozambique that are 500 years old, and a colonial history that set up a system of separation that provided zero education to the majority of its population for 450 years. Then you have a period where nearly all the educated people in the country left. These were the same people who had gained so much benefit from the country in which they lived. And then you’re trying to rebuild a health system in 40 years to go from zero to something that has taken 150 years in America. The fact that Mozambique has come this far under these circumstances is pretty damn amazing.

The number of physician surgeons practicing in Mozambique remained extremely low. Most estimates placed the number between 20 and 25, serving a population of about 25 million. Dr. Noormahomed noted that one of the biggest challenges facing Mozambique’s health care system was a “shortage of human resources—a shortage of surgeons.” She explained, Surgeons are very few in this country, and of course very, very busy. So when you are a medical doctor in the hospital, the first thing asked of you is to take care of the patients, first and foremost. And then if you have time left, you will think on research, you will think on teaching. Since our doctors are so overwhelmed with work and patient care, there is little time afforded them to do research and teaching. So, yes, the challenge is to have many more people trained to become physicians in Mozambique.

An estimated 35% of Mozambique’s population had either a current or previous surgical issue. As of 2014, Mozambique maintained 56 rural hospitals, 8 provincial hospitals, and 3 central hospitals, situated in a country whose land mass was about twice the size of California. Compounding its surgeon shortage was the fact that many Mozambican patients faced challenging, often prohibitive, circumstances in travelling back and forth to hospitals. Dr. Funzamo explained, It’s a challenge because first of all, the majority of our patients live far from our hospitals. They go to surgery, they’re discharged, and they go home. Sometimes it’s difficult to come back, to come just for follow-up. For those who live close it’s much easier. But for the vast majority, they live very far away. They certainly live far from the biggest hospitals.

In 2012, the Mozambican government allotted approximately $40 per capita for health expenditures, compared with the regional average of about $1,000 per capita. Respectively, only 0.4 physicians and 4.1 nurses and midwives per 10,000 citizens served Mozambique. (See Exhibits 1A and 1B for additional WHO health data on Mozambique.) Some seasoned doctors feared that the strain of working in the resource-constrained public system forced doctors to find part-time positions in private clinics in an effort to supplement their incomes. Dr. Bendix pointed out that while some Western surgeons enjoyed the luxury of insisting on using only their favorite suture in the operating room, or choosing among needles of fine size gradations, Mozambican surgeons typically made do with only a perfunctory kit of medical supplies. “They’ve got one suture for a hernia repair at many of the district hospitals,” he said. “No one individual should be faulted for having poor [surgical] outcomes in many of the country’s facilities.”

Cultivating a Research Environment

Despite the country’s dramatic need for increased healthcare infrastructure and spending, Dr. Rose viewed the medical research environment in Mozambique as relatively “progressive” and particularly well-suited to a project like NSQIP-Lite. Dr. Rose described the data-centric culture that existed in Mozambique.

Five or six years ago, the Ministry of Health started holding meetings every other year to review surgical statistics. In terms of research infrastructure,
Mozambique has a National Institute of Health, which collects reports from each province, with the provinces consisting of many districts. And so the director of each province will present their health report from the surgical perspective every two years. In my mind, this is something that is very progressive, as many countries don’t operate this way.

Given the culture of data collection and the existence of a nationalized healthcare system, Dr. Rose believed that some aspects of NSQIP-Lite would be easier to implement in Mozambique than they might be in the United States:

I find the process of collecting data much easier than in the United States, because clinicians in Mozambique are accustomed to having their work evaluated. When someone in the US says “we want you to collect data or fill out a form”, you get a lot of hems and haws from the surgical department. But in the Mozambican context, after seeking consent of the local health authorities, there is a nationalized healthcare system where order and structure come down from the top, so dissemination is more streamlined.

Promoting Surgery: A Global Health Agenda

Public funding for surgery-related resources was historically limited in Mozambique. Researchers, clinicians, and policy makers with a strong interest in improving surgical delivery on a global scale often lamented the relatively low level of funding and attention given to improving the treatment of surgical disease in low- and middle-resource countries, whether drawn from governmental, non-governmental, or philanthropic sources. Dr. Bickler noted a recent primary health care project in Northern Mozambique, funded at about $70 million, “that didn’t even mention surgery—so surgery got no attention.” He continued, “Until there’s a concept that surgery is a component of health systems, then it is never going to change. You know, surgery is always going to be forgotten.”

A common explanation for sub-standard funding of surgery-related research, supplies, and other initiatives rested on a kind of zero-sum game for health funding; prevalent infectious diseases such as HIV/AIDS, tuberculosis, and others tend to draw the largest share of the funding. Of Mozambique’s $1 billion annual budget, an estimated 1/3 was spent on health, of which 80% was directed towards HIV/AIDS. Important global players also appeared drawn to funding the treatment of high-profile, dangerous infectious disease, with the U.S. government allocating $6 billion to HIV/AIDS outside the United States in 2014. Few questioned the wisdom of funding these prominent global diseases, and much progress had been made in recent years to stem infection and mortality rates of HIV/AIDS worldwide. Dr. Bendix stated, “Bilateral donors and large funding agencies like the World Bank and WHO are focused on things that are considered to be causing the most morbidity and mortality.” He continued, “The idea is ‘We’ve got to choose just a couple of problems to focus on – let’s pick these.’” Because HIV and malaria were the leading causes of death in Mozambique (see Exhibit 2 for the Top Ten Causes of Death in Mozambique), funders appeared to be following a “get the most bang for the buck” strategy. However, although these diseases were the top ten causes of death, these rankings fail to include surgery, which impacted the mortality and quality of life of patients.

However, some global health professionals questioned the rationale of dedicating such a high percentage of aid dollars to a relatively small number of infectious diseases. In recent years, there had been increasing criticism of disease-specific or “vertical” approaches and a push for interventions that focused more on developing health systems and capacity building, often called “horizontal”...
or “diagonal” approaches, such as the MEPI working group. An upcoming 2015 Lancet Commission Report on Global Surgery might also help to raise awareness of global surgery needs, but as of yet, there had been no major changes in funding.

Furthermore, others argued that some of the common metrics used to define the costs and patient outcomes of specific health problems were overly simplistic and failed to capture the broader needs of the population. For example, Dr. Bickler indicated that mortality rates relating to surgical disease were grossly understated in Mozambique. “Mortality rates at district hospitals in Mozambique are pretty low,” he stated. “It might be one percent. In the U.S., it might be way below 0.1 percent. But in Mozambique, nobody wants to go to the hospital to get a surgery (they don’t trust) and die from it. So people don’t go. Mortality is then a very misleading number.”

Medical Education Partnership Initiative (MEPI): Moving in the Right Direction

Launched in 2008, MEPI was a partnership between UEM and UCSD, with the support of Mozambique’s Ministry of Health. One key feature of the partnership, which received funding through the U.S. Department of State, was that it was a Mozambican-driven program that sought to fulfill a Mozambican research agenda. Dr. Rose commented,

I would be very quick to point out that I am a member of the team and not the head of the team. The head of the team is Mozambique and has always been Mozambique. The team is based at the University Eduardo Mondlane, and it is led by a partnership because that is the way the grant is set up. This partnership mechanism is designed to give power to the African institution. So the money actually goes to the African institution, to the researchers within that institution. And then they decide who they are going to partner with, with a requirement that they partner with a U.S. institution.

Creating MEPI Leadership and Vision

In putting many research programs in place under the MEPI umbrella, Dr. Noormahomed worked with great care to assemble a committed team of Mozambican researchers. She explained,

We created a core group of researchers, Mozambican researchers, and we work together with our partners from UCSD. We identified young people, junior residents interested in doing research. We organized courses, writing grants, writing manuscripts, writing research methodologies—to provide them all the tools they need to be future researchers. We identified mentors for the different ideas they have for research, and they developed their research proposals. We believe that over time we will be able to scale up the number of researchers in the country.

The NSQIP-Lite project fit well with the research interests of UCSD’s Dr. Rose and his mentor, Dr. Bickler, who observed, “The main thing is to have a specific question you want to answer. As a researcher, what drives me is, I want to know how I can improve global surgery. We have an important question, a question we want to answer, a problem we want to solve.”

Researching Surgical Outcomes

The specific aim of the NSQIP-Lite research was to develop and implement a data-gathering protocol to monitor surgical outcomes in resource-poor hospital settings in Mozambique. Hospitals in the country already maintained standard logbooks that captured important clinical variables, including basic patient profiles. It was not clear, however, if this data could be used in a systematic way to monitor and improve surgical delivery in the future. Specifically, there was no mechanism in place to compare outcomes across patients, across hospitals, or across systems of care. If, for example, mortality rates resulting from Caesarean deliveries varied greatly between Hospital A and Hospital B, it was difficult to draw statistically-supported conclusions about what factors accounted for these differences. Did the patients themselves differ in terms of age, health status, or some other critical variable? Did one hospital have relatively inferior medical supplies and infrastructure, such as a blood bank? Was there an important difference in the training and expertise of surgeons responsible for patient care?

Understanding the relative risk profiles across patients could be difficult. Dr. Rose commented,

Suppose you’ve got two women who come in pregnant. One of them is bleeding, and she’s lost a liter of blood, and the other has a dead fetus inside of her uterus. Which one has more risk for post-operative infection? That’s actually really difficult to understand, the discrete difference between the two cases. What we’ve done in the United States, we’ve created a kind of gold standard system to risk-adjust for surgical outcomes, so we know that if there are two hospitals that have different mortality rates, or any other metric, I’m just picking on mortality in this case. If they have variation in mortality rates, we need to account for the case mix that presents
Teaching Case

Working from Precedent
The “gold standard” approach to risk-adjustment was known as the National Surgical Quality Improvement Program, or NSQIP. It was well-established in the United States and followed a rigorous data-gathering protocol involving 135 distinct variables for each patient, cutting across pre-operative, intra-operative, and post-operative complications. Administratively, this required hiring a full-time nurse for the explicit purpose of verifying the variables.

While the depth and rigor of NSQIP was laudable and provided statistically relevant findings when administered in the United States, carrying out NSQIP in its full form was impractical to the point of being prohibitive in low-resource countries such as Mozambique. Still, the MEPI Working Group believed that a customized version of NSQIP, referred to as “NSQIP-Lite” among team members, could provide valuable evidence-based insight that might otherwise never materialize.

In conceiving its research strategy and project plan, the MEPI Working Group divided their activities into four broad areas: 1) planning, 2) developing messages and materials, 3) implementation, and 4) assessing effectiveness and making refinements.

Planning and Strategy Development
One decision that the project team needed to make was determining which hospitals would serve as pilot locations for the research. The MEPI Working Group decided on three rural hospitals located in geographically disperse locations of Mozambique: Chokwe (southern), Nhamatanda (central), and Ribaue (northern). (See Exhibit 3 for Map of Mozambique showing location of the three pilot sites.) Dr. Funzamo, who would eventually accompany Dr. Rose on site visits, indicated that finding sites in different regions of Mozambique was important, as was finding sites with a sufficiently high population; each hospital’s catchment area was composed of approximately 250,000 people. The pilot sites needed to represent regional differences and be significant in size to ensure a large data sample. Additionally, some members of the MEPI Working Group had already developed relationships with physicians and staff at hospitals in Chokwe, Nhamatanda, and Ribaue as a result of a prior research project. These existing relationships, the team believed, would help to pave the way for deeper involvement and collaboration.

Before visiting any of the sites to begin implementation, the MEPI Working Group determined which variables they believed would predict surgical outcomes in Mozambique. Dr. Rose and his colleagues expected the number of variables could be greatly reduced while still maintaining a high level of statistical significance. This initial hypothesis proved correct. Dr. Rose explained, “We took the entire NSQIP database, and we ran multiple regression to find out how many variables you need, and in what sequence, before you see diminishing returns on the discriminatory value for post-operative complications and mortality.” Focusing on so-called in-hospital outcomes was another adaption the team made to its low-resource setting. The practical difficulties of obtaining follow-up data from patients who, on average, faced difficulties returning to the hospital for post-surgery follow-up drove this adaptation.

The team determined that only four variables were required to achieve a C-Statistic of 0.93. In fact, the researchers found that a single variable actually
accounted for about 70% of variation. The crucial variable used to predict mortality and morbidity outcomes was called the ASA score, a score on a scale of 1 to 6 based on the patient’s Physical Status, given prior to surgery by the attending anesthesiologist (See Exhibit 4 for the ASA Physical Status Scale.) “It mattered more than any lab value, more than any vital sign,” Dr. Rose explained. “In a way it’s bizarre, because we like to think that our technology and labs and testing are so very important. And yet across the board, across multiple types of surgery, ASA was the one thing that really mattered most.”

Developing Messages, Materials, and Approach
In the months leading up to the first site visit in 2011, the MEPI Working Group developed a computer-based platform for gathering patient data. From the outset, there was a strong interest in developing a simple, user-friendly approach to gathering and recording data, one that would not overly tax the clinicians and hospital staff.

The MEPI Working Group recognized that it would be impractical to hire a full-time person devoted to data gathering and verification, as was the practice in resource-rich U.S. hospitals carrying out the full-scale NSQIP model. Nonetheless, the team believed that assigning and training one person at each pilot hospital to serve as the Surgical Quality Champion was important. In the words of Dr. Rose, the team expected the Surgical Quality Champions to “be the ones who are ultimately responsible for data collection,” and to serve as a link for the hospital, the Ministry of Health, and the MEPI Working Group.

The MEPI Working Group followed an approach to research collaboration based on Frederick Murphy’s “Community Engagement, Organization, and Development for Public Health Practice.” This included identifying local customs and surgical practice, assessing available resources and assets, and identifying community gatekeepers to accommodate formal and informal leadership roles. For example, the Surgical Quality Champions became important leaders for the group’s work and local surgeons’ opinions were critical for deciding which variables to use in NSQIP-Lite. This approach squared more generally with Dr. Bickler’s summary of his work in a variety of settings in Africa, “I think I learned a long time ago from my work in Africa that relationships are everything. And so our job is to be as supportive as possible, to move things along, but at the same time to let others lead things.”

Learning from Initial Implementation
Following many months of preliminary planning and data work, including selecting the three pilot sites, developing a statistically-supported sub-set of pre-operative variables which were most critical for predicting post-operative outcomes, as well as developing a computer-based platform for building the new database registry, it was time for the MEPI Working Group to move on-site. The plan was for Drs. Rose and Funzamo to begin the implementation period by visiting Chockwe. Located just three hours by car from the capital city of Maputo, Chockwe was the most logical site because of its proximity to the research team at UEM. Once the Chockwe site was set up, the plan was for Dr. Rose and Dr. Funzamo to visit all of the sites on a rotating schedule, at a rate of one site every two months.

The first visit to Chockwe in the summer of 2012 proved to be, in Dr. Rose’s words, “a flop.” One of the early challenges included the fact that the iPad designated for collecting data “disappeared in a week,” leaving the researchers with no way to begin developing the registry. In addition to this technology problem, it was clear that the research team and the on-site clinicians and staff at the hospital in Chockwe lacked a shared understanding of the methods and goals of the project. The research team had underestimated the challenges of seemingly simple activities, such as reviewing patient logs, which were often incomplete and inaccurate. Given that even initial data collection proved more problematic and labor-intensive than they had anticipated, the research team realized that they needed to provide additional education and some basic monetary incentives before moving on to more complex indicators such as ASA class and functional status. While the additional training inevitably slowed progress in Chokwe, the experiences at the pilot site proved instrumental when the team moved on to set up the other two sites. Comprehensive training became a key component of implementing NSQIP-Lite and helped develop a sense of collaboration and shared goals between the research team and on-site personnel.

