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WOMEN'S HOSPITAL

Surgery at AIC Kijabe Hospital in Rural Kenya

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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 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 600,000 internally displaced persons.

In June 2008, President Kibaki launched Kenya Vision 2030,¹ 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,² 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%.³ Food insecurity was common (see Exhibit 2 for socioeconomic and demographic indicators).



Exhibit 1: Map of Kenya

Source: Public domain retrieved from University of Texas Libraries.

List of Abbreviations

AIC	African Inland Church
AIDS	acquired immune deficiency syndrome
ACGME	American Council for Graduate Medical Education
COSECSA	College of Surgeons of Eastern, Central, and Southern Africa
DOTS	directly observed therapy, short course
ICU	Intensive Care Unit
KRNA	Kenya Registered Nurse Anesthetist
KEPH	Kenyan Essential Package for Health
MOH	Ministry of Health
NHIF	National Hospital Insurance Fund
OT	operating theater
PAACS	Pan-African Academy of Christian Surgeons
USD	United States dollars
WHO	World Health Organization

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).⁷

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 6,190 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 7,000 people in 2013, including a third of the

Indicator	Measurement	Year
UN Human Development Index ranking	143 out of 187	2011
Population (thousands)	41 610	2011
Urban Population %	22	2010
Drinking water coverage (%)	52	2010
Poverty rate (% living under USD 1.25 per day)	43.4	2012
Gini index	42.5	2008
GDP per capita in PPP (constant 2000 USD)	647	2012
Literacy (total/female/male)	87/84/91	2009

Source: Compiled by case writers using data from the following sources: United Nations (UN), United Nation's Children's Fund (UNICEF), World Bank, and United Nations Educational, Scientific, and Cultural Organization (UNESCO).

Exhibit 2: Kenyan Socioeconomic and Demographic Indicators

Indicator	Measurement	Year
Average life expectancy at birth (total/male/female)	63/65/62	2013
Maternal mortality (per 100,000 live births)	360	2010
Infant mortality (per 1,000 live births)	48	2011
Under-five mortality (per 1,000 live births)	73	2011
Vaccination rate (% of DTP3 coverage)	88	2011
Undernourished (%)	30	2012
Adult (15-49 years) HIV prevalence (per 100,000)	6200	2011
HIV antiretroviral therapy coverage (%)	72	2011
Tuberculosis prevalence (per 100,000)	288	2011
DOTS coverage (%)	100	2012
Malaria cases (per 1,000)	303	2008
Government expenditure on health as % of total government expenditure	7.7	2010
Government expenditure on health per capita (current USD)	36	2010
Total health expenditure per capita (current USD)	37	2010
Physician density (per 10,000)	1.7	2008
Nursing and midwifery density (per 10,000)	1.9	2008
Number of hospital beds (per 10,000)	14	2012

Source: Compiled by case writers using data from the World Bank, UNICEF, WHO, and the Government of Kenya.

Exhibit 3: Kenyan Health System and Epidemiologic Indicators

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

Year(s)	Event(s)
1895	African Inland Mission (AIM) arrives in Kenya with a group of missionaries from Philadelphia (Pennsylvania Bible Institute)
1915	"Theodora Hospital" (later renamed Kijabe Hospital) opened at Kijabe Mission Station
1961	Initial buildings of current campus constructed, 65 bed capacity and small, basic surgery capacity
1968–1970	Creation of a nursing school, dormitory for 48 nursing students constructed
1969	Expansion, 2nd building with a 30 bed maternity unit, 3 private rooms, and 1 operating theater with increased capacity
1970s	African Inland Church becomes independent of AIM
1972	Establishment of a Board of Governors—made Christian medical ministry central to hospital's mission
1977–1980	German National Church doubled bed capacity of Kijabe Hospital (65 beds to 130 beds)
1980	3.5 year community nurse training program begins; new outpatient building opened by former president Moi
1991	2 year dental training program for Kenyan dentists begins in Dental Dept.
1995	Christian Kenyan doctor creates new Intern training program, physician training with the University of Nairobi
1998	Kenya Registered Nurse Anesthetist (KRNA) training started
2004	BethanyKids at Kijabe Hospital opens specialized pediatric surgical center
2007	Kenyan Nursing Council formally recognizes KRNA training
2010	Major Operating Theater (OT) expansion Engineering Ministries International (EMI) creates master plan Electric and waste water systems upgraded
2012	EMI finalizes master plan

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

Exhibit 4: AIC Kijabe Hospital Timeline

(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 Mangenge. Chaplains rounded with medical teams, provided consults, and met with each patient during hospitalization. All visiting staff agreed to and signed an ethical code of conduct upon arrival.

Services

By 1980 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.¹⁰

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.¹⁰

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.¹¹ The majority of Kijabe-trained KRNAs worked in rural areas of Kenya.



