University of Alberta

A Convergence of Cultures and Strategies to Improve Electronic Health Record Implementation within a Tanzanian Clinical Environment

by

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Dedication

To Abby, my darling girl, for making every day a cherished one.

To Sa, for holding on to the threads.

Swahili proverb:

Haba na haba hujaza kibaba

Little by little the pot is filled

Abstract

This research explored the question: "How can we improve the implementation of an Electronic Health Record (EHR) within a Tanzanian clinical environment?" The objectives included working with local stakeholders to identify opportunities to improve, and exploring barriers and facilitators to change. My role changed over time from facilitator to change agent, and carried with it the promise that my presence was part of the solution, and the realization that it was also part of the problem.

The research is presented as an ethnographic case study. It draws from socio-technical and social interactionist theories in which information systems are understood by looking at the interrelation between the technology and its social environment. Field research occurred on site at Haydom Lutheran Hospital (HLH) in Haydom, Tanzania from March 2007 to May 2008. A two-week follow-up visit occurred in Fall 2008. HLH is a pilot site for the Care2X hospital information system. Data was collected through multiple qualitative and quantitative methods.

During the field research period, EHR implementation could not be expanded beyond Outpatient Registration. Server issues were the bottleneck and had a cascading effect. These issues identified a gap in knowledge and expertise to implement changes. But the problems went deeper still to reveal issues related to trust and power.

The research provides insight to guide stakeholders through EHR implementation so that they might better formulate their own plans to improve the collection and

use of health information. This begins with asking the question: Is an EHR necessary? Important steps are understanding barriers and facilitators for change, the influence of organizational culture and strategy, and the importance of context as these have implications for system success and sustainability. However, these lessons are not all new.

What this research does do is tease out the influence of outsiders in the clinical environment. Reliance on expatriate resources is not uncommon within low-resource environments and leads to a convergence of cultures and strategies. This research contributes to understanding the dichotomy between local and expatriate power, and is a timely contribution to existing, but limited, research studies on EHR implementation in Sub-Saharan Africa.

Acknowledgement

This journey began with a presentation by Dr. Yuri Quintana at a Colloquium to honour my MSc supervisor, Dr. Jochen Moehr, Professor Emeritus at the University of Victoria. Yuri spoke about the Paediatric Oncology Networked Database (POND) in Central America, and inspired me so that I thought I would like to do health informatics research in a resource-poor environment. This, in turn, led to extensive reading about Central and South America, and Africa. But where could I find a fit? Fate intervened while I was mulling this over. I read a school newsletter about a UVic Health Information Science graduate, Ms. Neema Mgana, a Tanzanian, and I contacted her to ask her advice: Haydom Lutheran Hospital was one of her suggestions. A few months later, I found myself at the Arusha Airport contemplating my impending flight to Haydom in the smallest plane I had ever been near. I stared in agony at my friend Shannon, likely the funniest person I have ever traveled with, except that day when she pointed out that it was my idea to check out Haydom in the first place. She became my constant companion throughout this experience through endless email correspondence.

Every step of this journey has been one transition to the next. In fact, the steps leading up to the field research, the time in Tanzania, the return to Canada, and writing this dissertation are so entangled in my life, that it is difficult to know how I could possibly limit my acknowledgements to a reasonable length. While typing this, I have decided that that length will be one page. This arbitrary, but reasonable, length both decreases my anxiety because it is manageable, and increases my anxiety, as I worry that I will be forgetting someone.

Thank you to my daughter, Abby, and her dad, Chad, for making the journey with me. My parents, Roger and Carol, provided endless support and reassurance, despite harrowing email accounts of Tanzanian wildlife. My sister, Marissa ("Sa"), has held on to the many threads of my life and my research, and I have received unconditional support from my brother-in-law, Chris, and my niece, little Sofia. My extended family, Neala and Troy (Taewyn, Mhina), Shannon, and Jochen and Chris have also been part of this extraordinary journey.

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I have exceeded my express goal to limit this section, which served its purpose well to get me started on a very difficult task. So many more people made this research possible, and I am grateful to each of you.

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List of Abbreviations

AMMD	Assistant Managing Medical Director
AMO	Assistant Medical Officer
AMPATH	Academic Model for the Prevention and Treatment of HIV/AIDS
CMT	Core Management Team
CO	Clinical Officer
COSTECH	Tanzania Commission for Science and Technology
EBP	Evidence Based Practice
EHR	Electronic Health Record
ELCT	Evangelical Lutheran Church of Tanzania
EMR	Electronic Medical Record
FDA	Food and Drug Administration
HDI	Human Development Index
HIS	Health Information System
HISP	Health Information Support Program
HLH	Haydom Lutheran Hospital
HMIS	Health Management Information System
HSN	Haydom School of Nursing
ICD	International Classification of Diseases
ICT	Information and Communication Technology
IICD	International Institute for Communication and Development
IPD	Inpatient Department
IT	Information Technology
KCMC	Kilimanjaro Christian Medical Centre
MEMS	Mission for Essential Medical Supplies
MMD	Managing Medical Director
MMRS	Mosoriot Medical Record System
MOHSW	Ministry of Health and Social Welfare
MTUHA	Mfumo wa Taarifa za Uendeshaji wa Huduma za Afya (Health Management Information System)
NICU	Neonatal Intensive Care Unit
NIMR	National Institute of Medical Research

NOIC	Nursing Officer in Charge
NS	New Outpatient Department Numbering System
OPD	Outpatient Department
OS	Old Outpatient Department Numbering System
PID	Patient Identification
RNE	Royal Norwegian Embassy
SSA	Sub-Saharan Africa
UofA	University of Alberta
UPS	Uninterrupted Power Supply
WHO	World Health Organization

Chapter 1: INTRODUCTION

The Research

Problem

There is a drive to improve the collection and use of health information in developing countries. Accurate information is necessary to inform decision-making and policy formulation, to reveal health inequities, to report to donors and government agencies, and to track progress towards health development goals, among others. While both paper-based and electronic systems can be used to collect health information, electronic health records (EHRs) are being increasingly turned to as they have the potential to improve: the accuracy and quality of patient data; access to health information; quality of care; and healthcare and health documentation efficiency [1, 2], and reduce medical errors [3]. An EHR contains an individual's personal health information, which is input electronically and accessed by healthcare providers.

Despite the potential benefits, EHR implementation can be unsuccessful and divert limited resources without meaningful gain. Implementation requires a comprehensive change management approach at both organizational and individual levels [4-10], and ongoing evaluation to iteratively inform the implementation process [1, 11]; unfortunately, there is limited literature on the experience of paper-based and electronic health record implementation and evaluation in Sub-Saharan Africa [12-14]. This leaves a gap in information that could be used to inform organizations grappling with how to improve the collection and use of health information with limited resources.

Purpose

The purpose of this research was to explore the question: "How can we improve the implementation of an EHR within a Tanzanian clinical environment?" The objectives were to work with local stakeholders to identify opportunities to improve, explore barriers and facilitators to change and build plans for improvement, and understand the specific conditions and limitations of the resource-poor environment.

My role changed over time from facilitator to change agent, and carried with it the promise that my presence was part of the solution, and the realization that it was also part of the problem.

Site

Field research occurred on site at Haydom Lutheran Hospital (HLH) in Haydom, Tanzania from March 2007 to May 2008. A two-week follow-up visit occurred in September/October 2008. Haydom is located in the Manyara Region, Mbulu District, approximately 350 km SW of Arusha. HLH is a pilot site for the implementation of the Care2X electronic hospital information system.

Methodology

The research is presented as an ethnographic case study [15]. The research draws from socio-technical and social interactionist theories [11, 16] in which information systems are understood by looking at the interrelation between the technology and its social environment. This approach acknowledges the importance of exploring the culture and context of the natural environment, over a period of time and with the people living the phenomenon. Data was collected through multiple qualitative and quantitative methods, among them: observation; informal discussions and interactions; meetings; email correspondence; interviews; and document review. There were 107 participants directly involved in the research.

Significance

This research contributes to the fields of health informatics and evaluation primarily, but also has lessons for human resources, cultural sensitivity, ethnography, and other related fields. This research is exciting because it provides a rich and holistic case study description of an EHR implementation experience with lessons that can inform other low-resource clinical environments within developed and developing countries. The research provides insight to guide stakeholders through the process of EHR implementation so that they might better formulate their own implementation plans to improve the collection and use of health information. Important steps in this process are understanding the barriers and facilitators for change, the influence of organizational culture and strategy, and the importance of context as these have implications for system success and sustainability. However, these lessons are not all new and are confirmed by Western and African literature.

What this research does do is tease out the influence of outsiders in the clinical environment. Reliance on expatriate resources (money, skill, time) is not uncommon within low-resource environments in which management turns to outsiders to provide guidance and assistance for information technology implementation and leads to a convergence of cultures and strategies within the clinical environment. This research contributes to understanding the dichotomy between local and expatriate power and the rich grey area that characterizes the spectrum between the two. This research is a timely contribution to existing, but limited, research studies on EHR implementation in Sub-Saharan Africa (SSA).

The next section provides an overview of the research site, including a summary of the national Health Information System (HIS) in Tanzania and the rationale to adopt an EHR within a resource-poor hospital.

Background

United Republic of Tanzania

After experiencing nearly 80 years of German and British colonial rule, Tanganyika and Zanzibar gained independence in 1961 and merged to become the United Republic of Tanzania in 1964 [17]. Tanzania is located in East Africa and shares borders with Mozambique, Malawi, Zambia, Democratic Republic of

Congo, Burundi, Rwanda, Uganda, and Kenya. It is one of the world's poorest countries and also one of the most stable in SSA. It is ranked 159th out of 177 countries on the Human Development Index (HDI) scale [18] with 36% of the total population making less than $1 US a day [17, 19]. Life expectancy at birth is 51 years [18].

Tanzania has a population of 41 million. On the mainland, 99% of the people are African with 95% of those Bantu (an extensive indigenous population) and consisting of more than 130 tribes [17]. Religion is fairly evenly divided between Muslim (35%), Christian (30%), and indigenous (35%) beliefs [17]. Kiswahili and English are the official languages of Tanzania, though most people grow up speaking their tribal language first [20].

The majority of Tanzanians live in rural and remote areas. Agriculture employs 80% of the people, who cultivate only 4% of the land because of challenges with topography and climate. Tanzania's climate ranges from tropical, along the Indian Ocean, to temperate in the highlands. It is the home of Africa's tallest mountain, Mt. Kilimanjaro, which rises 5,895 metres above sea level [17]. Agriculture products include coffee, sisal, wheat, cassava, bananas, cotton, tobacco, cashew nuts, tea, sheep and goats. Other industries include agricultural processing, diamond and iron mining, apparel, and wood products; Tanzania is the third largest producer of gold in Africa [17, 20].

There have been significant strains on the Tanzanian economy. Under Nyerere's leadership, the 1967 Arusha Declaration outlined a plan for "*ujamaa*" (extended family) [21], in which people were taken away from subsistence farming life and relocated to villages. Agriculture plummeted as a result of this new socialist structure and led to economic decline, decreased exports and increased imports. Debt was further compounded by the war with Uganda and prolonged drought in the 1970s. The country accepted international loans from the International Monetary Fund and World Bank in the 1980s through Structural Adjustment Programs [22]. In 2001, it qualified for relief through the Heavily Indebted Poor Country program, which will reduce its external debt by 54% [20].

National Health Policy

The National Health Policy's vision is "to improve the health and well being of all Tanzanians with a focus on those *most* at risk, and to encourage the health system to be more responsive to the needs of the people" (p.4)[23]. Its mission is "to facilitate the provision of equitable, quality and affordable basic health services, which are gender sensitive and sustainable, delivered for the achievement of improved health status." (p. 4)[23].

The National Health Policy is linked to the Tanzanian Development Vision 2025 and includes universal access to primary health care and safe water, reduction in infant and maternal mortality rates, food security, and gender equality [23].

While the National Health Policy does not mention computers, eHealth, or ICTs in strategic plans, it does state that monitoring and evaluation require evidence-based information including: information from the Health Management

Information System (MTUHA) described below; burden of disease data; and country status of internationally notifiable disease [23].

Health Sector Reform

The move of Health Sector Reform initiatives from a curative to preventive system started shortly after independence in the 1960s [24]. The World Health Organization's (WHO's) Primary Health Care strategy expanded in the 1980s to rural areas in an attempt to embed equity in health services [25]. However, during the economic upheaval of the 1980s, important gains were reversed and left people with lower quality health services and unsatisfactory health status. This experience identified a weakness in the existing health services management structure and became a catalyst for adopting a decentralized system in the early 1990s.

The Tanzanian government now acts as "a facilitator and key player in policy formulation, legislation, regulation and quality control" [24] with power devolved to the districts. District Health Management Teams therefore have the authority and responsibility to engage communities in participation to improve health services [24]. This decentralized approach is promoted by WHO as it empowers districts to act as their own entity to better integrate health programs and services and respond to district-based health information [25].

In 1989, Tanzania's Ministry of Health began development of a paper-based Health Management Information System (HMIS) called "MTUHA" (Swahili acronym for "Mfumo wa Taarifa za Uendeshaji wa Huduma za Afya"); a computerized version was implemented in 1993. The program's goal is to improve health service delivery through informed decision-making, based on information provided at the health facility, district, regional, and national levels [26]. The foundation of this decision-making lies at the health facility level, where initial statistics are collected and sent to the district. It is therefore important that accurate data is collected and reported [1]. A detailed summary of HMIS implementation in Tanzania can be found, for instance, in Smith [27] and Kimaro [25, 28].

The Ministry of Health and Social Welfare's (MOHSW) proposal to strengthen health information systems [29] discusses the importance of quality information to monitor, for instance, progress towards Millennium Development Goals; however, current data falls short. The challenges to MTUHA include incomplete reporting, data gaps and overlaps, poor local information culture, and insufficient feedback from higher levels back to the facility level. The proposal recognizes that the underfunding of health information systems has led to fragmentation through erratic and incomplete investment. The MOHSW acknowledges the importance of including all stakeholders in the process of identifying information needs and delivering useful results to build support for change. Improved data collection and use is tied to organizational procedures and culture [29].

The MOHSW aims to strengthen health information quality by focusing on: action oriented information use at all levels using timely, quality information; building capacity through on-site support and education; establishing a national

MTUHA support network and information culture; and building on experience and learning from best practice [29].

The proposal suggests district and hospital computerization over time to facilitate reporting process. This begins with establishing a more basic, stable, and useful electronic system first and then continuously developing functionality and expanding outwards to more users through continuous change cycles. There is a risk that the planned MTUHA improvements will be too technically advanced; the approach will therefore be to keep the process simple and to build a strong foundation [29].

Information and Communication Technologies (ICTs)

According to WHO's Global Observatory for eHealth, Tanzania's challenges for ICTs in health include lack of funding, skills, electricity, and Internet service providers, and inadequate telephone connections. Tanzania is working on national information and eHealth policies which describe standards, funding, and procurement. ICT knowledge and skills are being addressed in health sciences university curriculum [30].

The Tanzanian ICT policy has emerged over recent years and envisions Tanzania "to become a hub of ICT Infrastructure and ICT solutions that enhance sustainable socio-economic development and accelerated poverty reduction both nationally and globally" (p. 2)[31]. Its broad objectives are to create a national framework to utilize ICT to achieve development goals and to build a knowledge-based society. There are ten focus areas: strategic ICT leadership; ICT infrastructure; ICT industry; human capital; legal and regulatory framework; productive sectors; service sectors; public service; local content; and universal access. Embedded within the policy's service sector section is a provision for ICT to empower the health sector, by developing and implementing a national e-Health system to support underserved areas [31].

The Health Sector Strategic Plan for July 2009 – June 2015 [32] discusses the use of ICTs in health. The ICT objectives include defining an ICT strategy for health and creating a country-wide information network. ICT use is spreading with computers being used in the health sector primarily for data processing, aggregation, and analysis. Internet access is slowly expanding.

> However the systems are weakened by poor maintenance of computers and network infrastructures, as well as invasion of viruses. There is no good storage and back-up policy leading to loss of critical information. Opportunities for web-based communication and collaboration are insufficiently used. (p. 44)[32]

An ICT strategic framework and implementation plan will be formulated by the MOHSW as part of their monitoring and evaluation strategy [32]. An eHealth strategy will also be developed by the MOHSW with government and International Institute for Communication and Development (IICD) funding [33].

This national overview provides the setting for ELCT Health and the Care2X hospital information system, which are described below.

Evangelical Lutheran Church of Tanzania (ELCT) Health and Care2X Hospital Information System

ELCT Health is responsible for 20 hospitals, over 160 health centres and dispensaries, and a variety of community-based health services, all of which represent approximately 15% of Tanzania's health services. It is involved in the delivery of health services with a holistic (mind, body, soul) approach to the individual. Its functions include the "coordination, facilitation and linking of health services within and without the ELCT health facilities" [34], human resources planning, capacity building, policy harmonization, advocacy, technical and health services support, and facilitation of management and good governance [34]. The offices for ELCT Health are located in Arusha, Tanzania. ELCT Health is keen to improve clinical care and reporting through EHR implementation.

ELCT Health conducted a comprehensive review of available EHR software. Assessment criteria included low cost, good quality, ability to provide remote support, and an implementation process matched to available IT skills. ELCT Health selected the Care2X hospital information system (www.care2x.com) to implement within their hospitals [35]. Care2X is an open-source, web-based software accessible through a web browser [36]. It is used by hospitals in South Africa, Kenya, Egypt, Malaysia, India, and countries within Europe. ELCT's goal is to work with other ICT professionals and the International Institute for Communication and Development (IICD) to create an East African version of Care2X, which individual hospitals can further tailor to their needs. "We keep our work free for all, because we believe that is the way to build a strong African base for the program. We have small resources and we should not work parallel but together" [35].

ELCT Health first piloted Care2X in June 2004 with Selian/Arusha Town Clinic (an ELCT hospital). It has since expanded its efforts to implement within and outside ELCT hospitals. The biggest challenge has been user acceptance, including training and motivation [35]. Haydom Lutheran Hospital (HLH) is an ELCT hospital that implemented Care2X within its Outpatient Department in January 2007. I visited Haydom Lutheran Hospital in January 2006 and was invited to return to explore what the implementation of Care2X would mean for change management; HLH served as the research site for this dissertation.

Haydom Lutheran Hospital

Haydom Lutheran Hospital (HLH) is located in the southwest Mbulu District of Tanzania, and borders four other districts which it also serves: Hanang, Iramba, Singida Rural, and Meatu [37]. Other health institutions in these areas include two government run district hospitals, one Lutheran church-run hospital, and several bedded and non-bedded government and church-run dispensaries [38]. Haydom village's population is estimated as 20,000 [38]. There are 295,000 people in the immediate catchment area with a combined district reference area of approximately two million people [39]. In this area, the four major African

languages (Nilotic, Cushitic, Bantu, and Khoisan) converge and are represented by the Datoga, Iraqw, Iramba, Isanzu, and Hadzabe tribes [40]. The nearest city centre is Arusha, approximately 350 km northeast of Haydom.

The Norwegian Lutheran Mission built HLH in 1953 in response to the colonial government's request to develop the area. The hospital was built where only one or two families lived, after bush had been cleared to remove the tsetse fly danger. The town grew up around the hospital, and over time, homes, farms, schools, water distribution sites, and stores became part of the landscape [41].

Hospital administration was handed over to ELCT Health in 1963 [38]. Figure 1 illustrates the location of Haydom Lutheran Hospital, as well as the other nineteen ELCT Health hospitals in Tanzania.

Figure 1: Map of Tanzania and location of Haydom Lutheran Hospital [34]

HLH's vision is "To cater for the needs of the whole human being – physical, mental, spiritual and social" (p. 4)[39]. HLH has grown from a 50- to a 400-bed hospital that employs approximately 550 people. In 1955, the hospital opened ahead of schedule when patients arrived after being attacked by a leopard. Dr. Olaf Olsen, the first Managing Medical Director, saved the patients after locating surgical supplies in boxes and operating by flashlight. Leadership has remained in the Olsen family for this time period, with father (Olaf, 1955-1961), son (Ole, 1961-2005), and grandson (Øystein, 2006-ongoing[1]) running the hospital over

[1] Leadership transitioned from Dr. Olsen to Dr. Olav Espegren, October 2010.

time. The hospital has grown to include the addition of a laboratory and paediatric ward (1981), Nurses Training School (1984), and an expanded 100-bed paediatric ward and HIV/AIDS prevention and treatment program (2003). Since 2000, the hospital has added an eye department, and diabetic, epileptic, psychiatric, and alcoholism clinics [41]. It has an extensive ambulance network, which includes the services of Flying Medical Service and Missionary Aviation Fellowship.

The hospital provides a broad range of inpatient and outpatient services including surgery, maternity, paediatrics, eye, tuberculosis, and physiotherapy. Additional medical services include reproductive and child health services, HIV/AIDS, mental health, and diabetes, among others. The hospital operates six health centres and dispensaries in nearby communities. In 2007, the hospital saw approximately 12,500 inpatients and 54,000 outpatients [39]. The most common diseases are multiresistant malaria, respiratory tract infections, gastroentreritis and diarrheal diseases [38]. Figure 2 shows an aerial view of the hospital buildings.

Figure 2: Aerial view of HLH courtesy of http://haydom.no

The Decision to Adopt Care2X

HLH collects a large volume of statistics to meet the needs of the Ministry of Health and donors. However, the statistics did not realize their full potential for benefiting patients, healthcare employees, and administration. HLH therefore began working with ELCT Health to customize the Care2X system to meet local needs [39].

The decision to adopt Care2X was influenced by both internal and external goals to provide better information to decision-makers within the hospital and external stakeholders, like donors. The donors wanted to ensure that internal controls and

financial management were accurate, and this would benefit the hospital as well. While the donors stated they would not fund the implementation of an electronic health information system (paper-based improvements were expected), the hospital wished to proceed with implementation of Care2X.

HLH made the decision to implement an electronic health management information system in the late 1990s. ELCT Health ("ELCT") played a large role in selecting the digital system at HLH as they were already reviewing solutions. ELCT first helped HLH evaluate a Clarion-based health management information system, which HLH spent time and resources trying to implement from 1998-2002. The system was successful in terms of generating interest, producing reports, and preparing the groundwork for future electronic systems, but the hardware was unable to keep up with progress. After using the system for about six months, the hardware was no longer able to do daily backups: it restarted each morning and all data from the previous day was lost; the initiative ended as a result. ELCT was hoping to use the system for other ELCT Health hospitals, but explored other options after HLH's experience.

ELCT looked at open-source systems and identified the Care2X hospital information system ("Care2X") as a promising solution. The idea was presented to HLH in 2005; however, HLH administration was not initially convinced that Care2X would be the right solution as they wanted an electronic system that could be implemented quickly. HLH therefore explored other software solutions over the course of a few months, including the Norwegian Church Aid financial management solution in Kenya, and other health management information systems, in consultation with Selian Hospital in Arusha and the Tanzania Ministry of Health.

The decision between investing in a ready-made (off-the-shelf) solution, or an open-source web-based system, was a difficult one for HLH to make. The rationale was: with ready-made solutions, people come in to the environment, implement the system, and follow-up. The hospital would be left with a product, but not know if it was going to work.

> "On the other hand, by using open-source solutions that you have to develop yourself, you probably have wider ownership of the process, but it doesn't guarantee you anything; in the end you don't have a system in the hospital [because the process] takes too long. There are too many stakeholders. There is too little dedication [and] nobody earns money. There is no incentive to finish this apart from volunteerism and good objectives." (Participant 7)

It is difficult to know what the less expensive option is. Not knowing what, for instance, the hospital is spending money on over the course of several years can be more expensive than spending thousands of dollars upfront on a commercial product to track that information. In the end, the decision was made to choose the open-source Care2X system because of the network of support through ELCT Health.

The hospital prepared for the implementation of Care2X in 2006 by reviewing how health information was collected in both outpatient and inpatient departments [42] and creating plans for Care2X implementation [43, 44] through the creation of a steering committee.

The 2006 HLH steering committee considered the lessons learned from Selian Hospital's experience with Care2X in Arusha, Tanzania. The primary purpose for Selian's adoption of Care2X was to enter registration information for patients only once (instead of within each unit like pharmacy, radiology, billing, etc.). The secondary purpose was to be able to create statistical reports, with the acknowledgement that theoretically, each unit would need to be entering patient information for reports to be complete. Clinical applications were not utilized at Selian in 2006 because doctors and nurses were reluctant to use the system; however, Care2X was starting to be used within registration, laboratory, and pharmacy [44]. Contrary to Selian's focus on clinical needs, HLH's primary focus was to provide statistical reports for improved decision-making [44]. Three levels of reports were envisioned: horizontal (between departments); vertical (to feed up to administration); and meta (providing information to donors, researchers, and the government).

The next chapter explores the literature on EHR implementation in developing countries.

Chapter 2: LITERATURE REVIEW

This literature review focuses on the implementation of Electronic Health Records (EHR) in developing countries. It begins with a description of healthcare delivery in developing countries before describing Health Information Systems (HIS) and EHRs, the influence of context, strategy, and organizational culture, and the barriers and facilitators for change. The review draws from African and Western literature, among others.

Full-text, English language databases[2] for a 10 year period (1999-2009) were searched with the following terms: (health information systems or patient record) and (implementation or improvement) and (developing countries or Africa or Tanzania or low-income countries). As articles were reviewed, targeted searches were conducted through the Web-of-Science and specific journals including Information Technology for Development, Electronic Journal on Information Systems in Development Countries, and the International Development Research Centre. Concepts were added to the point of saturation.

The terms EHR, EMR (Electronic Medical Records), and information systems are used within this literature review. Over time, the lines have been blurred with respect to the distinction between "H"ealth and "M"edical records; sometimes the terms are used rather interchangeably, while other times EMRs describe information systems within one institution used by hospital staff, and EHRs describe information systems used across multiple institutions by hospital staff and other decision-makers; other variations exist. For the purposes of this review, "EHRs", "EMRs", and "information systems" are used to describe the electronic collection and use of patient information for decision-making within and without a hospital environment.

Healthcare delivery in developing countries

There are challenges to healthcare delivery in developing countries:

> Working conditions in developing countries can be overwhelming, and include lack of sufficient staff, absence of continuing education, poor physical facilities, and long distances between health centers. In rural settings where much of the population lives, bad roads and incomplete coverage by telephone systems make transportation and communication difficult. Erratic supplies of electricity and other fuels can threaten the 'cold chain' for vaccines. Add to this the combined burdens of diseases such as cholera, malaria, and AIDS, the effects of chronic malnutrition, and the new 'double burden' of chronic illnesses. (p. 439)[45]

Developing countries have weak infrastructures characterized by an absence of basic telecommunications facilities [46]; poor-quality electricity and water

[2] PubMed Central, Academic Search Complete, CINAHL, Cochrane Database of Systematic Reviews, Health Source: Nursing/Academic Edition, Health Technology Assessment, MEDLINE, IEEE Explore

supplies [47, 48]; poor environmental sanitation [48]; impassable roads [48]; lack of transport [47, 48]; and long distances to health facilities [49]. Health systems suffer from underfunding [48] and a lack of resources including: health facilities [48], doctors and other health-care workers [46-50], and medical supplies, especially drugs [47, 48, 50]. There are too many patients [47] to be served by too few workers, and poor quality of care can result [49]. Inappropriate donor interference has also fragmented some local health systems [47, 51]. Social issues compound the strain on existing healthcare services and include: illiteracy [46]; low health education [48]; political factors [46, 47]; and a frayed social infrastructure [46].

Developing countries bear the burden of 90% of global disease, but only 10% of global spending on medical research is directed toward this burden [48]. Poverty plays a central role in health and economics; it is a main cause of illness, and illness in turn causes a downward spiral of lost income, or the selling of commodifiable goods, which leads to greater poverty and greater illness. At the heart, there is a lack of equity.

> Health equity is the absence of systematic health differences between more and less socially advantaged groups; it is based on principles of justice, reflecting equal opportunity for all people (individuals and groups) to be as healthy as possible…Strong HIS incorporating both population and facility-based data are essential in helping governments to demonstrate and address such inequalities, but HIS currently provide few of the data needed. (p. 598)[52]

In the absence of reliable health information, bad decisions can be made based on inaccurate information [53]. Reducing health inequities are at the heart of the Millennium Development Goals [52]; however, few developing countries are able to track the information needed to see if they are meeting these goals [54].

Health Information Systems and Electronic Health Records

Health Information Systems (HIS) have the potential to reduce health inequities between and within countries and populations [55]. While paper-based HIS can be successful for low patient volume with sufficient staff [12], they do not lend themselves well to data aggregation [2]. Paper-based systems are generally considered inadequate to provide effective information for healthcare and decision-making as the information collected is generally fed up the system to other decision-makers and not utilized locally [5, 25]. Electronic Health Records (EHR) are increasingly being implemented within healthcare environments in an effort to improve the collection and use of health information for decision-making.