In early 2013, the MEPI Working Group returned to Chockwe with a more refined approach. Dr. Rose spent...
many weeks on site, devoting much time and effort to training the Surgical Quality Champion, whom he described as “super sharp, right on top of things, right with us every step of the way.” As a result, the hospital uploaded the first data to the MEPI Working Group’s computer-based platform. All patient data was de-identified in keeping with patient confidentiality. To the dismay of the research team, however, the Surgical Quality Champion left his position at the hospital, having found a higher-paying job in another province of Mozambique. According to Dr. Rose, the Surgical Quality Champion’s departure represented a “huge set back.” Not only would Dr. Rose need to train a new person during a subsequent site visit, but the new hire would also need to learn even higher-order skills to make sure that the data regarding patients’ ASA functional status was accurate.

Revising Approach: Pilots Continue

Site visits to the three selected hospitals progressed, with the MEPI Working Group incorporating lessons learned at the Chockwe site into subsequent visits in Nhamatanda and Ribaue. Throughout 2013 and 2014, Dr. Rose and Dr. Funzamo maintained regular contact with other members of the MEPI Working Group to report on how things were going on site and to solicit thoughts from the research team. Some of these meetings took place in person at UEM in Maputo, while others were carried out over Skype, thereby connecting researchers in Maputo with Dr. Bickler and others in the United States. Dr. Bickler praised the research team’s ability to take the full-form NSQIP approach and “distill things down to what is useable.” As a rule, the team benefited from the small, closely connected network of physicians and surgeons in Mozambique.

Collaborating with this network, the MEPI Working Group developed two important tools to facilitate the on-site data gathering and reporting. The first was an on-site data sheet to be completed for each patient, with data captured at the pre-operative, peri-operative, and post-operative stages. The creation of this tool revealed some issues regarding the research methodology. Specifically, the MEPI Working Group had determined in advance of the initial trip to Chockwe that 10 variables would be used to capture data for the study. However, in discussions with Chockwe’s surgical technicians and nursing staff, during which the MEPI Working Group indicated that they only needed 10 variables before diminishing returns ensued, the Mozambican surgical staff advocated strongly for including 30-35 variables instead, to cover maternity patients who are not captured in the U.S. NSQIP dataset. (See Exhibit 5 for Excerpted Datasheet.)

Commenting on the design and content of the data sheet, Dr. Rose found it to be “too complicated, too busy.” He added, “If this were up to me, it would have been 10 variables and that’s it. But it’s their datasheet. If the Mozambican staff tells you ‘We think these variables are important,’ you need to account for that. They are the ones who are actually gathering the data. They’re the ones who actually have to take five extra minutes to fill out a little form.”

The second important data-gathering tool developed by the MEPI Working Group was a mobile device platform that could save inputted research data on a cloud-based server. Because of this, data could be entered at a pilot site via smartphone provided by the MEPI team for this purpose. Data could then be reviewed by the MEPI Working Group in Maputo, San Diego, or any other remote location. Creating this mobile-based platform, which was developed in Open Data Kit (ODK), was an important technological advance from the prior approach, as it provided both mobility for the medical team collecting the data and remote access via the cloud for MEPI members to view the data. (See Exhibit 6 for Mobile Device Platform – Screen Shots.)

As the on-site work continued, with each hospital beginning to make the process their own, the research team realized that while collecting data was the easy part, the research team would need to remain vigilant to
fundamental infrastructure. Dr. Rose explained,

considering how to use the data

Considering How to Use the Data
One important decision was whether to place initial focus on Quality of Care improvement or Implementation Science. The former places data in the hands of clinicians and hospital administrators to enact local change, while the latter places data in the hands of the Ministry of Health to enact broad changes to the healthcare system’s fundamental infrastructure. Dr. Rose explained,

Quality [of care] improvement traditionally is where we’re going to take a centralized database and give you your hospital’s results, but only to you. So you are going to know where you are in relation to your peers, but no one else knows where you are and you don’t know where anyone else is. All we need everyone else for is to risk adjust your outcomes, and then it is up to local staff to affect change.

In the United States, for instance, if it were discovered that one hospital’s urinary tract infection rate following surgery was 3 times the national average, after adjusting for patient risks, then it would be clear that the practices at the hospital were problematic. Were catheters being removed soon enough? Were patients encouraged to get on their feet and urinate on their own appropriately? Were patient complaints and early symptoms being addressed aggressively? In the United States, where most hospitals have access to similar resources, it is practical to compare risk-adjusted outcomes and consider the local practices and procedures that might be improving health. However, when hospital resources and patient access to hospitals differ greatly in ways that are systematic at the level of the healthcare system, additional information must be obtained to make fair comparisons and eventually improve care.

Some MEPI Working Group members, including Dr. Rose, believed that Implementation Science was the best first use for the data. The goal would be to identify strategies for provision and use of effective health services. Dr. Rose commented,
results in a scientific mode, perhaps creating questions to provoke discussion, because the ultimate goal is to improve the health care delivered.

Drawing Funds for Global Surgery

Another important discussion area which emerged in the MEPI Working Group during the project was how to use the data to draw funds from the international philanthropic community. Dr. Bickler expressed his concern that the NSQIP-Lite research might not be adequately understood by key constituencies (pilot site medical professionals, external funders, etc.) at the time the results were coming in, thus providing a potential barrier to gaining funding. “I keep telling [Dr. Rose] that I don’t think people completely appreciate where all this is going and how significant this is; and I think that’s the key,” he said. This raised the question of how the MEPI Working Group could overcome the current approach by international funders and draw more funds for surgical care.

As part of its strategy for using the data, the research team also understood that the Ministry of Health may be, in effect, limited by the interests of its funding partners. “If you look at the Ministry of Health, it is dominated by infectious disease projects, it is dominated by vaccination campaigns,” explained Dr. Rose. “If you look at the funding behind most of those projects, most of it comes internationally.” (See Exhibit 7 for Mozambican Indicators Relating to Total Health Expenditure.)

Communicating with Diverse Stakeholders

Given the diverse range of constituents who might be interested in the findings, the MEPI Working Group needed to think carefully about its communication strategy for the research. “Now that we have results from the research, we have to think about how best to pass them on,” said Dr. Noormahomed. She continued, “You know, which messages we need to pass to politicians, which to health providers. We cannot pass the same messages to all groups. I think it’s a matter of communication.”

The meeting of the MEPI Working Group had a full agenda. The research team planned to begin by discussing the NSQIP-Lite pilot implementation and identifying the key lessons. They also needed to discuss the analysis and possible uses of the data, as well how to leverage their results to gain the attention of potential international funders. These topics were pivotal for the project’s success, and each was complicated. The meeting began.

Footnotes
3 Estimate provided during case interview with Dr. Stephen Bickler.
4 Estimate drawn from case interview with Dr. Peter Bendix.
6 The U.S. Department of State disbursed $130 million in MEPI funding, $11 million of which went to Mozambique. Source: Case interview with Dr. Noormahomed.
7 C-Statistic was defined as the probability that predicting the outcome is better than chance. Values for this measure range from 0.5 to 1.0. A value of 0.5 indicates that the model is no better fit than chance at making a prediction of membership in a group and a value of 1.0 indicates that the model perfectly identifies those within a group and those not. (From Manitoba Centre for Health Policy.)

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<td>65.7</td>
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<td>General government expenditure on health (GGHE) as % of THE</td>
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Exhibit 7: Mozambican Indicators Relating to Total Health Expenditure
As a partner of the Ministry of Health, we now operate Haiti’s largest and newest public teaching hospital, with state of the art equipment. We knew this hospital could serve as a model of care delivery and training, but also wanted it to serve as a model of innovative financing. So with the Ministry, we took on the challenge of designing a financing strategy that would allow this public hospital to receive multiple funding streams to support its mission of providing high-quality care to all.

Dr Claire Pierre, Senior Manager of Health Financing Team

Hôpital Universitaire de Mirebalais (HUM) opened in March 2013 (Exhibit 1). The hospital was being planned in 2010 when a major earthquake hit the country’s Capital and prompted the design team to plan it as a teaching hospital for care and training outside of the Earthquake fault lines. In partnership with Haiti’s Ministry of Health, Partners In Health/Zanmi Lasante ( PIH/ZL) funded its construction and supported its operations. HUM was one of 13 clinical sites in Haiti supported by PIH/ZL, with a mission to increase access to care for all by strengthening the public health’s network of clinical sites. Dr. Claire Pierre, PIH/ZL’s Senior Manager of Health Financing, wanted HUM’s financial support to come from a unique combination of public sector funds, private donations, and reimbursements from private insurance companies, employer groups, and self-pay patients. Attracting this blend of funding would require that HUM examine its costs and efficiency from a new perspective, one that recognized the difference between costs and prices and that optimized work processes for a safe, sustainable environment for both patients and providers.

Haiti

Haiti shared the island of Hispaniola with the Dominican Republic (Exhibit 2) in a location prone to hurricanes and, more recently, active earthquakes. Its population of 10.5 million was the third largest in the Caribbean but its 2013 gross domestic product of $13.4 billion was the lowest per capita in the Western Hemisphere. The World Bank classified Haiti as one of 34 Low Income Economy (LIE) nations. In 2010, Haiti had an unemployment rate of 40%. The World Health Organization (WHO), in a 2000 ranking, had placed it as 138th out of 191 member states. Exhibit 3 shows recent WHO healthcare statistics for the country.

Haiti’s public sector, drawing upon the poorest population in the Western Hemisphere, had very limited ability to fund health services. It spent 7% of GDP on healthcare (65th highest in world) but the $83 per capita level of healthcare spending was the lowest in the Western hemisphere. The country relied heavily on health services and funding from private philanthropies, religious charities, and medical NGOs. A 2013 survey identified a total of 907 health care establishments in the country: 25% were private for-profit institutions; 18% were private non-profit without public sector assistance; 38% were funded by the Ministry of Health (also known as the Ministry of Public Health and Population, with the French acronym MSPP); and the remaining 20% had mixed funding (non-profit supplemented by government subsidies). Only 250 of these facilities had inpatient facilities; near 300 were health centers without beds, and most of the remaining were small-scale health clinics. Fewer than half of these had consistent electricity services, and only 11% had access to a computer with internet service. The vast majority did not have a toilet for patient use.

An estimated 40%–60% of the population had no access to health care services, apart from traditional healers. Utilization of health services was low; residents visited a health care establishment, on average, once every two years. Health care clinics and practitioners were clustered in urban regions leaving the countryside—with 70% of the country’s population—notably underserved. Rural Haitians seeking care often had to travel up to 15km to reach the nearest medical facility, either on foot or by transit that cost a day’s wages or more.

WHO estimated that only 43% of the target population received recommended immunizations. A skilled health professional assisted in only one-fourth of births, contributing to a 2010 infant mortality rate of 49 deaths/1000 live births (40th highest in the world) and a maternal mortality of 350 deaths/100,000 live births, 31st highest in the world. Haiti had the highest incidence...
of HIV/AIDS (human immunodeficiency virus/acquired immune deficiency syndrome) outside of Africa. People in most rural areas had no access to health care and were, therefore, susceptible to otherwise highly treatable diseases. In 2003, an outbreak of typhoid fever in Haiti led to dozens of deaths because of a lack of access to doctors and safe water. A 2010 cholera outbreak rapidly spread through the nation, affecting over 700,000 people and leading to more than 8,500 deaths. Haiti's 0.25 physicians/1000 population was 10% of the U.S. average; its 1.3 beds/1000 population was 40% of the U.S. ratio.

In 2010, a deadly earthquake further undermined the country's health system. The earthquake led to over 200,000 deaths, displaced more than 1 million people, and destroyed dozens of health structures including Haiti's main public teaching hospital and nursing school. The Ministry of Health faced the daunting task of rebuilding the country's healthcare network with limited human and capital resources.

**Partners In Health and Hôpital Universitaire de Mirebalais**

Dr. Paul Farmer, a prominent medical anthropologist, physician, and University Professor of Global Health and Social Medicine at Harvard Medical School and Brigham and Women's Hospital, co-founded Partners In Health (PIH) in Boston in 1987 to deliver health care for residents of Haiti's mountainous Central Plateau region. Over two decades, PIH (and its sister organization of the same name in Haitian Creole Zanmi Lasante (ZL)) partnered with the Ministry of Health (MSPP) to support 12 sites across Haiti focusing on rural underserved communities. By 2014, PIH/ZL had become one of the country's largest NGOs with a staff of 5400 Haitians and serving a patient population of 1.3 million people (Exhibit 4). Simultaneous with its growth in Haiti, PIH expanded around the world to operate clinics and hospitals in low-income rural communities in Rwanda, Lesotho, Malawi, Mexico, Peru, and the Navajo nation in the U.S.

PIH/ZL had been collaborating with MSPP on the construction of a new community hospital in the city of Mirebalais; 60 km northeast of Port-au-Prince. With the 2010 destruction of Haiti's main teaching hospital, they decided to increase the scope of services and build a teaching hospital with tertiary service capacity. The hospital, located 45 minutes from the capital and away from the geological fault line, would serve the country's need for training health care providers. PIH/ZL financed the $26 million construction cost of Hôpital Universitaire de Mirebalais (HUM). The 205,000 square foot, 300-bed facility opened in March 2013. By 2014, HUM's 700 employees, including 300 nursing staff and 50 doctors, provided a robust set of services for approximately 185,000 people in Mirebalais and two neighboring communes. HUM also provided training programs for nurses and medical residents including new specialties, such as Emergency Medicine, for the country.

HUM's primary service lines included general medicine, surgery, pediatrics, maternal health, emergency room care and, unusual for an NGO, breast cancer care (Exhibit 5 for the complete list of clinical offerings). By December 2013, HUM had registered 67,000 patients, provided more than 75,000 clinic visits, and had an average daily census of about 700 patient visits per day. HUM served an area with one-third of Haiti's population and had seen a continual increase in the number of patients traveling to Mirebalais from outside its geographic region.

**Financing and Reporting**

Dr. Maxi Raymonville was Executive Director of HUM. He had over 20 years of experience at PIH/ZL and carried a strong commitment to the hospital serving as a model for clinical care delivery, teaching and financing. Dr. Claire Pierre, with over a decade of work with PIH/ZL, was tasked with building a leadership team that would work closely with Bryan Mundy, the Director of Finance. Mundy had extensive experience in health care financing in many countries, including a number of Low- and Middle-Income Countries (LMICs). The team included Dr. Reginald Ternier who carried experience as a senior manager of one of Haiti's private insurance plans and Franciscia Lucien, who trained in economics and public health and served as PIH/ZL's manager of health system strengthening and capacity building. The team had a senior economist, Pierre Cremieux, who served as an advisor.

HUM's operating expenses in 2014 were approximately $12 million (Exhibit 6). Its revenues came from three primary sources. MSPP provided about $8 million, 70% of HUM’s annual funding. Contributions from foundations, corporations and individual donors provided another $4 million of HUM’s support. These private donors wanted to invest in medical education, innovations in service delivery and access for the underserved. Additional funding from patients able to...