Exhibit 5: Administrative Organisational Structure, 2012
Source: Medical Director’s Office, AIC Kijabe Hospital.

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

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 Kaburak 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, 2013.

Exhibit 6 for a list of postgraduate training programs at AIC Kijabe Hospital). Dr. Leland Albright, a renowned pediatric neurosurgeon who had written the seminal

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

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 35 000 to USD 117 000 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

Inpatient Wards			
	Admissions	Discharges	Deaths
ICU	480	--	160
Maternity	3333	3428	4
Nursery	833	1049	29
Pediatric	2686	2719	66
Private	349	352	8
Salome (Women's)	1569	1649	135
Wairegi (Men's)	2109	2160	104
Total	11 039	11 468	457

Outpatient / Clinic	
	Number of Patients
General Outpatient	61 527
Private Outpatient	3058
Surgical	8784
Orthopedic	6284
Diabetic	1798
Gynecology	3136
Casualty	7262
AIDS Relief	5154
BethanyKids	4458

Permanent Surgeons and Specialties 2009, 2013		
	2009	2013
General	3	5
Orthopedic*	2	3
Obstetrics-Gynecology*	1	3
Pediatric	2	1
Pediatric Rehabilitative*	1	
Pediatric Neurology*		1
Plastics*		1
Ophthalmology (Clinical Officer)*		1
Dentistry*		1
Anesthesiology*		1
Total Permanent Surgeons	9	17
Total Specialties*	5	8

Source: AIC Kijabe Hospital Grant Proposal, 2013.

Exhibit 7: Patient Demographic and Surgical Specialties (2011)

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

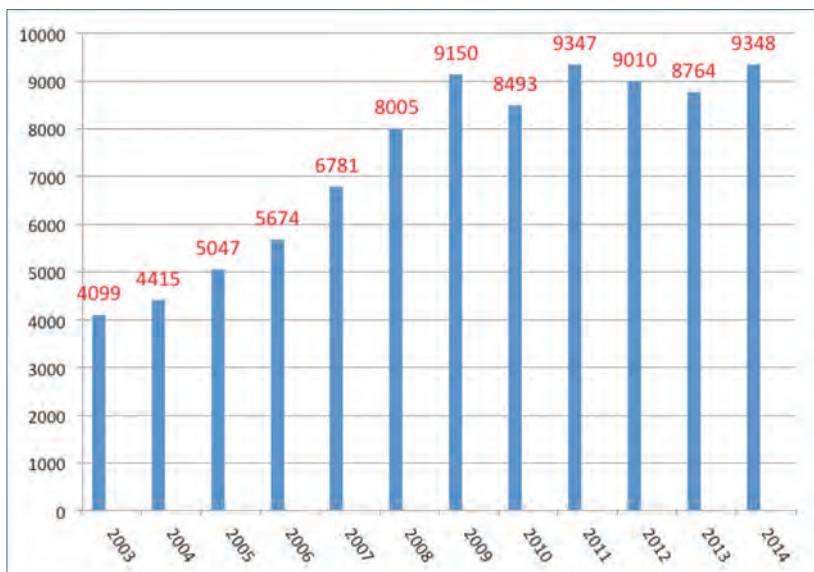


Exhibit 8: Total Theatre Case Load at Kijabe Hospital, 2003-2014
Source: Peter Bird, Kijabe Hospital.



Exhibit 9: Surgical Facilities at AIC Kijabe Hospital
Clockwise from top left: hand wash sinks outside operating theater; endoscopy/minor procedure suite; operating theater mini-store room with attendant; post-operative recovery area with wall oxygen, suction, and vital sign monitoring. Source: Case writers.

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 Osoi, 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 specialties from 5 to 8 (see Exhibit 7 for a list of permanent surgeons and specialties).

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

	2009	2010	2011
Income			
Patient revenue		5 919 858	7 166 118
Donated Staff Services		1 171 968	1 190 363
Income			
Other Income		319 790	383 324
Total Income	6 286 434	7 411 616	8 739 804
Expenditure			
Staff costs		(2 691 816)	(3 390 861)
Supplies		(1 833 678)	(1 959 306)
Donated staff services costs		(1 171 968)	(1 190 363)
Administrative expenses		(533 867)	(785 129)
Establishment expenses		(429 008)	(624 297)
Other operating expenses		(648 785)	(671 304)
Total expenditure	(6 267 404)	(7 309 123)	(8 621 260)
Surplus/ Deficit	19 030	102 493	118 545

Source: AIC Kijabe Hospital Office of the Finance Director, 2011

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

	Number	%
Staff		
Admin Staff	90	13.6
Health Care Professionals	378	55
Support Staff	215	31.4
Total	683	100
Non-Physician Health Care Provider Staff Training Level		
Masters	20	3
Bachelors	30	4
Advanced / Higher Diploma	17	2
Diploma / Cpa	308	45
Certificate	60	9
Total	435	