An Electronic Health Record is:

> a collection of data and information gathered or generated to record clinical care rendered to an individual. It is a comprehensive, structured set of clinical, demographic,

> environment, social and financial data and information in electronic form, documenting the health care given to an individual. (p. 229)[56]

The primary purpose of an EHR is to provide patient care [56-58]; whereas secondary purposes include research, statistics, education, quality assurance, and policy formulation [56, 58].

Potential benefits of EHR systems in developing countries include the ability to manage large numbers of patients [12], improved planning, evidence-based decision-making [55, 59], drug tracking [60], and reporting [61]. EHRs can improve patient care through better access to quality health information [1, 3, 58], improved clinical management [58, 60], screening and follow-up [62], and reduced medical errors [61, 63]. However, investment is not without its drawbacks. Investing in EHRs takes funding away from other areas like conventional public-health measures (e.g., sanitation, safe drinking water, nutrition) [47, 64]. There is also a danger that the use of an electronic system will speed up the dissemination of incorrect health information, which will then be incorporated into decision-making [61]. Costs of EHRs are discussed further in the "Barriers and Facilitators" section below.

The implementation of an EHR can be strongly resisted for multiple reasons including resistance to change [1, 65] and to the technology itself [1, 66]. EHR implementation therefore relies heavily on user acceptance, which is the willingness of staff to use the new technology [67, 68]; if users refuse to use the system, or if the system is underutilized [69], the investment of resources has been wasted and the EHR will not be sustainable [70].

Implementation of an EHR is a continuous change process requiring a proactive response [27]. The implementation process can be considered a mutual transformation between the organization and the technology, best served by iterative feedback from users.

> Change management is the process by which an organization gets to its future state, its vision. While traditional planning processes delineate the steps on the journey, change management attempts to facilitate that journey. Therefore, creating change starts with creating a vision for change and then empowering individuals to act as change agents to attain that vision. The empowered change management agents need plans that provide a total systems approach, are realistic, and are future oriented. Change management encompasses the effective strategies and programs to enable those change agents to achieve the new vision. (p. 118)[65]

Change takes time as it involves a gradual change in organizational culture and capacity, as the EHR becomes accepted and institutionalized as a success, or rejected as a failure [28].

It is important to assess an organization's readiness for the change initiative prior to beginning the change process. Organizational readiness is defined as:

> the extent to which organizational members are psychologically and behaviorally prepared to implement organizational change. Readiness is thought to be a critical precursor to successful organizational change because organizational members seek to maintain a state of affairs that provides them a sense of psychological safety, control, and identity. Attempts to alter such a state of affairs often produce strong resistance. (p. 381-382)[71]

Identifying the preconditions for success can help set realistic expectations and help prepare the infrastructure, processes, and culture for change [72].

Weiner et al.'s 2008 comprehensive review of organizational readiness [71] suggests that there are two dimensions to organizational readiness for change: individual motivation and organizational implementation ability; both are needed to make change happen. Understanding individual and organizational readiness for change can inform plans to fill gaps, add resources, and build support for change. When there is a high readiness for change, members of the organization are invested in the change, expend effort, and are persistent despite obstacles.

Examples of electronic health information systems in developing countries include the Mosoriot Medical Record System (MMRS) and the Health Information Support Program (HISP). The MMRS, created in Eldoret, Kenya, was the first outpatient EMR in Sub-Saharan Africa [73]. It is used to track care for HIV/AIDS patients, submit public health data to the Kenyan Ministry of Health, and conduct research [74]. The MMRS reduces patient waiting time, improves patient care, and helps bridge the digital divide [59, 73]. MMRS contributes to the Academic Model for the Prevention and Treatment of HIV/AIDS (AMPATH) in areas that include antiretroviral treatment outcomes and the impact of treatment on microeconomics in villages that surround Mosoriot [73]. The creators of MMRS worked with local stakeholders to create the system, and thus have been able to achieve sustainability. Similarly, HISP is a collaboration to share learning and support among developing countries (including Tanzania, South Africa, Mozambique and India) to improve health information for primary health care decision making [61, 75]. HISP uses an action research approach to design and develop a district-based health information system through participatory customization [76]. Participatory customization enables users to customize the system to suit their needs and to be consistent with work practices [67].

Context, Strategy, and Culture

'Context' is the setting or circumstances that surround an event. Implementation of an information system is context sensitive [77]; therefore it is important to take the local context into account [78-82].

> A deep understanding of the context in which clinical work is occurring is increasingly recognized as requisite for the successful implementation of an information system. (p. 45)[83]

Context is redefined when a new information system is introduced [80]. Historical context is institutionalized over time and can be difficult to change [84]; an earlier positive experience with change [72] can facilitate the implementation of a new information system [85]; whereas an earlier negative experience can hinder implementation efforts.

Organizational culture is the shared values, beliefs, and norms within an organization [4]. The most visible symbols of culture are work practices; they are supported by norms and derived from imbedded organizational values. Values act at a subconscious level and exert their interest directly on behaviour. Subcultures can emerge within the dominant culture and can have competing values and beliefs [4, 7, 86]. While some subcultures support organizational values, others can work against them [4]. Information system implementation can introduce new forms of culture, which challenge traditional ways of doing things [25]. Conflict results when an organization tries to implement new changes that are inconsistent with the organizational culture [87].

Strategy is the plan of action or policy designed to achieve an organization's goals. Information systems should be aligned with objectives and strategies [88]; these are linked to culture.

> While culture is the foundation from which strategy emerges and can facilitate or impede change, strategy is also influential and has the potential to strengthen both positive and negative aspects of culture, and encourage or discourage support for change. (p. 72)[4]

If the culture is hostile within the healthcare environment in general, or toward information systems in particular, system implementation can fail [65]. In this case, the organization could build on positive aspects of culture and nurture new ones that go with the routines, ideas, values, and meaning of the new system [25, 65].

Sustained EHR initiatives require a culture open to change [4], innovation [85, 89], information [90], and design [67]; the absence of which could threaten the success of the system implementation.

But what is success? Success is a socially negotiated and dynamic concept.

> Success, in short, has many dimensions: effectiveness, efficiency, organizational attitudes and commitment, worker satisfaction, patient satisfaction – and not all parties in and outside of the implementing organization may agree about which dimension should be the most relevant…The question about the success of a system, then, becomes the question of success for whom? (p. 145)[16]

Success has many dimensions and can be defined differently by different parties. Views can change over time.

There is no one approach to technology implementation; one must learn how to implement in a particular context by going through the process itself [16]. It is

important to understand the barriers and facilitators for change in order to better plan the implementation process.

Barriers and Facilitators for Change

Barriers and facilitators for EHR implementation include issues related to: the transition from paper to electronic records; infrastructure and cost; leadership and communication; participation; human resources and capacity building; usability; design; and data. The goal of EHR implementation is to achieve sustainability and scalability. Each of these is described below.

Transition from paper to electronic records

It is a challenge to transition from paper-based to electronic records [91].

> Converting from a paper-based to an EMR system is complex and difficult because it represents a paradigm shift for the work of physicians and other staff. The transition requires a systematic activity and must be managed from many aspects' clinically, administratively, culturally, and organisationally. The transition must include not only the process changes inherent in the use of a new tool, but also the technical and procedural training, and the resultant changes to physician and staff roles within the office. Subsequently, it requires a strong management commitment and motivation. Secondly, involvement of all stakeholders, care providers and other users of the system right from the beginning is necessary for survival and sustenance of the project. Involving the stakeholders will help them to have a clear understanding of why the organisation is making the change. Involvement and understanding also helps users (care providers) to identify themselves with activities that will make the transition very smooth to achieve desirable outcomes. (p. 141)[58]

A well functioning paper-based system is considered a prerequisite to an electronic solution [1, 92]; therefore it is important to solve current healthcare documentation problems before implementing an EHR. This includes ensuring that there is a unique patient identifier before moving forward with automating a paper-based system. Unique patient identifiers are needed to prevent duplication and correctly identify patients [12], the absence of which is a barrier to EHR implementation [91, 93].

Good planning is required before EHR implementation begins [58, 79]. The formation of a steering committee, with various roles and users represented is the first step. WHO [1] recommends that the steering committee review the current health record system to: identify strengths and weaknesses; determine EHR type and benefits; set achievable goals; and define strategies to achieve goals. If an EHR plan looks feasible and practical through an establishment of a business case, then an executive committee can be formed to move forward the implementation effort. The executive committee should have individuals with technical, information management, EHR implementation and health informatics

backgrounds [1]. This includes appointing an implementation coordinator and team and establishing task-related working groups. Phased implementation, with dual (paper and electronic) systems, is recommended to manage the impact of change [1, 94].

There are several security issues related to EHR implementation and use. Poor system security can lead to viruses and spyware [60], inadequate data back-ups [1, 60], and issues related to privacy and confidentiality [1, 58]. Time should therefore be spent to proactively plan how to ensure system security including secure workstations, and access and audit controls [1], among others.

Infrastructure and Cost

Inadequate infrastructure is an ongoing challenge for EHR initiatives [46, 64, 69, 79, 95, 96]. These challenges may include: unstable or inadequate power supplies and lack of secondary power sources [3, 60, 61, 66, 91, 97, 98]; shortage of telecommunications [1, 61]; lack of hardware [3, 66], space [1, 68], Internet connectivity, and service providers [3]; and unavailable or expensive bandwidth [70].

Cost is an important consideration, particularly within a resource-constrained environment. The costs that might immediately come to mind are those associated with hardware (e.g., computers, printers, backup devices) [1, 3, 68] and software acquisition [97]. However, EHR implementation costs extend beyond that to include infrastructure, such as electricity and connectivity, maintenance and repair [68], human resources and training (capacity building) [12, 68], time [65, 68, 97], and opportunity cost of forgone expenditures on other areas of the hospital [68]. Cost overruns [65] can threaten the implementation process. It is therefore important to secure sufficient funds to implement an EHR [85]. Low-cost solutions are encouraged [85, 99].

Leadership and Communication

EHR implementation requires a strong leadership commitment ("top-down") to, and participation in, the change [4, 58, 67, 81]. Leaders should create a shared purpose and vision for the change [4, 65, 85], and offer encouragement and support [68, 97], as these have the potential to strengthen favourable aspects of organizational culture and change assumptions and procedures [100]. Lack of leadership support and top down management are barriers to the change process [7, 65] and can lead to resistance [4].

Ineffective communication and listening [7, 65] are barriers to EHR implementation. Leaders need to prepare the staff for an EHR [65]. Clear communication and feedback can reduce uncertainty, increase buy-in, and modify behaviour for change initiatives [4] by, among others: clarifying information [3, 69], objectives, roles and responsibilities [65]; sharing vision; obtaining commitment to change; and challenging the status quo; while reducing anxiety and resistance [101]. Similarly, employee involvement ("bottom-up") can reduce uncertainty and increase buy-in [4].

Participation

Employee participation in the implementation process legitimizes membership [84] and builds support for change [4]. Participation includes shared decision making [102], collaborative design and development [60, 103, 104], testing [60], and training [102]. It is important to ensure that the appropriate stakeholders, including end users, are involved in the participatory process [1] and released from their normal duties to attend meetings [102]. Participation takes maneuvering as compromise and consensus are desired for complex change initiatives, but also require time and negotiation [4].

Participation is not participation when organizational culture, power and politics constrain what people can say [67] and "prevent apparently participative processes producing truly participative outcomes by constraining who can say what and how within any kind of group activity" (p. 2-3)[105]. Similarly, traditional deference to authority can make participation difficult as workers might agree with those higher in power [27, 103]. Paternalistic approaches (authoritative management style), hinder participation and can prevent understanding of the local reality [86, 106, 107].

Human Resources and Capacity Building

Human resource limitations include a shortage of trained healthcare staff [1, 97], in part due to rapid turnover [65, 68]. This results in additional staff workload [104]; overwork is an additional impediment to EHR implementation [108]. Onsite IT (Information Technology) support is important, but there is a lack of expertise within health facilities [3, 66].

Lack of Information and Communication Technology (ICT) skills and knowledge, including those related to computers, is a largely cited barrier to implementation [1, 3, 66, 67, 82, 95, 96, 109]. "Technology leapfrogging" becomes relevant here as it involves upgrading from an old system, past successive versions of technology to something new (for instance, skipping telephones and adopting cell phones). To put this in perspective, people in developing countries do not have the same long-term exposure to technology as people in Western countries. There can be a learning curve as people in developing countries do not have the same implied knowledge for use. IT cannot be immediately adopted with the expectation of receiving the same benefits [110]; a culture shift is required [111].

ICT literacy, like technology, is not static and requires continuous learning [82]. Lack of ICT skills and awareness can create fear, which in turn can result in resistance to change [68].

> In addition to technical skills, ICT literacy includes skills for dealing with information and understanding the impact of ICTs on work processes. Most health care organizations of developing countries are overloaded with information but lack capacity to manage and analyze data using ICTs and to use the generated information for decision making. (p. 4)[82]

Capacity building can ensure that employees have the knowledge and skills required for EHR implementation [1, 81, 89, 104]. These go beyond basic computer skills and software training [57, 67, 70, 91] to change and information management skills [4]. It is important to build understanding of how to utilize the information collected to make evidence-based decisions [61]; one needs to know how to manage information in order to manage and measure care [57].

> Ideally, capacity building goes beyond development of basic skills, extending to technical skills, planning, policy analysis and formulation, and management of ICTs. It involves activities related to the development of human resources through training, formal education, and promotion. It is also a continuous process whereby people and organizations develop their abilities individually and collectively to perform activities, deal with problems and manage according to set objectives. Human capacity building depends on the institutional capacity to provide a conducive environment for learning. Institutions with unclear objectives, inadequate structures and resources, lack of incentives or weak practices are unlikely to achieve a productive and motivated work force because these factors do not lead to a conducive working and learning environment. (p. 3) [82].

Difficulties with participant selection [67], inadequate or poorly timed training [60, 65, 96], and lack of available training courses [96] contribute to knowledge barriers [79] related to the EHR and have implications for data quality and completeness [60].

Usability

Usability is the ease of use and usefulness of the information system [85, 98, 112]. Easy to use technology includes a user-friendly interface and low complexity [85, 89, 113]; whereas usefulness includes a clinically [99], and immediately [114], useful application.

Perceived usefulness impacts the acceptance and use of EHRs [7]. It is important, therefore, that value can be demonstrated, for instance, in terms of time saving [97], the quality of information, system performance [81], or other personal incentives [79], particularly for those users who collect the data [60]. System adoption is challenged when systems are too difficult to use or too complex. It is important to understand usability as some problems can lead to prescription or medical errors [115].

Design

System design should not introduce radical change in terms of how work is completed [116]; EHRs should support workflow [85, 97] and become integrated into user routines [1, 25]. Poorly designed systems can lead to unintended consequences [65]. A flexible [12, 98, 99] system, adaptable to the local context [117], can help ensure that the EHR is a good ‘fit’ for the users and organization. ‘Fit’ describes the relationship between the software, user requirements, and the

organizational environment [81, 118]. A good fit is one that sensitively matches local needs to available technologies and resources [60].

It is recommended to provide users with a pre-developed system that can be customized to suit their needs [67, 85]. Open-source software is recommended over proprietary software [3, 60, 94, 119]. Not only are costs minimized because the license is free, but it can be flexibly adapted to different environments [2]. Reverse engineering is not required and the code can be made available to other programmers in the event a project programmer leaves an implementation environment [60]; explanatory notes are also important artifacts to pass on to the next programmer. Local skills are important to support and maintain the software [57, 82].

Participatory customization can motivate users when suggestions are translated into results quickly [67, 97, 99]. Data should be locally relevant [61] and be kept to the minimum information required for decision making [56, 60]. There should be a practical focus on the things that matter, like clinical care [120], as well as a consideration of needs and how they can be met. Sharing resources and learning from other's experiences can produce better systems [60, 90].

Poor procurement [65], inadequate testing [65], too much technological orientation [65], and lack of appropriate foreign language options [60, 66] are barriers for implementation. Poor initial design can limit capabilities and the potential for future expansion [58, 60]. System implementation encounters challenges when a technical fix is applied to a management problem [65] or when there is more focus on the technical aspects of the system over the reasons why one should use the system [121].

Data quality

Timely data entry and completeness are required for up-to-date access to accurate health information for decision-making and reporting [1, 12, 60, 68, 93, 122]. Data entry can be hampered, however, due to illegibility of clinical notes [58, 114]. Lack of standard terminology [1, 109], combined with inadequate knowledge of disease classification systems, can lead to inaccurately and inconsistently coded data. The use of standardized medical languages can reduce medical errors and identify treatment opportunities [2]. A concept dictionary, created through a participatory process, can clarify definitions and coding, and can be set up to allow new items to be added without a programmer [119, 120, 123].

Sustainability and scalability

It is important to think proactively about the sustainability of EHR implementation. A key to sustainability is the alignment of organizational culture and strategy to support EHR implementation through a unified approach [4]. A central area is ensuring that local staff not only create the EHR, but have the knowledge to support and maintain it [57, 82] using local resources [91, 104]. Sustainability begins with a plan to shape and adapt the system to the local vision and context [77] through participatory teamwork and collaboration [77, 99]. The

organization should work to cultivate local learning and build capacity [25, 67, 77, 82] so that the EHR can be supported by local expertise [77]; responsibility should be passed to local people [77] and EHR routines institutionalized over time [5, 89]. This requires a continuous change process of assessment and proactive response to challenge the status quo and work together on creative problem solving [77]. Ideally, working solutions should spread to other environments through a scalable, long-term vision [5, 60].

Conclusion

EHR implementation is complex; it requires consideration of multiple factors, each intertwined with the other. Factors include the context, organizational culture, organizational strategy, and the technology itself. Each of these has barriers and facilitators for change that must be considered, and perhaps overcome, before sustainable EHR implementation can be achieved. Evaluation is imperative to not only iteratively improve the implementation process, but to understand EHR implementation in the context of a resource-poor healthcare environment within a developing country. By sharing knowledge and skills and building on successes, future implementations can be built on prior learning and experience and potentially lead to sustainable and scalable solutions for EHR implementation in developing countries.

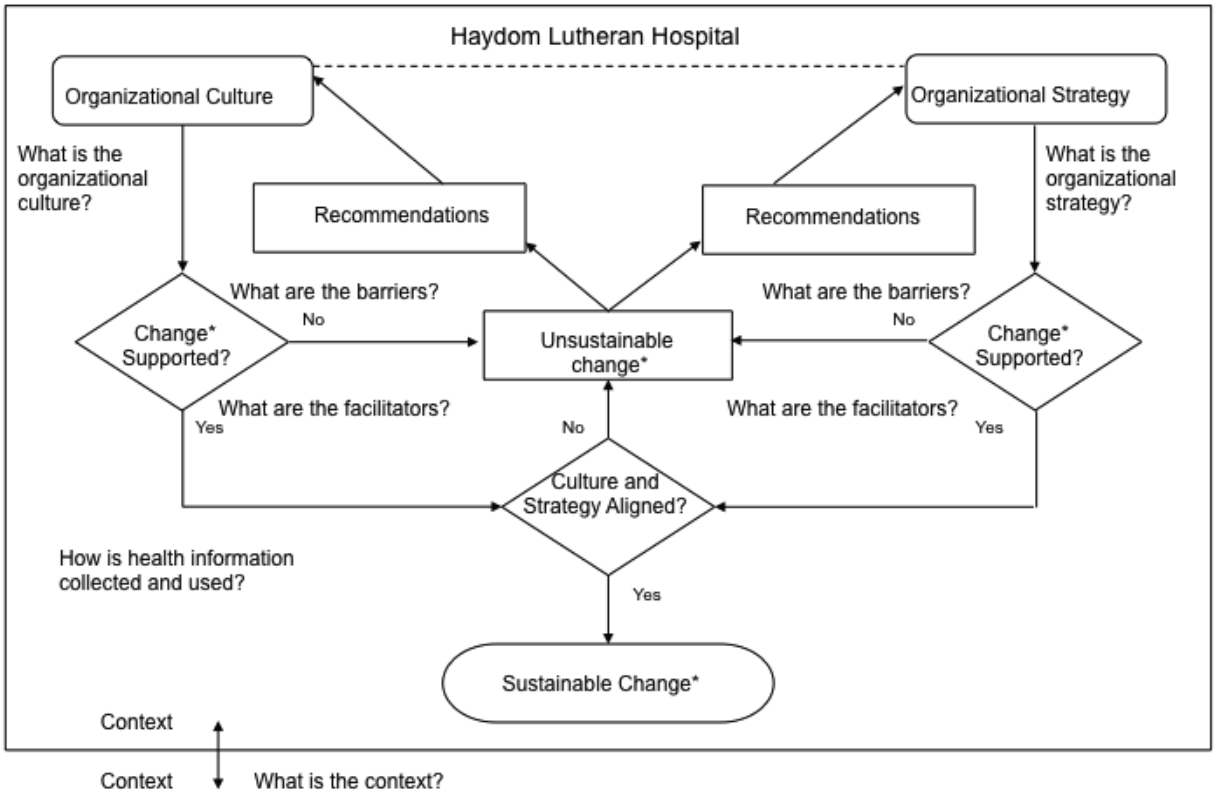
Before evaluating the development and implementation of an EHR in a developing country, it is desirable to place the research in a conceptual framework from which research questions can be derived. This is the topic of the next chapter.

Chapter 3: CONCEPTUAL FRAMEWORK and RESEARCH QUESTIONS

This research uses an ethnographic case study approach, drawing from socio-technical and social interactionist theories, to explore the question: *"How can we improve the implementation of an Electronic Health Record within a Tanzanian clinical environment?"* Sub-questions are derived from the conceptual framework, and when combined, address the larger research question.

The conceptual framework (Figure 3) illustrates the importance of context and the influence of organizational culture and strategy on EHR implementation within the clinical environment, as outlined in the literature review. Briefly,

- There is tension between organizational culture and strategy; both influence change implementation and require alignment for change to be sustained.
- EHR implementation is influenced by organizational culture and strategy and has barriers and facilitators for change.
- It is important to understand the external and internal conditions and limitations of the environment to put research in context.



*Change: In this case, implementation of electronic health record.

Figure 3: Conceptual Framework

The conceptual framework is a modified version of one created during my MSc health informatics research to understand the influence of organizational culture and strategy on implementation of Evidence Based Practice (EBP) within a Canadian Neonatal Intensive Care Unit (NICU) [4].

In this framework, organizational culture and strategy influence the ability to achieve sustainable change. If the culture supports EHR implementation but the strategy does not, then it is important to analyze the strategy to determine if a change is needed; the same is true if strategy supports EHR implementation but the culture does not. If both culture and strategy support EHR implementation, then the next step is to determine if culture and strategy are aligned. It is possible to have a culture and strategy supportive of EHR implementation but not aligned with each other. For instance, the organizational culture might support an EHR to improve patient care; whereas, the strategy might support an EHR to improve efficiency; both culture and strategy support EHR implementation but with the goal of achieving different outcomes. Lack of support or alignment can lead to unsustainable initiatives and should therefore be taken into consideration when changes are initiated.

The research draws the following sub-questions from the conceptual framework to answer the question *"How can we improve the implementation of an EHR within a Tanzanian clinical environment?*

1. What is the context?
2. What is the organizational strategy?
3. What is the organizational culture?
4. What were the efforts to improve Care2X implementation?
5. What are the barriers and facilitators for change?
6. How do the context, organizational culture and strategy influence implementation of an EHR? Are organizational culture and strategy aligned? Where is there convergence? What are the implications for sustainability?
7. What is the role of participation? How can participation be used to facilitate EHR implementation?
8. What is the influence of outsiders on EHR implementation efforts? How can one balance the dichotomy between local and expatriate power?
9. How do the results compare to what we know about achieving sustainable EHR implementation? What are the implications for EHR implementation in low-resource clinical environments?
10. What conclusions can be made based on this research? What recommendations and lessons can be drawn?

This research teases out the influence of outsiders within a low-resource clinical environment, and the role of participation to achieve sustainable change. The first 5 questions are answered in the Results section, whereas the last 5 questions are

addressed in the Discussion, Conclusions, Recommendations, and Lessons Learned sections of this dissertation.

The following chapter describes the materials and methods for exploring the research questions.

Chapter 4: MATERIALS and METHODS

Site

Field Research

Field research was primarily conducted on site at Haydom Lutheran Hospital (HLH), Mbulu, Manyara, Tanzania from March 2007 to May 2008. A two-week follow-up visit occurred in September/October 2008.

At times, meetings occurred in Arusha, Tanzania at the Evangelical Lutheran Church of Tanzania (ELCT) Health Change Management and IT Team office (Lutheran Centre), Selian Hospital, Arusha Town Clinic (Selian Outpatient Clinic), and St. Elizabeth Hospital.

A timeline of events is presented in Appendix A.

Participant Description

I arrived at the hospital with the initial strategy to get my bearings in the environment.

> Ethnographers typically use an informal strategy to begin fieldwork, such as starting wherever they can slip a foot in the door. The most common technique is judgmental sampling – that is, ethnographers rely on their judgment to select the most appropriate members of the subculture or unit based on the research question. This approach is quite natural, requiring the ethnographer to ask very simple, direct questions about what people do. Natural opportunities, convenience, and luck also play a part in the process if the ethnographer is savvy enough to make good use of them. (p. 35)[124]

Over time, I was able to refine my focus and target enquiries to the people who could inform a particular phenomenon under study. Participant selection was iterative, and was influenced by the issue being explored, research evolution, and changes in human resources over time. Participants were identified by me and recommended by others. While some participants were involved for the duration of the data collection period, others had limited, targeted involvement. I tracked participant role and division to ensure I was building a comprehensive picture.

A total of 166 participants were involved in 149 meetings, 1648 emails, and 37 interviews during the data collection period. Of these, 107 participants were directly, and 59 indirectly, related to the research. Additional participants also contributed to the research process in the Town Halls, and site visits (see Meetings and Observation sections below).

Direct participation

One hundred seven participants directly informed the research, the majority of whom worked at HLH. HLH had the broadest representation of participants (82 participants representing 24 roles) tied to change and project management, leadership, quality improvement initiatives, registration and medical records, and

the implementation of the Care2X hospital information system ("Care2X"). HLH participants belonged to each of the nine hospital divisions, Administration, Finance, IT and Statistics Unit, Secretarial Services, Diocese, and Board. The chart, below, shows the distribution of participants across units.

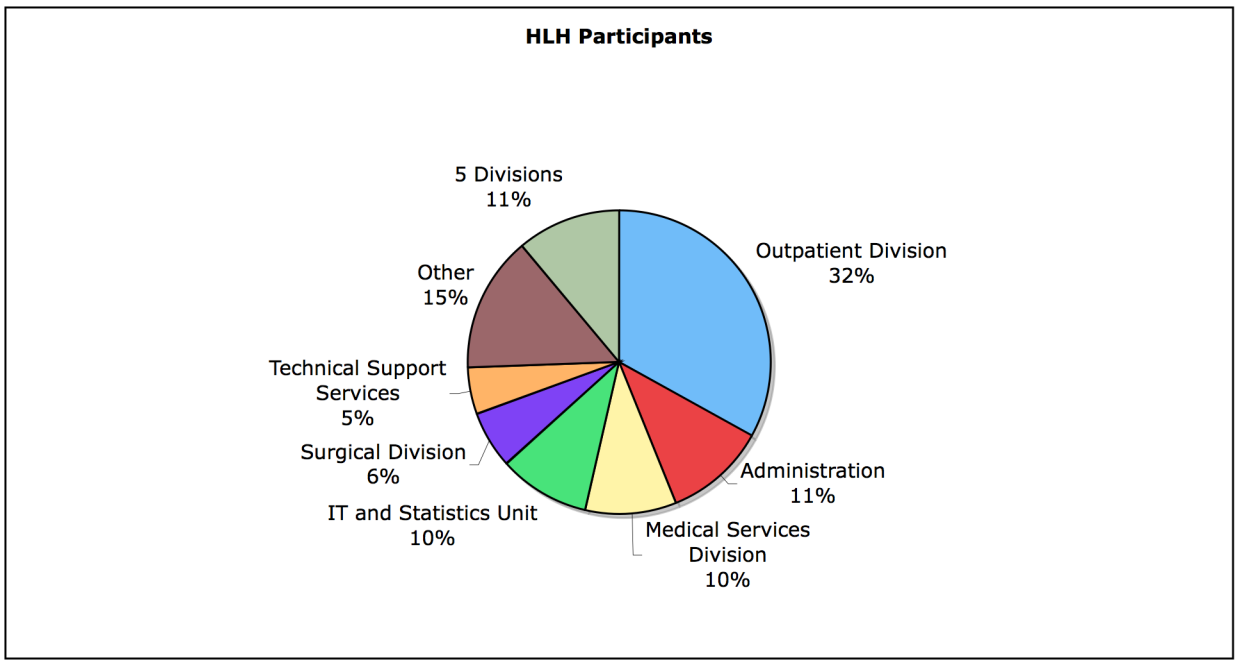


Figure 4: HLH participants by unit

Of the 82 participants at HLH:

- 32% (27 participants) worked for the *Outpatient Division*, within the main Outpatient Department; Eye Clinic; and HIV/AIDS clinic;
- 15% (12) worked for *Other* groups: multiple divisions (4), Board (3), Finance Department (3), Diocese (1), and Secretarial (1);
- 11% (9) worked in *Administration* and were tasked with administrative duties;
- 11% (9) worked for *5 Divisions*: Mother and Child (Maternity, Paediatrics) (2), School of Nursing (2), Pharmacy (2), Medical (2) (Psychiatry), and Outreach (1);
- 10% (8) worked for the *Medical Services Division* within Medical Records and main Laboratory;
- 10% (8) worked for *the IT and Statistics Unit* within the IT and Statistics departments;
- 6% (5) worked for the *Surgical Division* within the Surgical Wards, Theatre, and Intensive Care Unit; and
- 5% (4) worked for *Technical Support Services* within the Garage.