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*Exhibit 2: Map of Caribbean (source Google maps)*
contribute for care through insurance, employer benefits, and other mechanisms was being considered. In 2014, HUM received $75,000 from one employer group contract. Each new patient at HUM paid 50 Haitian Gourde (about US $1.10) for a registration card, after which all care, was free. By December 2014, HUM had signed contracts with two of the country’s main insurance carriers allowing their clients to access HUM for services.

While not a direct source of funding for HUM, national and regional programs and special funds, such as bonds and integrated development zone initiatives, also contributed to the nation’s health by improving basic infrastructure and economic opportunity. These programs reduced poverty, a principal cause of poor health, and improved access for rural populations to regional and national health care providers. The health care financing team worked with local economists and local authorities to show the economic impact of the hospital in the region ($1.8 for every $1 invested) and to encourage continued investments in health as a way to contribute to local economic growth.

HUM’s leadership was committed to transparent and auditable record keeping. HUM’s general ledger accounting system collected and reported information on assets, liabilities, revenue, funding and expenses. A monthly report summarized cash receipts and expenditures. Finance personnel ensured that cash transactions were appropriately captured and that all payments were properly verified and approved.

Raymondville and Mundy prepared an annual operational budget. Daily expenditures were reported by budget procedure codes, enabling hospital administrators to compare cumulative expenditures, by budget code, to the annual budget. Any significant changes from the initial budget had to be approved by the PIH/ZL leadership in Boston. Expenditures on fixed assets, such as equipment above a certain price, were recorded in the general ledger.

Payroll was captured for full time and part time employees and included the basic pay, any allowances, and salary-related employee deductions (e.g. family health insurance cover). Payroll procedures would ensure that employees were paid in accordance with their letters of appointment and that these payments and any salary advances were properly accounted.

General reports and departmental reports were generated monthly for senior management and the
Teaching Case

board of directors, with donors also receiving periodic financial reports. HUM submitted reports to MSPP on its performance on specified health metrics, such as infant mortality, number of births and volume of patients seen along with some of their demographic details.

Cost Measurement at HUM
Shortly after HUM’s opening, MSPP asked USAID, the United States Agency for International Development, for a team of economists to conduct a cost analysis. The team used the Management Accounting System for Hospitals (MASH), a step-down costing approach found in most hospitals in the U.S. and around the world, to estimate HUM’s cost of delivering its various service lines. The team used various allocation bases, such as volume of patients or number of employees in each medical department, to allocate the expenses reported in the hospital’s administrative departments (finance, human resources, maintenance, security, general administration, etc.) down to medical departments, referred to by MASH as Final Cost Centers. HUM’s medical departments included the multiple outpatient clinics, inpatient wards, and the maternal labor and delivery unit. MASH also allocated the costs of Intermediate Medical Services, such as pharmacy, laboratory and radiology, to the medical departments (Final Cost Centers). Exhibits 7a–d show MASH’s sequence of allocations.

MASH added together each medical department’s direct costs (those incurred within that department) to its allocated administrative and intermediate medical service costs to obtain the full cost for that department. In a final step, MASH divided each medical department’s full cost by the quantity of patients seen or the number of inpatient days to obtain the average cost per outpatient visit or cost per inpatient day. The analysis provided an estimate of the cost of various types of inpatient bed-days by medical condition and the cost of an outpatient visit by service line. (Exhibit 7c). Mundy observed, “The report certainly gave a reasonable overview of the operating costs down to
departmental levels. It was not, however, very accurate about the costs per outpatient visit or inpatient day."

The consultant’s report acknowledged the limitations of only having one month of data in a period shortly after the hospital had opened. Other issues were also evident. Mundy commented that the surgical ward was reported to have a bed occupancy rate of 174%, most likely the result of including many patients undergoing day procedures (such as endoscopy) in the patient volume counts despite their short stays on the ward (Exhibit 7d). He cited the estimated cost of a neonatal intensive care bed being lower than a regular pediatric bed as another anomalous result.

**Time-Driven Activity Based Costing (TDABC)**

Dr. John Meara, Chair of the Department of Plastic and Oral Surgery (DPOS) at Boston Children’s Hospital, had directed the Program in Global Surgery and Social Change (PGSSC) in collaboration with Partners In Health since 2008 and volunteered for PIH in Haiti. He had recently collaborated with a costing team at the Harvard Business School (HBS) to apply a new costing approach for his clinical department. Meara saw how more accurate costing, at the medical condition level, helped him redesign care delivery and also provided him with valid information for negotiating new reimbursement approaches that would link payments to the delivery of better outcomes at lower costs for patients.

Meara and the HBS costing team approached Dr. Pierre about doing a similar costing project for the newly-opened HUM facility. Pierre readily accepted the offer and helped to recruit a diversified project team to conduct the cost analysis (See Exhibit 8 for project team membership). Francisca Lucien, Health Systems and Capacity Building Manager, became the HUM project leader. Lucien had been extensively involved in the planning and operational design of the hospital. She was joined by three medical students, Morgan Mandigo and Katherine O’Neill, from PGSSC, and Eva Luo, an MD/MBA student at HBS and Jean Claude Mugunga, analyst in the Quality and Economic Evaluation team (PIH).

The project applied time-driven activity-based costing (TDABC) to calculate costs at the medical condition level of analysis. TDABC was a bottoms-up costing approach that built upon inputs from clinical and financial personnel. The HBS cost team had been helping many medical centers in the U.S. implement TDABC to achieve two objectives: stimulate process improvement that would produce substantial cost savings while maintaining clinical quality; and serve as a basis for developing bundled payments that reimbursed providers for delivering high-quality care for specific medical conditions.

TDABC started by documenting the actual clinical and administrative processes used over a complete cycle of care for treating patients with specific medical conditions. For each process, the project team identified the resources used—personnel, equipment, and supplies—

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**Exhibit 6**: Hôpital Universitaire de Mirebalais: 12 month operating budget Ministère de la Santé Publique et de la Population for 2014

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**Exhibit 7a**: Cost Hierarchy for the MASH report
and the quantity of time each resource is devoted to the patient. Finance personnel helped the team estimate the cost of each resource type. The total cost of treatment could then be obtained by multiplying the quantity of resource time by its cost and summing across all the processes involved in the patient’s care cycle (See Exhibit 9 for the detailed sequence of steps in a TDABC analysis).

The TDABC projects at HUM

HUM selected two medical areas for the initial TDABC analysis: maternal health and breast cancer care (including mastectomy). These were two of the highest volume and fastest growing service lines (Exhibit 10) with clear start and ending points for the care cycle. The hospital’s obstetric department had experienced tremendous growth and was already operating at 90% of capacity in early 2014, with plans to expand to serve even greater volumes. HUM handled about 270 births each month, with a Cesarean delivery rate of 23%. About 60% of the obstetric patients came from Mirebalais, 30% from the two neighboring communes, and 10% from outside these communities. The team studied the costs for normal spontaneous vaginal delivery (NSVD) without complication and for Cesarean delivery performed for a prior uterine scar. These would provide a comparison between surgical and non-surgical births. It would also inform HUM’s decision-making as it participated in a national dialogue about how to reduce Haiti’s high maternal mortality rates.

The provision of oncology services was unusual for an NGO even though a recent study had documented that 56% of newly diagnosed cancer worldwide occurred in LMICs, with a forecast that the percentage would rise to 70% by 2030. By providing oncology services in Haiti, HUM was responding to PIH co-founder Farmer’s exhortation:

[We must] address the immense and immediate need for treatment to save and extend the lives of millions of people with cancer. The humanitarian rationale is clear: many of the 4 million deaths from cancer every year in low-income and middle-income countries can be averted through early detection and treatment. Millions of people with advanced or untreated cancer, but without access to true palliation, will die with great and preventable suffering, impoverished from attempting to meet even the most basic treatment costs.

Cancers in LMICs usually presented late and the survival rate was low. Haiti had an annual reported breast cancer incidence of 4.4 per 100,000 females and an annual mortality rate of 2.0 per 100,000 females, producing a relative mortality of 45%. The United States, in contrast, had a much higher annual reported incidence of 121.2 per 100,000 females, a higher annual mortality rate, 23.5 per 100,000 females per year, but a much lower relative mortality rate of 19%. As a new provider of oncology services in Haiti, HUM drew patients from all over the island. The team defined the cycle of care for breast cancer to comprise the diagnosis by core-needle biopsy; 8 cycles of doxorubicin, cyclophosphamide, and paclitaxel (ACT) chemotherapy; and a modified radical mastectomy. It also included the cost of related services from departments such as radiology, laboratory, and pharmacy.

The TDABC team considered costing the conditions that presented in the Emergency Department (ED), especially trauma. But the diversity and complexity of ED visits led the team to defer this study to a subsequent project.
Process Mapping

The project team started the process mapping by interviewing staff involved with the two medical conditions. The initial interviews provided a reasonable overview of the activities, but obtaining time estimates proved difficult in some circumstances. In those situations, the team directly observed a number of cases to obtain more accurate time estimates. Exhibits 11a–c shows examples of several maps for births and oncology treatments. The initial maps reflected uncomplicated deliveries and the full cycle of breast cancer care, which included eight cycles of chemotherapy and modified radical mastectomy without complication. The maps also identified when significant variation occurred during a treatment; for example, a pregnancy test was performed in just 10% of patients in maternal health. The final cost for the medical condition was a weighted average cost for a typical patient’s care cycle.

Midwives with support as needed from physicians and nurses, managed most of the care for normal spontaneous vaginal deliveries at HUM. As anticipated, the length of stay for patients who underwent Cesarean delivery was longer with a two-to-three day post-partum stay after a normal spontaneous vaginal delivery. The team did not use process mapping for specific activities on the labor, post-partum, and post-operative wards, where patients needed constant monitoring by a nurse and other auxiliary staff and an on-call physician to be available on site. For these wards, the team used staffing ratios (the number of patients per clinician) to assign clinician costs to individual patients. The analysts multiplied a patient’s average length of stay by the number of each personnel type required per shift, and divided by the number of beds at full capacity. The obstetric wards generally operated at 90–100% capacity.

Direct Costs

Mundy’s finance office provided financial and cost data to the team, and also guided decisions about indirect cost allocations. With HUM’s excellent accounting records, expense information was readily available from the general ledger.

Personnel costs constituted the majority of expenses at HUM. The team calculated each personnel type’s capacity cost rates (CCR) by dividing personnel costs by each type’s practical capacity. For a given employee type, the team calculated the personnel cost (the numerator in the cost per minute ratio) as the sum of salary, bonus, benefits and a percentage of any support staff or administrators for that personnel type. If the personnel type had paid non-clinical activity, such as research or management time, the costs associated with the non-clinical activity were subtracted from the total.

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<th>Cost per inpatient days</th>
<th>Bed Occupancy rate</th>
<th>Average length of stay (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient pediatrics</td>
<td>$612,850</td>
<td>698</td>
<td>$90</td>
<td>84%</td>
<td>8.8</td>
</tr>
<tr>
<td>Inpatient medical ward</td>
<td>$115,879</td>
<td>1074</td>
<td>$108</td>
<td>62%</td>
<td>9.8</td>
</tr>
<tr>
<td>Inpatient surgical ward</td>
<td>$156,827</td>
<td>1369</td>
<td>$115</td>
<td>74%</td>
<td>13.3</td>
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<tr>
<td>Inpatient NICU</td>
<td>$51,642</td>
<td>646</td>
<td>$80</td>
<td>164%</td>
<td>14.1</td>
</tr>
<tr>
<td>Inpatient isolation ward</td>
<td>$18,253</td>
<td>59</td>
<td>$309</td>
<td>20%</td>
<td>14.4</td>
</tr>
<tr>
<td>Inpatient prenatal ward</td>
<td>$28,837</td>
<td>202</td>
<td>$142</td>
<td>63%</td>
<td>7.5</td>
</tr>
<tr>
<td>Inpatient postnatal ward</td>
<td>$41,500</td>
<td>761</td>
<td>$55</td>
<td>155%</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Exhibit 7: Bed occupancy calculations from MASH

Exhibit 8: TDABC Team Members

Maxo Raymonville, Executive Director, HUM
Militza Michel, Director of Administration (MSPP)
Bryan Mundy, MS, Director of Finance
Claire Pierre, MD, Senior Manager of Health Financing
Francisca Lucien, MA, Health Systems & Capacity Building Manager
Jean Claude Mugumba, MD, MS, Analyst, Quality and Economic Evaluation, PIH
Christophe Milien, MD, Chief of Obstetrics and Gynecology
Yolande Nazaire, BA, Manager of Oncology Services
Ruth Damuse, MD, Chief of Oncology
John Meara, MD MBA, Director of Paul Farmer Global Surgery Program, PIH
Morgan Madigo, MSc, Medical Student
Kathleen O’Neill, BA, Medical Student
Bipin Mistry, MD MBA, Senior Research Fellow, Harvard Business School
Karla Betrand, BA, Research Fellow, Harvard Business School
Eva Luo, MBA, Medical Student

Exhibit 9: TDABC analysis: step by step

1. Select the medical condition
2. Define the care delivery cycle
3. Develop process maps with the following principles:
   a. Each step reflects an activity in patient care delivery
   b. Identify the resources involved for the patient at each step
   c. Identify any supplies used for the patient at each step
4. Obtain time estimates for each process step
5. Calculate the capacity cost rate for each resource using the following equation

\[
\text{Capacity Cost Rate of Resource A} = \frac{\text{Expenses attributable to resource A}}{\text{Practical capacity of Resource A}}
\]

6. Calculate the total direct costs (personnel, equipment, space, and supplies) of all the resources used over the cycle of care
7. Identify and allocate the indirect costs (ICA) attributable to the cycle of care
The team estimated the practical capacity—the denominator in the cost per minute ratio—by estimating each personnel type’s number of minutes available for clinical activities in a year. The available time included direct time for patients, such as during clinical shifts, and on-call time, but not vacation and holiday days or time for continuing medical education. During interviews, several clinicians noted that their clinical times for patients sometimes exceeded the contracted time because of HUM’s rapid growth and the tremendous unmet need in the community. Some work was performed by (unpaid) volunteers, but their involvement in treatment varied greatly with an effort to use their expertise only when needed or for training, so the team excluded them from the analysis.

The capacity cost rate of equipment was calculated from the initial cost of buying the piece of equipment, the cost of maintenance for a year and the expected life span. For donated equipment, this cost was determined based on replacement cost of comparable equipment. The maintenance costs were available for some equipment, but were difficult to ascertain for all. When some equipment malfunctioned, for example, it could be replaced and therefore had no maintenance costs. The practical capacity of the equipment would be calculated from how many minutes the equipment was available for use during the year, assuming normal quantity of shifts per day, less time for maintenance.

The capacity cost rate of equipment was calculated from the initial cost of buying the piece of equipment, the cost of maintenance for a year and the expected life span. For donated equipment, this cost was determined based on replacement cost of comparable equipment. The maintenance costs were available for some equipment, but were difficult to ascertain for all. When some equipment malfunctioned, for example, it could be replaced and therefore had no maintenance costs. The practical capacity of the equipment would be calculated from how many minutes the equipment was available for use during the year, assuming normal quantity of shifts per day, less time for maintenance.