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

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

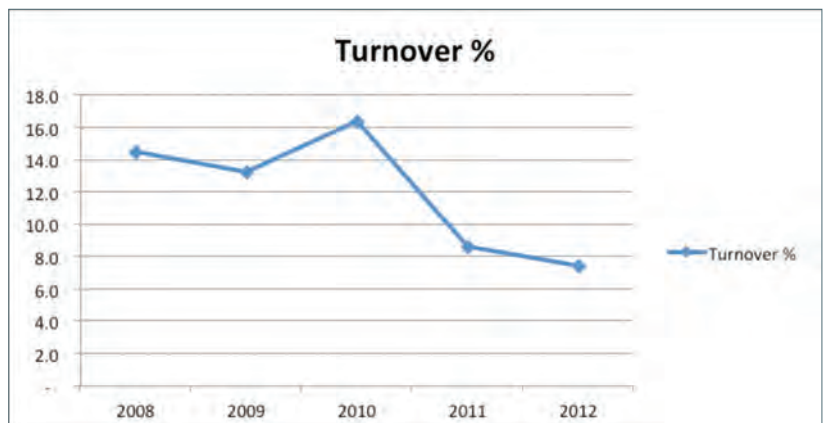
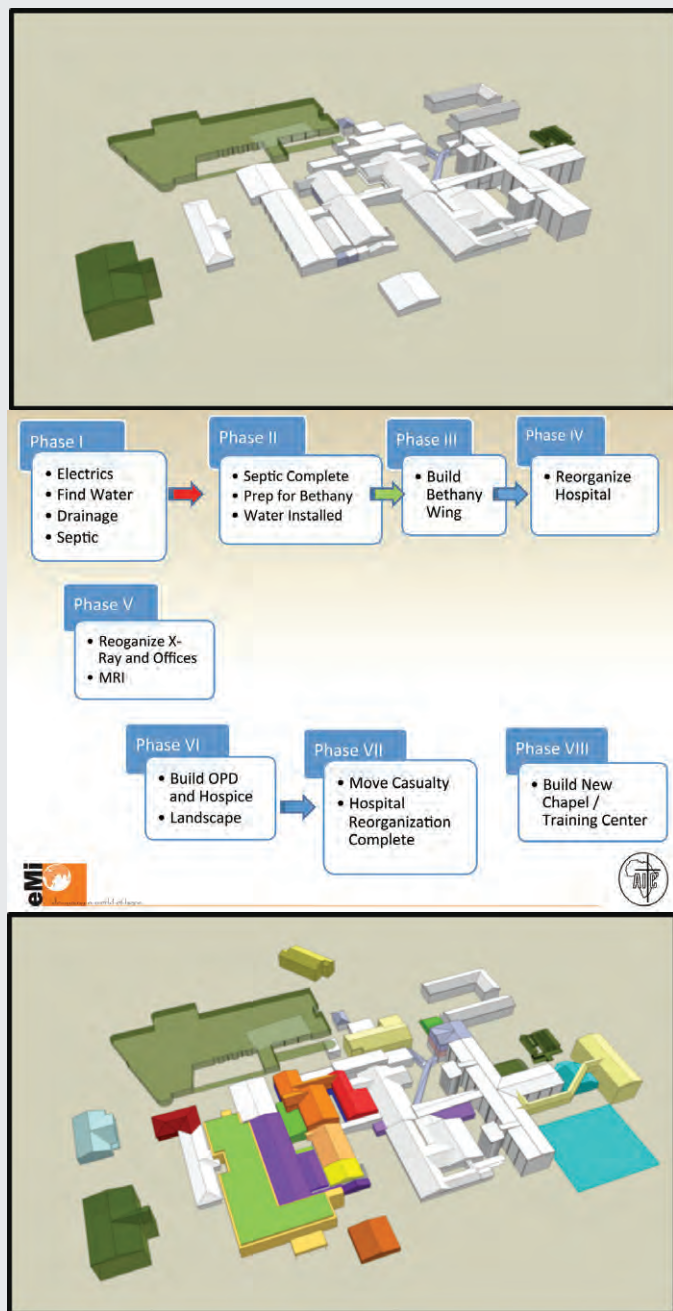


Exhibit 12: Staff Turnover at Kijabe Hospital

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

Exhibit 13: Kijabe Hospital Existing Buildings and 10-year Plan, 2012



Surgery expansion

- Radiology, Pathology, Lab expansion
- OPD, ER addition, including Records and Admin
- Ears, Nose, & Throat (ENT)
- Morgue update
- Engineering and Facility Dept
- New Staff Kitchen and Dining (Temp Chapel)

- Café (concept only)
- Car Parking / Traffic Flow Security
- TB & HIV building
- Storm water
- Medical Gas

Source: Engineering Ministries International "10-Year Master Plan Part 2" Presentation, Oct 29, 2012

construction plan). 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?

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