Outside HLH, 25 participants directly related to the research worked for:

- Change Management and IT Teams at Evangelical Lutheran Church of Tanzania (ELCT) Health (10); Selian Hospital/Arusha Town Clinic (9); and St. Elizabeth Hospital (1), located in Arusha, Tanzania. ELCT Health facilitated the implementation of Care2X at Selian Hospital/Arusha Town Clinic and St. Elizabeth Hospital, as well as other health care facilities in Tanzania.
- Kilimanjaro Christian Medical Centre (KCMC) (1). KCMC and the Norwegian Peace Corps loaned an IT specialist to Haydom to provide onsite assistance with the implementation of Care2X.
- Volunteer Services Abroad (VSA) (1), as a community development facilitator for villages near Haydom.
- Other national (Tanzanian) and international (Germany, Norway) Finance and Information Technology consultants (3) working on hospital audit process requirements, and implementation of Care2X and the webERP financial management system for HLH.

Indirect Participation

59 participants indirectly informed the research. The majority (51) worked for organizations affiliated with research-related activities and included universities, funding agencies, research and ethical clearance agencies, and charities and included members of my supervisory committee, advisors, collaborators, and employees at funding agencies, research and ethical clearance agencies; and various local, national, and international researchers

The remainder of the participants were affiliated with KCMC (1), the Norwegian Peace Corps (1), accommodation (2) and transport (4).

Approach

I had initially intended to use a Participatory Action Research approach, with neat, cyclical, participatory changes and evaluation. This approach had to be tailored, however, to reflect the challenges of partnership, ownership, and control within the research environment. I adopted a quasi-approach to PAR through an ethnographic lens. This research is an ethnographic case study and draws from socio-technical and social interactionist theories.

Participatory Action Research

PAR is a style of interpretive research, not a method [125]. PAR builds on Paulo Freire's critical pedagogy to drive social action [126]. It is context bound [127] and has been described as:

> a way to build theory, knowledge, and practical action by engagement with the world in the context of practice itself. (p. 116)[76]

PAR is a way of "knowing" about a phenomena that is driven by stakeholders "living" the phenomena [128, 129]. PAR builds capacity by empowering local stakeholders to participate in the identification, collection, and analysis of issues

directly related to the implementation process. Specifically, PAR has the potential to build support for an EHR initiative by: identifying barriers and facilitators to change; empowering participants; increasing communication and feedback between different stakeholder groups [4, 5, 130]; and improving the quality of the implementation through iterative action plans built through participant consensus [128, 131]. These in turn can help drive the sustainability [5] of the initiative and identify cost-effective solutions to iterative quality improvement [132, 133].

Within this approach, I had intended to limit my involvement to being a facilitator to the process, bringing people together to make participatory decisions about the EHR implementation, and providing them with support to implement and evaluate changes iteratively. As it happened, over time I also became a change agent, which helped move processes forward as I filled a gap in human resources, but also hindered processes as my presence embedded reliance on an outsider to fill a gap best left to locals.

Ethnography

I used an ethnographic approach to the research. Ethnography is an interpretive form of social research, not a data collection technique. Ethnographies answer how and why questions with a focus on contemporary events [134]. Ethnographies aim to be holistic and context-rich, and benefit from extended field research [124]. This interpretive approach explores the social and technical aspects of information systems including the links between the implementation process and context [77, 86].

This research is presented as an ethnographic case study and examines the social setting within which the information system is being implemented [77, 135]. The research reflects the real-world context, and enables comparisons across settings [15] (with multi-case studies).

> Case studies, like experiments, are generalizable to theoretical propositions and not to populations or universes. In this sense, the case study, like the experiment, does not represent a "sample" (p. 15) [134]

Case studies expand and generalize theories (analytic generalization) and not frequencies (statistical generalization) [134].

The research draws from socio-technical and social interactionist theories. In the socio-technical theory, understanding information systems requires a focus on the interrelation between technology and its social environment; it looks for 'fit' between technology and the organization [16]. In social interactionism, interactions are understood through exploring the culture and context of a natural environment, over a period of time and with the people living the phenomenon; it employs multiple methods and addresses a variety of evaluation issues [11]. Both are context-driven, and iterative, incremental change processes.

Methods

This discovery-driven research utilizes a mix of quantitative and qualitative research methods. Rich descriptions and a holistic perspective are emphasized to

present a comprehensive picture of a social group [136, 137]. The field research itself enabled me to immerse myself in the community within which I lived and conducted research.

Fieldwork uses a naturalistic approach to investigate a phenomena in its natural setting [136].

> Long-term residence helps the researcher internalize the basic beliefs, fears, hopes, and expectations of the people under study. (p. 37) [124]

Generally, more fieldwork is needed to understand the relationship between information systems and the social and organizational settings that they are implemented within [135].

There is an interplay between data collection and analysis, and between experience and theory. The research was an iterative process of discovery, rediscovery, and member checking to ensure that my understanding of issues was correctly reflected. Enquiries led back and forth to each other, while asking "who, what, where, when, why, how" questions constantly. My field research journal was an important part of my data collection process.

> If a researcher is the facilitator or instigator of a change process, part of the research documentation is the researcher's roles, actions, and decisions. Because of this lived complex reality, keeping a research journal is a vital piece of any action research methodology; it is a chronicle of research decisions; a record of one's own thoughts, feelings, and impressions; as well as a document reflecting the increased understanding that comes with the action research process. Beyond these, it is important to keep track of the ethical decisions made throughout the research process. (p. 77)[138]

My research journal enabled me to chronicle my research decisions in the face of untidy, unpredictable processes. It serves as a record of my thoughts, feelings, and impressions and reflects the increased understanding that comes with the research process.

Data Collection

While I did not speak Kiswahili when I first arrived at the research environment, I spent a lot of time learning and practicing the language shortly after arrival. Over time, my competence with the language improved and opened up opportunities to converse with non-English speakers in informal and formal settings.

Data was collected on site in Haydom from March 2007 to May 2008, with a two-week follow-up visit in September/October 2008. There was limited email correspondence to follow up outstanding issues identified in October 2008.

Data was collected through: observation; informal discussions and interactions; meetings; email correspondence; interviews; heuristics; data quality check; and document review.

Observation

I was able to observe a broad range of activities during my field research, from those within the hospital to those within the community and beyond.

- Within *Haydom*, observation was integral to my understanding of the hospital environment and community, and included patient registration, human resources, infrastructure, workflow, culture, and community and social issues.
- Outside Haydom, I had the opportunity to tour *Arusha Town Clinic* (October, December 2007 and April 2008) and *St. Elizabeth Hospital* (January, April 2008), both located in Arusha, Tanzania, to see Care2X in use and discuss implementation issues with staff.

In addition to the regular informal trips I took to neighbouring communities, I engaged in site visits to increase my understanding of local community development processes and traditional cultures.

- I visited *Four Corners Cultural Centre* to learn about the traditional cultures of the four tribes that represent the convergence of four language groups in Haydom, Tanzania (Iraqw, Datoga, Hadza, Nyiramba). Three of the tribes are pastoralists/farmers, while the Hadza tribe continue their tradition of hunting and gathering in the Great Rift Valley (May 29, 2007).
- I made two visits to nearby *Endamasak* to observe how a Tanzanian and expatriate team facilitated community development meetings and to broaden my understanding of poverty and gender issues in the district. Water security and governance issues were discussed, and participants engaged in community team-building exercises (May 31, 2007 and June 4, 2007). I was formally introduced at the beginning of the meetings as a student conducting research in Haydom.

Observations were recorded as field notes and drawings. Reflexive journal entries and audio recordings were made. Photographs were taken with informal verbal consent. When possible, copies of pictures were provided back to participants.

Informal discussions and interactions

Daily informal discussions and interactions with people within the hospital and within the community expanded my general knowledge of the environment, from hospital-related issues, to social and community concerns. In addition to those connected directly to my research, I also made a concerted effort to meet with Tanzanian and expatriate visitors to the hospital to discuss my research and learn about their work. These individuals included those involved in community development, research development, social science research, telemedicine, and evaluation, among others. In keeping with the local culture, these interactions were easy and informal and generated reflexive journal entries and reflexive audio recordings.

Meetings

I participated in 149 formal and informal meetings ("informal interviews" [124]) with 95 participants (89 direct, 6 indirect) during the data collection period. There was an average of two people plus myself in each meeting with a range of 1 – 12 people. Meeting participants differed, depending on need, enquiry, opportunity, availability, or planning. Meeting frequency is presented in Figure 5, below.

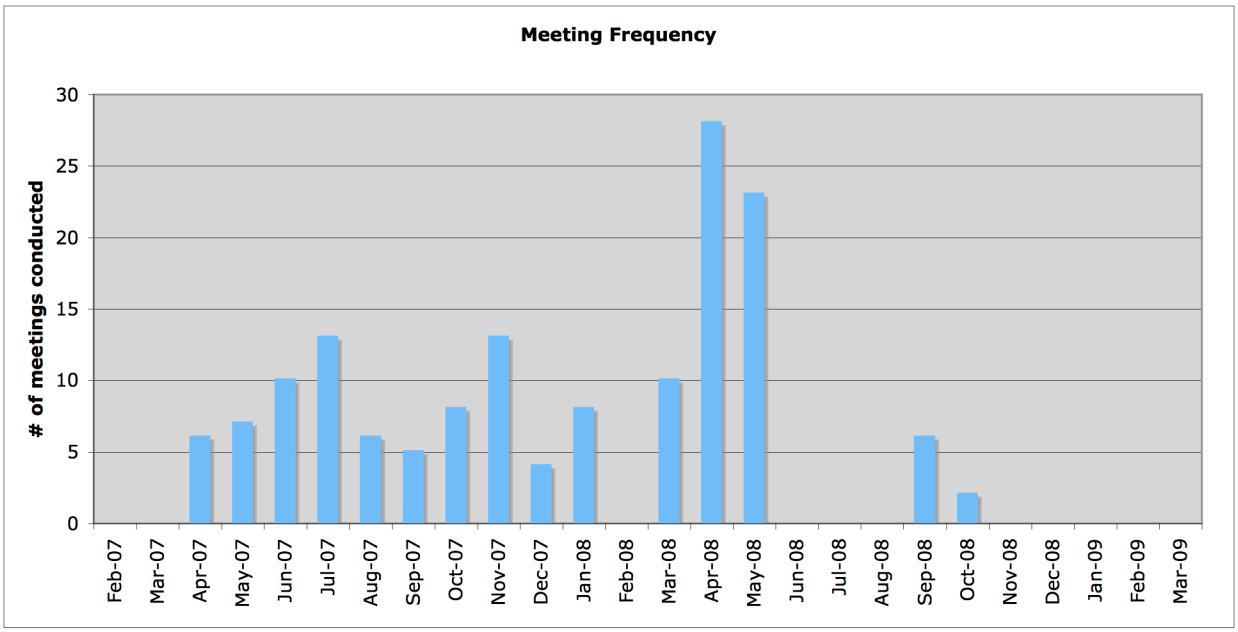


Figure 5: Meeting frequency

Meetings began shortly after my arrival in Haydom. Increased meetings coincided with exploration of Outpatient Registration procedures (June-July 2007); the formation of Division Leader meetings and exploration of Eye Clinic Registration (Oct-Nov 2007); and the hiring of a data entry cadre, formation of a project management group, and preparation to leave the research environment (Apr-May 2008). Meetings resumed during my two-week site visit in Sept-Oct 2008. Figure 6 gives an overview of the types of meeting groups I met with.

The majority of meetings (42%, 62/149) occurred with numerous IT and Change Management participants at HLH, ELCT Health, Selian Hospital/Arusha Town Clinic, and St. Elizabeth Hospital. In addition, 13% of the meetings occurred with the Care2X data entry clerks to discuss HIS improvements; 10% with researchers; 9% with the Eye Clinic; 8% with the Project Management team; 7% with administration and Division Leaders; 6% with Registration groups; and 5% involved community development, the Laboratory, Nursing, and History. Meeting topics primarily addressed: HIS implementation; server issues; capacity building; change management; project management; leadership; patient record; and statistics. At times, meetings addressed the implementation plans for both Care2X and the webERP financial management system, which would eventually be linked to the Care2X system.

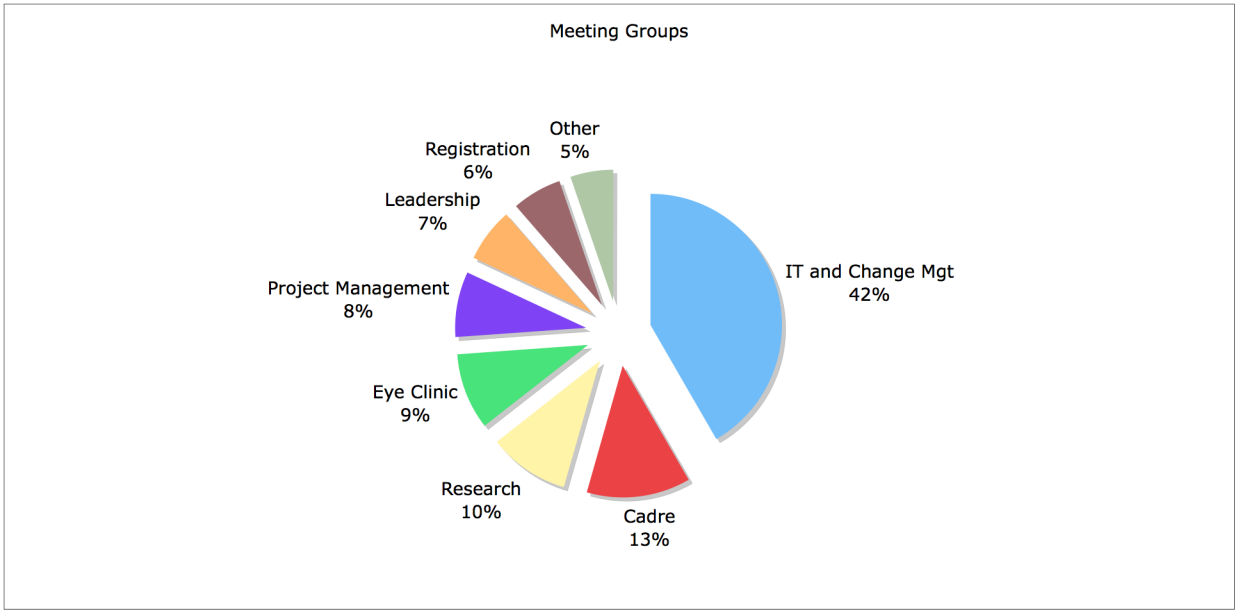


Figure 6: Meeting groups

The roles most commonly represented in meetings were: Information Technology (14%); Finance (12%); Change Management (10%); Administration (9%); Cadre (8%); and Registration (7%). The majority of the meeting participants worked at Haydom Lutheran Hospital (76%), and ELCT Health (9%). One hundred twenty-five of the meetings (84%) were held in Haydom. The remainder of the meetings were held in Arusha (11) at ELCT Health, Selian Hospital/Arusha Town Clinic, and St. Elizabeth Hospital; in Dar es Salaam (1) at the University of Dar es Salaam; and via phone (4) and SKYPE voice-over IP (8) while in Haydom.

Meetings generated meeting notes, reports, spreadsheets, reflexive journal entries, and reflexive audio recordings.

Town Halls

I held two "Health Information Systems town halls" to explore in large groups the strengths and weaknesses of Health Information Systems at HLH (August 21st and 23rd, 2007). The two-part session was held during time allocated for Continuing Studies sessions and was entitled "Working Together to Improve Health Information Systems". Health care professionals, administration, and nursing students attended the initial presentation and then the nursing students returned to classes. The remainder of individuals broke into 7 groups (44 people total, 5-9 people in each group) to work on the questions: How is health information collected and used? What is good about it? What is not so good? A representative from each group presented group results at the end of the session. Group notes were handed in at the end of the session, summarized, collated, and provided back to the group in the second session two days later.

The second session included a presentation of the summary results, a question and answer period, and a team-building exercise. Health care professionals, administration, and nursing students attended the full time period (approximately 120 people). Photographs were taken with informal verbal consent.

Email Correspondence

Email correspondence was regularly used to communicate with both local and distributed individuals and groups. Approximately 3,300 emails were reviewed from the data collection period. Of those 1648 emails (837 sent versus 811 received), involving 120 participants (64 direct, 56 indirect), were identified as research-related. Figure 7 illustrates email frequency.

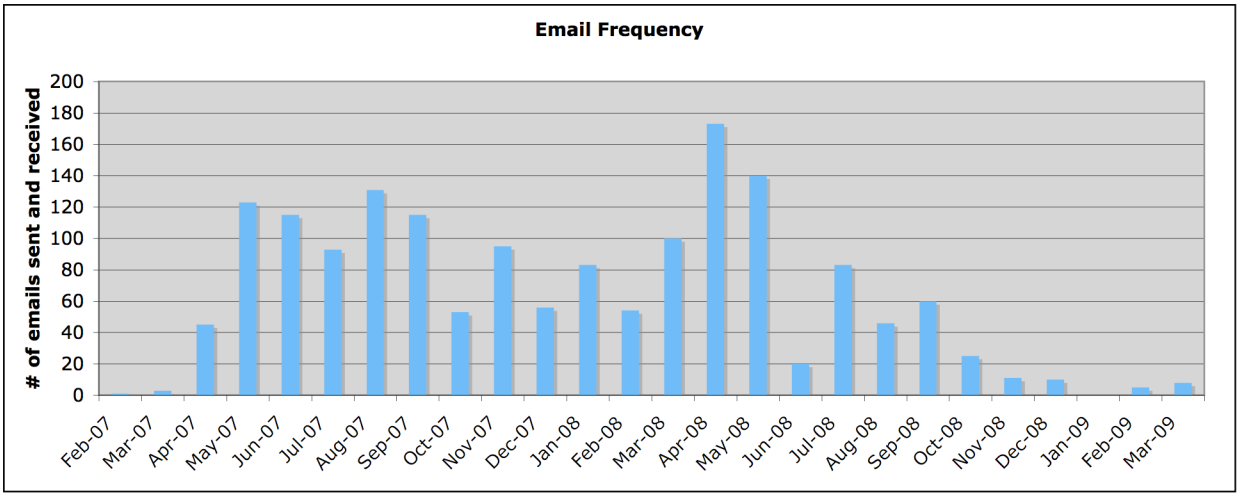


Figure 7: Frequency of sent and received email correspondence

The majority of emails occurred during the field research period, between May 2007 and May 2008. The peaks in Figure 7 represent increased communication to deal with targeted Care2X HIS implementation issues (server access, programming issues, capacity building, collaboration building) and specific academic issues (consent form, funding issues, publications), among others. Less correspondence occurred during the December 2007 holidays and once I left the research site (mid-May 2008). Increased communication from July to September coincided with planning the follow-up site visit and returning to Haydom in September 2008.

There is an average of two people plus myself involved in each email message, with a range of 1 – 12 people from multiple organizations (a range of 1 – 5). Most emails involved people working in Haydom (34%); followed by research-related organizations (27%); ELCT Health (18%); and distributed consultants (10%). Information Technology and Committee/Advisors represent 19% each of the roles represented in email correspondence; followed by Change Management (15%), Administration (9%); Research (7%); Finance (6%); and Programmer (5%).

Diverse topics were discussed through this mode of communication and included: HIS and webERP implementation; capacity building; Arusha accommodation and transportation arrangements; activity updates and progress reports; server issues; consent form modifications; funding; interview and meeting notes; meeting arrangements; research permits; and information for visiting advisors. There was a heavy emphasis on making connections between individuals and groups to coordinate disparate activities.

These interactions resulted in the email correspondence itself, reports, and reflexive journaling.

Interviews

I conducted 37 interviews with 31 participants from April 2007 to October 2008; 27 interviews occurred between April 2007 and May 2008 and 10 interviews occurred from September to October 2008. All interviews were in Haydom, primarily within participant office space or at my home. The interviews were conducted in English.

Interview frequency is illustrated in Figure 8.

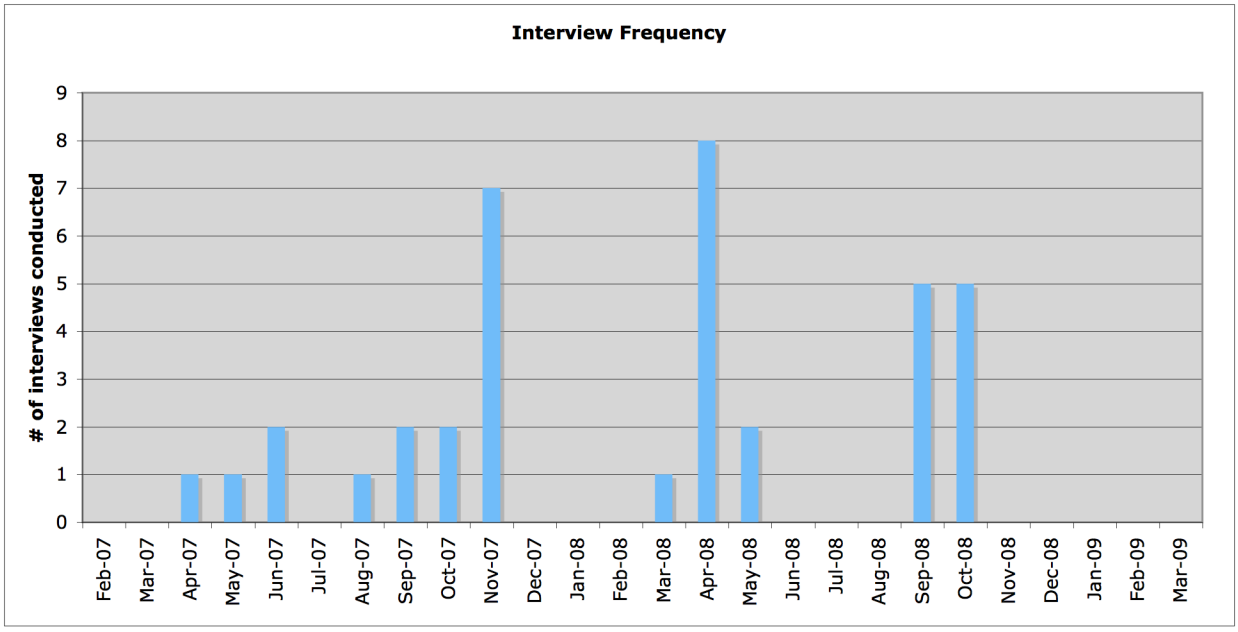


Figure 8: Interview Frequency

Increased interviews occurred in November 2007, after the new organizational structure was implemented; April 2008, after implementation of the Project Management team, and hiring of the Care2X data entry cadre; and September to October 2008, during my follow-up visit to HLH. Purposeful sampling was used to identify interview participants and was influenced by timing, availability, context, participant referrals, and other issues identified within the research environment. There were 36 one-on-one interviews and one interview involved two participants. The majority of the interviews were conducted with HLH Division Leaders (18%); Administration (16%); Doctors (11%); and Nurses (6%). The majority of the Division Leaders (6/9) were nurses, but were coded as Division Leaders. Eighteen interviews were audio recorded with permission. Detailed notes were taken. Audio-recorded meetings were between 17 – 60 minutes with an average length of 41 minutes. Exact times are not available for non-recorded meetings but are comparable to the audio-recorded meetings.

A semi-structured format was used at the beginning of each interview to understand participant challenges and opportunities within the hospital. The

format was flexible to allow for discussion and to pursue emerging areas of enquiry either identified within the interview itself, or within the research timeframe. Interview topics broadly included HIS implementation, change management, participation, gender issues, leadership, communication, community development, and sustainability. Interviews generated interview notes, audio recordings, transcripts, and reflexive journal entries.

Shortly after I arrived in Haydom, I realized that the 3-page, Grade 12 level English consent form I had prepared was not appropriate for the environment. Not only were lengthy consent forms not standard in this environment, but there was also a language barrier. Some of the key participants spoke Kiswahili only. From May to June 2007, the consent form was made shorter and the English-reading level simplified. The new version was translated to Kiswahili. In order to ensure informed consent, the form was explained to participants prior to interviews to ensure that the content was understood. In the event the consent form was not readily available, verbal consent was obtained and recorded. Consent to participate was reflected in the notes provided back to participants when interviews were not recorded. Otherwise, verbal consent was recorded. In all instances, participants were provided with the opportunity to review the interview summary to add, subtract, or modify notes.

Participant quotes were assigned an anonymized participant number unless they could be identified (e.g., in an email that was sent to multiple people). In these cases, the quote is presented without a participant number assigned.

Heuristic evaluation

The Care2X user interface was systematically reviewed for usability issues. I worked through the demo software to register test outpatients, enter diagnoses, order and complete laboratory work, write and fill prescriptions, and discharge the patient following billing and payment. I then tried retrieving the patient I had previously registered. Problems were identified and recorded in detail to inform the programmers.

In addition to reviewing the existing Care2X system, I also worked with participants to iteratively review the Eye Clinic module in its developmental stages. This was a paper-based, rather than electronic, process of reviewing screen shots prepared by the software programmer and received via email. Notations were made on paper-based screen shots, scanned, and sent back electronically to the programmer for revisions.

This method generated reports, spreadsheets, and screen shots.

Data quality check

In June 2007, with the assistance of employees in the IT Department, Outpatient Registration, and Medical Records, I conducted a data quality check of the first 7,000 Outpatient registration records for 2007. The sample size was 218, with a 90% confidence level and 5.5% margin of error. I had originally intended to check 373 of the 12,000 records available at the time (95% confidence level and 5.0% margin of error); however, limited access to the paper registration book,

combined with Care2X implementation issues, led to a revised approach and new areas of enquiry. Care2X was implemented in Outpatient registration January 1, 2007.

The Outpatient Department registered patients by hand in a large registration book, and also entered the information into Care2X. I reviewed every 32nd entry in the paper-registration book for the time period January 1 – March 19, 2007. Entries in the registration book were compared to the information in Care2X and tracked in a spreadsheet. Fields were taken from the information collected in both the Care2X and paper-based registration systems. I compared the information within the two systems (paper-based and electronic) and assigned a "0" if no difference existed between the fields or a "1" if a difference existed between the fields. I used the following fields based on the information collected in the Care2X and paper-based systems: record number (#); Care2X registration time (#); Care2X registration date (date); book registration date (date); occupation (0/1); surname (0/1); first name (0/1); father's name (0/1); *balozi* (ten-cell leader (the leader of every 10 families)) (0/1); tribe (0/1); book age (#); Care2X birth date (date); sex (0/1); town/city (0/1); religion (0/1); religion comment (text); Care2X data entry clerk name (text); and other remarks (text). Two additional fields (district and ward) were collected in the paper-based system but not tracked in the Care2X system at the time.

The data quality check included observation of the registration process and discussions with employees in IT, Outpatient Registration, and Medical Records to plan improvements. Detailed notes were taken and entered into the computer, and formed the basis of spreadsheets and reports.

Document review

I reviewed HLH documents, audit reports, and webpages, along with scholarly and grey literature, and books for information that could iteratively inform the research questions. Topics included strategy, change management, East African culture and history, health information systems implementation, quality improvement, gender issues, community development, participatory approaches, qualitative research methodologies and ethics. Field notes, drawings, and reflexive journal entries were generated.

Data Analysis

Manual qualitative coding of data was an iterative process. Data was read interpretively and reflexively, and I bracketed my own thoughts from those of others. Each data collection method was qualitatively coded separately, and then this triangulated (coded) data was combined according to theme in order to present a rich, holistic picture. This was an iterative process and involved dividing themes broadly to fall within context, culture, and strategy, among others, to tell the implementation story. Through this process of interpretation, hierarchies were formed and information was prioritized.