The total expense for space capacity included annual depreciation costs, based on actual construction costs, plus annual maintenance costs, including operational costs, utilities and housekeeping. The annual space costs was divided by the available quantity of space (estimated from construction drawings) to obtain the space capacity cost rate (CCR) per square meter. If a given quantity of space was occupied by more than one patient, such as in the obstetrics wards, the space cost was divided by the number of patients in that space. For example, on the postpartum floor there were 20 patients in a large ward, so for each patient the applicable space capacity cost rate would be 1/20th of the ward’s CCR.

Haiti experienced frequent energy interruptions (typical of many LMICs), with the national grid typically inoperative for 40–50% of the day. The hospital had been built with solar panels to reduce purchased energy needs, and HUM had installed back-up generators to ensure a continual supply of electricity during power outages. These generators were expensive to purchase and install and incurred high fuel costs. The project team recognized that not all service lines or areas had similar demands for electricity. Energy consumption was highest in areas that needed air conditioning units and refrigerators to run constantly, and in surgical operating rooms.

The team estimated electricity consumption of each space based on their power ratings and the cost per kilowatt hour obtained from the financial records. The electricity cost for most wards was done on an average cost per square meter, but separate calculations were done for some areas that had its own air conditioning units such as the Neonatal Intensive Care Units (NICU). The energy costs of operating rooms, radiology, laboratory, pharmacy, and oncology units were measured separately since each space had different energy demands. For example, the operating room had an energy-intensive sterilization machine (autoclave) that had to run, without interruption, for a two-hour cycle. The autoclave’s energy costs were almost half its total operating costs (see illustrative data in Exhibit 12). With two autoclaves available for use, the team felt that running the machines under capacity led to unnecessarily high energy costs.

The team obtained the cost of consumables, such as drugs and materials, from utilization records. It included the cost of donated medicines from online searches and using the Management Sciences for Health’s Cancer Medicine Prices for LMICs (2012).

**Indirect Costs**

The project team applied TDABC to the laboratory department and for X-rays and ultrasounds in the radiology department. But many administrative and operational costs could not be attributed directly to patient activities. The team decided to allocate these with a daily Indirect Cost Allocations (ICA) per patient day, based on where the patient’s care was delivered. They defined four types of ICAs:

1. A daily ICA, applied to all patients
2. An inpatient ICA per day, applied to hospitalized patients only
3. An oncology ICA, applied to oncology patients only
4. A daily ICA for Emergency Department patient visits
Normal vaginal delivery

The following maps show the activities occurring for some of the stages. The numbers in the circle represent the minutes of the activity.
The daily ICA would be applied to any patients who attended any clinical area in the hospital. This enabled costs to be assigned to outpatient surgeries, a category of patient visits that had been lumped into the surgical inpatient volume by the MASH analysis.

The inpatient ICA was applied to any patients admitted to the hospital, and was calculated from cost categories that related to inpatient needs, such as laundry and food services. For example, a mother who had a Cesarean delivery and stayed as an inpatient for two additional days would get assigned two days of both the daily ICA and the inpatient ICA, in addition to the direct costs of her surgery. In contrast, a mother in the normal spontaneous vaginal delivery care cycle would incur only the daily ICA, but not the inpatient ICA, because her length of stay was 6 hours and she would not have been transferred to an inpatient bed.

The oncology ICA, applied only to oncology patients, reflected the costs of the infusion center and the oncology team that obtained biopsies, tracked their delivery to Boston for reading, and then obtained and tracked the reports. Several of the oncology staff were paid at US
salary rates. Brigham and Women’s Hospital in Boston donated services for preparing and reading the biopsies, so these costs were excluded from the oncology ICA, though Pierre advocated for their eventual inclusion.

The HUM team calculated the ICAs by extracting the indirect costs—administration, security, biomedical, Information Technology (IT), transportation, laundry, nutrition services and education—from the general ledger, and allocating them into the four ICA categories. They then divided the total cost in each category by an estimate of the patient volume for that type of care. For example, the daily patient ICA equaled the total daily indirect expenses divided by the patient capacity of the entire hospital. In contrast, determination of the final medical cost center was distorted by using only actual patient volume during their study period, without accounting for the unused capacity. The team felt that some indirect costs needed further analysis. For example, transport costs had been allocated to all patients but these costs varied greatly from month to month depending on factors such as the timing of procurement for materials and equipment, the number of visiting volunteer staff, and the transport of Haitian staff. Also, the team learned that outpatient staff had ordered the vast majority of laboratory and radiology tests. The MASH methodology had allocated half of these costs to inpatients only, assuming (incorrectly) that they were the highest consumers of laboratory and radiology testing.

The team considered analyzing the TDABC costs of pharmacy but then learned that the procurement cycle for obtaining a medicine could be very complicated and depended on the drug. For example, some medications were donated and then stored in a source country, shipped to a distribution center in Florida, then transported to Port-au-Prince for storage in a warehouse, until transported to the hospital as needed. Medications needed in an emergency, on the other hand, were flown directly to Haiti. The team decided this variety would be too time consuming to map and deferred the pharmacy analysis to a subsequent project.

The future
By the end of 2014, HUM had established a reputation as a center of reference for care in the country and as one of the best training sites for health care professionals. In Fall 2013, HUM enrolled the first class of medical residents for training in surgery, medicine and pediatrics through a competitive application process that drew graduates trained in the country and beyond. In 2014, it began training residents for other specialties such as obstetrics and gynecology and emergency medicine, and had plans to extend resident training to orthopedics, anesthesia, intensive care and neonatology. HUM also began a certified nurse anesthetist training program in 2014 and continued to adjust its staffing and provide on-site training for employees across disciplines.

Dr. Pierre and HUM’s senior executives met with the project team and outside consultants to review the data. The lively and productive discussion covered opportunities for process improvements and capacity utilization management. Mundy stated:

Both our costing exercises had value. The MASH system gave us an accurate holistic cost of operations that supported our budgetary forecasts, and enabled us to produce the financial reports our partners demanded. But TDABC gave us the information to really understand our process costs and where we could look to improve efficiency. TDABC has enabled us to align our costs to specific procedures and, ultimately, will allow us to budget based on the number, and type, of services we deliver. We could then budget based on real requirements rather than the availability of funds.

As one specific example of a process efficiency opportunity, the high cost of electricity embedded in the
Teaching Case

The team was particularly interested in applying TDABC to other medical conditions in the hospital and to community health centers around the country. PIH/ZL had historically trained and located community-based health workers who referred patients for nearby care as needed. But in HUM’s first year of operations, patients from all over the country had traveled long distances to reach the facility. The team therefore wanted to explore how TDABC could help estimate the cost of accessing care from the patient’s perspective. PIH/ZL had long advocated for community based care and primary care linked to secondary and tertiary care for safety. With TDABC, the team hopes to have financial impact data that could be used to design the proper mix of community-based and tertiary care with the goals of increasing access, improving utilization, and lowering the total costs of operating a national health care system.

Armed with this information, along with the USAID report, Dr. Pierre and her executive team refined the targets for each of HUM’s primary revenue streams: government...
funding, insurance reimbursements, and philanthropic investment. She anticipated a near-term meeting with MSPP and PIH personnel on the future of health care delivery in Haiti. She planned on using the information from the recent cost studies to start a dialogue among the government, donors, partners and other hospitals about how to finance the increased access to health care that everyone valued. This would include using TDABC data along with the MASH data, to put in context the various price lists from insurance companies, condition specific donor programs and the national effort to revise the public sector’s price list. She will wanted to engage with ZL/PIH leadership, clinicians, and hospital staff to use process maps for workflow redesign that would improve the experiences of patients and providers.

References

Endnotes
1 Dr. Pierre also served as Director of the Program in Health Systems Strengthening and Social Change in the Department of Global Health and Social Medicine at the Harvard Medical School.
2 Self-pay patients could include tourists who became sick or injured while visiting Haiti.
3 These data represented a substantial decrease from the 2008 rate of 583 and the 1990 rate of 898 deaths per 100,000 births
4 A bundled payment is a single payment, intended to provide a positive margin above the costs incurred by efficient and effective providers, for treating a patient with a specific medical condition across a full cycle of care. The payment can be contingent upon achieving good patient outcomes for that medical condition.
5 Surgery for emergency trauma and obstetric complications were among the highest volume surgical procedures in most LIE countries. A study of the global burden of disease estimated that 11% of the global burden of disease could be treated with surgery, with the largest categories of demand for surgeries being injuries (38%), malignancies (19%), congenital anomalies (9%), complications of pregnancy (6%), cataracts (5%) and perinatal conditions (4%).

59
In 2013, Mary Muchendu, a senior nurse, was the executive director of African Inland Church (AIC) Kijabe Hospital, a rural Christian mission hospital internationally renowned for sophisticated surgery and anesthesia services. Muchendu became executive director in 2010, the same year that Kijabe opened three additional operating theaters (OTs) and an endoscopy suite.

Three years after assuming leadership of the nearly 100-year-old hospital, Muchendu understood the challenges of surgical care delivery, which went far beyond ensuring adequate operating space. While the hospital remained committed to serving the poor and providing “health care to God’s glory,” Muchendu had to figure out how to generate revenue to meet operating and infrastructure expenses. She also had to consider the sustainability of its staffing model; a majority of the specialized physicians were expatriate missionaries. What could she do to make the hospital more sustainable while helping fulfill its mission?

Overview of Kenya
Kenya is located along the equator in East Africa (see Exhibit 1 for map). The country gained independence from Great Britain in December 1963. Mwai Kibaki became Kenya’s third president in what was widely considered a free and democratic election in 2002. In December 2007, Kibaki was re-elected. Though Kenya was historically one of the more politically stable countries in the region, amidst allegations of vote-rigging and corruption, riots broke out, resulting in 1300 deaths and over 600000 internally displaced persons.

In June 2008, President Kibaki launched Kenya Vision 2030, a campaign to advance Kenya to middle-income country status by 2030 and simultaneously achieve the Millennium Development Goals by 2015. The majority of people in Kenya lived in rural areas, and most rural Kenyans derived their primary income from small-scale subsistence agriculture. Between 2008 and 2012, GDP grew 2–6% per year. Official unemployment rates hovered around 40%. Food insecurity was common (see Exhibit 2 for socioeconomic and demographic indicators).
Health in Kenya

Life expectancy for Kenyans fell from a peak of 60 years in 1989 to 55 years in 2009, largely due to AIDS-related mortality. In 2008, leading causes of adult mortality were HIV/AIDS, injuries, cancer, and cardiovascular disease. The major causes of morbidity per 10,000 Kenyans in 2008 were malaria (11.9), diseases of the respiratory system (9.7), skin diseases and wounds (2.5), diarrheal diseases (1.7), and accidents (0.8; see Exhibit 3 for health system and epidemiologic indicators). Maternal morbidity and mortality in Kenya remained high, yet below average for sub-Saharan Africa. Well over half of maternal deaths stemmed from surgically preventable or treatable conditions, including severe bleeding, obstructed labor, infection, complications of aborted pregnancy, and hypertensive emergencies.

Health System

In an effort to better coordinate public health services, the Kenyan Ministry of Health introduced the Kenyan Essential Package for Health (KEPH) in 2005. The KEPH framework integrated the public sector—roughly 48% of the 6190 health facilities in the country in 2008—and private sector, which included faith-based organizations, for-profit companies, and not-for-profit entities. Outpatient clinics as well as district, provincial, and referral hospitals all provided some level of surgical care.

Financing

The National Hospital Insurance Fund (NHIF), an autonomous government entity, provided inpatient health insurance to wage-earning adults, with premiums based on income, ranging from USD 0.35 to USD 173 and above per month.

The NHIF classified hospitals into three coverage categories. It provided 100% coverage in A facilities, which included Ministry of Medical Services hospitals; a set daily benefit for inpatient admissions with varying levels of co-pays for B coverage facilities, which included not-for-profit and faith-based organizations, and for C coverage facilities, which included for-profit companies.

As of 2008, 35-8% of all health care costs were paid out of pocket, 31-0% by donor funds, 3-3% by private companies, and 0-1% by private foundations. The public sector covered 29-3% of costs. Private insurance and charity hospitals helped patients finance hospital care outside NHIF.

AIC Kijabe Hospital

Missionaries founded Kijabe Hospital in 1915 in a rural area 65 kilometers northwest of Nairobi in Kenya’s Rift Valley Province “to glorify God through compassionate health care provision, training and spiritual ministry in Jesus Christ.” Kijabe Station, the community surrounding the hospital, was home to 7000 people in 2013, including a third of the hospital’s staff, all the doctors in training, and short-term missionaries. In addition to Kijabe Hospital, Kijabe Station included a church, Kijabe Boys’ School, Kijabe Girls’ School, a prestigious international Christian boarding school—Rift Valley Academy—that targeted missionaries’ children, and numerous small businesses.

History and Overview

Large mission organizations provided volunteers and supplies to Kijabe Hospital, which had made upgrades and small improvements over time as it was able, including adding inpatient wards, a maternity ward and operating theatre.

Training programs followed, including the establishment of a nursing school in the 1980s, medical internships in 1996, and surgical residencies and fellowships thereafter. Dental services, anesthesia, pediatric general surgery, neurosurgery, and services for disabled children and HIV/AIDS care were soon available...
## Teaching Case

**AIC Kijabe Hospital Timeline**

<table>
<thead>
<tr>
<th>Year(s)</th>
<th>Event(s)</th>
</tr>
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<tbody>
<tr>
<td>1895</td>
<td>African Inland Mission (AIM) arrives in Kenya with a group of missionaries from Philadelphia (Pennsylvania Bible Institute)</td>
</tr>
<tr>
<td>1915</td>
<td>“Theodora Hospital” (later renamed Kijabe Hospital) opened at Kijabe Mission Station</td>
</tr>
<tr>
<td>1997-1980</td>
<td>German National Church doubled bed capacity of Kijabe Hospital (65 beds to 130 beds)</td>
</tr>
<tr>
<td>1998</td>
<td>Kenya Registered Nurse Anesthetist (KRNA) training started</td>
</tr>
<tr>
<td>1999</td>
<td>BethanyKids at Kijabe Hospital opens specialized pediatric surgical center</td>
</tr>
<tr>
<td>2004</td>
<td>Major Operating Theater (OT) expansion</td>
</tr>
<tr>
<td>2007</td>
<td>Kenyan Nursing Council formally recognizes KRNA training</td>
</tr>
<tr>
<td>2008</td>
<td>Creation of a nursing school, dormitory for 48 nursing students constructed</td>
</tr>
<tr>
<td>2009</td>
<td>BethanyKids opens comprehensive pediatric center, AIC CURE International Hospital opens five-bed Intensive Care Unit</td>
</tr>
<tr>
<td>2010</td>
<td>University of Nairobi (UG) and the University of Nairobi School of Medicine provide anesthesia services</td>
</tr>
<tr>
<td>2012</td>
<td>EMI finalizes master plan</td>
</tr>
</tbody>
</table>

Source: Compiled by case writers using sources from Kijabe Hospital.

(see Exhibit 4 for AIC Kijabe Hospital’s timeline and Exhibit 5 for its organizational structure). The hospital served as the primary referral center for four hospitals and over 50 rural clinics.

While there were long- and short-term (less than one year) missionaries, the hospital preferred long-term. Dr. Mark Newton, an American long-term missionary anesthesiologist who had worked in Kijabe since 1998, explained:

The strength of Kijabe is in the foundation (mission) and long history of the hospital having western doctors committed to serving in Africa over long periods, over 10 years each. Dr. Bransford [who stayed for decades] was a medical student here, and that was over 40 years ago. [There was] a Scottish nursing educator who stayed in Kenya for over 40 years; long term commitment is the key.

Spiritual ministry was important to care delivery. “We do not separate the medical and spiritual world in Kijabe Hospital; both are together. Our vision is to glorify God in everything we do,” said Pastor Agnes Mangeng’e. Chaplains rounded with medical teams, provided consultations, and met with each patient during hospitalization. All visiting staff agreed to and signed an ethical code of conduct upon arrival.

### Services

By 1990 Kijabe Hospital was serving inpatients in addition to outpatients. In 2010, Kijabe had a 50 km catchment area that covered over 2.8 million people. Patients came from far away: “Kenya, Ethiopia, Sudan, Somalia, Tanzania, Burundi, Ghana, Central African Republic, Cameroon, Comoros Islands. They come from all over,” noted one surgeon. Somalis, living in Kenyan refugee camps and Nairobi’s Mogadishu neighborhood due to civil war (1991–2006) accounted for 20% of patients.

Kijabe’s reputation for high quality and low cost made it attractive. In 2009, Kijabe admitted approximately 11,000 patients to the 265-bed hospital, with an average length of stay of 6–3 days. That same year, it performed 9049 operations and almost 2000 obstetric deliveries, saw more than 110,000 outpatients, and provided 4655 patients with HIV care.

Emergent surgical procedures were performed without pre-payment, while urgent or elective procedures required a deposit, typically around USD 950, depending on the estimated bill. Each patient was billed for his specific procedure, anesthesia and surgical consumables. Patients often spent several weeks raising money for their medical needs through Kenyan community self-help events called harambees. Some had NHIF coverage that provided USD 29 per day of inpatient ward hospitalization, which helped defray costs. “Are we the referral center for East Africa? No, but we are probably the most financially accessible,” said one pediatric surgeon.

The pediatric surgical department, working with a mission-based charity called BethanyKids since 2004, provided general surgery and neurosurgery services in two pediatric operating rooms. They treated spina bifida, hydrocephalus, gastrointestinal and urological disorders, burns, and cleft lip and palate, among others. A separate institution on campus, AIC CURE International Hospital, provided pediatric orthopedic surgery, the majority of which was trauma-related.

Clinical infrastructure included portable radiograph, portable ultrasound, a blood bank, pathology, biochemistry, hematology, bacteriology, and parasitology. Newton, a long-term missionary, department head of anesthesia at Kijabe Hospital and associate professor of clinical anesthesiology at Vanderbilt University in Nashville, Tennessee trained the Kenyan Registered Nurse Anesthetists (KRNAS) that provided the entire spectrum of anesthesia services for the surgical cases.

### Intensive Care Unit and High-Dependency Units

Kijabe Hospital opened its five-bed Intensive Care Unit (ICU) in 2005, including one isolation/pediatrics room. The ICU could provide continuous intravenous medications and fluids, ventilator-assisted respiratory support, constant monitoring of vital signs and dedicated nursing and physician staff to respond to acute changes in status. The ICU staff cared for patients who underwent major and elective procedures. The ICU reduced post-operative mortality and allowed the hospital to provide more surgically and medically advanced care.
Hospital administrators constantly had to weigh the costs and benefits of ICU access. A day in the ICU cost USD 52, or USD 87.50 if the patient was on a ventilator, almost two to three times as much as the NHIF reimbursed. Between 2005 and 2008, the ICU served 1347 patients, a quarter of which were children. Half of these patients underwent major surgery, 77% of whom survived to discharge. Non-surgical ICU patients had a 66% rate of survival to discharge, compared to 97.6% for hospital inpatients overall.

Internal medicine, pediatric, family medicine, and anesthesia physicians staffed the unit, with consultation from specialty services upon request. Kenyan medical and nursing trainees also participated in clinical care. Nurse-to-patient ratios in the ICU were 3:5, compared to 1:12 in the wards.

ICU physicians and surgeon managers focused on training and maintaining reasonable costs. Doctors also learned to make tradeoffs between optimal care and reasonable costs—a practice unfamiliar to most expatriates. “We cannot charge a lot for our patients, even though we give quality care. We have to consider and balance whatever things we do. We can’t check blood gases or do invasive blood pressure monitoring or dialysis. Those are things you would want to do if you had the option,” said Lilian Kinyanjui, the ICU nurse-in-charge. The ICU used less expensive means of monitoring patients, such as pulse oximetry or non-invasive blood pressure monitoring. Interventions such as rapid fluid resuscitation, early antibiotics, and patient monitoring were relatively inexpensive and still provided significant benefit.

ICU services, especially mechanical ventilation, were in high demand. Only three ventilators were available, and some patients were ventilator-dependent for protracted periods. Hospital leadership established a committee to review the literature and Kijabe’s data and provide guidance on ventilator use. High-dependency units were also established as an intermediate level of care, with nurse-to-patient ratios less than in the ICU, but greater than on the wards ratios.

Education and Training

Hospital leadership saw the development of competent, compassionate providers for rural Kenya and other remote areas as furthering the work of God. Kijabe Hospital developed a multi-layered medical education program—undergraduate electives and internships, postgraduate medical training, nursing training, professional development, and research. Many expats served as teachers.

The KRNA training program, started in 2006, was the only one in Kenya and trained 15 students per year. Hospital leadership noted that providing nurse anaesthetist training allowed for a fourfold increase in surgical caseload. The majority of Kijabe-trained KRNAS worked in rural areas of Kenya.

Kijabe-trained ICU nurses were frequently recruited to private ICUs in Nairobi that paid more. For example, of the 30 nurses who participated in an intensive two-month course when the ICU opened, only five remained at the hospital one year later. Some faculty found it difficult to work with a constantly changing group of nursing staff, while others believed that it was a natural consequence of teaching quality and compassionate care.

Since July 1, 2008, Kijabe had offered an accredited surgery residency funded by the Pan-African Academy of Christian Surgeons (PAACS). Dr. Rich Davis, surgery residency program director at Kijabe, explained:

PAACS’s goal is to choose people who would be missionaries to their own countries and voluntarily not go open a boutique plastic surgery practice in Nairobi. Probably the best way to get people like that is to ... look for people who are committed to their faith and committed to serving people who don’t have access to care otherwise. A lot of PAACS graduates are working in areas that wouldn’t otherwise have access to a surgeon, so it seems to be working.

Depending on PAACS funding and housing availability, Davis aimed to take one resident per year. He added basic orthopedic and urologic surgical care to the US surgical residency to train highly competent “African surgeons” who would be well equipped to deliver essential surgical care anywhere. Surgery and neurosurgery residents from domestic and international programs rotated at Kijabe Hospital.

Kijabe launched East Africa’s first fellowship program in pediatric surgery in 2007 as well as East Africa’s only pediatric neurosurgery sub-specialization training (see
textbook on the topic and had visited Kijabe Hospital annually since 2001 on short-term mission trips, said:

“I think even after we leave, there will be neurosurgery residents, fellows, and some staff that will continue to come. It’s a phenomenal opportunity. You see things you would never see in the US. In the US, I saw three children with frontonasal encephaloceles, which is a hole in the skull with brain coming out through the face. Here we do probably 15 a year.”

Kijabe welcomed visiting residents of other specialties from national and international hospitals as well.

*Kijabe Hospital under Muchendu*

In 2010, Mary Muchendu, who had been the principal of the nursing school for 10 years, was appointed the hospital’s CEO. Being a local person with a lot of experience made her particularly well suited to navigate the politics. She brought a new approach. She explained:

“Mission hospitals are not really known to be business-minded. We say, in Kiswahili, ‘Shauri ya Mungu,’ meaning, ‘It’s God’s will.’ You don’t want to push further, you want to leave it to God, and then you find you lose supplies, and you lose equipment. You’re not maximizing resources. I found it quite a challenge to turn ‘Shauri ya Mungu’ into, ‘You’re responsible for supplies; you have to use it well, and have strict financial management so that you minimize financial risks.’

**Operating Theater Expansion**

Kijabe Hospital’s surgical capacity and tertiary care services were commensurate with the level six national referral centers (see Exhibit 7 for patient demographics and surgical specialties). Total operating theatre load had grown annually, from 4099 in 2003 to 9150 in 2009 (see Exhibit 8 for operating theatre case load). Newton, along with Dr. Peter Bird, a surgeon from Australia, had been advocating to expand operating theatre capacity since the mid-2000s to meet demand. They convinced the hospital leadership that surgery should be prioritized and approached large organizations, the Australian government, and individual donors to raise money.

Simultaneously, the hospital leadership worked to develop a long-term plan to meet “the needs within the organization.” Expanding the operating theatres would be the first stage of their 10-year plan—a milestone on an otherwise long race…to achieving the broader ministry—that also included expansion of training programs, more disciplined management of finances, and several major infrastructure improvements that would secure Kijabe’s longevity."

The three new OTs opened in 2010. Mary Njenga, a newly appointed operating theater manager, enforced strict sterile practices, and, with the input of surgeons, rearranged the OT space to force everyone to pass

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**Exhibit 6: Postgraduate Training at AIC Kijabe Hospital**

**General Surgery**
- A 5-year residency program accredited by the PanAfrican Association of Christian Surgeons, the Loma Linda University (USA) and by the College of Surgeons of East, Central and Southern Africa (COSECSA)
- A one-month resident rotation site under MOU with Vanderbilt University Medical Center (USA).
- Orthopedic surgery – 5-year registrar training (in partnership with AIC Cure Hospital) accredited by the College of Surgeons of East, Central and Southern Africa (COSECSA).

**Family Medicine**
- The Family Medicine program will be administered by the Kabarak University, with new students set to enroll for the 2014-15 academic year.
- 1 month resident-level internal medicine training rotation site under MoU with Swedish Hospital Family Practice training Program (USA).

**Pediatric Surgery**
- 3-year fellowship level training Programme in Pediatric Surgery (PAACS and COSECSA accredited)
- Accredited 3-month rotation site in Pediatric Surgery for the PAACS General Surgery Registrar Programme (for PAACS trainees from outside Kenya);

**Pediatric Neurosurgery**
- 1-year fellowship level training Programme in Pediatric Neurosurgery. The fellowship is being accredited by the University of Nairobi. (FPNS (UoN)
- 1 month resident-level training rotation site under MOU with University of Nairobi

**ENT Surgery**
- 1 month resident-level training rotation site under MOU with University of Nairobi

**Anesthesia**
- 1-month rotation for anesthesia registrars under MOU with University of Nairobi.
- 1-month resident-level anesthesia training rotation site under MOU with Vanderbilt University Medical School (USA).
- Founding partner in the East Africa Pediatric Anesthesia Fellowship with Kenyatta National Hospital and Gertrudes Children’s Hospital (Nairobi).

**Internal Medicine**
- 1 month resident-level internal medicine training rotation site under MOU with University of Texas Medical Branch (USA)

Source: AIC Kijabe Hospital Grant Proposal, 2012

---
through a changing room. She also implemented an inventory accounting system. Njenga noted:

This theater had run for 30 years without any control measures, even the billing system. [There was] no accountability. They used to just let everything go. I thought, ‘It’s time for the team to take up the duty and own up the department.’ .... I lead the way, and they follow. It’s better that way for the group, because in [the operating] theater, you have to make it as a team.

Each item was documented in a proprietary electronic inventory tracking software and in a patient’s record, used for billing. Initially, almost everyone complained about the system, but Bird and Newton supported Njenga. “I would explain the vision, and they would back me up,” Njenga noted. The new system was estimated to increase the theatre profitability from USD 35000 to USD 117000 per month by reducing waste and inefficiency.

The team began using a modified WHO Surgical Safety Checklist that confirmed patient identity, vital signs, allergies, lab values, and proper preparation for surgery (patient had not eaten, etc.) prior to each procedure. Inventory of surgical supplies, such as gauzes, sponges, and needles were performed at pre- and post-surgery “time-outs.” Each patient had anesthesia records that included trends in vital signs, medications given, and fluid status (urine output, blood transfusions, etc.). In the immediate post-operative period, a nurse monitored patients every 15 minutes until patients were deemed stable to move to the surgical ward.

The efficiency of case scheduling improved as well. The operating theatre staff maximized patient flow and rearranged cases if patients cancelled. Non-emergent cases were typically scheduled within one week, and emergent cases were addressed after the operating theatre nurse manager, emergency department, and surgeons coordinated.

Despite these improvements, inefficiencies remained. Slow bed turnover was still a problem; sometimes over a dozen patients medically ready for discharge remained on the floor because they lacked funds to pay. These occupied beds made it difficult to complete the daily surgeries, and admission wait times could span two days.

The number of surgical procedures performed annually decreased dramatically in 2010. Total caseload increased in 2011 and then decreased again thereafter annually. This was due, in part, to more complex cases being referred, the more detailed cost accounting that led to rising fees, as well as the increased amount of time spent per case on teaching the growing number of trainees. “Increased theaters gave us more time to teach. The expansion of theaters coincides with the expansion of training programs. Having more theaters means much less pressure to get cases done and now trainees get to do cases, and they take twice as long.” said Bird.

From 2007–2012, Kijabe Hospital hosted 131 medical students, including 66 from the US. The first surgical resident to graduate from Kijabe’s program earned the highest graduating test scores among all African surgeons and joined Kijabe Hospital Department of Surgery as a consultant in 2012. The nurse anesthetist program was doubling every 12–18 months.

### Workforce

The new operating theatres accommodated more surgical faculty. By 2011, Kijabe Hospital surgical services included: general surgery, pediatric surgery, pediatric neurosurgery, ENT surgery, obstetrics and gynecology, plastic surgery, and anesthesia (see Exhibit 9 for the surgical facilities at...
AIC Kijabe Hospital). Post-operative care took place in all of the seven wards: male adult, female adult, pediatrics, maternity, nursery, private and ICU.

Total staff costs were USD 3.4 million in 2011 (see Exhibit 10 for AIC Kijabe Hospital financial statements including staff costs by year). A total of 634 personnel— including 194 nurses, 32 fully trained foreign and national physicians with expertise in a wide range of medical and surgical sub-specialties, and 21 doctors in training—staffed the hospital and outpatient clinics in 2013 (see Exhibit 11 for hospital staff data). Staff salaries were not competitive with the private or government sectors. Kijabe Hospital paid medical officers about USD 1750 per month while government hospitals offered USD 2340. Consultants made a third of what they would make outside Kijabe. “That’s why our consultants represent the highest level of commitment. Compared to what they would make out there, they have the highest level of sacrifice,” said Thiongo.

Pediatric neurosurgeon Albright and his wife “felt God leading us to come here to do and teach pediatric neurosurgery full time. So we did. We arrived September 1, 2010.” Kijabe soon became one of the highest volume pediatric neurosurgical centers in the world. “We did 1326 cases in 2011, and about the same in 2012—and this is two of us, me and a fellow. Nobody that I know of does anything like that. We see more spina bifida than any place in the world, about one a day. Most large children’s hospitals in the States may see 20–25 cases per year,” said Albright.