The rigorous and lengthy coding process can be summarized as:

- Transcribed handwritten notes and audio recordings and separated according to data collection technique (e.g., all interviews were kept separate from meeting notes).
- Reviewed word processed documents individually for high-level thematic codes and added to mind map (e.g., server issue, donor pressure). These themes over time became the "main" categories/headings.
- Reviewed word processed documents individually for sub-categories under main headings and added to mind map.
- Combined word processed documents by data collection technique (e.g., all interviews), and iteratively condensed the main categories and subcategories, drawing out examples (e.g., quotes) to support arguments.
- Combined thematic information (main and subcategories) from all data collection techniques (for instance, information about the nursing shortage from all interviews, meetings, observations, discussions, emails, literature).

This process took a very long time given the amount of data I had collected during the field research period. 'Theming' began as soon as I arrived in the research environment, and began with my many questions, which became part of the research, and my life, in Haydom. A mind map was developed and iteratively revised, for the duration of the field research period and subsequent analysis and write-up of the data, as new information was placed within the growing (but bounded) model to the point of saturation. Similarities and differences were explored across sources and contexts [139]. The iterative process of data collection and analysis led to insights, which in turn led to more questions and plans of action.

Observation

Field research and reflexive journal notes and drawings were converted to electronic format. Personal audio recordings were transcribed verbatim. Observations were qualitatively coded for information that could inform the research questions. Patient information flow diagrams, charts, reports, and presentations were generated, along with high-level statistics (for instance, number, location) of resources.

Photographs from Arusha Town Clinic and St. Elizabeth hospital tours were incorporated into presentations to demonstrate Care2X usage. The site visits to Endamasak informed the organization of the August 2007 town hall meetings at HLH.

Informal discussions and interactions

Informal discussions and interactions led to later reflection as I placed new learning into the mental model that had become my life and research in Haydom. Most informal discussions and interactions were internalized and added to my own implicit understanding of the environment. Audio-recorded reflections were transcribed, and notes and transcriptions were qualitatively coded. Some

reflections are presented as anecdotes or stories to reflect my lived experience [140].

Meetings

The results of meetings often set the direction for subsequent meetings. Meeting notes were recorded in my research journal and later entered into the computer for qualitative coding. Meeting content was provided back to participants as text summaries or member checking. Meeting summaries, diagrams, reports, and transcribed reflexive recordings were converted to electronic format and qualitatively coded.

Town hall group work was collected at the end of the first session and summarized. The information was presented back to the group during the second session. Detailed notes were taken in my research journal and converted to electronic format; the notes were qualitatively coded.

Email correspondence

All research-related emails were printed and filed chronologically by broad themes: Care2X implementation, Care2X expansion, Eye Clinic, server access, change management, process management, developers, Division Leaders, capacity building, data entry cadre, and Unique Patient ID. The correspondence was qualitatively coded.

Interviews

Interview audio-recordings were transcribed. Interview notes and recordings (when available) were summarized and provided back to all participants for feedback within a specified, but flexible, timeframe. All participants were provided with the opportunity to add, subtract, or clarify points before the notes were incorporated into my research. Minor revisions were made to seven interview summaries, at the request of participants. The remainder of the interview notes were incorporated into the research unchanged. Interview summaries were qualitatively coded.

Heuristic Evaluation

Both the Care2X electronic and paper-based module reviews involved identifying user interface issues, recording the problem in detail, and formulating questions to better inform improvements to Care2X [112, 141].

Data quality check

High-level statistical analysis was applied to the data quality spreadsheet to identify the most common errors. Results were discussed with the departments to determine next steps. This process generated charts, reports, and recommendations.

Document review

HLH was in the process of generating documents on their internal processes at the time of the field research. Available documents were opportunistically reviewed for information on HLH strategy, culture, and history. These included webpages,

annual reports, audits, and previously produced summaries of Care2X implementation plans. Additional documents reviewed during the data collection period included books and articles on participation, community development, East African health care and history, management, and qualitative research. Learning was incorporated iteratively into the research. Notes were qualitatively coded and summaries were generated.

Validity and Reliability

In terms of *construct validity*, multiple perspectives [142, 143] and sources of evidence [144] were triangulated [144-146] to provide a more complete evaluative picture [147]. Member-checking [145] and peer debriefing were used to clarify questions and confirm interpretations. A journal was kept to locate me within the environment and phenomena being studied [148] and included observation, methodological, theoretical, and personal notes [149], and also acted as a record for the chain of events [144].

The research process was modifiable and both formative and summative in nature. This helped to realize the benefits of pursuing important issues that arose in the evaluation process, and increased the value of the enquiry [142].

In terms of *external validity*, general theory was incorporated throughout the iterative enquiry and helped inform next steps and generalizability of results [143, 144]. Thickly detailed descriptions are provided as a means for applying the research findings to other contexts. Rival explanations for phenomena were explored and are presented [143]. Finally, in terms of *reliability*, the protocol was thoroughly recorded [144].

Ethical and Research Approval

The research proposal was accepted by Haydom Lutheran Hospital in Spring 2006. The research was granted ethical approval from the Human Research Ethics Board at the University of Alberta (UofA) in June 2006. Ethical clearance was approved by the National Institute of Medical Research (NIMR) in Tanzania in February 2007 for the duration of the research.

Research Clearance

Research clearance was granted from the Tanzania Commission for Science and Technology (COSTECH) in March 2007 and renewed in May 2008.

COSTECH granted my initial research permit and renewal, which was required for conducting research in Tanzania, securing Tanzania residence, and obtaining regional and district work permits.

Work Permits

Work permit applications were prepared with the assistance of Haydom Lutheran Hospital upon arrival at the research site; they were approved by the Manyara Region and Mbulu District, Tanzania in May 2007. In April 2008 I returned to Dar es Salaam for a day to finalize my COSTECH research permit (one-year) renewal.

Residence permits

My residence permit was approved by Tanzania Immigration in March 2007 and renewed in May 2008.

Chapter 5: RESULTS

I arrived to chaos in the environment and administrative firefighting to deal with constant crises. As a researcher keen on engaging people in a participatory process to improve health data collection and use, the environment was daunting.

A turning point came for me while sitting in *sala* (morning prayer) one morning in May 2007. The room was full, with more than the usual number of people attending. The Bishop was on site and, as there was no translator and I did not yet know sufficient Kiswahili, I sat with a blank look on my face most of the time, trying to understand why he was throwing candy at us. From what I gathered from the selective translation, the holiday that celebrated the late Dr. Olsen's life, on the anniversary of his death was upcoming, and we were expected to give money to the poor patient's fund; he was sharing the wealth (candies) with the audience. During this time, one of the female workers stood up and said something in Kiswahili to an attentive audience. When she sat down, a man stood up and loudly proclaimed, "There is a gap between workers and management". The tension was palpable. And Mama Kari, the matriarch of the hospital and the late Dr. Olsen's wife, stood up and spoke passionately in Kiswahili. When she was done, people broke out into applause. I didn't know what was going on until afterwards when I was told that, yes, we have our problems, but this was not the forum to be dealing with them – not on a holiday for her husband's death. They would be together on Tuesday and hope that they would still be together on Wednesday. At that time, the Bishop said that there were lots of problems but there were many donors and dignitaries coming for the Dr. Olsen *Sikuku* (holiday) and that we could either present a clean house or a dirty house, and we were told to present a clean house. "Oh no", I thought, "How am I going to engage people in this environment?" This thought became my constant companion for the duration of the research.

Idealistically, I wanted to find areas of unity – to bring people together to focus on what is shared and work outwards to build plans for change to improve the Care2X implementation. But this idealism clashed with the realism of the environment. The Care2X implementation was just one of many simultaneous change initiatives at HLH. And while one could argue that we were together on Tuesday, and every other day for that matter, we were not united. So varied and fragmented were the cultures and strategies that a search for convergence began in earnest. I started to wonder, how am I, as an outsider, contributing to the dynamics of the hospital? And, is my presence part of the problem?

WHAT IS THE CONTEXT?

It was a time of hospital transformation. The implementation of a new organizational structure reorganized reporting systems and introduced a new layer of management to bridge the gap between workers and administrators. There was a new Managing Medical Director, who was taking over the position his late father had held for 44 years, and new leaders were introduced in response to Church-elected positions and the instatement of Division Leaders (delegated authority). The 5-year Strategic Plan ended in 2006 and work was being done to lay the foundation for a future strategic plan, including identifying core hospital values, and building objectives and strategies to support those. There was a strong sense of urgency at an Administrative level to improve internal systems and build accountability mechanisms into hospital processes, in part due to the findings of donor audits and reviews.

The hospital struggled to manage scarce resources within a community of want. The absence of nurses, reduced opportunities to upgrade skills, and lack of essential supplies, were regularly cited by hospital employees as some of the greatest challenges in the environment. Moreover, change was generally resisted in the environment and low-tech initiatives to improve paper-based health information collection and use had not been implemented, despite participatory planning.

Hospital Transformation

Implementing a New Organizational Structure

The development of a new organizational structure was an initiative taken by the hospital's Managing Medical Director (MMD) Dr. Ole Olsen in 2003-2004, in response to the growing hospital's management needs. Dr. Olsen hired consultants who worked with the administration, ward leaders, diocese, and other stakeholders within the hospital to create a new organizational framework and the Board and Executive Council approved the changes.

Prior to 2005, the hospital functioned well and management and staff displayed a high degree of loyalty to the hospital [150]. In the original ("old") structure, management was centralized [151] and held by the MMD, Assistant MMD, Nursing Officer in Charge (NOIC), Assistant NOIC, and the Administrative Officer [152]; eight departments reported to the MMD and doctors reported individually [151]. Dr. Olsen was very visible both in the hospital and in the community and was involved in every aspect of the running of the hospital. A 2004 report described his day as follows:

> His working day typically begins in the work shop, where he organises the daily work. He continues to the doctors meeting, and thereafter to the "sala" [the daily morning meeting]…Thereafter he sees to different questions, often with a tail of people around and after him, who wants to speak to him. The rest of the normal working day is usually used in patient work, and in the evening different types of meetings are held until quite late. (p. 9)[151]

After 2005, however, there were 5 leaders for 550 staff, and a gap was developing between the two. Problems stemmed from communication issues, lack of capacity to implement changes in the wards, and decision makers having limited contact with workers and patients [153]. The "new" structure aimed to solve these problems by including more people in administration "to get a wider ownership to running the hospital, and to create better planning tools, and monitoring and evaluation tools" (Participant 7) through delegated authority (Division Leaders) and the creation of nine Divisions: Technical Support Services; Pharmacy; Outreach; Outpatient; Medical; Mother and Child; Medical Services; Surgical Division; and Nursing School.

The purpose was to improve health care through the establishment of clear expectations, responsibilities, and reporting lines, and make key decisions closer to the patient through the involvement of both division leaders and administration. These were accomplished through: monitoring activities, resource use, guideline implementation, and quality; and identifying problems at an early stage so that they could be solved quicker. It was desirable to make successes easier to see and celebrate [154], and to bridge the gap between workers and management.

Before the new structure could be implemented, however, Dr. Olsen became ill and had to leave his position as MMD. After his death in 2005, his son, Dr. Øystein Olsen, was hired to lead the hospital and was instated in 2006. Small adjustments were made to the framework under the guidance of the new leadership. The old and new organizational charts are presented in Appendix B.

Leadership Transition

Managing Medical Director

The previous Managing Medical Director (MMD) had led the hospital for 44 years before his son embraced the role. The transition of the new leadership from father to son invited comparisons to be made between their leadership styles. The late Dr. Olsen's leadership style was described as entrepreneurial and autocratic, immediate and responsive.

> He worked very, very hard and from what I understand…he seemed to be largely making decisions himself in a very benign way…and obviously very concerned for the people in the community. But he was very effective and in management terms [he] was something of a benign autocrat. He himself acknowledged to us that the hospital had grown a lot and that that style of leadership was going to be difficult to sustain with the increase in the number of staff that had occurred over the years since he had started being in charge. (Participant 8)

In a way, people seemed to be comfortable with the late Dr. Olsen making decisions. Anecdotes and interviews revealed the late Dr. Olsen as one who asked people for ideas, involved the worker's union in discussions, and listened to people when they didn't agree. He was close to his staff and communicated with them. While the late Dr. Olsen was strict, he had a lot of experience working

within the local culture. He led with an understanding of the community, and the reality of people's lives. He communicated change by telling people why things were going to be changed, describing the change process, and then proceeding. He did not seem very keen on change, however, and it did not appear that he had plans for major organizational change, despite the plans for a new organizational structure. He kept things running.

Conversely, the late Dr. Olsen's son, Øystein Olsen, while also a doctor, was not considered a visible presence within the hospital wards and consequently, seen as being disconnected from the group. People cautioned that this was not necessarily true as his work was in top management, not to engage in clinical work. The perceived gap between the administrative floor and the rest of the staff became a persistent image. The employees had become used to the late Dr. Olsen's autocratic leadership style, making it difficult to embrace the more participatory, delegated style embedded in the new organizational structure. While there was a new MMD, the management team itself remained the same. Some doubted that the new MMD was getting the kind of support he needed to enable him to lead effectively.

When he arrived, Dr. Øystein Olsen faced an almost insurmountable task of understanding how the hospital had run to date, and moving the hospital forward to a more participatory style. While some control routines existed, the level of information required to run the hospital was unavailable. He found that virtually none of the processes had been written down, guidelines were out of date, and charitable funds were running without documentation. Detailed personnel information was unknown, including job descriptions, level of education and capability. This basic information had to be established.

Lack of documentation was a large barrier to being able to understand historical decisions and to plan next steps.

> When you have one [very capable] leader who has grown up with the organization, [he] remembers…which policies worked and which didn't. And also [has] a spinal reaction to what is possible and what's not possible. And he would also know a lot more about who are where and why. And when you come into…that when you don't have any administrative tools [it's a real challenge]. (Participant 7)

The administrative team met with each department to ask about their vision and objectives, and the status of their guidelines, of which there were few. The departments were mostly using a combination of historical, Ministry, and WHO conglomerate guidelines, depending on what doctor was in the department at a given time.

There were about 80 different types of allowances and programs at the hospital – all of which had to be mapped out. Nobody knew which allowance schemes the hospital had as the late Dr. Olsen dealt with those directly. The management team brainstormed existing programs and added on as people came in and asked for more. Decisions were made about how much the hospital would pay for each

program and the accounting staff worked with the management team on allowance policies. This created new problems because people were used to a more pragmatic approach, but that takes a lot of time. While listening to people was not a problem in itself, it was time consuming and took a lot of administrative capacity, which was already stretched.

Like his father, Dr. Olsen travelled with a tail of people behind him. On some days it would take him half an hour to walk from the administrative building to his home for a meal, 200 metres away, because people would hide behind trees and approach him when he was free. I was guilty of cornering him on hospital grounds myself. I learned that I would not be able to speak to him otherwise unless I was willing to sit outside his office for an hour or two. I had tried that before and it wasn't the best use of my time. Nor was it the best use of anyone's time to sit in his office for hours, only to not have the opportunity to speak to him and have to return the next day. This was particularly true in early 2007, when the MMD lacked a full management team that could take some of the burden off of him.

The MMD's time was primarily spent on "ad hoc" micromanagement, with people coming into his office from 7:30 am onwards. No appointments were available through his office, though the secretaries were able to act as gatekeepers, when asked. He dealt with many things that would be best handled by other offices, had they existed at the time, and were largely related to personnel, advances, and allowances. The remainder of his time was spent dealing with crises, some of which were believed to be caused by factions within the hospital. Over time, the handling of many of these issues was transferred to the Finance Department and the newly created Personnel office.

The leadership transition continued in accordance with the new organizational structure, and coincided with Church-elected positions and key leadership resignations. During this time, a change management advisor arrived to support and give confidence to administrative decision-making.

Elected positions

Every four years, the Church elects or re-elects people to fill top leadership positions: the Nursing Officer in Charge (NOIC), the Haydom School of Nursing (HSN) Principal; and the Assistant Managing Medical Director (AMMD). In Fall 2007, rumours began circulating. It had been two weeks since leadership elections took place in Mbulu, and no announcement had been made on the results, though information had made its way back to Haydom informally. Some rumours were right, others were wrong, and none took the place of a formal announcement. One remarked, "a rumour is no substitute for clear, open, transparent communication" (Participant 8). This period of not knowing was a very stressful time for employees, and some people threatened to resign, depending on the outcome of the elected leader announcement.

Finally, the time came when two changes to elected leadership were announced in morning prayer (*sala*): the Nursing Officer in Charge (NOIC), the Matron, from 1982-2007 was succeeded by one of the Assistant NOIC; and the HSN Principal

of 7 years was succeeded by a past HSN Principal who had worked to create the School 25 years ago. The Assistant MMD leadership remained unchanged.

The nursing students immediately responded with a hunger strike. They sang hymns under the sausage tree within the school courtyard and refused to return to classes until they could speak to the Bishop. It is possible that the Bishop might have been perceived as impartial, and an easier person to explain their feelings to than someone directly tied to their schooling or potential future employment. Instead, the MMD offered to meet with the students, which follows HSN guidelines. The students were directed to sign a letter that they would support the new Principal and return to classes the next day. But the students refused and were sent home to their families for two weeks. They were instructed to return with a parent and sign a letter of support for the leadership change. Rumours circulated that some students, along with leaders of internal factions, continued to place pressure on nursing students who would otherwise support the new Principal. While the students returned two weeks later and resumed classes, the underlying issues may not have been addressed.

The announcement for the new Division Leaders was postponed after the elected leadership announcement, subsequent nursing student strike, and key leadership resignations (described below).

Resignations

In the days that followed the elected leadership announcement, the former HSN Principal, the Head of Human Resources, and the Union Leader resigned from the hospital. Administration did not make a formal announcement of the departures, and relied on the filter-down method of communication for people to be informed of the new developments. Some staff surmised that those who left were singled out as people working against administration, but there was no clear communication to know if the speculations were true. One individual pointed out that, while the changes to the organizational structure were meant to encourage people at different levels to make decisions, the reality could be that administration is reluctant to pass on responsibility.

> It could be that there is a sort of hangover effect from the previous situation where people still remember the unpleasant nature of going against the previous administration and are afraid that the situation may still apply. And I can see why that might be because, even fairly recently, a number of senior people have suddenly left the hospital. Sometimes, in one case, two people left in the same week. And so people could easily have the impression that the autocratic leadership style is in fact not changed. (Participant 24)

During this time period, I was contacted by people outside Haydom worried about rumours they had heard of turmoil between staff and leadership. I was cautioned that these types of major problems could have implications for change management, and efforts taken to implement improvements in the environment might not be successful in this climate.

Division Leaders

Division Leaders were formally inaugurated the third week of November 2007. Without people to fill the positions Division Leaders were taken from, they generally kept their old positions while assuming additional responsibilities to fulfill their new roles.

Division Leaders were hired through a standard selection process. Only internal candidates (within HLH) passed the initial screening. Short-listed candidates were interviewed by the MMD and Norwegian change management advisor. Those selected were approved by Administration and then the candidates were offered the positions [155].

Four criteria were used for selecting Division Leaders:

1. Motivating others – "Enthuses others and facilitates successful goal accomplishment by promoting a clear sense of purpose, inspiring a positive attitude to work and arousing a strong desire to succeed among team members."
2. Action competence – "Making active attempts to influence events to achieve goals; Self-starting rather than accepting passively; taking action to achieve goals beyond what is required; being proactive."
3. Professional skills – "Demonstrates detailed knowledge and expertise in relation to the job; readily absorbs new information and keeps up to date in specialist areas."
4. Loyal to HLH (including budget understanding) – "Maintains high ethical standards both personally and professionally; shows integrity and fairness in dealings with others; is reliable and trustworthy." (p. 4)[155]

While the staff accepted most of the nine Division Leaders, not everyone was pleased. One Division Leader in particular bore a lot of scrutiny for being selected. Some staff who had unsuccessfully applied for division leadership positions had difficulty adjusting to their new leaders who had rated higher on the selection criteria.

Core decision-making was changed with the new organizational structure. The management team grew from five people in Administration, to nine Division Leaders with five to six people in each Division team (including doctors, department leaders, ward leaders). This increased the number of people potentially involved in core decision-making at the hospital.

Participation was "sealed" with the Core Management Team (CMT) agreement. The agreement was a contract signed by the Division Leaders with the MMD saying that they agreed to the quality indicators and activities to reach hospital goals. The Division Leaders were engaged in a participatory process to identify quality indicators, which they were also accountable for because they had selected them. This was to achieve buy-in. By selecting the quality indicators themselves, the Division Leaders also knew to ensure that quality was being met.

Division leaders met twice a week for leadership training, co-facilitated by the change management advisor and the Co-Head of Finance. A goal of the sessions was to create a sustainable forum for leaders to discuss challenges and successes in their Divisions and build plans for improvement. There were three main concepts for the division leadership training: understanding the report format, including recording and reporting on both good and bad activities and making plans for the future; understanding roles and decisions within their power; and building communication and leadership skills. "Quality control" (an iterative quality improvement process) runs through all of these. The term "quality improvement" was generally not used as administration believed that workers would perceive it as meaning more work.

During this time, I facilitated sessions that discussed the collection and use of health information for decision-making, quality improvement processes, and planning.

To build pride and motivation, you need to have some achievements. By collecting baseline data in 2008, leaders could potentially look back in subsequent years and see what improved. Examples of baseline data (e.g., the number of deaths in the paediatric ward) were used by the change management advisor to demonstrate how trends could inform decision-making. It was anticipated that, over time, divisions would build skills to collect and analyse data.

Figure 9: Planning tree adapted from [156]

An improvement model was taught in the nursing school, and other similar improvement models were brought in to the hospital by outsiders (Appendix C). The underlying approach was the same, however, to plan, implement, evaluate, and discuss changes in an iterative manner. I used the "planning tree" (Figure 9) to illustrate that there are opportunities and challenges to improve issues (the roots of problems), and consequences for each decision made.

Strategic Plan

The hospital's last strategic plan was for the years 2002-2006 [152], and a new strategic plan was in its initial stages in 2007. The reasons for delaying the new strategic plan included incorporating the new Core Management Team (CMT) in the process, formulating division objectives and strategies, identifying resources, and "redefining the core values of the hospital to align with the vision and main objectives" (p.2)[157], as "values underpin behavior" (p. 11)[158]. The CMT was primarily comprised of top administrators and the Division Leaders.

In addition, the administrators were waiting to hear the outcomes of some of their planned initiatives, as this would have implications for future strategic planning. These initiatives included: their application to the government to become a teaching hospital; exploring the benefits and drawbacks of becoming a foundation; and offering an on-site upgrading course through the nursing program. They reasoned that it would not be very useful to make a five-year plan without knowing the outcome of some of these key initiatives as they would define the next life of the hospital. It was important to complete work on the strategic plan because unknown goals combined with unarticulated values are difficult to achieve.

The first step in building a new strategic plan was to reassess the values. Values were reviewed for the previous five-year plan, and were implicitly reflected in other past strategic plans. The CMT emphasized that the hospital motto, vision, and mission would not change. These were rooted in history and not open to modification, in part due to external pressures to maintain them. Hospital activities were also rooted in history and were based on, among others, the values from when the hospital was first opened.

In January 2008, the CMT had a value workshop in which values were identified from scratch. This process was an important one:

> By identifying the core values of HLH we are making it clear to all our partners, whether that is patients, staff, guests, donors, and community, who we are. It will build awareness of our identity which again makes us proud of our organisation. Likeminded Institutions and people can easier see us as who we are and build relationship with us. (p. 1)[159]

A list of draft values emerged through a series of group work and discussion: diakonia; holistic approach/care; dynamic; team spirit; hospitality; trustworthiness; and courage [159].

Strategy documents were to be completed at the beginning of October 2008. Once the strategy documents were complete, the hospital would have the strategies for each of the Divisions and transform them into the 5-year plan. Strategy documents moved from values, through to objectives and activities. Every Division worked to formulate activities and objectives that would enable the main hospital objectives to be reached. The five-year plan was expected to be completed sometime in 2009.

Donor Funding, Audits and Reviews

A review of HLH as a hospital and development participant [160] and an audit of internal control systems [161] were conducted in September/October 2007 as part of the contract with the Royal Norwegian Embassy (RNE), the hospital's largest donor. The reviews indicated that HLH had weak accountability systems for health and financial information, and recommended, as a precondition for future assistance from the RNE, the implementation of reforms to strengthen these systems [160, 161]. The auditors wrote:

> The findings were not very encouraging. HLH's Management needs to seriously look in to their existing systems and redesign them to ensure better control. (p. 4)[161].

Among these, the hospital did not follow international accounting standards, including accrual accounting; there were weak procurement systems that invited possible theft; the management information system lacked structure and format; goods consumption was monitored incorrectly; and expense reporting did not match the budget. The auditors therefore recommended that immediate steps be taken to review and improve existing systems to ensure "proper controls, optimum utilisation of resources, value for money and confidence of the board and the donors" (p. 35)[161].

Two of the main challenges at HLH were related to information systems and change management [160].

In terms of information systems, hospital outputs over time were difficult to assess because of weak health and financial information systems. A number of challenges were found with the Outpatient Department (OPD) statistics alone:

> When it comes to the quantitative output and input indicators of the hospital, a general word of caution is needed before digging into the figures. Reported figures may be misleading due to 1) inaccuracy in the registration of primary data, and 2) mistakes in the process of aggregating data into final statistics. We performed a quality control review of the outpatient registries and found that the quality of registration appears to have declined over time, in particular in 2007. There also seems to have been a period in 2006 where reattendances were not counted as they should have been. Moreover, there appears to be some confusion whether the OPD figures represent the number of patients or the total number of patient/doctor encounters (i.e., including revisits to the doctor's office after, for instance, a lab test). Finally, we found that the statistics department has several potential sources for the compilation of final statistics. It was not clear whether the statistics department consistently used the most reliable source of information. Based on these and other observations, we have the impression that the quality of the health management information systems at HLH is inadequate at present, and indeed not good enough to support decision making effectively. (p. 5-6)[160]

HLH Administration acknowledged the problem and pointed to the implementation of Care2X as a way to improve decision making in the future. The reviewers recommended that the new health information system be made a priority, not only to improve decision-making and gain staff support for change, but to demonstrate accountability to the donor community to give them confidence that funds were being spent efficiently. The design and implementation of the health information system should ensure high quality data entry [160] and output.

In terms of change management, the reviewers concluded that communication systems required improvement, particularly for decisions that related to the working environment generally and the staff in particular (communication flow from administration to staff), and for staff to communicate to administration. They recommended caution when removing privileges that affect a large number of staff during a time of organizational change [160].

> Interviews with staff displayed a desire for increased openness and transparency in the organisation and a closer relationship between management and staff. Staff also perceived a lack of implementation force in the management team as well as expressing frustrations about removed privileges in relation to further educational opportunities. Most staff members supported the recent reform processes, but there is also some degree of uncertainty about what the future will bring. (p. vi)[160]

The reviewers recommended that HLH leaders manage change and maintain staff motivation by explicitly communicating the change management strategy and evaluating the change management process, with stronger staff involvement in decision making.

> While change is necessary and inevitable, it needs to be handled carefully, with patience and sensitivity. The challenge for the management is to help staff cope with their fears and at the same time see the need for change. It is our impression that there have been instances where the change processes could have been managed differently in order to generate less resistance among staff. We therefore encourage management to carefully consider its change management strategy. (p. 30-31)[160]

The new organizational structure was one way to strengthen communication. It was recommended that the Division Leaders take on reform processes themselves as part of an integrated management team [160].

Administration became overloaded with reform initiatives and turned their focus to the new organizational structure, health and financial information systems, and the development of guidelines and policies. The report stated that a small group of influential people seemed to work against these efforts [160].

Scarcity

Social Issues

Strong social connections bind people together in the community. Haydom and the surrounding area is characterized by poverty, with almost 50% of the population below the poverty line [160]. The population is made up of subsistence farmers and pastoralists, small business owners, hospital workers, and others. It is a cash society, with the nearest bank located 2 hours away by car. In this environment, it is difficult for the hospital to identify who the poorest of the poor are. Patients who come for treatment at the hospital cannot necessarily pay. It is not uncommon for family members or patients to remain at the hospital for weeks, working off hospital debt by cutting grass and sweeping the dirt roads. Other times, those without money can bring a letter from their village leader confirming their inability to pay for services, and this could result in the hospital reimbursing the service costs with the "poor patient's fund". Most times, however, full or partial payment is made in one form or another, including through specialized funding groups, the sale of cattle or other commodifiable goods, or by borrowed or begged funds.

The hospital strategy is to alleviate poverty through various programs including the development of a trade school, cultural project, infrastructure development (roads, water, schools, etc.), food for work (hunger and famine years), farm project, and supporting the development of primary and secondary schools [150].

While the hospital has worked on responding quickly and efficiently to community needs, it has acknowledged that this responsiveness is balanced by an awareness of

> the danger that community assistance from HLH can develop into excessive and unnecessary dependency. (p. 23)[160]

That being said, within the community of Haydom there appeared to be a culture of dependence on the hospital, as one might see grow between a benefactor and a recipient. Undercurrents of colonialism, though perhaps unintentional, were felt within the community. Some local primary school children, taught primarily in Kiswahili, are also taught some English phrases, and it was not unusual to have children call after foreigners strolling through town, "*Wazungu* (white/foreign people), give me money!"