“Of all the places I have been in this country, I would rate us above the national referral hospitals,” said Dr. Alfred Osoti, the obstetrics and gynecology department chair. “It makes you feel as an obstetrician you are making a difference.” The hospital was one of few outside Nairobi that could ventilate babies and give surfactant to assist with the lung function in premature infants, with access to the operating theatres.

When pediatric surgeon, Dr. Erik Hansen, who had also worked at Vanderbilt, joined the staff in 2010, an academic partnership was further strengthened between Kijabe Hospital and Vanderbilt University. Several other university partnerships followed. Between 2009 and 2013 the number of surgeons grew from 9 to 17 and specialities from 5 to 8 (see Exhibit 7 for a list of permanent surgeons and specialities).

The human resources group organized free hot tea delivery twice daily to every department, extracurricular sports teams, and team-building retreats. Surgical department retreats included everyone from surgeons to nurses to ancillary. The hospital held an all-staff chapel twice weekly. On those days, the operating theatre opened later. The chaplaincy organized an evangelism course for staff, as well as small group Bible studies. Each medical training program included Biblical training. The increased staff welfare initiatives were thought to be responsible for the large reduction in staff turnover, from
over 14% in 2008 to less than 8% in 2012 (see Exhibit 12 for graph of staff turnover over time).

Financing and Donations
Clinical and administrative staff often helped raise funds for their capital projects. Significant funding came from churches and individuals who believed in Kijabe’s mission. “When we needed an ICU built, a Christian church was contacted in the US where some of the long term missionaries had contacts, and they decided as a church that they would raise these funds, USD 30,000+ at their Christmas offering weekend,” said Newton.

Director of Finance Sam Mwarua noted from 2010 to 2011, Kijabe’s expenditures grew 18% from USD 7.4 million to USD 8.7 million, and its income rose from USD 7.5 million to USD 8.8 million (see Exhibit 10 for AIC Kijabe Hospital financial statements). Muchendu explained they were able to save USD 620,000 in operations “by just tightening the way we did our bills and expenditures and procurement.”

Of Kijabe Hospital’s revenue in 2011, 82% came from patient care, including USD 8.8 million from the department of surgery. With more administrative staff and more cost accounting, the charges to patients were going up. “The simpler cases don’t necessarily come to Kijabe anymore because our prices are higher. It’s been a double-edged sword, because we can’t manage the poorer patients but we can keep the hospital afloat,” said Bird.

Having volunteer missionary staff reduced the doctor’s fee. “Here, the hospital might charge USD 600, and the doctor’s fee may be less than USD 50. If you go to a private hospital in Nairobi, doctors’ fees might be equivalent to or higher than what they pay the hospital,” described one physician.

The poorest patients received free care, thanks to hospital funds and community fundraising efforts. The hospital discharge planner determined who received free care based on interviews with the family and the chief of the patient’s community. The hospital also began posting patients’—particularly children’s—stories and pictures to a website called Watsi.org. Donors could sponsor individual patients, and their gifts were deducted on the patients’ bill.

Patients enrolled in the National Hospital Insurance Fund (NHIF) were responsible for the cost of ICU care, which was not covered by the plan, as well as many surgical procedures. Records since 2010 showed unpaid debt and direct bill write-offs cost the hospital USD 60,000-80,000 annually, and were expected to rise as a proportion of overall revenue.

Infrastructure
Over decades, the expanding patient population and smaller capital upgrades increased stress on Kijabe’s basic facilities, including water, electricity, and waste management systems, last upgraded in 1978 (see Exhibit 13 for the existing buildings and 10-year

<table>
<thead>
<tr>
<th>Income</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
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<tbody>
<tr>
<td>Patient revenue</td>
<td>5,919,858</td>
<td>7,166,118</td>
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<tr>
<td>Donated Staff Services</td>
<td>117,968</td>
<td>119,363</td>
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<tr>
<td>Income</td>
<td>319,790</td>
<td>383,244</td>
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<td>Other Income</td>
<td>6,286,434</td>
<td>7,411,616</td>
<td>8,739,804</td>
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<tr>
<td>Expenditure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff costs</td>
<td>(2,691,816)</td>
<td>(3,390,861)</td>
<td></td>
</tr>
<tr>
<td>Supplies</td>
<td>(1,833,678)</td>
<td>(1,959,306)</td>
<td></td>
</tr>
<tr>
<td>Donated staff services</td>
<td>(1,171,968)</td>
<td>(1,190,353)</td>
<td></td>
</tr>
<tr>
<td>Administrative expenses</td>
<td>(533,867)</td>
<td>(785,129)</td>
<td></td>
</tr>
<tr>
<td>Establishment expenses</td>
<td>(429,008)</td>
<td>(624,297)</td>
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<tr>
<td>Other operating expenses</td>
<td>(648,785)</td>
<td>(671,304)</td>
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</tr>
<tr>
<td>Total expenditure</td>
<td>(6,267,404)</td>
<td>(7,309,123)</td>
<td>(8,621,260)</td>
</tr>
<tr>
<td>Surplus/ Deficit</td>
<td>19,030</td>
<td>102,493</td>
<td>118,545</td>
</tr>
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</table>

Source: AIC Kijabe Hospital Office of the Finance Director, 2013.

Exhibit 10: AIC Kijabe Hospital Financial Statements 2009-11 (USD)

<table>
<thead>
<tr>
<th>Staff</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin Staff</td>
<td>90</td>
<td>13.6</td>
</tr>
<tr>
<td>Health Care Professionals</td>
<td>378</td>
<td>55</td>
</tr>
<tr>
<td>Support Staff</td>
<td>215</td>
<td>31.4</td>
</tr>
<tr>
<td>Total</td>
<td>683</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: AIC Kijabe Hospital Office of the Finance Director, 2013.

Exhibit 11: AIC Kijabe Hospital Staff, Skills, and Training

Exhibit 12: Staff Turnover at Kijabe Hospital
Source: AIC Kijabe Hospital Office of the Finance Director, 2013.
Muchendu was given “a ship growing so quickly it could implode,” Medical Director Dr. Steve Letchford explained. Sewage breakdown ponds overflowed into surrounding communities, hospital-wide blackouts occurred sporadically, water shortages were common, and human waste was burned in open areas.

Collins Muiruri, trained in mechanical engineering and business in the US, had been appointed head of hospital engineering and facilities in 2010. “In mission hospitals, sometimes the doctors are doing everything from finance to projects to HR. That just creates a nightmare foundation,” he said. “We had to change that.”

A missionary group from Engineering Ministries International visited Kijabe in February 2010. The 24 civil and mechanical engineers worked with Kijabe’s staff to identify areas of need. The hospital soon installed a diesel generator for back-up power and a stable electric current, a water purification system, oxygen concentrating systems, a vacuum plant which allowed wall suction units in the wards and operating theatres, a medical gas storage building, and a human waste incinerator. In-country wholesalers familiar with Kijabe’s outstanding reputation offered flexible financing to make the upgrades possible.

Kijabe Hospital went from losing power 7–10 times per day to having a world-class electric system. “We did this to send a message that we can be a mission hospital but still have the best. Right now, we have one of the best power systems in East Africa,” said Muiruri.

Decisions

Plans were underway to create a neonatal ICU, expand the men’s and women’s wards, and add isolation rooms. There were plans to increase OT locker and storage space, add three more OTs (for a total of 12), add two neonatal resuscitation rooms, expand the central sterilizing department, add office space, and connect the operating theaters to labs and pathology.

Mary Muchendu and the rest of the hospital leadership were aware of the funding limitations they faced. In 2013, Muchendu considered offering outpatients the opportunity to pay a premium for greater convenience such as shorter wait times, improved amenities such as private rooms, and improved customer service. Revenue generated from these premiums could then be funneled back to the hospital. Some were concerned about “pursuing sustainability over care for the poor or education…Often the progression of faith based organizations designed for the poor is that if they stay in business, they become centers of excellence for the rich,” Letchford explained.

The leadership considered what would truly allow the surgeons to maximize their impact in both the short and the long term. How did their focus on expensive surgical care, training, and OT expansion align with their mission to serve the vulnerable? Could a hospital in Africa serve the poor and simultaneously provide high quality service and education without western volunteers, supplies, and equipment?
References
From 2008 to 2012, Dr. Nicholas Muraguri, head of Kenya’s National AIDS and Sexually Transmitted Infections Control Programme, had been working hard to promote male circumcision in Kenya. As part of the national HIV/AIDS strategic plan, Kenya’s goal had been to circumcise 80% of consenting uncircumcised men aged 15–49 by July 2013. Officials believed performing these 860,000 circumcisions could avert an estimated 900,000 infections over 20 years. Nyanza province, which had the highest HIV prevalence and lowest male circumcision prevalence in the country, was one of four targeted provinces and was expected to perform 426,500 circumcisions.

Over 395,500 men and boys, most of whom were from Nyanza, had been circumcised by mid-2012. Campaign implementers in Nyanza offered ongoing circumcision services in various delivery settings as well as an annual intensive 30-day Rapid Results Initiative (RRI), each of which resulted in over 30,000 circumcisions. Nyanza had increased the total percent of men circumcised by 18%. As national scale-up progressed, the country looked at Nyanza. One implementing director in Nairobi commented, “We borrowed lessons learned in Nyanza...however, we also recognize that each place is unique and requires different approaches to service delivery.”

Overview of the Republic of Kenya
The Republic of Kenya is composed of eight provinces, and is located in Eastern Africa (see Exhibit 1 for map). In 2012, 76% of Kenyans lived in rural areas, and approximately 43.4% of all Kenyans lived below the national poverty line (see Exhibit 2 showing basic socioeconomic and demographic indicators). Of over 70 ethnic groups in Kenya, the Kikuyu (22%), the Luhya (14%), and the Luo (13%) were the largest. The majority of Kenyans were Christian.

In December 2007, Mwai Kibaki was elected President for a second term after defeating Raila Odinga in a highly controversial election. Amid allegations of corruption, riots across the country led to deaths and over 600,000 internally displaced persons. In 2008 the United Nations Secretary Kofi Annan mediated a power-sharing agreement. Kibaki served as president and Odinga as prime minister—a newly created position.

Health in Kenya and Nyanza Province
In 2006, HIV/AIDS was the third leading cause of death in Kenya (see Exhibit 3 for table of key indicators). Among health facilities, 41% were public, 43% were private for-profit, and 14% were nonprofit (see Exhibit 4 for number of facilities). Acute and chronic disease management was free, though the government recognized that the public health infrastructure often fell short of its mandate without external assistance.
In Nyanza, the majority of public hospitals were understaffed and underequipped given the province’s more than 5 million people, including 1-2 million males aged 15–49. Non-circumcising groups, sought male circumcision from the health system. Many Kenyans, including those from non-circumcising groups, sought male circumcision from the health system. Many Kenyans, including those from non-circumcising groups, sought male circumcision from the health system. Prior to 2008, the cost of medical circumcision—USD 6–12—was prohibitive for many.

Non-circumcising groups faced stigma and included the Turkana, the Luo, and the Teso. Most of Kenya’s powerful political leaders came from circumcising ethnic groups, and circumcision status was often made public during elections. Nyanza Province had the country’s lowest circumcision prevalence, at 46.7% overall in 2007, with some primarily Luo districts at 17%.

HIV/AIDS in Kenya

The first official case of HIV/AIDS was reported in Kenya in 1984. By 2008, almost 7% of Kenyans aged 15–64 (1-4 million Kenyans) were HIV positive. Kenyan women were more likely to be infected with HIV (8-4%) than men (5-4%) (see Exhibit 6 for HIV prevalence by age). Transmission occurred most frequently through vaginal intercourse between casual heterosexual partners (accounting for 41% of cases; see Exhibit 7 for incident HIV infections by mode of transmission) in 2009. A majority of cases; see Exhibit 7 for HIV prevalence by age. Transmission occurred most frequently through vaginal intercourse between casual heterosexual partners. 

Transmission occurred most frequently through vaginal intercourse between casual heterosexual partners (accounting for 41% of cases) and within a month the World Health Organization (WHO) and the Joint United Nations Educational, Scientific, and Cultural Organization (UNESCO). 

Male Circumcision in Kenya

The majority of adult males in Kenya were circumcised in 2012, with a national prevalence of 91-2% (see Exhibit 5 for circumcision prevalence by province). Long before medical benefits were known, most ethnic groups in Kenya practiced male circumcision as a rite of passage. Traditional, non-professionally trained circumcision providers performed 10% of all circumcisions in 2008.

Prior to 2008, the cost of medical circumcision—USD 6–12—was prohibitive for many. Male circumcision in Kenya had a higher rate of adverse events than those performed by the health system. Many Kenyans, including those from non-circumcising groups, sought male circumcision from the health system. Many Kenyans, including those from non-circumcising groups, sought male circumcision from the health system. Prior to 2008, the cost of medical circumcision—USD 6–12—was prohibitive for many.

Non-circumcising groups faced stigma and included the Turkana, the Luo, and the Teso. Most of Kenya’s powerful political leaders came from circumcising ethnic groups, and circumcision status was often made public during elections. Nyanza Province had the country’s lowest circumcision prevalence, at 46.7% overall in 2007, with some primarily Luo districts at 17%.

Voluntary Medical Male Circumcision for HIV Prevention

The first suggestion that male circumcision had a protective effect against HIV was in 1986. In 2000, a cohort study in Rakai, Uganda, confirmed this for men. In 2006, data from a randomized control trial involving 18–24 year old males in Orange Farm, South Africa showed a statistically significant 60% reduction in risk of female-to-male transmission among those circumcised. Interim data from two other trials also showed over 50% protective effect that year. In February 2007 the final results of the trials were published in The Lancet, and within a month the World Health Organization (WHO) and the Joint United Nations

Exhibit 2: Basic Socioeconomic and Demographic Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average life expectancy at birth (total/female/male [years])</td>
<td>61.1/63/59 2012</td>
</tr>
<tr>
<td>Maternal mortality ratio (per 100 000 live births)</td>
<td>360 2012</td>
</tr>
<tr>
<td>Under-five mortality rate (per 1000 live births)</td>
<td>73 2012</td>
</tr>
<tr>
<td>Infant mortality rate (per 1000 live births)</td>
<td>49 2012</td>
</tr>
<tr>
<td>Vaccination rates (% of DTP3 coverage)</td>
<td>88 2011</td>
</tr>
<tr>
<td>Undernourished (%)</td>
<td>26 2012</td>
</tr>
<tr>
<td>Adult (15–49 years) HIV prevalence (%)</td>
<td>6.1 2012</td>
</tr>
<tr>
<td>HIV antiretroviral therapy coverage (%)</td>
<td>73 2012</td>
</tr>
<tr>
<td>Tuberculosis prevalence (per 100 000)</td>
<td>272 2012</td>
</tr>
<tr>
<td>DOTs coverage (%)</td>
<td>100 2012</td>
</tr>
<tr>
<td>Malnourished cases (per 1000)</td>
<td>82 2012</td>
</tr>
<tr>
<td>Expenditure on health as a % GDP expenditure</td>
<td>4.5 2012</td>
</tr>
<tr>
<td>Government expenditure on health as a % of total government expenditure</td>
<td>5.9 2012</td>
</tr>
<tr>
<td>Annual government expenditure on health per capita (international dollar/USD)</td>
<td>39/17 2012</td>
</tr>
<tr>
<td>Total annual health expenditure per capita (international dollar/USD)</td>
<td>84/45 2012</td>
</tr>
<tr>
<td>Physician density (per 10 000)</td>
<td>1 8 2011</td>
</tr>
<tr>
<td>Nursing and midwifery density (per 10 000)</td>
<td>8 2011</td>
</tr>
<tr>
<td>Number of hospital beds (per 10 000)</td>
<td>14 2010</td>
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</table>

Teaching Case

### Exhibit: Health Facilities, National and Nyanza Province

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>National</th>
<th>Nyanza</th>
</tr>
</thead>
<tbody>
<tr>
<td>dispensaries/health centres</td>
<td>5744</td>
<td>630</td>
</tr>
<tr>
<td>district general hospitals</td>
<td>432</td>
<td>84</td>
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<tr>
<td>provincial hospitals</td>
<td>107</td>
<td>2</td>
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<tr>
<td>national referral hospitals</td>
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### Exhibit: HIV Prevalence by Age Group, 2007

<table>
<thead>
<tr>
<th>Age Group (years)</th>
<th>National</th>
<th>Total number tested</th>
<th>HIV-infected</th>
<th>National</th>
<th>Total number tested</th>
<th>HIV-infected</th>
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<tr>
<td>15–19</td>
<td>3.5</td>
<td>1328</td>
<td>10</td>
<td>1375</td>
<td>2.3</td>
<td>2503</td>
</tr>
<tr>
<td>20–24</td>
<td>7.4</td>
<td>1598</td>
<td>1.9</td>
<td>1634</td>
<td>5.2</td>
<td>2622</td>
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<td>25–29</td>
<td>10.2</td>
<td>1345</td>
<td>7.3</td>
<td>1874</td>
<td>9.1</td>
<td>2219</td>
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<td>30–34</td>
<td>13.3</td>
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<td>8.9</td>
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<td>45–49</td>
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<td>732</td>
<td>5.6</td>
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<td>50–54</td>
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<td>519</td>
<td>8.3</td>
<td>425</td>
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<td>944</td>
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<td>55–59</td>
<td>4.7</td>
<td>425</td>
<td>2.3</td>
<td>380</td>
<td>3.6</td>
<td>805</td>
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<td>60–64</td>
<td>4.7</td>
<td>256</td>
<td>3.4</td>
<td>341</td>
<td>2.7</td>
<td>587</td>
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### Exhibit: HIV and Male Circumcision Prevalence by Province

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<tr>
<th>Province</th>
<th>HIV (2007)</th>
<th>Circumcision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nyanza (Luo in Nyanza)</td>
<td>15.3% (22%)</td>
<td>48.2% (12%)</td>
</tr>
<tr>
<td>Nairobi</td>
<td>9.0%</td>
<td>83.2%</td>
</tr>
<tr>
<td>Western</td>
<td>5.1%</td>
<td>87.8%</td>
</tr>
<tr>
<td>Rift Valley</td>
<td>7.0%</td>
<td>88.7%</td>
</tr>
<tr>
<td>Central</td>
<td>3.8%</td>
<td>95.5%</td>
</tr>
<tr>
<td>North Eastern</td>
<td>1.0%</td>
<td>97.3%</td>
</tr>
<tr>
<td>Eastern</td>
<td>4.7%</td>
<td>96.3%</td>
</tr>
<tr>
<td>Coast</td>
<td>7.9%</td>
<td>97.0%</td>
</tr>
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</table>

### Exhibit: HIV Prevalence by Age Group, 2007

<table>
<thead>
<tr>
<th>Age Group (years)</th>
<th>National</th>
<th>Total number tested</th>
<th>HIV-infected</th>
<th>National</th>
<th>Total number tested</th>
<th>HIV-infected</th>
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</thead>
<tbody>
<tr>
<td>15–24</td>
<td>3.5</td>
<td>2926</td>
<td>1.4</td>
<td>2299</td>
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<td>25–29</td>
<td>8.8</td>
<td>7849</td>
<td>5.5</td>
<td>5658</td>
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<td>30–34</td>
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<td>1200</td>
<td>4.7</td>
<td>1146</td>
<td>5.0</td>
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<tr>
<td>Total (15–64)</td>
<td>8.4</td>
<td>9049</td>
<td>5.4</td>
<td>6804</td>
<td>7.1</td>
<td>15833</td>
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</tbody>
</table>


Programme on AIDS (UNAIDS) issued guidance endorsing male circumcision accompanied by HIV counseling and testing, sexually transmitted disease treatment, safe sex promotion, and condom provision for HIV prevention. They advised countries with heterosexually driven, generalized HIV epidemics and low male circumcision rates to “scale up with urgency.” While UNAIDS recommended targeting men aged 12–30, another study found targeting men older than 30 might initially be the most cost-effective.12

The Kenyan government convened the first official male circumcision stakeholder meeting in September 2006, aiming to rapidly scale up existing male circumcision services.8,13 In October 2009, the government formally released the Kenya National Strategy for Voluntary Medical Male Circumcision. The aim was to increase the proportion of men ages 15–49 years who were circumcised in Kenya from 84% to 94% by 2013. The campaign prioritized provinces where circumcision rates were low and HIV rates were high, including Nyanza, Western, Rift Valley, and Nairobi.12

The following month, the third Kenyan National AIDS Strategic Plan 2009–2013 was released. It aimed to reduce the incidence of HIV infection by 50% and AIDS-related deaths by 25%. Of the USD 3·56 billion budgeted for the plan, about 19-5% was allocated to prevention.11 A large proportion (60-7%) of total government health spending was going to HIV/AIDS-related costs; so the plan aimed to ensure investments paid off. The plan stated, “The most cost-effective intervention, at about USD 225 per case averted, is that of VMMC for men in rural Nyanza aged 25 to 49 years.”11 All interventions were expected to cost less than USD 4000 per infection averted.11 The VMMC program comprised 1-6% of total AIDS funding in the 2009–2013 strategic plan.12 Kenya would be the first country in sub-Saharan Africa to roll out a national male circumcision program for HIV prevention.

### Voluntary Medical Male Circumcision in Kenya

Ministry of Health (MOH) leadership reached out to Luo community leaders to discuss the plan, and community engagement began in April 2007. Dr. Nicholas Muraguri, director of health promotion at the time, explained, “We took a very aggressive publicity approach. We wanted the message to be clear...that [male circumcision] was a medical intervention, not a cultural expectation.”

In the fall of 2007, the MOH named the National AIDS Control Council responsible for the national circumcision agenda and created the National Male Circumcision Task Force to ensure that male circumcision efforts aligned with national health system strengthening goals; that messaging regarding the 60% protective effect of VMMC was consistent; and to oversee training, monitoring and evaluation, development of program tools, and quality control.6

Muraguri became head of Kenya’s National AIDS and sexually transmitted infections control programme in July 2008 and prioritized the VMMC campaign. “It was the first thing we had that was going to be cost-effective and give us returns in a short time," he said. Prime Minister Raila Odinga, a Luo and Nyanza native, promoted male circumcision as well.

Many saw an opportunity to increase service utilization. Muraguri explained: “We know women...have a lot of
contact with the health system. But for men, the opportunities are rare. We see [VMMC] as an opportunity to address that gap.” The national program launched officially in November 2008. “Speed matters,” Muraguri said, “It was an emergency...and the ‘building blocks’... had been assembled.”

**External Support for Male Circumcision**

The total cost for the VMMC campaign over five years was estimated at USD 76·5 million (see Exhibit 8 for estimated program costs); around USD 7·3 million would go toward infrastructure, primarily in public facilities. The setup costs for each delivery site were estimated to be USD 12,000. Assuming no more than a 5% adverse event rate, USD 33·2 million was budgeted for complications. Cost per client was expected to decline over time, from USD 143 to USD 65; consumables were USD 15 per procedure in private sites and USD 22·50 in government facilities.

PEPFAR, the male circumcision implementation funder, channeled money to 11 sub-grantees and US agencies in Kenya through USAID and the CDC. In line with its mission to support long-term and equitable growth, including strengthening the health system, USAID incorporated VMMC into its large umbrella program called AIDS, Population, and Health Integrated Assistance (APHIA) II in Nyanza. Four public sector organizations trained providers and paid for locum services. By contrast, the CDC funded four direct grantees to conduct circumcisions, promoting rapid scale-up and innovation to achieve targets. CDC implementers hired dedicated staff and paid government staff as consultants to perform circumcisions.

Beyond direct implementation support, the Bill & Melinda Gates Foundation funded a five-year USD 18·5 million grant to launch a Male Circumcision Consortium in Kenya in 2008 composed of private, research, and academic institutions to support the government in developing a national strategy; expand research, training, health facility capacity, and monitoring; address misunderstandings about male circumcision; conduct its own research, and bring partners together to mobilize resources and work in sync with the MOH. “It’s like the Male Circumcision Consortium is the champion of the catalyst,” one stakeholder explained.

**Male Circumcision in Nyanza Province**

A provincial body—the Provincial Male Circumcision Task Force for Nyanza—coordinated delivery efforts in Nyanza. The Provincial Task Force posted implementers’ data at each meeting and encouraged sharing of resources. Some implementers felt they had an unfair disadvantage, depending on how many eligible men were in their assigned district. “It was the fight for the foreskin, to get as many...as possible,” one campaign leader said.

Though Task Force meetings could be tense due to competition among implementers, implementers ultimately represented their work as a joint effort. As one communications officer shared, “We don’t attribute leadership to any specific partner, but to the government.”

**Implementation Efforts**

**Training**

Teams consisting of a surgeon, a surgical assistant, an infection control officer, and a counselor received training in implementing an adapted version of the WHO/Jhpiego training curriculum in collaboration with the university that had spearheaded the Kenyan clinical trial (see Footnote B for full training guide). The training involved two to three days of classroom instruction followed by six to eight days of practicum in which each trainee observed two circumcisions, assisted with one, performed one with the trainer, and then performed 20 under supervision.

The total cost for training was about USD 6500 per team.

Many sites deployed a “train-the-trainers” model, and a refresher training was offered as needed.

On average, a newly trained provider could complete one circumcision in 25–45 minutes. With more experience, providers’ speed increased and risk of adverse events (most commonly, pain and swelling after the procedure) decreased. After performing 100 or more procedures, some VMMC surgeons completed the procedure in 10–15 minutes.

Newly trained providers were less likely to provide circumcisions in general. “People had too many doubts in their heads,” Muraguri explained. “They weren’t implementing or motivated.” VMMC program leaders observed that coaching and mentorship increased the confidence of those new to the procedure. Training was subsequently done on-site.

**Care Package**

Implementers began offering services in Nyanza in September 2008, prior to the national launch. When a client presented for circumcision, a counselor ensured

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<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td>Injecting drug users (IDUs)</td>
<td>0.28</td>
<td>0.84</td>
<td>0.11</td>
<td>0.30</td>
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<tr>
<td>Partners of IDUs</td>
<td>0.01</td>
<td>0.02</td>
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<td>0.01</td>
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<td>Sex workers (SW)</td>
<td>0.91</td>
<td>1.25</td>
<td>0.75</td>
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<td>SW clients</td>
<td>7.81</td>
<td>10.48</td>
<td>4.04</td>
<td>4.7</td>
<td>0.59</td>
</tr>
<tr>
<td>Partners of SW clients</td>
<td>1.81</td>
<td>1.11</td>
<td>1.81</td>
<td>2.6</td>
<td>1.68</td>
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<tr>
<td>Men who have sex with men (MSM)</td>
<td>0.61</td>
<td>4.49</td>
<td>0.99</td>
<td>3.6</td>
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<td>Female partners of MSM</td>
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<td>0.64</td>
<td>0.05</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>Multiple partnerships (MP)</td>
<td>23.73</td>
<td>18.31</td>
<td>33.96</td>
<td>13.4</td>
<td>31.04</td>
</tr>
<tr>
<td>Partners’ MP (PMP)</td>
<td>21.76</td>
<td>27.74</td>
<td>37.03</td>
<td>20.8</td>
<td>27.45</td>
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<tr>
<td>Mutually monogamous heterosexual sex</td>
<td>42.89</td>
<td>30.14</td>
<td>21.19</td>
<td>49.8</td>
<td>35.15</td>
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<td>Medical injections</td>
<td>0.06</td>
<td>0.55</td>
<td>0.17</td>
<td>0.01</td>
<td>0.04</td>
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<td>Blood transfusions</td>
<td>0</td>
<td>0.24</td>
<td>0.02</td>
<td>0.02</td>
<td>0</td>
</tr>
</tbody>
</table>

**Exhibit 7:** Incident HIV Infections by Mode of Transmission in Five sub-Saharan Africa Countries
Delivery Models

Both USAID and CDC implementers delivered services through “fixed” and “outreach” sites. Fixed sites existed in health facilities that had surgical capabilities, such as regional hospitals and health centers. Outreach sites, such as dispensaries, were set up for temporary services. CDC and USAID Regional hospitals and health centers. Outreach sites, such as dispensaries, were set up for temporary services. CDC and USAID deliverers explained that there was nothing wrong with going to a fixed site, as they said, “We provide surgical facilities, the same equipment and supplies with the view that when we leave, those instruments will stay...[and] be useful to the health system...We’re criticized for not being efficient.”

Implementers generally followed the WHO recommendations that surgical spaces have an operating table, instrument trolleys, and operating lamps or fluorescent lighting, though optimal lighting was not always possible.

Equipment and Supplies

The MOH mandated implementers use a consumables pack (including gauze, needles, scalpel blade, and gloves) and a reusable surgical instrument set for each circumcision (see Exhibit 9 for WHO-recommended VMMC supplies). After use, instruments were decontaminated, sterilized, and repacked.1 As one CDC-funded program officer said, “We provide surgical instruments and supplies with the view that when we leave, those instruments will stay...[and] be useful to the health system...We’re criticized for not being efficient.”