At the hospital, people were constantly knocking on residence doors asking for money and food, and within the community, approaching foreigners on the street and asking for gifts. In some instances, visitors found that those they had become friends with were no longer friends when the money ran out. The hospital did not provide information on how visitors could orient themselves to this type of environment within hospital grounds, but had rules for outside the gates.

> You know the irony of it is that you get asked when you come here not to go drinking [alcohol] up to town because it sets a bad example, but nobody has ever asked anyone not to give the

> children sweets or pens or anything like that because it sets a bad example. (Participant 9)

Neighbouring communities did not appear to have the *naomba* (I beg) phenomenon.

While people come to the hospital to work, they are mindful of 'their daily bread'. After working all day they still need to tend their crops, build fires, make food, collect water, and care for their children, in their modest homes, most times with no electricity. Women carry the burden of work in this traditionally paternalistic society. At the hospital, however, women and men share leadership equally.

According to the HLH Alcoholism Clinic and Outreach, there was an estimated 30-50% alcoholism rate in Haydom and surrounding communities during the field research period. The hospital itself was not immune, though the alcoholism rate was unknown. The lack of human resources put the hospital in a bind as employees who struggled with alcoholism could not contribute fully to the hospital's productivity, but were often kept because there was no one to replace them.

Resource Scarcity

<u>Human Resources</u>

Lack of qualified staff (doctors, nurses, paramedical) presented a real challenge to running the hospital and providing patient care. In 2005 and 2007, there were between four and six doctors (with only two doctors on call for months) [150]. When there were more doctors on site, it took pressure off of those who were on call. Even if the additional doctors did not work on call, they could see patients if, for instance, a doctor on call had worked 24 hours in a row and needed a break. This situation improved over time, though an ongoing challenge was that there were few medical specialists (e.g., paediatrician, internal medicine, surgeon) on site.

Similarly, the shortage of nurses was widely lamented and felt at all levels in the hospital. The reported number of nurses in the hospital from one time to another varies, depending on the source. Approximately 182 nurses with 7 more in training worked at the hospital in 2001 [152]; this declined to approximately 60-110 nurses in 2007 [160], and was consistently estimated by doctors to be about 45 by early 2008 (less than 10% of total staff).

The reasons for steady staff attrition, and inability to hire sufficient staff, over the years were many:

> One is that we're in the bush, and people [don't] want to be in the bush. Because if they work in the town, after working hours, they will have other part-time [work in a] different hospital, or the private hospital outside working hours to get more money. So that's one reason. Another reason is that, because we're in the bush, lots of people run to the town…for example, the nurses, because they want to change. Most of the nurses we get from our school here want to go to town and different places…A third

> [reason] is that most of the people since last year want to be employed by the government and we suspect that those get benefits when they retire. (Participant 20)

While the hospital matched government rates for hourly pay, they were unable to offer the salaries and pension benefits offered in government hospitals. This increased difference between private and voluntary-aided employees and government employees encouraged people to move in that direction. The decline of nursing levels over the years was also blamed on the discontinuation of the contract arrangement [160] with nurses from the Haydom School of Nursing (HSN) that permitted them to work for a specified period of time at the hospital and have a portion of their salary deducted to pay back tuition fees. This arrangement ended shortly after the MMD leadership change in 2006. While 65-85% of graduating nurses worked at HLH upon graduation, only 15% remained after one year [160].

Regular staff and nursing meetings were discontinued because of being short-staffed and nurses often worked double shifts to provide 24-hour patient support. Nurses could become unmotivated over time because of the strain on resources and the knowledge that they could be paid the same or more to work at a government facility. Basic nursing skills were inadequate, but due to the existing nursing shortage "you cannot, in reality, devote lots of time to education when patients aren't even getting basic care" (Participant 23).

The nursing shortage led to a large number of unskilled workers to be hired to work in the hospital wards. This had the potential to make improvements dependent on medical attendant, rather than nurse, acceptance since it is "easy for the fewer to be pulled by the more" (Participant 14).

There were not enough personnel to fill existing and future positions and there was a concern that when people left, there was no obvious person to replace them.

> I think this place will be dependent on an influx of people from the West for a very, very, very, very long time. So there's nothing that you can do to control that. The patients are dependent either on people immediately out of medical school in the West who want to come for a few years or retirees. (Participant 26)

It was difficult to make sustainable plans because of the ad hoc nature of dealing with crises and other challenges within the resource-poor environment. Yet this was the setting for large-scale change projects. Local and visiting workers ended up playing multiple roles to make up for the deficiency in staff or skills across departments.

The skills of visitors were not necessarily imparted to the locals, and no clear plan existed to replace people once they returned to their respective countries. When committees needed to be formed, there was some pressure to get foreigners to be on them and running them instead of Tanzanians, who might not be motivated to join. At times, the goal was to keep things running with the assumption that when

the time came, someone else would be there to take another's place or manage a looming crisis.

Tanzanians who continued to work at the hospital generally had family ties in the community. It was not unusual for immediate and extended family members to work at the hospital in multiple positions. There was some hope that the staffing situation would improve after the implementation of the new organizational structure, and could include hiring nurses directly from the HSN.

Staff development

Increasing the number of staff was important as there were few people to do a lot of work, both within the hospital and in outreach programs. One of the hospital goals was to keep and attract qualified human resources by training doctors and having them on an eight year contract, providing continuous medical education for staff, continuing exchange programs for staff and students, and being involved in international research programs [150]. By mid-2007, there were fourteen Tanzanians in hospital-sponsored MD and AMO (Assistant Medical Officer) training programs [160] in Dar es Salaam and Moshi. One completed the program in 2007 and 2-3 more were expected in 2008. There was no guarantee, however, that those trained would remain in their contract for the specified time. If the contract was broken, trainees were expected to repay the cost of the hospital's investment in their education. Realistically, it would take 10-15 years to build up a local contingent of MDs and specialists. In the meantime, the reliance on expatriates to fill the gaps continued [160].

Administration understood that employees wanted scholarships to go for training and maintained that opportunities were available but had to be prioritized given budget limitations. Applications were collected from those who wanted to go to school and the information was brought to the Core Administrative Team for discussion. Short courses or hospital exchanges (within or outside Tanzania) were important because many things were changing, including drugs. It was important that people who went for further study or on exchanges brought that information back to the hospital. It was helpful for HLH employees to see other hospitals and to look at what people were doing there, especially in Tanzanian government hospitals. While employees were provided with opportunities to learn from visitors who came to HLH for a short period of time, they did not necessarily show an interest in learning.

The hospital funded approximately sixty-five students every year in a variety of programs. In 2007, the hospital spent about 240Million Tanzanian shillings on education (approximately $180,000 USD). Communication of these opportunities was limited, however, to whether or not you knew someone in hospital-sponsored training, and left the impression with many that opportunities for further training ceased with the MMD leadership change.

Stories that did circulate were ones of struggle and penalty. Dissatisfaction spread "like ripples". When things were changed without notice, after having been the same for many years, it came as a shock. Previous support of upgrading courses was generally discontinued, in part due to the government announcement of future

distance education. However, the timing meant that nurses were faced with taking a correspondence course that was not yet running, or potentially being asked to resign if they asked for a leave of absence to attend an upgrading course that they themselves funded. These stories led to hurt feelings and dissatisfaction in the environment. One recommended that people be advised of their alternatives because they had "hard lives" and should be treated with respect. Employees would have benefited from having the budget presented to them and would likely have had a sympathetic response. Without this communication, people did not understand why they were not provided with the same opportunities as before.

Supplies

Lack of essential supplies was an ongoing issue and included shortages of gloves, IV materials, catheters, emergency and routine drugs, and reagents for laboratory tests. Lack of supplies impacted patient care. At times, there were no electrolyte solutions, which were required for surgical patients. There were certain levels set for essential items. When the level was reached, the pharmacy had to determine when and how much to order, and receive approval from the MMD and the Finance office to ensure there were funds to pay for the supplies.

The pharmacy had a reliable supplier in Holland to get most medical supplies, but it took 2-3 months to receive them. This was a long time to receive an order, especially when it contained essential items. At times the full order was not received. When orders could not be filled in Europe, the pharmacy ordered from Kenya or a similar country. The perceived quality of Tanzanian products is lower than supplies from these other sources, so local supplies were not generally purchased. Drugs were ordered within the country due to Tanzania FDA regulations. The hospital was not allowed to order drugs from abroad, unless the drugs were registered in Tanzania. Orders could be made to the medical stores department (government organization) for drugs or from MEMS (Mission for Essential Medical Supplies) in Arusha. If something was needed urgently, they ordered it from a private pharmacy in Arusha.

Stories circulated that there were items received over the years that could be useful to patient care and stored in the warehouse and containers located around the hospital. Access to the supplies was controlled by administration with the understanding that, until the items were catalogued, they would not be available for use.

> One of the problems we have is that nobody knows what we have. There's no good system to inventory what we have [in the warehouses and containers]. (Participant 26)

Another individual acknowledged that the items were largely gifts and not recorded properly but remarked that there might be a list of contents "in the back of the container that has been eaten by mice" (Participant 19). No one knew the truth.

During Christmas holidays (2007), a group comprised of expatriates and Tanzanians secured the warehouse keys from the person who held them

(apparently with permission), and entered the storage warehouse to identify supplies that could be put to immediate use within the hospital. Perhaps coincidentally, the timing of this initiative occurred when administrative representatives were largely offsite. The group found the large storeroom to be disorganized and recognized that a systematic approach would be needed to catalogue in a computer what was on hand and what was needed. However, "we were all very desperate" (Participant 25).

The group found some things that could be immediately useful. For example:

> No patient has had blood pressure measured or a heart rate measured except in exceptional circumstance. Inside the container we found maybe 20 blood pressure cuffs…And there are many pieces of equipment and supplies which are not inventoried and therefore not available. The administration didn't like the way that the doctors went in and just started looking through things. And indeed that's not the right way to do this; they must first all be inventoried, accounted for and distributed with the record keeping. But if the doctors had not done this on their own, all of that stuff would still be sitting in the containers. There's an enormous store room where some containers have been emptied. Nobody knows what's in there. And it is a huge warehouse-sized building stuffed with who knows what. And many things that we discovered in there had gone rotten and/or had expired so it couldn't be used, through lack of time and inventory. (Participant 23)

The group wrote down everything that they took from the storage building, and left with items that could be used immediately.

Administration was not pleased that people had obtained the keys for the supplies storage. The situation had made the key holder feel uncomfortable and administration met with the expatriates to discuss the situation. No Tanzanians were invited as it appeared that the expats were the instigators of the supplies search.

> I have the impression that as a result of that meeting, people are more reluctant to look in stores and things like that. But personally I'm afraid that this has been mishandled…I feel that the administration created yet another barrier to proper and efficient use of resources, and I think all sorts of issues arise from that. The effect of it is [to sort of] give back to administration the power to control what people do. In other words, to make the administration more likely to be effectively autocratic. (Participant 24)

Over time, it was hoped that the supplies would be inventoried in an Excel spreadsheet and then tracked by webERP (financial management software) at a later date.

Health Information

The Collection and Use of Health Information

Two town halls were held in August 2007 to explore ways in which health information was collected and used, and to identify 'good' or 'not so good' aspects. This participatory process provided a general overview of health information at HLH.

Figure 10: Group work at HLH to discuss health information systems.

Health information was collected through: examination; observation; documentation; tests; patient registration and discharge; talking; and media and Internet.

Health information was used to: diagnose and treat patients; coordinate patient care; generate statistics; promote community health; budget; plan; monitor disease prevalence (surveillance); evaluate and manage systems; simplify work; build relationships with patients and between staff; keep records and forecast; design surveys; and generate reports. These uses were all identified as "good".

The groups identified the following as "not so good" collection and use of health information: incomplete records and insufficient documentation; medicine was written in the chart but not given; no central patient file; multiple registration numbers for a single patient; morning doctor/clinical officer meeting discussions were not documented; lack of urgency; poor communication; time consuming processes; delayed medical procedures; lack of knowledge and skills; lack of doctor input/lack of doctors; lack of infrastructure/facilities (like computers); and ineffective systems.

Implementing Health Information Improvements

Implementation of low-tech solutions to improve the collection and use of health information proved challenging within the environment and caused some to wonder if high-tech solutions (like Care2X) would fare any better. Examples of these were attempts to implement: a paper-based drug sheet to be placed in the patient record; a new inpatient sheet that permitted additional notes to be

recorded; a registration window in the laboratory to pass all orders through; and nursing process. A brief description of these follows.

HLH's Quality Control Committee was tasked with planning and implementing quality improvement initiatives. While iterative, participatory planning and development worked well in the committee, implementation proved more difficult. For instance, the committee developed a drug sheet to be included with the patient record. With administration's knowledge, they iteratively presented and revised it at nurses meetings and through talking with doctors. Once developed, the committee found that the project did not have the support from senior leaders to implement. The committee was disbanded in early 2006, shortly after the MMD leadership change. It was considered no longer necessary as quality control would become the responsibility of the wards once the new organizational structure was implemented. In the meantime, nothing was in place to fill the gap until the Division Leaders were instated in late 2007.

Lack of support appeared to hamper the implementation of other initiatives, including a new inpatient sheet designed to provide additional space for writing patient notes – the current sheet provided only a few centimetres to record patient information, which was a challenge when patients had been in the hospital for an extended period of time. The new sheet changed the way medication and daily notes were written, and provided space to notify staff of how the patient was being treated, to promote continuity of care. While the form had been approved through participatory design, and discussed at doctor's meetings, it was rumoured to be sitting on an administrator's desk six months after its creation.

Further, the laboratory tried over the course of several months to implement a change in the communication flow of all orders and samples. Rather than have nurses walk into the laboratory and place orders in non-standardized locations, the lab opened a registration window for all orders and samples to pass through, and be immediately recorded in a statistics book. This was an opportunity for quality assurance, to ensure that all orders were processed in a timely manner. Despite signage, discussions, and presentations, the registration window was not used by the nursing staff and, over time, the laboratory abandoned the registration window in general.

Finally, nursing process is a way to build accountability into professional practice through iteratively recording within the patient record the assessment, diagnosis, planning, implementation, and evaluation of patient care. While nursing process is taught in the Haydom School of Nursing (HSN), it was generally not used within the hospital itself, despite efforts over a 2-3 year period to implement it. While the nurses expressed enthusiasm to implement the new process, implementation was a barrier, in part due to the administration's concern for the amount of paper that would be used, and the desire to have information between sheets link together in an electronic health record instead. Nursing process can only work with patient allocation (treating the patient as a whole) rather than task allocation (a different health worker for every task). Resources and lack of nurses were used as arguments to continue task allocation at the hospital, because it was considered more efficient; however, it did not permit holistic treatment. One of the hospital's

goals, therefore, was to move from a task-oriented culture (deliver medicine, clean floor, register patient data) to a goal-oriented culture (patient centred, reduce stay days, improve quality) [162].

Infrastructure

Upon my arrival, computers were scattered throughout the hospital and included:

- 3 Outpatient Department (2 reception, 1 office);
- 2 Eye Clinic (1 reception, 1 office);
- 7 Library (3 main, 4 Internet café);
- 3 Information Technology (IT) Department;
- 2 Server room;
- 5 Administrative offices;
- 7 Finance Department;
- 2 Statistics Department;
- 15 Nursing School;
- 3 Theatre (2 offices, 1 tea room); 1 Diabetes Clinic; 2 Mental Health unit (2 offices); 2 Maternal/Child (2 offices); 1 Physiotherapy; 2 Radiology (viewing room, CT room); HIV/AIDS Clinics (3 PEPFAR, 1 CTC/HAPO); and
- 1 Radio call room; 1 Canteen; 1 Security office; 3 Garage (1 office, 2 powerhouse).

The number of computers remained constant for the duration of the field research period. Not all computers functioned or were utilized. In addition, there were 11 Uninterrupted Power Supplies (UPS), primarily located in the Laboratory and Radiology; 4 voltage guards in the Eye Clinic; 1 voltage regulator in Radiology; 1 Stabilizer in the powerhouse; and 3 Stabilizers/UPS in the HIV/AIDS clinic (PEPFAR).

Power outages were not uncommon; the hospital therefore relied on the generator to provide power to the hospital when necessary. Securing a second generator was high on the priority list for fundraising.

The next section explores organizational strategy for implementation of Care2X.

WHAT IS THE STRATEGY?

What was planned, and the reality that unfolded, in many ways did not match. Initial plans were to expand Care2X outward from Outpatient Department (OPD) registration to the Laboratory, Pharmacy, and Billing, to learn from the experience and correct challenges before expanding further. This information would provide a holistic picture of the patient-clinician encounter for OPD, and inform the hospital about how the information linked. However, over time, administration grew tired of what appeared to be an endless piloting project without expanded implementation, and was not keen on processes that could cause further delays to hospital-wide implementation. Timelines were set by administration as an apparent strategy to force forward Care2X implementation, but did not address the deeply rooted problems that burdened the initiative. Data entry clerks (the "cadre") were hired to act as intermediaries between health care providers and Care2X, entering information into and extracting it out of the system for decision-making. However, there was no system for them to utilize, and the IT Department looked to me to provide cadre members with a plan to keep them busy. While existing employees were eager to learn the system themselves, this was not in accordance with administrative plans.

Despite efforts to update the system and expand outwards beyond OPD registration, no updates could be made to Care2X once the onsite foreign IT expert left the environment. The on-site server was managed from a distributed location (Norway), and neither locals, nor distributed programmers and other support personnel inside and outside Tanzania were able to access the server to make updates to the system. This situation, in effect, presented the greatest barrier to moving forward implementation of Care2X, and required persistent enquiries and follow-up to understand the underlying issues.

The creation of a Project Management group in February 2008 unified disparate projects. Unfortunately, projects were primarily led by foreigners, and all but one was scheduled to leave within 6 months. Over time, the Care2X program was placed under administrative decision-making power. During this time period, a collaborative relationship was developed between Selian Hospital in Arusha and HLH, in order to share the programming costs of creating a Care2X inpatient module (and associated MTUHA and other reports), and linking the information to the webERP financial management software.

While what follows is categorized as *strategy*, overlap exists between strategy and culture, and has been intentionally kept together to present a holistic picture. Teasing apart the two entirely would result in reduced meaning, and a disconnect between the strategies themselves and how they were interpreted.

Care2X implementation plans

The initial Care2X implementation plan

The initial 2006 steering committee at HLH decided to run Care2X parallel to the existing paper-based systems until all problems had been identified and improved [43], beginning with registration data [44].

Care2X was implemented in OPD Reception in January 2007. While computer literacy was not known, it was assumed that simple training would suffice for entering registration data into Care2X [43]. Two new staff were trained to enter registration information, with the intent that they would then teach other staff how to use the system at a later date [44]. Initial plans suggested that future stages could include utilizing the system for the Clinical Officer (CO)-patient encounter, where COs enter the information they write on the patient record into the Care2X system as well. This would, among others, increase the workload and training for COs. Another stage could include the laboratory to ensure that test requests and results were more quickly and accurately conveyed between OPD and the laboratory [43]. Billing was also a logical next step as it collected all patient information except for diagnosis. It was possible that, combined, this information would enable a breakdown of statistics for OPD and, eventually, each Inpatient Department (IPD) ward [44].

The initial implementation plan pointed to the need to understand specifically what Care2X was meant to be 'fixing'. Care2X was meant to improve patient care, but without understanding the existing challenges of patient care, how would the hospital know if Care2X was resulting in an improvement? In addition, Care2X did not match how health information was collected and used, so some restructuring of the patient encounter would be required. Additional success factors identified in the document included the appropriate infrastructure (power supply, computers), program usability, and computer literacy [43].

Prior to Care2X implementation, the IT department had strongly recommended that the existing patient numbering system be abandoned in favour of using the Care2X Patient ID (PID) as the primary patient number; it was automatically generated by the system and could create a "more stable and versatile filing system" which could be integrated for both outpatient and inpatient files. It was acknowledged that if the PID was adopted in the future, a mechanism to deal with power outages needed to be identified to compensate for the temporary unavailability of the system [163]. As it happened, the PID was rejected by the steering committee prior to implementation.

Revised implementation plans – October 2007

A revised implementation plan was described by administration in October 2007, in anticipation of server issues being resolved through distributed assistance. Implementation steps were separated into Human Resources and Software. Figure 11, below, illustrates the relationships between human resources, software, training, and module development and demonstrates how Care2X could expand outwards through a process of continuous quality improvement.

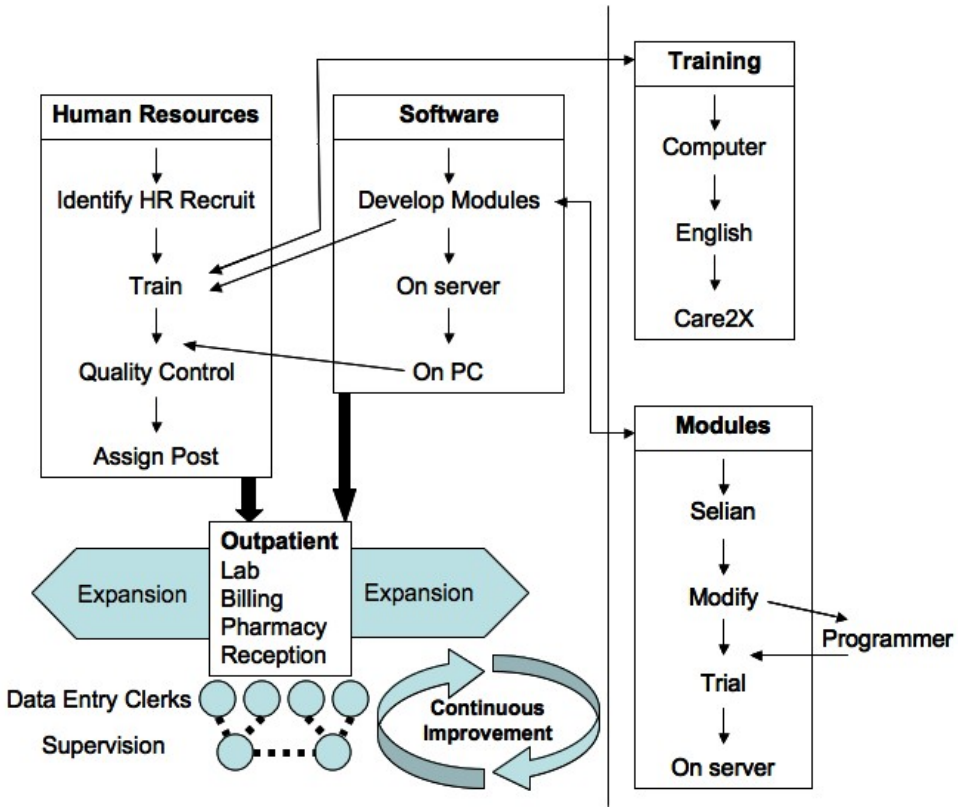


Figure 11: Care2X implementation steps at HLH

In this plan, Human Resources referred to the identification and training of appropriate people to utilize the Care2X system. Before being assigned to a post (a department that would utilize Care2X), trainees required instruction on basic computer skills, Care2X software, and English language. Software training relied on the development of modules by a distributed programmer, who could modify the OPD modules already in use at Selian Hospital. Modules required testing before being made 'live' on the server.

The first area to utilize Care2X was meant to be OPD, to follow a patient through registration, laboratory, pharmacy and billing. These efforts would be guided by a steering committee. Data entry clerks, supported by a supervisor, would enter health information into Care2X. Learning was achieved through continuous improvement cycles, before expanding outwards into other areas of the hospital.

These plans were stalled, however, when we were unable to view the most recent version of Care2X, nor update the HLH server. By this time, administration was worn down from change management processes that appeared to not lead to further expansion of the Care2X system, and the relationship with ELCT Health was wearing thin.

The Care2X cadre

The hiring of a Care2X cadre of data entry clerks illustrates a significant and unfortunate breakdown in communication between the administrative level, myself, and other participants. While a separate cadre was the desire of

administration, it initially lacked support by other leaders and participants who wanted to learn to use the system themselves, and was an approach strongly cautioned by ELCT Health and Selian Hospital, given their own experience implementing Care2X within hospitals. After a meeting with administrators in January 2008, I had understood that we had reached agreement to train existing employees and leaders on Care2X, rather than hire a separate cadre. Before returning to Canada for a one-month visit (February 2008), I met with the webERP facilitator, and members of the IT department, Statistics, and the Division Leaders to create a staged training plan for existing employees to learn Care2X. I returned a month later to find that administration had hired nine new cadre members during my absence. The IT Department looked to me to provide the cadre with full-time employment, as Care2X could not be expanded beyond OPD registration, due to ongoing server issues.

Despite the rough start, this situation turned into an opportunity for improving paper-based health information data collection and use. I became part of a team to assess computer skills and provide training and support to the new Care2X cadre. Working with individuals from IT, Statistics, and Finance, we designed a training program with three goals: 1. Provide basic computer skills training; 2. Provide English-language training; and 3. Increase awareness of health information data collection and use in seven hospital divisions: Surgical, Pharmacy, Outreach, Medical, Mother and Child, Outpatient, and Medical Services. Technical services and Garage were the remaining divisions, but were not using Care2X. Cadre members were provided with a weekly schedule and initially spent their time between computer training, English language classes, and job shadowing within divisions.

Meetings

Weekly cadre group meetings were held to build teamwork and to discuss challenges and opportunities for their work. The cadre meetings were co-facilitated by myself and the webERP leader, and included other visitors, as appropriate, including the MMD, the Statistics manager, the Process manager, and the new expat IT expert when he arrived in April 2008. Meetings were an opportunity to discuss, among others, training progress, issues with pay, and critical thinking about how to improve their work.

The cadre was given an initial presentation on paper-based and electronic health information collection and use, quality improvement, decision-making, and job shadowing in English and Kiswahili. We discussed the importance of their work and the seriousness of "garbage in garbage out" (poor information in the system provides poor information back). Following the meeting, the cadre was given a tour of the hospital by the Patron. A few weeks later, the cadre was also given a presentation on the Care2X outpatient implementation at Selian and St. Elizabeth Hospitals. They were shown photographs of the system in use, and we discussed the challenges and opportunities for Care2X within these environments.

We set the expectation to attend all scheduled work and classes, to work in a professional manner, and to respect other workers and students. We asked that

they concentrate on work while at work (rather than social activities), to listen to coworkers and instructors, and to apply what they learned in practice. We emphasized the importance of communication and were eager to create an environment where cadre members could share experiences and learn from each other: what works, what doesn't work, and what can we do to make an improvement? We stressed the importance of teamwork: for one of us to be successful, we must all be successful; if someone is struggling, we must work together to help. We cautioned that they should notify us (the facilitators) if they received pressure to do work outside Care2X/patient record/observation duties as that was not their mandate. The weekly meetings were very successful in terms of team-building and improved communication.

Training

All cadre members had at least one month of computer experience before they were hired. The cadre was given a basic computer competency test (MS Word and Excel) to gauge skill. One employee was released during this time by administration, so eight continued in a structured training program. The initial schedule for cadre members was to attend computer training three times a week to be introduced to computers and the Internet, to learn MS Excel basics and MS Word; to report daily to the divisions to job shadow the health information communication flow; and to attend English classes two times a week. The cadre members wrote weekly reports on their learning and submitted them to the Patron, who was also the Division leader for OPD.

The cadre moved quickly from job shadowing within wards (to understand data collection and use) to collecting data themselves. This is outlined in greater detail in the "Efforts to Improve Care2X Implementation" section.

Server Management

The server was managed off-site in Norway. The expat IT expert who had worked at HLH for two years and was leading the Care2X system implementation at the hospital left in August 2007 and no one remained on site who was able to manage the server. His absence revealed a lack of local knowledge on how to proceed with Care2X updates and testing, including lack of understanding of how the servers were set up. While instructions were provided to the IT department by the expat IT expert, they could not be located later.

From October 2007, I worked with distributed programmers, ELCT Health, and the HLH IT Department to understand why Care2X software updates could not be made to the Haydom server. While the HLH IT department was confident with providing regular IT support within the hospital, it required help with server issues. We therefore worked towards a temporary solution of remote Care2X updates and maintenance through ELCT Health and distributed programmers, with the understanding that a more sustainable solution would have to be found in the future. One remarked: "The black hole of maintenance is indeed the Care2X application itself for Haydom".

A combination of lack of transparent communication, uncertain problem definition, and issues related to power and control, resulted in a series of circular messages to try to understand and resolve server issues over the course of several months. The correspondence involved people within Tanzania (Haydom, Arusha, Dar es Salaam), Norway, and Germany. The diverse backgrounds (Norwegian, German, Finnish, Dutch, Tanzanian, Indian, Canadian) became a communication challenge. Some messages would be difficult to decipher given the different levels of English language competency and the occasional reversion to another language. The main issue was that we could not make updates to Care2X. When access was granted to view what was on the hospital server, all that could be found were empty development, test, and production folders designated for Care2X. It was a perplexing situation.

In December 2007, a distributed programmer (located in another country), and I met online via SKYPE, and through text messaging and simultaneous webpage review discovered to our surprise that we were not accessing the same Care2X program. We realized that there was another Care2X running on a different server – one that the programmer did not have access to.

We eagerly awaited the server master to come to Haydom as planned in February 2008, as we believed this would lead to quick resolution of the problems plaguing Care2X updates, and an opportunity to mentor local IT staff. Unfortunately, his visit was dependent on key components of a new server being available to him. The server was sent to Tanzania four months prior to his scheduled visit, and was being held by a charitable medical aid group. The boxes were received by HLH shortly before his anticipated arrival, at which time it was discovered that some key server components were missing. He therefore delayed his visit until May 2008 and we continued to rely on distributed communication. Shortly before his anticipated arrival in May 2008, the server master cancelled his trip.

Communication and control issues persisted when the server master received conflicting instructions. One wrote to me in April 2008: “Do you know something that I do not know?” I did not. While I continued to confirm that access be granted to the distributed programmer and ELCT Health, administration confirmed separately that the server master hold off granting server access to distributed parties because of his concern over diverging views. It is not clear where the specific divergence lay, though it appeared to be related to expansion of Care2X itself, rather than the basic updates that were requested and approved. The result was that server access was denied to the people who were asked to provide offsite support. This took months to sort out given the constant reassurance that everything was being done to facilitate remote update efforts. Once the problem was revealed and administration was consulted, I was asked to facilitate the connections once again to ensure server access was immediately granted to the distributed programmer for remote updates.

We needed someone in Haydom to administer the system and be the “eyes” for the distributed programmer and server master. We required the Care2X software to be migrated to the alternate server for future distributed access and updates to be made. With ELCT Health’s assistance, we identified and borrowed an expat IT

expert at a hospital 400 km away in mid-April 2008. His mandate for 2.5 months was to resolve the server issues by being the onsite resource for the distributed programmer and server master, and provide mentorship and support to the IT department for the duration of his stay. However, competing (additional) priorities and ongoing server issues stopped him from achieving the primary goals for bringing him on site. The inability to make updates to Care2X persisted without resolution when he departed ten weeks later and meant that the program could not be expanded beyond OPD Registration.

Project Management Group

Projects were not centrally coordinated. When newcomers arrived, there was the potential that they would be assigned work by administration that would overlap with existing projects. This left some people, including myself, scrambling to make connections with newcomers to retain control of their own work. Politics were at play: some newcomers appeared to have more influence and respect with administration, and this sometimes led to power struggles within the expat community, for instance, when newcomers received credit for work that had been done by someone else. Newcomers had the ability to influence plans that were already made. Without reiterating roles and activities, there was the potential that they would be taken over by someone new in the environment. Indeed, one had to be alert when a newcomer arrived.

A Norwegian from Deloitte, on site for 6 months, worked with administration in February 2008 to create a project group framework (Figure 12, below) that unified diverse projects that support auditor and hospital goals.

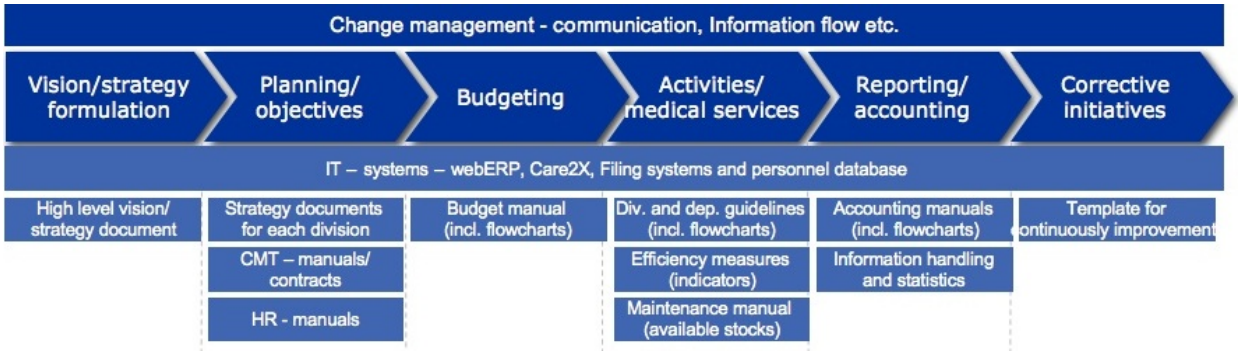


Figure 12: "The internal control wheel" and related projects/deliverables adapted from [164].

The top two rows of the figure denote the "internal control wheel" which is a continuous change management process consisting of six parts: vision/strategy formulation; planning/objectives; budgeting; activities/medical services; reporting/accounting; and corrective initiatives. Fifteen projects/deliverables fall below the internal control wheel: IT systems (webERP, Care2X, filing systems, and personnel data) span the entire internal control wheel; whereas, the remainder of the projects fall under specific aspects of the internal control wheel. Most of the projects were being worked on simultaneously to lay the groundwork for the template for continuous improvement.

> I think it's important to say that, when you look at all the frameworks and all the timelines and plans and everything, the first impression can be [that] this is too ambitious, too complex, [and] it doesn't make sense, because the gap between what I'm working with now and the level of organization is too high. But I think it's important to say that just to get the written documents is a value itself. (Participant 21)

The project management group met weekly to discuss challenges and opportunities of projects, track progress according to project timelines, and address resourcing needs, among others. This became an exciting time as it was the culmination of what a number of facilitators and stakeholders had worked on individually to achieve for some time. Group members rallied behind the project group as an opportunity to share experiences and move forward large-scale projects (see Figure 12 above). Administration was a supportive and integral part of the group, and project facilitators were able to work with the framework that had been created (above), and see how disparate projects 'fit' within the larger whole. There appeared to be a shared vision among the project team. Communication and leadership were essential in this group. We worked to build a team that promoted equality and mutual respect. It was an opportunity for increased communication, collaboration, and coordination.

However, cracks started to form as the novelty of the project group wore off. Some members became disillusioned as they were given projects to lead, but not empowered to truly lead (for instance, make a decision and implement it without administrative input). Administration was keen to discuss specific project details and approve or reject plans; this approach appeared to support an autocratic leadership style rather than the distributed one the change in organizational structure was meant to achieve. Issues of trust emerged as some projects were brought under stricter control. There was some discussion that if administration took over projects, they would not succeed because of the focus on outputs, rather than people. Project pacing and timelines were daunting:

> You really have to be patient and [not to] expect things to happen too quick. I see them [the administration] trying to bring in too many things at one time and that will only backfire. (Participant 25)

It was one thing to build a plan, but without the resources to achieve the plan, success was limited. We needed to build capacity to form a team with the right skills (e.g., IT, management) to put into action the plans that were made. Local leadership was important as the projects were largely led by foreigners, many of whom would leave by August 2008.

In April 2008, the balance of power shifted. In response to a strongly-worded email from the server-master to administration that an immediate communication plan be devised, administration prepared one and sent it out to the group for feedback. The message was that there was confusion with the process management of Care2X and webERP. The new plan was to have the project

group, with administration as head, make all decisions on the development of these programs, and advise the server master when to transition from software development to testing to production (implementation). The project facilitator positions ceased to exist in this new framework, and had implications for engaging local people interested in leading. The experience was disempowering and came out at a time when succession plans and recommendations were being completed.

Collaboration

Mentorship

I met with ELCT Health, Selian Hospital/Arusha Town Clinic ("Selian"), and St. Elizabeth Hospital in Arusha several times during the field research period. The meetings gave me an opportunity to understand Care2X implementation issues, as they had experienced them, and tour the hospitals to see Care2X in use. Each of these organizations kindly offered mentorship and support to HLH for Care2X implementation, and welcomed HLH employees into their organizations to learn directly from them.

We took advantage of this offer in May 2008, when two Care2X cadre members, the Head of Clinical Officers, a member of Pharmacy, the Division Leader in the Laboratory, the Head of Statistics, and a member of the IT department traveled to Arusha to meet with the ELCT Health IT and Change Management Team in Arusha. They were given tours of both Selian and St. Elizabeth Hospitals, spoke to Care2X users, and had a full-day training session on the software. When the group returned, they were very excited to form a Care2X implementation team at the hospital, planned a continuing studies presentation, and offered recommendations. The small group learning experience enabled the participants to bring knowledge, skills, and enthusiasm back to HLH and build connections between Care2X users at Selian and St. Elizabeth Hospitals, and ELCT Health.

Shared Development

In December 2007, members of ELCT Health, Selian Hospital, and HLH met in Arusha to discuss Care2X and webERP implementation issues. HLH participants included the implementation leader for webERP, the Statistics head, formerly part of the IT department, and myself. We discussed the possibility to form a collaborative relationship between Selian and HLH. HLH could learn from Selian's experience with Care2X implementation and get support for Care2X, and Selian could learn from HLH's progress with webERP development and get support for webERP. Selian Administration sent a follow-up message to HLH Administration in January 2008 to explore collaboration with Care2X and webERP, and to communicate their desire to share the process as requirements and solutions for Care2X and webERP were likely similar.

The Selian Hospital implementation team flew to Haydom for a one-day meeting in May 2008 to discuss Care2X and webERP implementation challenges and opportunities. The meeting resulted in a plan to work together with distributed programmers, and to learn from each other's implementation experiences.

HLH and Selian were eager to continue the collaborative relationship and tight deadlines were set by HLH administration to produce a list of all reports and data collected at the hospital, and a table that summarized the information needed for Care2X, webERP, and combined Care2X/webERP the following week. While a detailed timeline was requested for all implementation activities and software modifications, it was acknowledged that stakeholders needed to be involved to ensure that it was a realistic timeline.

The next section explores the organizational culture.

WHAT IS THE ORGANIZATIONAL CULTURE?

Organizational culture is embedded in the norms, values, and beliefs of the people working at the hospital. Work practices are the most visible symbols of culture, and are embedded in everyday routines.

The hospital transformation magnified a culture in transition, and perhaps unfairly exposed individual and group weaknesses over strengths. From my observations, employees themselves were largely friendly and devoted, generous and kind, clever and resourceful, but as a group, feeling worn down and worried about the future.

The dominant culture is difficult to define, and in part begins with a list of what it is not: it is not an information culture or a participatory culture; nor does it embrace change, innovation, or design. Tradition is a unifying factor that makes administrative-driven changes difficult to bear, regardless of the long-term benefit that change could ultimately bring. Sub-cultures and potential counter-cultures exist, and support or reject change in general. A discussion of leadership and communication, motivation, rewards and repercussions, and resistance to change provide further insight into the hospital's organizational culture.

Dominant Culture

The description of the dominant culture begins with a focus on sala, or morning prayer, which is held each workday. It exemplifies tradition. It is a physical coming together of people working at, or visiting, the hospital, and it is here that one can also observe divisions between sub-cultures.

Sala is a forum for morning worship, communication of announcements, introductions of newcomers, and farewells to those who are leaving. During my field research, the large sala room was divided in half, an aisle separating the left from the right. At the front of the room was a lectern for sermons and presentations. Sitting on the right hand side, halfway down, I could look around me and observe the others. I was surrounded by a riot of colour. To my right were the nursing students in their fresh pink (female) and white (male) uniforms, stripes on their sleeves denoting the program year they were in. The male students sat together in the front rows with the women arranged behind. On the right hand side, where I was sitting, the administrators and Division Leaders (in their suits or blue uniforms) occupied the front rows, followed by the pastor in his white medical coat and other health care professionals (in white) and unskilled labourers (in orange) behind. I sat amongst the expatriates, and local health care and non-health care professionals dressed in their respective uniforms, from pressed pants and colourful shirts, to coveralls. The matriarche sat with us in her blue skirt, white blouse, and colourful apron. When the bishop was on site or an important announcement was going to be made, all of the seats were taken, and latecomers broke tradition and sat wherever a free seat was available. Others stood at the back or peeked through the door from the outside.

Every morning began with a hymn sung by the nursing students to the beat of a drum. It was followed by a sermon, at first limited to five minutes, but over time

growing to up to 25 minutes in evangelical tone. After the sermon, the pastor made an announcement and nodded for the MMD or representative to rise and begin announcements: "*Habari za asubuhi?*" (How are you this morning?) and the crowd chanted back "*nzuri*" (good). It was always the same. After announcements, visitors were drawn from the group to stand at the front for formal introduction, often in English with a Kiswahili translation. They returned to the group and those who were leaving the environment were called to the front, individual by individual, family by family; this time, with the variation that their goodbyes may be in Kiswahili, and translated to English. Continuing studies announcements were made and, if nothing remained, we rose to say the Lord's Prayer in Kiswahili, and sala was over. People spilled out of the sala building, greeting each other, and returning to their duties within the hospital, some at a leisurely place, and others, like the MMD, with determination and purpose.

Tradition is what is known, and has therefore been drawn from to help people understand expectations and predict the future. Hospital transformation changed what is known, and poor communication and feedback created uncertainty in the environment. It is not that workers believed that change was not necessary – research participants consistently provided insightful observations about their work and how it could be improved – but they had not been asked to change on a grand scale in the past, and this led to a state of unknowing.

Essentially, the hospital transformation asked for a change in culture to support new initiatives. However, existing practices were embedded in history, and it would take time and patience to challenge the status quo. Further, HLH is located in the bush, and many employees grew up in Haydom and surrounding areas. The lack of exposure to different hospital environments made change all the more difficult, as some participants were unable to envision practices other hospitals engaged in, and adapt desirable aspects to suit their own work environment.

Sub-cultures

There are so many ways to divide: administrators versus workers; Tanzanians versus foreigners; non-Norwegians versus Norwegians; one tribe versus another. But no one person is part of one group; one is part of many. Some foreigners have lived and worked in Tanzania or neighbouring countries for decades; others are new. Some leaders are Tanzanians; others are not. Sub-cultures existed within the hospital, and united people in different ways including professional roles, departments, levels of education, origin, tribe, language, role in the community, and gender, among others. For the purposes of this research, however, I do make a distinction between sub-cultures in general and expatriates, in particular, to help inform the discussion of the dichotomy between local and expatriate power in later chapters.

Some smaller departmental units had an information culture and supported change, whereas the hospital as a whole, struggled with these. For instance, the Eye Clinic, which is discussed in greater detail in the next chapter, built a culture that not only collected and used health information for regular shared decision-making, but experienced success improving these processes as well, which in turn

motivated staff and improved practice. The Laboratory was similarly successful, despite an earlier abandoned attempt to change workflow. Both the Eye Clinic and Laboratory were cohesive groups of approximately 20 unchanging staff members with specialized training, and benefited from: strong, participatory leadership; regular staff meetings to identify challenges and opportunities to improve work practices; and education and mentorship within the unit.

The diversity of the sub-cultures involved in Care2X implementation resulted in ongoing disagreement amongst them on how to focus implementation efforts, and mixed perspectives on sustainability, empowerment, and decision-making. Those individuals who had power and influence could ultimately take control of implementation efforts, despite attempts to circumvent this through transparent communication and participatory planning.

Different sub-cultures had different priorities, and this had implications for strategy formulation. An example of this is Care2X vision formulation during a stakeholder's meeting in July 2007. In the discussion, administration emphasized *reports* ("reports are killing us"); whereas, the remainder of the group (largely comprised of health care, IT, and registration staff) emphasized *improved work and patient care* by: increasing communication between people and departments; improving patient record access and backup; improving diagnoses; reducing errors; improving inventory tracking, billing and finance; and simplifying epidemiology, statistics and report generation. While reports were a primary focus for administration, it was understood that it would have the secondary benefit of improved work and patient care. Conversely, improved work and patient care were the primary benefits for the rest of the group, with report generation as a secondary benefit.

During this time, I wondered about the impact of *wageni* (visitors) in terms of making improvements in the hospital, and how that was confounded when people continually arrived and tried to make changes. I knew that as an outsider, I too would be implicated by this enquiry.

Expatriates

The hospital's packaged response to locals and visitors alike is: *"Wageni ni baraka"* ("Visitors are a blessing"). Visitors, primarily from Europe, bring with them skills and experience that could be lacking at HLH. In addition, HLH is famous among Norwegians and some visitors travel to Haydom simply because it is something they have heard about since they were children. Over 1,000 visitors came to the hospital in 2008 alone [165].

Depending on a number of factors, including length of stay, affiliation with influential organization(s), country of origin, and possession of desirable skill sets, short-term visitors may have been wooed by HLH in order to draw them back for a longer-term commitment, or to carry a favourable message about the hospital's work back home. Perhaps this was natural, given the constraints the hospital faced. When onsite for a longer period of time, however, one could see divisions within the expat community itself, and an unofficial hierarchy

depending, once again, on the same factors listed above (sub-sub-cultures). These had implications for treatment within the environment.

It was easy to feel set apart from others. I was not high up in the cultural hierarchy that characterized the hospital expat community. Others felt the same. It was clear that Norwegian missionaries were at the top of the hierarchy, with an evolving cycle downward to embrace our group, largely composed of non-Norwegian, non-missionaries, with a penchant for innocent vices, with some exceptions. One of our friends referred to our group of misfits as "the dregs of Haydom society". We gravitated to others like us, as people tend to do, both within and without the expat community.

Many foreigners come to Haydom with their own ideas of how work at the hospital can be improved. However, visitors' lack of knowledge of local work practices, culture, and resource constraints can cause Tanzanians to lose heart. There was a lack of recognition that the Tanzanians may be doing similar things, but did not have it written down or didn't express it in the same way. Foreigners followed up activities, but they did it in their own way and expressed it in their own way that may be contrary to Tanzanian tradition. The Tanzanians have a tradition where you repeat things, you tell things, and you listen to people. In meetings, it is common for locals to refrain from making comments until the very end of a meeting, after attendees have a chance to hear what everyone has said. It was not uncommon for foreigners to dominate meeting discussions.

Perceptions of time, priorities, and success, among others, differed and led to frustration and misunderstandings within the workplace. It was suggested that foreigners should be obliged to attend an orientation in Haydom before beginning work or research in order to better integrate into the hospital environment.

> I think that the people come here [and] that's good. But we need to have a system that will explain to the people the way they will follow according to the rules of the hospital. And I was thinking that I would suggest, when they come here they will have [an orientation week]. [The new arrivals could begin] with the teaching and seeing the hospital and seeing all the places. And we [could] start with the leaders for the divisions and everybody [giving] their ideas, and after that we can go to the hospital to work. That thing I think I will discuss with [administration] and if they agree, they will put into their program that if you want to work here for four weeks, [and] will lose one week before that four weeks [to attend an orientation]. That will help us and also help them because…[it is] quite a big change. (Participant 20)

Another reiterated:

> I find that people coming from abroad, they have [been very impatient]. And if they don't get their objectives fulfilled immediately, it's easy to get upset. And I find that it makes, even decision-making, more difficult among the Tanzanians. Because they resist against this, as I see. Because if you are not taking time

> with them, they may agree to press through something very quickly, but the implementation of it, sometimes [does not last] long. (Participant 13)

In general, people in the hospital did not openly share information that could be useful for newcomers to function in their jobs. One had to ask specific questions to get answers, for instance, to how to get medicine, where to see outpatients, how patients are discharged, etc. These types of things were not mentioned in an orientation. Visitors needed time to walk around the wards to feel the atmosphere and the culture, and to understand how things were managed and led. While a document exists that provides a general overview of the environment [166], additional details on how visitors can better integrate themselves into the hospital could be helpful. Information about relocation and settlement in Haydom was not easily volunteered, and newcomers did not necessarily have enough information to know what specific questions needed to be asked to increase understanding in the environment. This often led orientation up to sympathetic expatriates, who themselves experienced uncertainty when they arrived.

Counter-cultures

Possible counter-cultures existed. It was believed that a small group of influential people worked against the hospital. Administration believed that it could not move forward with hospital transformation plans until the factions were identified and the issues addressed. Little information was available about counter-cultures, beyond hushed rumours, nervous speculation, cautious disclosure, and references to factions in the auditor's report [160].

Leadership and Communication

Leadership was in transition. Not only was there a new MMD, but Church-elected positions changed the HSN Principal and the NOIC, and a new layer of management was introduced with the hiring of Division Leaders. It was desired to build a culture where the Administration is supportive of the Division Leaders, and not the other way around.

In the non-confrontational Tanzanian culture, it was difficult to delegate responsibility because with that comes the requirement to stand up and say what is not right. Some leaders were unable to cope with reprimanding employees, so they did not confront them if they were late for work or not doing their job. Employees could feel threatened by criticism, which made it almost impossible, culturally, for locals in positions of responsibility to criticize their subordinates. It was difficult for improvement to occur when problem issues were not addressed. Foreigners sometimes introduced a new and complicated dynamic when they utilized a blunt approach to deal with employee issues.

Effective communication and transparency was highly valued within the environment. It was important that decisions be communicated quickly to ensure that different messages were not circulated. Direct information was better than hearing about things indirectly.

Different cultures communicated in different ways; while some were direct, others were indirect. The local custom was to repeat things again and again. Every time something was told, there was a risk that the message was changed to a 'different translation'. People recommended, therefore, that they be together and receive the same message. People could then talk afterwards and help each other gain a better understanding. Lack of feedback was a problem.

> You need to have some sort of response, and sometimes it's a bit difficult to know whether the lack of activity is because your message has been heard and someone has decided not to act on it, or whether your message [has] just not been heard. (Participant 24)

While one-on-one communication can be an effective way to communicate, it was time consuming. Changes were normally communicated during staff meetings or morning sala. While small change announcements could be made in sala, it was not an appropriate place to announce larger changes as the format did not permit discussion, and the timing excluded the attendance of some employees who were working on the wards.

Meetings were considered a better setting for asking questions and receiving feedback. Feedback was important, because without it, "it's impossible to adjust" (Participant 21). Meetings could be time consuming, however, as people worked towards consensus. One participant remarked, "I haven't seen so many meetings in my life as in this hospital, and so little done" (Participant 26).

At times, important messages were filtered down by word of mouth and resulted in rumours, misunderstandings, and general distrust in the environment as 'not knowing' translated into worst-case scenarios. People generally found it difficult to communicate upwards to the administrative level. While administration was aware of these problems, they seemed to count on the hiring of Division Leaders to bridge the gap in communication between workers and administration.

Lack of walking the talk (doing what you say you will do) contributed to distrust in the environment. Regardless of the context, both staff and administration were aware of when they were told one thing and saw something else. Recognizing trust as an issue is only a first step. The next is to manage trust.

> The more you think about it, the more you theorize and perhaps that leads to more lack of trust, because people become more suspicious of your theories if you don't practice what you preach…It is very difficult to practice what you preach in an environment which is highly political and highly power-based, because there comes a time when you can't be friends with everybody and you have to choose a side. When you have a group of people who have a very, very strong agenda, then there's a limit for what trust can do. (Participant 7)

Some people felt betrayed and marginalized as a result.

Motivation

The hospital acknowledged the importance of a motivated staff and how to maintain motivation, in its 2002-2006 strategic plan:

> The level of inputs through human, technical and financial resources are greatly dependent on the level of motivation towards efficiently utilising these inputs…the hospital has several occasions in which it honours its workers through celebrations and awards. Four workers are chosen to be the workers of the year and receive a gift from the hospital. There is also a substantial award to those workers with 25 years within the institution as well as a trophy for the winners of the cleanest and best run department twice per year. In addition the hospital arranges a yearly Christmas and First of May celebration in which the departments contribute with entertainment. (p. 41)[152]

In practice, however, lack of motivation was cited as one of the greatest challenges in the environment and was most particularly related to carrying out routine work and change initiatives. People need to be motivated and demonstrate discipline to do their jobs, including showing up for work on time and not leaving early. At times, doctors had challenges in having certain nurses carry out their routine or urgent orders. There was also lack of motivation to change practice and to learn from mentorship opportunities in some departments.

The causes were speculative. Some of these issues could be tied to perceived power relationships between nurses and doctors. Sometimes it depended on who the order was coming from. The situation could be seen as a form of resistance:

> You could use [not doing your work] as a power thing because you know that the doctor wants it…You know if I don't do it I kind of make her or his work difficult. (Participant 6)

Some people may have felt overloaded by work and not motivated to make a change that looked like more work, or perhaps looked like it would not work. People would not necessarily say anything to clarify what they didn't understand, and the lack of information could have implications for motivation. In addition, it is possible that the nursing profession has changed over time from a caring profession to an opportunity in the region.

> I think there are too many people who are coming in this profession because they didn't have anywhere to go. So then they are forced to kind of have that education. (Participant 12)

But what motivated people? It was an elusive concept that many believed could be solved by money, and being paid a stable salary on time [152]. Some people who were previously paid overtime were now paid an allowance (a set amount of pay based on work, not time). This situation caused some people to quit extra work. There was a lack of perceived equity between workers who were paid overtime versus those paid an allowance.

Others pointed to the need for a good process to involve people in decision making, demonstrate people's value, encourage and support nurses to remember critical things for patient care, delegate work, and redesign jobs and processes to make work easier. These types of interactions could help leaders to recognize, build on, and nurture natural skills. Some people did not feel empowered, not necessarily because administration was unwilling, but rather because of feelings that specific departments had been "written off as a loss" (Participant 26). There was a general feeling that management had given up on some of these issues while they dealt with others.

Rewards and Repercussions

Rewards and repercussions are entwined with the culture and saving face. Most rewards were financial, as those seemed to motivate people within the environment. Recognizing good work through ongoing praise did not necessarily build motivation or work ethics. People knew when they received rewards, and were also aware when they didn't receive rewards. While there was generally no culture of praise, people appreciated praise when it was given.

Repercussions were not a very well-known phenomenon, though they did occur when something very bad happened. You can lose face quickly though through repercussions.

> So if you reprimand somebody then you've lost that person for a very long time – maybe years. [People] don't forget [so] that's why reprimand or repercussion is a very tricky and a very difficult thing to do. [Because of the way they look at it], if you give somebody a warning, then that sticks with them for life. (Participant 7)

This was true even when the warning was given to someone privately.

Repercussions were not always appropriate because people did not necessarily have the skills to do a good job. For instance, one leader remarked that if ward attendants were giving medication and attending deliveries because there was no one else available, and they might have completed a couple of years of high school and started working, then expectations for how that work was done should be adjusted.

Resistance to Change

Whether changes were brought by outsiders or came from within the organization, if an individual did not want the change, there was a challenge. When people spoke of resistance, they largely spoke about change, and more specifically, fear of change caused by a lack of communication or understanding. People wondered, "what will the change bring?" (Participant 12). While some resistance was considered relatively benign, other resistance was considered an act of disloyalty against the hospital itself. Factions were believed to be at the heart of constant and systematic disruptions within the hospital environment. These more serious issues could not be resolved until the root of the problem was identified and dealt with.

People resisted change in a number of ways including: not turning up on time for work; not taking responsibility for work that had been agreed upon; not

responding to reports; agreeing to work but doing it slowly (malicious compliance); curtailing processes by meeting in small groups; raising job demands that could not be implemented; and writing letters of complaint. There were also instances of the morning salas being used as a form of resistance by making thinly veiled political statements in the sermons, for instance, concerning trust or leadership; some religious stories had characters that closely resembled HLH leaders.

In a non-confrontational society, resistance may have been the only control that people felt they had to exert.

> Sometimes [people] feel too much…too much information, too much work, too much everything, and so they say 'no, we'll just block, no'. They may not say no to you but they just feel like acting negatively…[Or] sometimes the people are being polite in saying yes to everything and never say no, and then later on they don't act on that. (Participant 12)

Others supported this view:

> I don't think there's anybody who really has a malicious intent. I think there are a lot of people who are really committed to the hospital who really don't want to leave here and who are really concerned about the community and concerned about poverty and the healthcare problems that people have here. I think there's a lot of people who have really got a great commitment to the place, and I know people who have been offered better jobs in other places but they've stuck here because they're really concerned about the community and the situation here. And there are people here who are bright, who are experienced, [and] who could even become a lot more comfortable [in] life in many ways. So I think [that the staff] feel that they're being treated like they're expendable – like they don't really matter much. And I think that's a grave mistake. (Participant 8)

Staff resisted when they felt they were not being involved in the change, through discussion and shared decision making. This situation was exacerbated when the changes were coming from the many visitors, and caused local frustration.

There are variations, however, to how change was perceived. The barriers and facilitators to change are discussed in a subsequent chapter. But first, the next section outlines efforts to improve the collection and use of health information at HLH, in particular, within the Outpatient Department, Eye Clinic, Inpatient Department, and Medical Records. It ends with a summary of sustainability plans and the findings of a follow-up visit to the environment four months after my initial departure.

WHAT ARE THE EFFORTS TO IMPROVE CARE2X IMPLEMENTATION?