Exhibit B: VMMC Estimated Program Costs, 2009-2013

<table>
<thead>
<tr>
<th>I. Through Mobile Teams</th>
<th>Annual cost year 2</th>
<th>Total cost years 3-4</th>
<th>4-year cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Target numbers of AMCs</td>
<td>160 000</td>
<td>408 000</td>
<td>688 000</td>
</tr>
<tr>
<td><strong>Human resources</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of teams needed</td>
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<td>102</td>
<td></td>
</tr>
<tr>
<td><strong>Breakdown</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Salary &amp; benefits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile team</td>
<td>3 280 000</td>
<td>8 364 000</td>
<td>14 104 000</td>
</tr>
<tr>
<td>2. Surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment &amp; infrastructure</td>
<td>480 000</td>
<td>120 000</td>
<td>1 320 000</td>
</tr>
<tr>
<td>Consumables @ $15/MC</td>
<td>2 400 000</td>
<td>6 120 000</td>
<td>10 320 000</td>
</tr>
<tr>
<td>3. Training costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US $6500 per team</td>
<td>130 000</td>
<td>143 000</td>
<td>520 000</td>
</tr>
<tr>
<td>4. Rural outreach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle @ US $30 000</td>
<td>600 000</td>
<td>600 000</td>
<td>2 400 000</td>
</tr>
<tr>
<td>Petrol &amp; maintenance</td>
<td>800 000</td>
<td>2 040 000</td>
<td>3 440 000</td>
</tr>
<tr>
<td>5. Complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adverse events (5% default)</td>
<td>200 000</td>
<td>1 020 000</td>
<td>1 370 000</td>
</tr>
<tr>
<td><strong>Total Direct Costs (1-4)</strong></td>
<td>7 890 000</td>
<td>18 467 000</td>
<td>33 474 000</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>II. Through Support to Public Health Facilities</th>
<th>Annual cost year 2</th>
<th>Total cost years 3-4</th>
<th>4-year cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target numbers of AMCs</td>
<td>40 000</td>
<td>102 000</td>
<td>172 000</td>
</tr>
<tr>
<td><strong>Facilities upgraded</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitals</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health centers</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Facilities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Human resources</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two teams per facility for 140 facilities</td>
<td>280</td>
<td>0</td>
<td>560</td>
</tr>
<tr>
<td><strong>Breakdown</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Incentives</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>$10 per circ done</td>
<td>1 395 484</td>
<td>2 120 274</td>
<td>4 881 484</td>
</tr>
<tr>
<td>2. Surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment &amp; Infrastructure</td>
<td>3 360 000</td>
<td></td>
<td>6 720 000</td>
</tr>
<tr>
<td>Consumables @ $22.5/MC</td>
<td>900 000</td>
<td>2 295 000</td>
<td>4 972 500</td>
</tr>
<tr>
<td>3. Training costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$6500 per team</td>
<td>1 820 000</td>
<td></td>
<td>3 640 000</td>
</tr>
<tr>
<td>4. Complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adverse events (5% default)</td>
<td>50 500</td>
<td>127 500</td>
<td>235 000</td>
</tr>
<tr>
<td><strong>Total Direct Costs (1-4)</strong></td>
<td>6 530 000</td>
<td>3 442 500</td>
<td>16 165 000</td>
</tr>
</tbody>
</table>

| III. Other costs                               |                    |                     |            |
| Monitoring & evaluation (7.5%)                 | 1 395 484          | 2 120 274           | 4 881 484  |
| Warehousing & distribution (7.5%)              | 1 395 484          | 2 120 274           | 4 881 484  |
| Communication campaign (10%)                  | 1 860 645          | 2 827 032           | 6 508 645  |
| General administration (15%)                  | 2 790 968          | 4 240 548           | 9 762 968  |

| IV. Overall                                     |                    |                     |            |
| **Overall goal**                                |                    |                     |            |
| Target numbers of AMC                           | 200 000            | 510 000             | 860 000    |
| **Human resources**                             |                    |                     |            |
| Overall number of teams                         | 360                | 662                 | 662        |
| **Overall program costs**                      | 21 862 581         | 32 217 629          | 76 475 810 |
| **Overhead per client (national)**              | 109                | 65                  | 89         |

Kenyan policy had originally restricted surgery to medical officers. When the Male Circumcision Consortium found that task-sharing would increase the number of facilities capable of participating in VMMC from 12% to 85%, the government allowed nurses to perform VMMC, starting in June 2009.1,42

USAID-Funded Delivery
APHIA-II Nyanza worked in its assigned districts starting in November 2008 to train public providers to provide circumcisions, however none of the 81 facilities in two key districts was prepared to offer VMMC (see Exhibit 11 for assessment criteria).43 Eight of the 59 public hospitals were able to participate (see Exhibit 12 for facilities meeting criteria).44 All 140 facilities were renovated by 2010.

At capacity, district hospital sites could theoretically support 10–20 procedures per day. In practice, many public providers prioritized contractual responsibilities and acute medical care, which did not include VMMC. “If you have a convulsing child and a person waiting for VMMC, then the VMMC client must wait”, explained one implementer.45 Public providers had a much higher rate of adverse events than those working for CDC-funded projects.46

In addition to the 9 health facilities, public providers also provided VMMC in 11 outreach settings, which saw much greater demand for VMMC. At one site, the team provided 343 circumcisions in one three-week period. Regular outreach was not possible due to workforce shortage, however. Public-sector staff working through APHIA-II performed about 12% of VMMCs in Nyanza. The average cost per USAID-funded VMMC procedure was USD 38–62.44

CDC-Funded Delivery
CDC-funded implementers were free to set up sites anywhere.1 Surgical teams were each expected to provide 12 or more circumcisions per day, and implementers frequently worked late performing circumcisions or holding after-hours meetings to maximize daylight procedure time.46

Mobile services were the most expensive service delivery model to set up. Established in hard-to-reach places, implementers transported staff, tents, water, and generators to the sites. When distance or weather required, they increased staff compensation to account for onsite camping. Mobile sites’ counseling was sometimes done under nearby trees. A 100-square-foot tent with one surgical table could be the operating theater. One officer commented, “When it rains, the tent floods. When it’s sunny, the tent is hot. If it’s dry, the dust...drifts through. But we work with all of this.” A single mobile team with a regular Friday scheduled provided as many as 18 circumcisions per day and maintained an 80% follow-up rate. CDC implementers performed 88% of all procedures in Nyanza.47 The average cost of CDC-funded procedures was USD 44–24.48

Exhibit 9: WHO-Recommended Male Circumcision Equipment and Supplies
“Pre-packs” or “consumables” contained:
- two sizes of latex gloves
- plain and petroleum jelly impregnated gauze
- one scalpel knife handle and two blades
- one 10-millilitre syringe
- one 18- or 21-gauge needle
- chromic gut or vicryl 3-0 and 4-0 sutures with a three-eighths circle reverse
- cutting needle

Surgical packages (reusable) included:
- fine-toothed dissecting forceps
- two straight and two curved artery forceps
- curved Metzenbaum’s scissors
- stitch scissors
- Mayo’s needle holder
- sponge-holding forceps

Other supplies kept on site included:
- surgical masks
- aprons
- lidocaine anesthetic solution
- povidone iodine
- 80 cm x 80 cm “o” drapes with 5 cm holes
- sterile marking pens to mark the line of incision
- emergency medications for anaphylactic reactions
- sterile drapes
- gallipots for antiseptic solution
- instrument trays


Exhibit 10: Mobile Service Delivery Model Images
Group counseling on male circumcision (A). Mobile circumcision counseling site (B). Circumcision being conducted in tented delivery site (C). Source: Nyanza Reproductive Health Society.
Monitoring and Evaluation

Implementers reported data electronically. PEPFAR primarily evaluated implementers on the number of circumcisions performed. By the end of 2009, the MOH adopted VMMC indicators for inclusion in its health and management information system. Providers completed an intake form for each client, with CDC and the APHIA-II sites aggregating their data separately. In 2010, providers called for greater standardization of data.

The Male Circumcision Consortium worked to assess how to improve efforts in Kenya. One analysis found only 38% of sites were equipped for VCT, which could take up to 45 minutes, required a private space, and counselor training. The surgery was taking only 8–45% of total provider time. Provider-initiated counseling and testing did not require additional space or staff. The Male Circumcision Consortium’s recommendation to switch from VTC to provider-initiated counseling and testing increased testing rates to 60% and eventually to 93–6%. Counseling and testing sessions dropped to less than 20 minutes.48 The Male Circumcision Consortium supported research that found after VMMC, most men either did not alter their sexual behaviors. Most described being able to perform more rounds of sex, easier condom use, and fewer cuts on the penis during sex.49

The Rapid Results Initiative

National success hinged on Nyanza’s goal to provide 76,500 circumcisions in the first year, 100,000 in the second, and 125,000 in each of the final two years (see Exhibit 13 for VMMC targets over four years).15 The model predicted that 80% coverage could reduce HIV prevalence in Nyanza by 45–67%, dropping male prevalence from 17% to 10%.4,5,53 USAID estimated that reaching 60% of the target population by 2014 could avert 47,000 infections by 2025, saving USD 247 million in HIV care and treatment costs.51 Programming would use a “high-quality, high-volume” approach. The strategy codified many ongoing activities from Nyanza.11,53

In 2009 when the RRIs began, 50,526 circumcisions had been performed (see Exhibit 14 for circumcisions performed over time), each costing an average of USD 86. Two Nyanza implementers suggested a province-wide campaign, modeled after previous Kenyan immunization campaigns, to reach targets.52 The implementers agreed to pool resources to increase efficiency and reduce costs. The Provincial Task Force oversaw district committees and provided technical oversight, as well as a supervision team with experts on logistics, data management, and waste disposal. All 110 implementing teams used a checklist adapted from the WHO quality-assurance toolkit and aimed to serve 12 clients per day for a total of 30,000 eligible boys and men within 30 working days.52,53 RRIs were held during school holidays, when many return home, and promoted with public outreach.1

NGO personnel worked with MOH and locum staff to train public hospital staff and leverage human resources from different agencies.52–54 Experienced providers partnered with less-experienced providers and served as team leaders to ensure quality.

Initially, two- to three-day supplies of pre-packed reusable surgical kits were distributed to sites a week before the RRI; each partner tracked supplies, allowing districts to forecast needs daily. Since only reusable surgical packs were distributed, basic decontamination was done on site.
and instruments were brought to district autoclaves for sterilization. Unpredicted variation in demand could lead to complex supply and waste management problems despite several vehicles helping with staff and supply distribution. Counseling and screening clients on the eve of surgery and group counseling in high-volume sites increased efficiency during the RRIs.

Over time, RRI implementers began to use two operating tables per team to reduce time between surgeries, used prepackaged supply kits, and delegate tasks to different level providers. In high-volume areas, some clients received counseling the day before surgery so surgeons could start working first thing in the morning. Intentional mobilization and advocacy efforts targeted men 15 and older, particularly those 18–49. In order to increase access, implementers also opened after hours “moonlight” services—sometimes as late as 3 a.m.—at 20 locations. RRIs began to surpass their goals at times by excesses of more than 30%.

Impact
Over the course of the Nyanza implementers’ RRIs, an average of 33,000 circumcisions were performed per 30 days at USD 39 per procedure (see Exhibit 15 for circumcisions per month over time). After the first RRI, the complication rate was under 2%, and most complications resolved completely. Forty-five percent of clients were below age 15 and only 39% consented to on-site HIV counseling and testing, a lower percentage than expected or ineffective health care delivery practice. Case development support was provided in part by The Bill and Melinda Gates Foundation, The Abundance Foundation, and The Harvard Medical School Department of Global Health and Social Medicine. A full length version of this case is available through Harvard Business Publishing or GHDonline.org/cases. © 2013 The President and Fellows of Harvard College. This case is licensed Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported. Visit the Global Health Delivery online communities, GHDonline.org, and join thousands of health care implementers and experts from around the globe in discussion and learning. Case development support was provided in part by The Bill and Melinda Gates Foundation, The Abundance Foundation, The Harvard Medical School Department of Global Health and Social Medicine and the Global Health Delivery Project at Harvard University.

VMMC to other diseases. What could they learn from the VMMC campaign’s success? Were there other surgical procedures that could be performed successfully by mid-level providers? How could the campaign promoting VMMC also increase surgical capacity?

Acknowledgments
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Footnotes

A Male circumcision was believed to be effective in aiding HIV prevention because it removed tissue most susceptible to HIV. The inner mucosal surface of the human foreskin present in uncircumcised men had a high density of HIV target cells. During intercourse, this mucosal surface was exposed to vaginal fluid that could contain HIV, providing an environment conducive to HIV transmission.

B See Manual for Male Circumcision under Local Anaesthesia (http://www.who.int/hiv/pub/malecircumcision/who_mc_local_anaesthesia.pdf)

References


37 Russell L. In it to Save Lives: Scaling up Voluntary Medical Male Circumcision for HIV Prevention for Maximum Public Health Impact. USAID and PEPFAR, 2008.


Medical Circumcision of Adults

Three methods were recommended for adult and adolescent male circumcision for HIV prevention: the forceps-guided, the dorsal slit, and the sleeve resection method. Advantages and disadvantages are summarized in the table below. Though the sleeve resection method was regarded as having the most ideal result, it required the highest level of surgical skill. The dorsal slit was the most widely used procedure by trained surgeons worldwide, but ran the risk of uneven foreskin removal, as there was no guide to ensure a uniform incision since the provider cut free-hand around the circumference of the penis. Finally, the forceps-guided method, the simplest method, was regarded as ideally suited to most resource-limited clinical settings. It was the simplest to teach and perform, and was the method used in Kenya’s VMMC campaign. All recommended adult and adolescent circumcision procedures require knowledge of penile anatomy, training in draping and skin preparation, anesthesia administration, haemostasis, and suturing. Each technique removes a uniform amount of the foreskin sufficient to expose the glans whether the penis is erect or flaccid.

### Appendix A
Male Circumcision

#### The Forceps-Guided Method

To perform a forceps-guided circumcision, surgeons sterilize the skin with iodine and drape the body so that only the penis is exposed. After administering injected anesthesia, surgeons pull back the foreskin to separate any adherions between the foreskin and the glans. Then, surgeons pull the foreskin forward to mark the point at which the foreskin meets the glans as the line of incision. Surgeons clamp the foreskin, evenly holding the foreskin just past the glans. Surgeons use their fingertips to ensure the glans had not been caught in the forceps and was still located before the line of incision. Then, using a scalpel, surgeons cut along the exterior line of the forceps, removing the foreskin. The surgeon retracts the skin on the shaft of the penis to tie off blood vessels as necessary. Surgeons place at least six sutures, then check for any remaining bleeding and dress the wound.

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
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</thead>
<tbody>
<tr>
<td>Dorsal Slit</td>
<td>A surgical assistant is helpful but not required</td>
<td>Requires more surgical skill than forceps-guided method</td>
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<tr>
<td></td>
<td>Widely used by surgeons throughout the world</td>
<td>Small risk of asymmetric result</td>
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<tr>
<td>Forceps Guided</td>
<td>Can be learned by surgeons/surgical assistants who are relatively new to surgery</td>
<td>Cosmetic effect may be less satisfactory</td>
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<tr>
<td></td>
<td>Ideal for use in a clinic with limited resources</td>
<td>Leaves 0.5–1.0 cm of mucosal skin proximal to corona</td>
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<td>Can be done without a surgical assistant</td>
<td>Requires highest level of surgical skill</td>
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<tr>
<td>Sleeve Recession</td>
<td>Better cosmetic results than other two techniques</td>
<td>Better suited to hospital rather than clinic setting</td>
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<td></td>
<td></td>
<td>Requires an assistant</td>
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<td></td>
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<td>More room for surgical error</td>
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Advantages and Disadvantages of Adult Male Circumcision Methods
## Useful Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>APHIA</td>
<td>AIDS, Population, and Health Integrated Assistance</td>
</tr>
<tr>
<td>CDC</td>
<td>US Centers for Disease Control and Prevention</td>
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<tr>
<td>Gates Foundation</td>
<td>The Bill &amp; Melinda Gates Foundation</td>
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<tr>
<td>PEPFAR</td>
<td>US President’s Emergency Fund for HIV and AIDS Relief</td>
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<tr>
<td>PMTCT</td>
<td>prevention of mother-to-child transmission</td>
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<tr>
<td>UNAIDS</td>
<td>The Joint United Nations Programme on AIDS</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>USD</td>
<td>United States’ dollar</td>
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<tr>
<td>VCT</td>
<td>voluntary counseling and testing</td>
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<tr>
<td>VMMC</td>
<td>voluntary medical male circumcision</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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