This section is presented in two parts. The first is an overview of how health information is collected and used in the Outpatient Department (OPD), the Eye Clinic, and the Inpatient Department (IPD), and the efforts to improve those processes with Care2X (OPD, Eye Clinic, IPD), and modified statistics collection (Medical Records). The second part summarizes participatory recommendations and the succession plan formulated at the end of the field research period, and describes what actually happened from the time I left the environment in May 2008 to my follow-up visit four months later.

PART ONE

The *Outpatient Department* (OPD) was the first, and only place, to have Care2X implemented during the field research period. During this time period, no updates were made to the software due to server and related issues. This meant that the hospital could not run the most recent version of Care2X, and useful statistics could not be collected because patients were not discharged from the system at the end of each day. Furthermore, participatory suggestions to improve data collection and quality could not be implemented, despite a quick and eager response from ELCT Health to program improvements on behalf of OPD registration staff suggestions.

The *Eye Clinic*, which is part of OPD, was very enthusiastic to implement the Care2X system to improve the collection and use of health information for decision-making. The Eye Clinic had previous success implementing improvements to their paper-based systems. A Care2X Eye Clinic module was created by distributed programmers by converting the Clinic's Excel-based health information collection sheets and establishing a continuous process to review and improve the module by viewing screen shots and weblinks via email. Server issues prohibited testing and implementation of the software on site.

The *Inpatient Department* (IPD), and in particular, Medical Records, benefited from the Care2X cadre members entering information from the patient record into the discharge books from which statistics are drawn for various internal and external reports. HLH also began a collaboration with Selian Hospital during this time to jointly fund the development of a Care2X inpatient module. Inpatient module progress is discussed in the section describing research follow-up.

Outpatient Department (OPD)

Background

The Outpatient Department consisted of general outpatient services for diagnosis and treatment of patients not requiring admission as an inpatient. In addition to the main department, other specialty outpatient clinics existed: the Eye Clinic, Dental Unit, and Physiotherapy. The OPD was a large building separated from the main hospital, which enabled patient traffic to be drawn away from the main

buildings. It primarily consisted of examining rooms, a dispensary, a lab sample room, a billing office, and registration.

The OPD received drugs from the hospital's main pharmacy. When a patient required drugs, the Clinical Officer provided a prescription to the patient, and the patient submitted the prescription to the OPD dispensary. The patient then proceeded to OPD billing to pay for the prescription and took the proof of payment to the dispensary to receive the drugs.

When a laboratory test was required, the patient took the laboratory test paperwork the Clinical Officer provided to billing and paid for the test. The patient then brought proof of payment to 'Room 10' in OPD, where the laboratory order was viewed and sample was taken. The patient was told when to return for the results. An employee walked over the sample to the main laboratory and the laboratory test was conducted. Once the test results were picked up by an OPD employee, the information was given to the Clinical Officer and the patient was told the results. Further treatment was prescribed, if necessary.

If an x-ray was required, or the patient required other additional care, the patient was discharged from OPD and registered as an inpatient.

Registration was the focus of this work and is discussed in greater detail below. This discussion begins with a summary of how health information was collected and used by OPD.

OPD Registration

Health information was collected in the Outpatient Department (OPD) by:

- *Reception* on the patient card (record) and within the new patient and return patient log books;
- *Clinical Officer* on the patient card, log book, and government "green" reporting book;
- *Billing* in the log book;
- *Laboratory* where all records were kept by the main laboratory;
- *Xray* where results were kept in the radiology department; and
- *Pharmacy* in the log book, supply and inventory books.

From the hospital's opening in 1955 to December 31, 2006, patients were on an old numbering system (OS). Patients were assigned a temporary chronological number in a number/year format (e.g., 1436/06 represents the 1,436 patient in 2006). This process would begin fresh each year so that the last patient of 2006 might be numbered 20001/06 and the first patient of 2007 would be numbered 1/07 [163].

The new numbering system (NS) was meant to replace the OS as of January 1, 2007. In this system, patient numbers were again assigned a number chronologically, with the intention that the process would continue uninterrupted

the following year. For instance, the last patient in 2007 might be 20001 and the first patient in 2008 would then be 20002 [163].

There were a number of considerations when a patient came to the OPD registration window. To illustrate:

I show up at the Outpatient Department (OPD) with a complaint:

- *If I am a new patient* (defined as "new" to 2007), then I am registered in a 2007 new patient book, which records my name, birthdate, sex, address.

- *If I have never been to the OPD*, then a new file is started for me. I am assigned a sequential number for my file (a double-sized index card in a box filed sequentially). If I am the first patient for 2007, then my number is 1/07. If I come at the end of the year, my file number might be 25435/07. My patient information and file number are written on my index card, and my file number is also written on a 2x3 card (for me to keep). I am given both cards and wait to see a Clinical Officer.

The 2x3 cards are blank cardboard OPD patient records torn up into an approximate 2x3 inch size. The patient ID is written on one of the sides with no other identifying information. There is the potential for multiple cards for multiple years for multiple people to be in the same household.

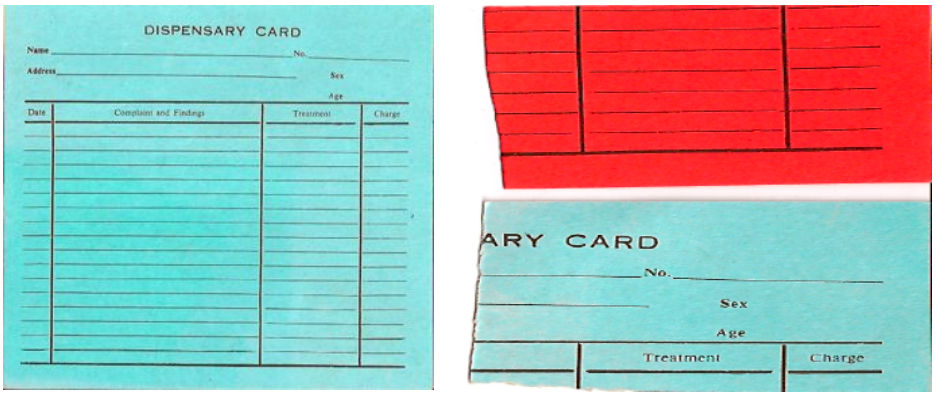


Figure 13: OPD patient record and ID card

- *If I have been to the OPD in the past but not in the current year*, then I present my 2x3 card (e.g., with a 2006, 2005, or other file number) and registration staff locate my file in one of the patient file boxes located in the registration room. Files are kept for 5 years. They pull my patient record, enter my information into the new patient log book, assign me a new sequential file number, write it on my file and on a new 2x3 card for me to keep, and give me my file and new 2x3 card.

- *If I am a return patient* (defined as 2nd+ visit to the Outpatient Department in 2007), then I present my ID card to retrieve my file, and my information is written in a "return patient" registration book.

- *If I lose my 2x3 card but am in the Care2X system*, theoretically reception can look up my file number in the computer system, as long as my information was correctly entered the first time.

- *If I lose my 2x3 card and am not in the Care2X system, but can remember the month and year that I last visited*, reception can try to locate my card by manually searching through the month/year file boxes. Approximately 200 - 300 patients are seen each day, 5 days a week.

- *If my file cannot be found*, a new file is made for me but I am not assigned a new number. I am assigned an "X" instead of a number, and I am filed away in the "X"-File Box.

Once my file is found or a new patient record is created for me, I wait to see the Clinical Officer (CO) by sitting in the waiting room. There is no system for the CO to know who the next patient is, so patients sit on benches near the CO office(s) and shuffle down each time a patient closest to the CO office(s) is seen. The Clinical Officer takes my patient record, writes my complaint, sends me for tests, if necessary, and writes the diagnosis and treatment on my record. He then keeps the record to resubmit to the OPD reception at the end of the day for filing. He also has a book on his desk where he writes all of the patients he sees that day: name, age, sex, complaint, diagnosis, and treatment. This information is utilized for statistics gathering and reports.

Early Care2X implementation

The first quarter (Jan-Mar 2007) evaluation of the Care2X implementation occurred when I arrived on site. During this time period, Care2X was limited to patient registration to see if real-time registration was possible and to understand how the patient number worked. Real-time registration of outpatients began January 2, 2007 and within the first quarter, it took less time to input data into the computer than to write it in the paper-based log book [163].

Figure 14: Outpatient Department and Registration. One woman enters registration information into the Care2X system while the other records almost identical information in a paper-based log book. The boxes stacked on shelves hold 5 years of patient records, filed by year and ID number.

The information between the log book and Care2X registration page are fairly evenly matched, as demonstrated in Table 1, below:

Description	Paper Book	Care2X	Explanation
Record #	√	X	Refers to the ID number assigned by OPD Registration
Registration Time	X	√	The registration log time assigned automatically in the Care2X system
Registration Date	√	√	The date the patient registered at the registration window
Occupation	√	√	Employment description (e.g., farmer, teacher, student)
Surname	√	√	Last name
First Name	√	√	First name
Father's Name	√	√	Father's name (often the same as last name)
Balozi	√	√	The patient's "10 cell leader" (leader of 10 families, including the patient's family)
Tribe	√	√	Tribe (e.g., Iraqw, Datoga)
Age	√	√	Age in years
Date of Birth	X	√	Age in years is entered into Care2X and a birthdate is automatically generated as July 1st
Sex	√	√	Male or Female
Town/City	√	√	Town of Residence
District	√	X	District of Town
Ward	√	X	Ward of Town
Religion	√	√	Religion
Registered by	X	√	Name or initials of registration staff

Table 1: Comparison of the data collected in the Outpatient paper-based log and the Care2X registration page

The first quarter evaluation focused on the challenges of Patient ID numbers. In particular, wrong patient numbers were entered into the Care2X system, which caused inconsistency between the paper-based and electronic registration systems. At times, numbers were accidentally pressed twice or a completely different number was entered. In addition, skipped numbers were not uncommon in the paper-based book. For instance, after number 4099, the next number jumped to 5000. In another case, the number jumped from 6560 to 6570. The numbers were entered identically into the Care2X system and gave an inflated idea of the number of new patients coming into the OPD, which could create problems with statistics and patient record retrieval [163].

At the time of my arrival, no outpatients had been discharged from the Care2X system. This meant that patients were only being registered in the Care2X system

for their first 2007 visit and not for their return visit, if applicable. Return visits could not be registered in the system because the patient was already virtually waiting to see a Clinical Officer (a carry-over effect from the first visit) and could not be re-registered. Return information was captured, however, in the return patient (paper) registration book.

What happened?

<u>Updating the patient registration page</u>

After an initial meeting with the OPD Registration group, I was invited by staff to return to observe their processes and welcomed to make suggestions for improvement. I was able to watch how the employees were entering information into the registration books and Care2X system, and asked questions (at times, with the assistance of a translator) to clarify my own understanding of existing processes. Shortly afterwards, I borrowed the registration book to conduct a data quality check between the paper-based and electronic systems.

I returned to the OPD the following week with my translator. The OPD registration group was very interested in the preliminary results for the data quality check. Briefly, there was no data quality check of the paper-based system to know how accurate it was; I therefore compared what was in the paper registration book to what was on the Care2X registration page and noted when differences occurred between the two. I drew a sample of 218 records from the first 7,000 patient registration entries in 2007. Some of the differences observed between the paper and electronic registration record were in the following subcategories: Surname (35%); Father's name (34%); First name (28%); Town (32%); and Sex (15%). This had implications for the ability to retrieve the patient record from the Care2X system during subsequent visits.

Given the early stage of the enquiry, I provided high-level information as available. I observed to the registration staff that the order of the information in the paper-registration book differed from the order entry required in the Care2X system. This comment generated an enthusiastic response, which included lots of paper shaking, pointing to the paper-registration book and to the computer screen. They said that they would appreciate changing the order of the patient name entry in the Care2X system to reflect the paper-based system (and the way patients naturally gave their names).

At the end of the meeting, the registration group reiterated that they welcomed any information I might have that could improve their work. They also said that even though no changes had been made to date, they really appreciated me working with them and having a chance to talk about their work. I left with the commitment to ask the Care2X programmer at ELCT Health if the name order could be changed. I was keen to work with the employees in OPD and translate their ideas to improve data quality into a "win". We could then work together to assess the change and determine if it resulted in an improvement.

The changes to the Care2X registration page were made within two weeks of the June 2007 request and are illustrated in Figures 15 and 16 below.

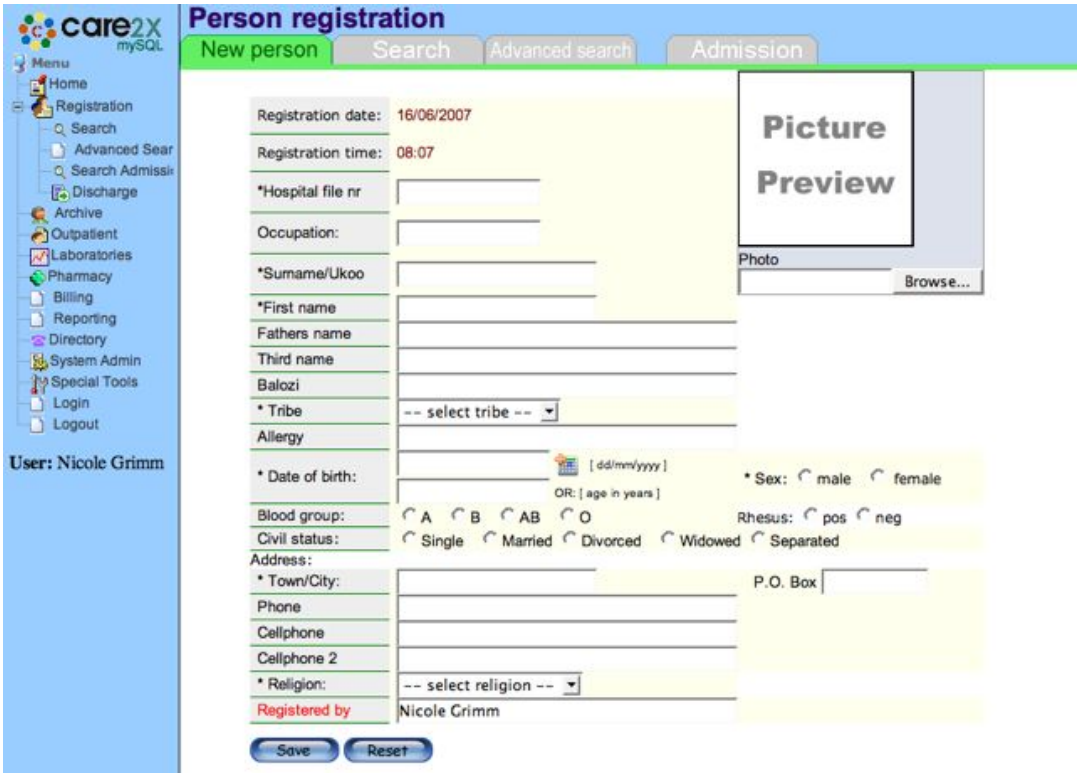


Figure 15: The original Care2X patient registration page used by OPD

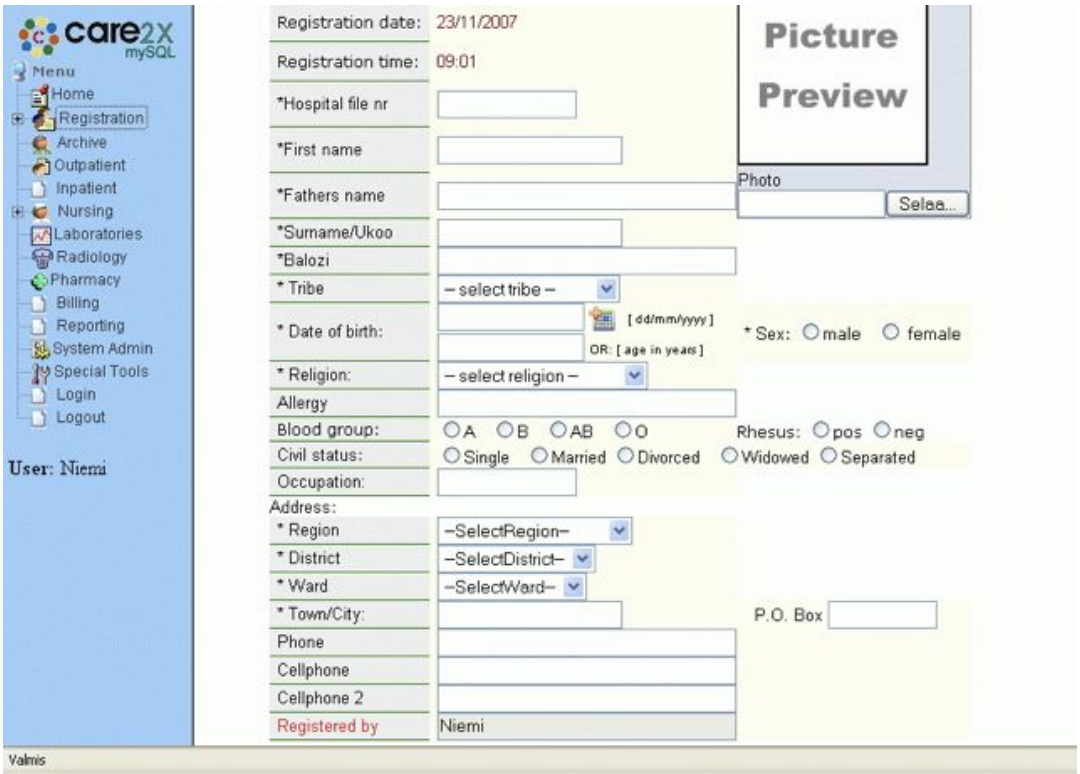


Figure 16: The updated Care2X patient registration page with name order change and drop-down menus

The IT department was notified of the changes, and implemented them one morning in July 2007, a couple of hours before the expat IT expert was set to leave on a one-month vacation. While the OPD registration staff was enthusiastic with the changes, initial review of the registration page on their computer revealed a potential problem with the drop-down menus (which were part of an earlier update to the software but not previously implemented at HLH). The changes were immediately removed and the old registration page reinstated until such time that the challenges could be reviewed.

Little did I know at that time that no updates would be made to the Care2X system. The IT expat permanently left the environment the following month, taking with him programming expertise and knowledge of the server. The situation revealed deeper issues that would impact the ability to expand Care2X implementation within the hospital.

Eye Clinic

Background

The Eye Clinic (*Kliniki ya Macho*) is an Outpatient Clinic that has operated since September 1, 2004. Prior to that, patients came to the Outpatient Department and urgent operations were sent elsewhere. An Eye Team from Kilimanjaro Christian Medical Centre (KCMC) came to Haydom for one week every quarter before the Eye Clinic opened.

A core group of approximately 20 staff worked within the Clinic. The employees were led by a foreign ophthalmologist with over 2 decades of experience working in sub-Saharan Africa. The Clinic primarily treated outpatients who were encouraged to come directly to the clinic, rather than through the Outpatient or Inpatient Departments, in order to speed up service.

The *Outreach Program* collected data from the vehicle logbook, receipt book, and patient data sheets (screening forms). This information was used to understand: transportation costs; income generated from the sale of glasses, medication, and operations; patient demographics; diagnosis; and treatment. When combined, the information gave a picture of the work that was being done by the Outreach Program, which in turn encouraged staff and produced useful information for improved planning and decision-making. Diagnostic and working statistics were linked to funding. The ophthalmologist wanted to modify existing statistics to track serious conditions. Follow up of more serious conditions could be accomplished by keeping records on file at the Clinic.

The *Outpatient Eye Clinic* kept all patient records on site from 2005 onwards. Patient information was collected on computer-generated forms, which were printed and filed by year and patient ID number. The Clinic used different coloured paper to differentiate between treatment years. The disadvantage of this practice was that coloured paper was twice as expensive as white. Patient ID numbers were manually generated. When a patient arrived at the Clinic for the first time, he or she was assigned a patient ID number. The ID number was written on a piece of cardboard (same as OPD registration) and given to the patient for safekeeping. When the patient returned, the ID number was used to retrieve his or her patient file. A patient's records from multiple visits were stapled together so that all information was available to the health care provider. A new number was assigned each year. There were gaps between patient numbers. For instance, there was a jump from record number 3099 to 4000. This gave an inflated impression of the number of patients treated.

Retrieving patient records was a challenge and was considered the greatest problem in November 2007. If the patient lost his or her ID number, then the patient name had to be found in the register book. This process was time-consuming and required knowledge of when the last visit occurred. In addition, the file could be missing due to misfiling, clinician use, or its location in another room. In the past, the computer in the registration room was used for entering patient data and to assist in patient record retrieval (by searching for patient ID numbers by patient name). The woman who once entered this information did not

return from Maternity Leave. While there was a nurse assistant and a cashier, there was no registration clerk, per se. The Clinic statistics were potentially more comprehensive than Outreach (tribe, ward, district, etc.) but aligning statistics was more of a challenge. This may have been easier if the data was entered daily on the computer, instead of being analyzed monthly. The registration book was used to collect statistics by month and year. The Ophthalmologist entered data into his office computer monthly.

In November 2007, the Eye Clinic was used as an example of good activity report use by the change management advisor (and followed with a presentation by the Eye Clinic) [167] in a continuing studies session. The presentation emphasized that the way the Eye Clinic was collecting and using health and financial information for informed decision-making was what the hospital would like to see in all of the wards at HLH.

The Clinic wanted to demonstrate through statistics how much work was being done within the clinic and in outreach, and provide financial predictions for decision-making. Decisions were largely made at the Clinic level, which enabled it to avoid delays inherent in asking for approval at a higher level.

What happened?

The Modified Eye Patient Form

The Eye Clinic had been successful at implementing improvements of their paper-based eye patient form. In an effort to conserve paper, a modified paper-based eye patient form, for use by all Clinic workers, was introduced in July 2007. The modified form was only used within the Clinic and filing of the form remained unchanged. Unlike the previous form, this form had tick-boxes for recording patient information. Improvements over the old form included reduction of paper use and more specific identification of signs, symptoms and diagnoses. The new form could be torn in half to become two patient detail forms. Challenges were also identified. Clinic professionals were only using the tick-boxes to check off abnormal comments. From a medico-legal point of view and practice, it was desirable to tick everything as normal or abnormal. Writing space for treatment and other notes was also a problem. At times, treatment for one day continued on to the form for the following visit. In an effort to save paper, there was a risk of compromised data quality and detail. One way to handle this was for one record to appear per page, rather than two. Alternatively, if the patient diagnosis was known, it could be written in the history section at the top of the page to conserve notes space. In addition, there was no place for refraction. Opportunities to improve this included a refraction ½ sheet to be stapled to the other notes, refraction being recorded on the bottom half of the eye patient form, and modifying the form for refraction by adding a tick-box to indicate refraction notes. I met with the Ophthalmologist and staff in September 2007 to discuss the eye patient form. Based on staff input, the form was modified and on the whole it was used satisfactorily.

Transition to Electronic Health Information System

There was general agreement amongst staff that an electronic health information system could reduce paper-use, aid in the retrieval of patient records by various staff, and improve reporting and decision-making. If there was a good system, patient information could be entered directly into the computers in reception and treatment rooms. It was desirable to explore solutions that would help Clinic workers in their work.

In November 2007, there was no specific Care2X module for the Clinic, nor had one been planned. The implementation of Care2X would require computers at reception and in the examination room, and then expand later to the Visual Acuity Room and Optometry later. Eye Clinic stakeholders believed it best that clinicians entered clinical data and registration details be entered by reception. There was a lack of computer knowledge amongst Clinic staff. Employees would require training on computers and Care2X. Staff would use the computers for data entry, and files could be printed out if necessary. An additional receptionist would be needed to free one person up to enter patient information into the computer.

Exam details might not be as useful as higher level information on diagnosis and treatment. Excel spreadsheets had been used to collect Clinic statistics. In addition, the paper-based forms were created with Excel and could lend themselves well to programming an Eye Clinic module in Care2X.

It was possible to use ICT10 Coding at the Clinic and an enquiry was made to ELCT to discuss the possibility. While not many people had health insurance, it was important to be aware of the implications of coding for insurance reimbursement. The Clinic wanted to demonstrate to funders that it was doing things in the right areas (e.g., with glasses dispensing). It was desirable to have a more simplified system, including basic coding for cataracts. Coding decisions varied by individual. Perhaps the most common diagnoses could be made available to Clinic workers for ease of reference.

Care2X Eye Clinic Module

Administration approved the creation of an Eye Clinic module with the condition that the Eye Clinic module became an integrated component of the hospital Care2X Outpatient module (as one of potentially several outpatient clinic modules for the hospital). ELCT Health recognized the importance of user motivation and was therefore very supportive of working on the Eye Clinic module. They indicated that champions were needed for system use and that the Eye Clinic could become a model for HLH. This was particularly important as progress was not being made on expanding the system within OPD, due to server issues outside ELCT's control.

With this encouragement, the Ophthalmologist and I reviewed the ELCT Care2X demo online (Outpatient modules) to identify screens already available, and outline additional screens, that could be used for the Eye Clinic. We mapped the potential information flow (Figure 17). This information was provided to ELCT Health in December 2007, along with questions and a request for feedback. The

priority was to put patients on the appointment list to see the doctor, optometrist or surgeon, enter patient information into the patient chart folder, and generate prescriptions.

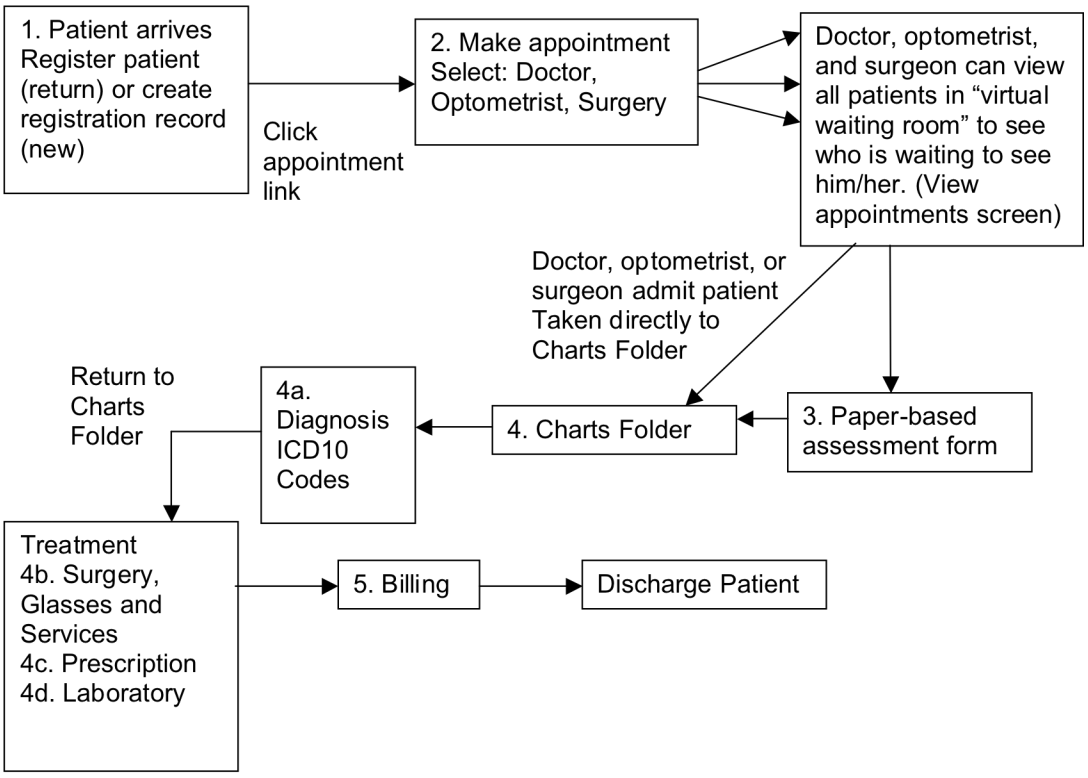


Figure 17: HLH Eye Clinic Information Flow

In the above figure, the patient arrives in the Clinic and is registered as either a new or returning patient in the Care2X system. Registration then assigns the patient to one of three virtual waiting rooms (doctor, optometrist, surgery). The doctor, optometrist, and surgeon, in their respective rooms, can view all patients to see who is waiting to see them. As patients are seen in turn by the respective care provider, they are 'admitted' into Care2X so that information can be entered into the electronic patient charts. Due to programming priorities, a paper-based assessment form would be initially completed to assess patient complaints; however, we later found that the paper-based forms, created with Microsoft Excel, lent themselves well to programming and treatment forms were therefore created (more below). The care provider will enter diagnosis and treatment information directly into Care2X system. The patient proceeds to billing after the exam.

ELCT Health responded in January 2008 with positive feedback. Much of what was outlined in the information flow diagram already existed in Care2X but was 'hidden' from view. We sent Microsoft Excel versions of the paper-based history and examination sheets to ELCT Health in January and February 2008. The paper-based versions of these documents were in use at the Eye Clinic, and had been through quality improvement processes already. The Ophthalmologist and myself therefore worked directly with ELCT Health to automate the paper-based forms.

The ELCT team and programmer were located in Arusha and Dar es Salaam respectively. We therefore relied primarily on email correspondence and screen shots of the Care2X program to improve the quality of the Eye Clinic module in development.

Examination Sheets

The first electronic examination sheet was received via email March 5, 2008. The attachment opened in a web browser and the Ophthalmologist and I were able to test the radio buttons and drop-down menus. We sent an email back to the programmer the following day with suggestions for improvement. The figures below give examples of the Excel spreadsheets provided to ELCT Health (Figures 18 and 20) and associated screen shots of ELCT's programming response (Figures 19 and 21).

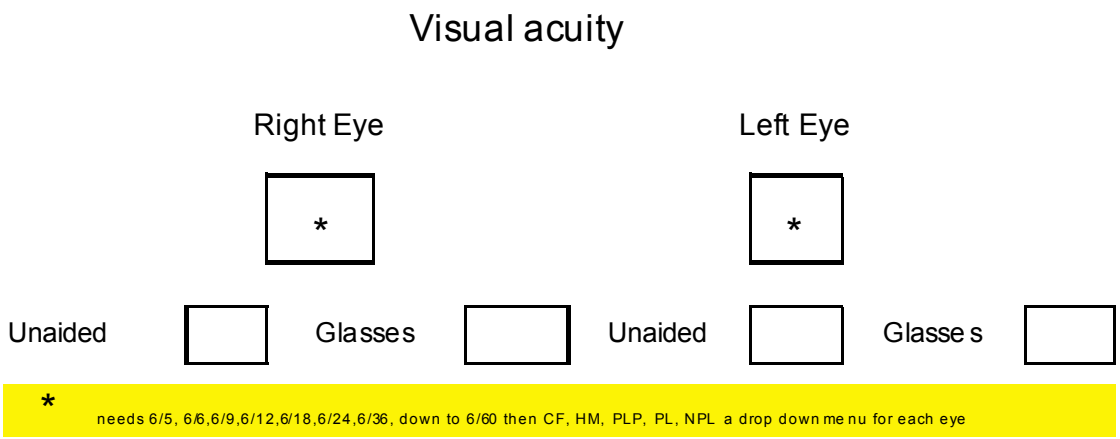


Figure 18: Examination Sheet: Visual Acuity Example (Excel)

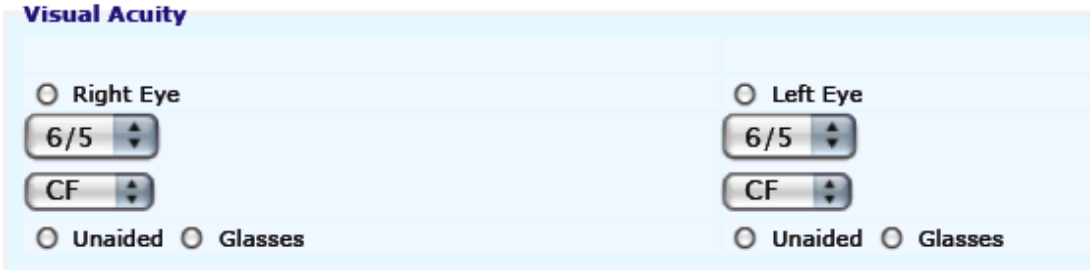


Figure 19: March 5, 2008 Examination Sheet: Visual Acuity example (Care2X)

Our suggestions to the programmer related to Visual Acuity were:

- To remove the radio buttons beside "Right Eye" and "Left Eye" as both eyes would be examined at the same time.
- To revise the drop-down menu beginning with "6/5" for both Right Eye and Left Eye. All the choices in the drop-down menu were "6/5". These should have read: 6/5, 6/6, 6/9, 6/12, 6/18, 6/24, 6/36, 6/60.
- To revise the drop-down menu beginning with "CF" for both Right Eye and Left Eye. Only some of the choices were listed (CF, HM and PLP). Add "PL" and "NPL" to the drop-down list.

- There were two radio buttons for both the Right Eye and Left Eye that were labelled "Unaided" and "Glasses". Requested "Pinhole" be added to this radio button selection for both Right and Left Eyes.

An example of checkboxes is provided below for facial, ocular, orbital symmetry (Figures 20 and 21). No changes were necessary.

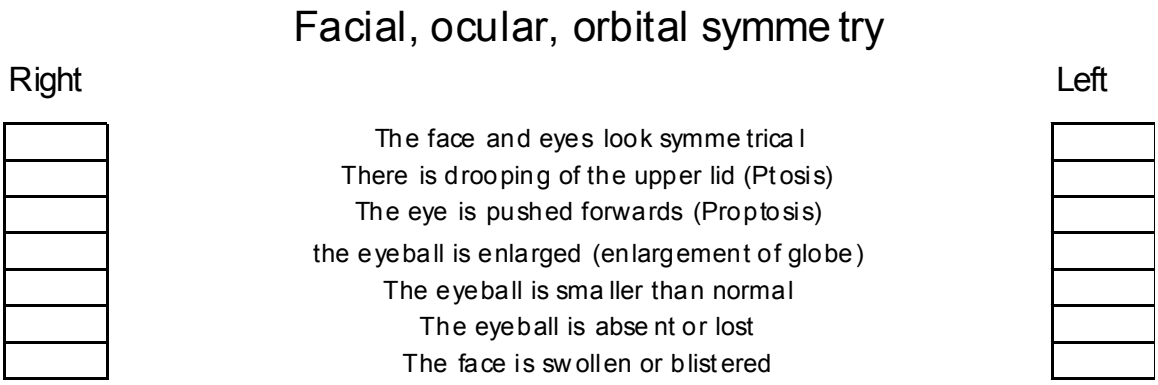


Figure 20: Examination Sheet: Facial, ocular, orbital symmetry example (Excel)

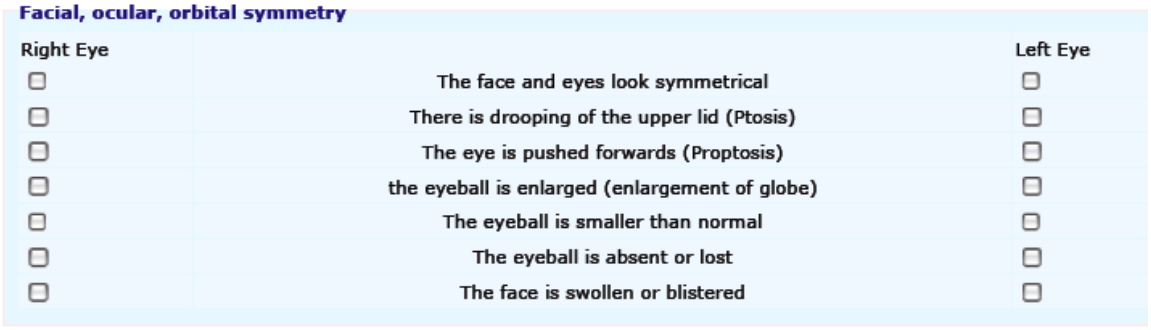


Figure 21: March 5, 2008 Examination Sheet: Facial, ocular, orbital symmetry example (Care2X)

Changes were made, as requested, to the radio buttons and drop-down menus.

History sheets

ELCT Health sent screen shots of the conversion of Excel Eye History spreadsheets on April 21, 2008. To understand the iterative nature of the process, an example of the original Excel document is provided below (Figure 22), along with screen shots that demonstrate the changes that were made over time (Figures 23-26).

Patient complains:

I have a problem seeing

		which eye?			duration of symptom				
		Both	R	L	Today	One Week	One Month	2-12 Months	Years
☐	At night								
☐	in distance								
☐	Near by (reading/sewing)								
☐	both near and distance								
☐	I have double vision								

☐ I do not have a problem seeing

Other comments:

Figure 22: History sheet: "I have a problem seeing" example (Excel)

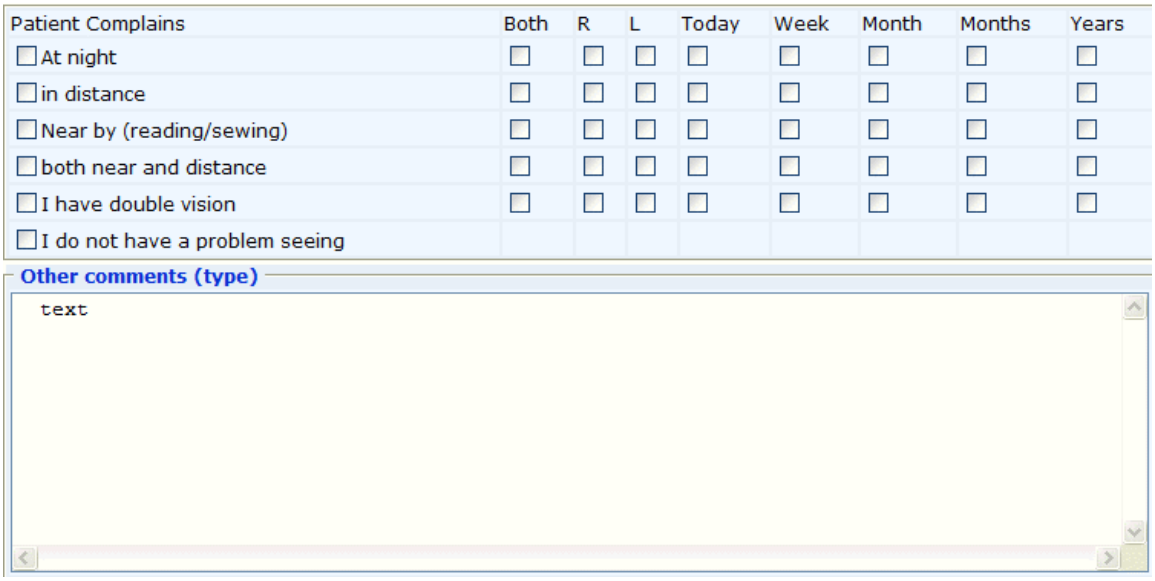


Figure 23: April 21, 2008 History sheet: "I have a problem seeing" example (Care2X)

After the screen shots were reviewed in Haydom, we sent an email response to ELCT that included a description of desired additions, along with scans of revised screen shots. What was common to all screen shots was:

- To add: “Which eye?” above “both R L” boxes; “Duration of symptoms” above “Today Week Month Months Years” boxes; “up to 1” above “week”; “up to 1” above “month”; and “2-12” above “months”.
- To increase space between the “Which eye?” group and “Duration of symptoms” group (between “L” and “Today”).

Scanned revisions to screen shots accompanied the text instructions (see Figure 24 for example).

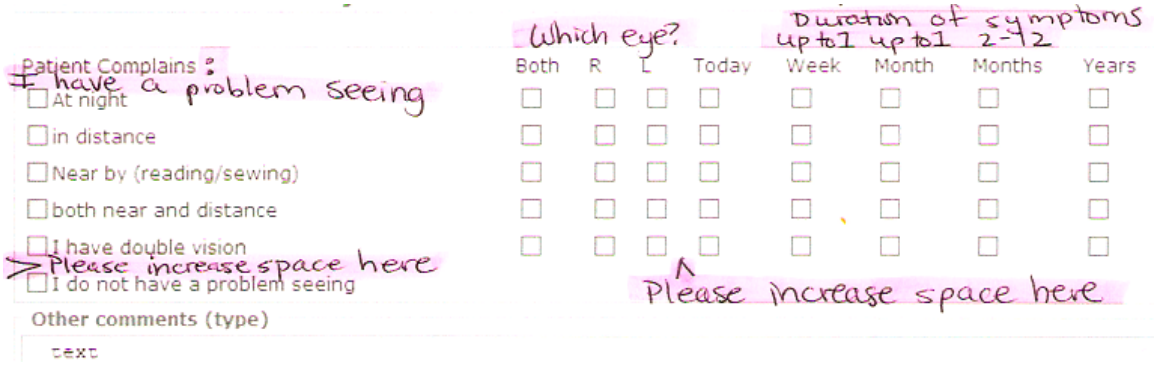


Figure 24: April 29, 2008 History sheet: “I have a problem seeing” example (Care2X)

Revisions were made by ELCT Health and sent back within days (Figure 25, below).

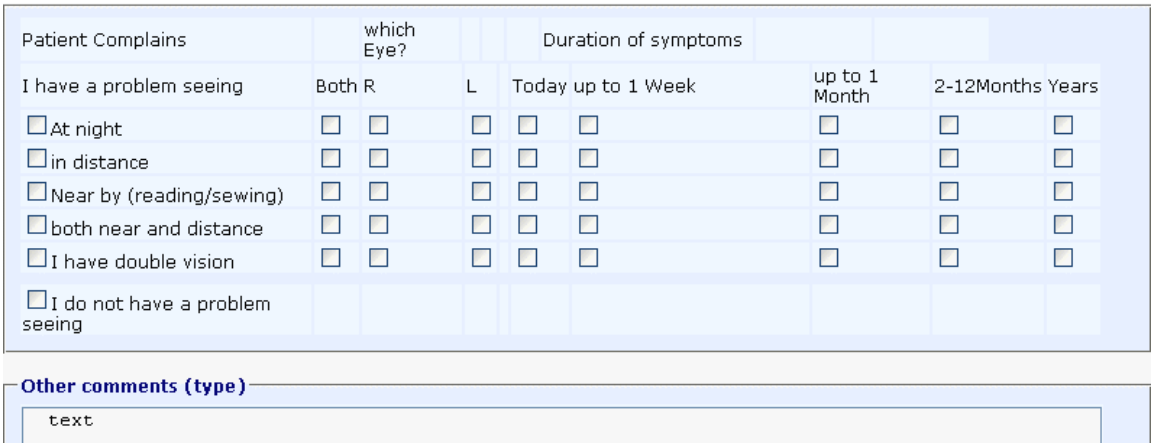


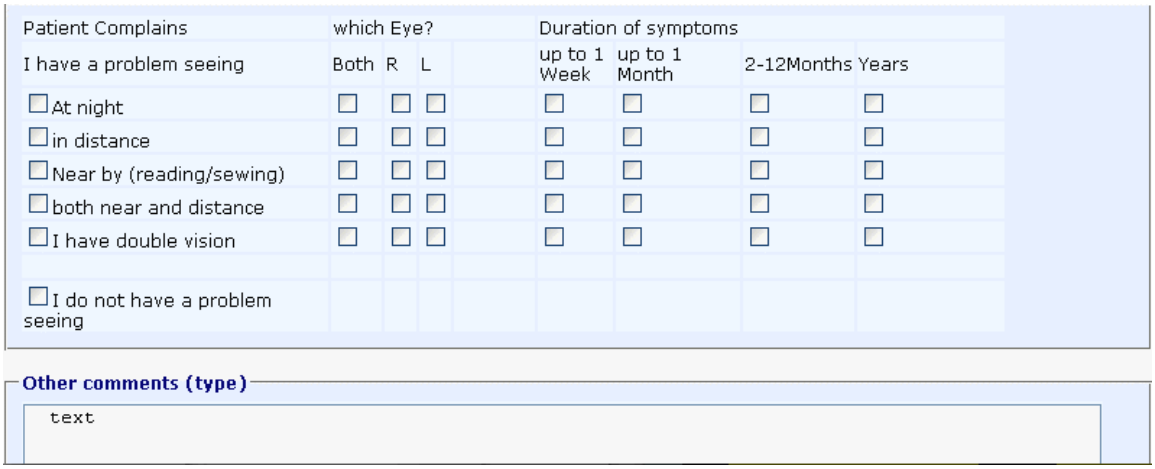
Figure 25: May 2, 2008 History sheet: “I have a problem seeing” example (Care2X)

We responded the same day with some minor suggestions. The main issue was cosmetic and related to the tick boxes. We asked to:

- Merge the cells for “which eye” across “Both R L” columns.
- Merge the cells for “duration of symptoms” across “Today”…to… “Years”.
- Word wrap “up to 1 week” so that week appeared below “up to 1” (like how “up to 1 month” appeared). And
- Word wrap “2-12 Months” so that “months” appeared below “2-12”.

These changes addressed the large gaps in spacing and brought the information closer together again (as with the previous version).

ELCT Health made the changes and sent back the final version June 4, 2008 (below).



Patient Complains	which Eye?			Duration of symptoms			
I have a problem seeing	Both	R	L	up to 1 Week	up to 1 Month	2-12Months	Years
☐ At night	☐	☐	☐	☐	☐	☐	☐
☐ in distance	☐	☐	☐	☐	☐	☐	☐
☐ Near by (reading/sewing)	☐	☐	☐	☐	☐	☐	☐
☐ both near and distance	☐	☐	☐	☐	☐	☐	☐
☐ I have double vision	☐	☐	☐	☐	☐	☐	☐
☐ I do not have a problem seeing							

Figure 26: June 4, 2008 History sheet: "I have a problem seeing" example (Care2X)

Despite the success of the iterative improvements to the Eye Clinic module, and the Clinic's eagerness to implement Care2X, the challenges that plagued Care2X updates in OPD registration also impacted the Eye Clinic. Eye Clinic module updates could not be viewed in a testing environment on site, nor could the registration module be implemented, because changes could not be uploaded to the Haydom server. The updates to the registration module included being able to view the computer-generated unique patient ID, which would be used across all outpatient (and later inpatient) clinics and wards. They also included a script to discharge all patients currently in the system (all patients who had visited OPD from January 1, 2007 onwards). Without these changes, the Eye Clinic would not be able to register and discharge their own patients.

Inpatient Department (IPD)

Background

While there was no Care2X module developed for the Inpatient Department (IPD) during the field research period, cadre members were able to assist Medical Records with collecting statistics from patient records and recording them in the discharge books, as described below.

Health information was collected in the IPD by:

- *Reception* on the admission or readmission forms, consultation forms, and admission and readmission log books;
- *Wards* on the patient file, log book, government "green" reporting book, laboratory request book, and pharmacy order book;
- *Laboratory* in- and out-patient test log books, laboratory request book, inventory book, and pharmacy order book. Statistics were entered into an Excel spreadsheet for government reports;
- *Pharmacy* in a goods received book, log book for ward requests, patient prescriptions, and bin cards for each medicine which were also recorded in the computer for inventory levels and ordering;
- *Radiology* in the test log book, summary log book, and monthly breakdown of statistics;
- *Billing* in the form of invoices, receipts, and transaction summaries provided by Finance. Full payment records were kept by reception whereas partial payments were kept with the billing office so that the file could be found when the family returned to pay the remainder of the debt.
- *Medical Records* collected admission and re-admission log books from reception and recorded discharge information. When a patient was discharged, his or her patient record was brought to medical records and a Clinical Officer recorded summary patient information into a discharge book. An out number was assigned which was a tally of discharged patients for the year starting with #1 for the first discharged patient of the year. This number was written on an index card and included the patient's name, 'in' date, 'out' date, and out number. The card was filed alphabetically by year. The patient record was filed by out number. The patient's last name and year of last visit was required to retrieve the patient record. This information was used to look up the index card (filed by year, and retrieved alphabetically by last name); the out number on the index card was used to retrieve the patient record from the Medical Records building. Not all patient files could be retrieved as some patients did not know the year of their last visit. In this case, a new patient record was created.

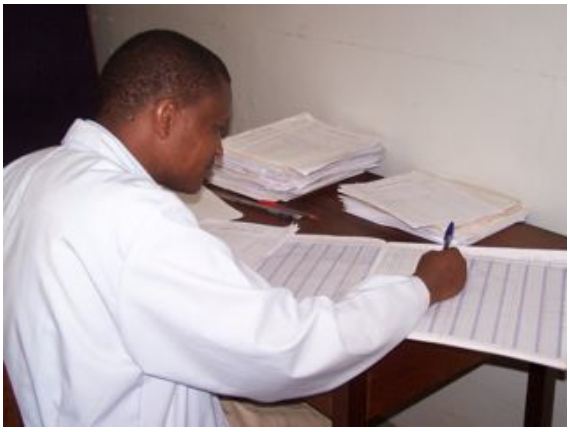


Figure 27: A Clinical Officer records patient information into a discharge book.

There was a separate inpatient discharge book for each ward. The inpatient discharge book collected: Serial number (a number assigned chronologically to each discharge entry and starts new each month (monthly tabulation)); Registration number (Inpatient number); Full name of patient; Age (years or date-month-year); Sex; Village/Address; Ward; District; Admission Date; Discharge Date; Leaving Date; Stay Days; Delayed Days; Total Days; Diagnosis; ICD Number; Death; Referral; and Remarks. One of the challenges with the diagnosis is that it was written in the patient chart at the time of admission, but might change during the course of treatment (for instance, after lab tests were completed) and that revised diagnosis was not necessarily written on the front of the chart.

Stay, Delay, and Total Days were manually calculated. Stay Days refers to the number of days between the Admission and Discharge Dates; whereas Delay Days refers to the number of days between the Discharge and Leaving Dates. Total Days is a sum of the two. Not all patients leave the hospital when they are discharged: technically, a patient cannot leave until the bill is paid or alternate arrangements are made to pay off the amount owing. This means that patients or family members can remain on site for weeks or months after care has finished.

Monthly summaries were manually calculated at the end of each month and appeared within the discharge book. The following information was summarized: Total number of patients discharged; Total actual stay days for all the patients; Total actual stay plus delay days; Total number of deaths; Number of referrals to higher level; Total number of absconded (the number of patients that left without paying); Total delay days; and Number of referral cases from a lower level.

All patient records were kept in the Medical Records building from 1955 to present (except for patient records in the current year, which were kept in the inpatient department).

- *Statistics* collected all inpatient and outpatient log books, assigned ICD-9 coding, and entered all information into a DOS-based program (Epi-info6). The stats office reported monthly, quarterly, and annually to the

government and quarterly to each department. The information was utilized in the HLH annual reports.

Figure 28: Pictured is Inpatient index card storage (left), the Medical Records building (middle), and the Epi-info6 statistics program (right).

What happened?

<u>Medical Records</u>

Two weeks before the bi-annual Board meeting in April 2008, administration discovered that the 2007 statistics were essentially a copy and paste of the 2006 statistics. No statistics appeared to have been entered into the computer in 2007, due to the employee-in-charge's struggle with personal issues. Two members of the Care2X cadre with strong computer skills were identified to help enter hospital statistics data (inpatient and outpatient discharge books) into the computer in order to prepare for the Board meeting.

During this time, the Maternity ward leader, the head of Medical Records, and a Clinical Officer (CO) trained two other cadre members on how to interpret patient charts and enter the information into hospital discharge books. The CO first gave an orientation to the patient record, and clarified common remarks and abbreviations (e.g., "pt" means "patient"). He demonstrated where information was found on the patient record and where to write it in the patient discharge book.

Figure 29: Care2X cadre members are trained by a Clinical Officer on how to understand and interpret a patient chart for statistics.

The CO instructed the cadre members to record their initials on the front of the patient chart to indicate that the information was entered in the book. He sat with the cadre members and watched them enter information. He instructed them to set records aside if they had any questions and returned that same afternoon to check their work and identify problems.

We received positive reports back as this activity freed CO time to devote to patient care. The two cadre members trained on patient records worked with the CO and Head of Medical Records to train the remaining cadre members on entering patient information into patient discharge books. This work expanded from the Maternity Ward to include patient records in all hospital wards. The two original cadre members who helped with the annual statistics continued to work in the Statistics office to provide much appreciated support.

PART TWO

As my time in the environment drew to a close, one participant echoed what was in my own heart: "I don't really want to leave here until I see things run smoothly because I know if I leave here and things are not complete, it will fall right back where it was" (Participant 25). While I presented participatory recommendations to the project management group, and a detailed succession plan for discussion, I worried none-the-less that leaving without a project facilitator to take my place would jeopardize the work and learning that had been accumulated over the field research period. I would later learn that the recommendations and succession plan were quickly discarded in favour of an alternate, administrative-driven approach.

Plans for Sustainability

Succession Plan

The key to sustainability was identifying both short- and long-term activities to advance the project with foreign (short-term) and Tanzanian (long-term) stakeholders. A detailed succession plan was discussed at length with the Project Group May 2, 2008, and is presented in Appendix D.

The plan was approved by the Project Group team two weeks prior to my departure and was to be facilitated by top administration, as there was no one to replace me. The succession plan outlined primarily Tanzanian people to follow-up specific activities. Unassigned work was to be divided amongst the Project Group members. However, the Project Group was also comprised of foreigners, many of whom were scheduled to leave Haydom by the end of August 2008.

Details of current and anticipated activities were presented to the group and are summarized below. Each activity had associated individuals listed to follow-up and guide work.

- *Care2X development* included: server access and updates: testing of registration page; testing pharmacy, laboratory, and radiology modules for readiness; and ongoing testing of Eye Clinic modules under development.
- *Care2X implementation* included: making "live" the updates to the registration page, as well as the pharmacy, laboratory, and radiology modules; making "live" the Eye Clinic module patient eye assessment, diagnoses, and treatment sections after completion and testing; staged implementation of new modules that may be developed; and development of a confidentiality agreement.
- *Care2X cadre training* included: capacity building in Arusha (May 2008); basic and advanced computer-skill proficiency; English language training; Care2X proficiency; assessment of knowledge and improvement; patient chart knowledge; weekly discussion of opportunities and challenges.
- *Project group meetings* to discuss Care2X implementation and continuous improvement plans.
- *Server*: ongoing trouble-shooting of server issues.

- *Computer assessment and maintenance* included: preparing newly acquired computers for use and ensuring viruses were removed from existing computers.
- *Statistics* to continue with the electronic and paper-based recording of statistics, and to identify reports to be created for Care2X.
- *IT capacity building* to increase information technology capacity.
- *Infrastructure assessment* to ensure organizational readiness for the Care2X system.
- *Asset management* to electronically catalogue hospital assets.
- *Unique Patient ID* was to review Selian's Unique Patient ID card and modify, as necessary, for HLH hospital-wide implementation.

Of these, Care2X development and implementation, project group meetings, server trouble-shooting, IT capacity building, and infrastructure assessment were directly linked to the server issues described in detail in the next chapter.

OPD patient and communication flow for Laboratory tests and prescriptions was also mapped and provided to project group members to help guide implementation efforts (Appendices E and F respectively).

Recommendations

This research would have been much easier to write up, though perhaps no less interesting, had the succession plan (above) and recommendations (below) been followed. I had intended to list the recommendations in their entirety here. However, upon further consideration, I realized that, even though administration changed the course of the Care2X implementation by discarding participatory recommendations after I left the environment, it does not make the recommendations themselves any less relevant to the new reality that they created (refer to the "What happened?" section below). I therefore provide a brief summary of the recommendations below, and a more detailed summary in Chapter 7: Conclusions and Recommendations.

Recommendations, based on participatory learning and feedback over the duration of the field research period, largely focused on two areas: staged implementation and expanding human resources. They were supplemented by the Arusha Care2X training group recommendations.

Staged implementation includes:

- continuous assessment through iterative, participatory change management;
- data quality checks to ensure the accuracy of the information entered into Care2X;
- knowledge of work- and patient-flow to understand how Care2X supports, or changes, existing practices;
- exploration of usability issues (ease of use and usefulness of Care2X); and

- the continuation of existing statistics work as CO time was freed to see patients, rather than entering patient information into discharge books.

Expanding human resources includes:

- designating a project facilitator, as there was no one dedicated to this task on the Project Group;
- building Information Technology capacity to support local sustainability of Care2X implementation;
- expanding Care2X data entry clerks by training existing employees to not only use the information, but use the system themselves. This means decreasing the reliance on a separate cadre of employees;
- the transition of my involvement to an external reviewer role included being available via email for discussions related to the sustainability of the initiative; and
- involving ELCT Health in mentorship activities in order to learn from their extensive IT and change management experience.

As with the succession plan, addressing server issues was embedded in the following recommendations: continuous assessment; designating a project facilitator; building IT capacity; and involving ELCT Health in mentorship activities.

Arusha trip

I met individually and in small groups with the people who traveled to Arusha to meet with ELCT Health, receive Care2X software training, discuss implementation issues, and tour Selian Hospital/Arusha Town Clinic and St. Elizabeth Hospitals to see Care2X in use. Their recommendations were sent to members of the Project Management Group prior to my departure as a supplement to the recommendations I had previously submitted and discussed. They are summarized below and presented in greater detail in Chapter 7.

Everyone I spoke to demonstrated an awareness of the challenges of workflow and change management and discussed possible solutions. They were enthusiastic and wanted to be part of a team to actively drive the Care2X implementation immediately. The participants identified the following key observations:

- It was important to understand how *workflow and communication flow* will change as a result of the Care2X implementation.
- *Knowledge and skills* were needed to understand medical terminology, basic computer skills, and Care2X software.
- *Human Resources* were needed to guide Care2X implementation and utilize the system.
- The Arusha trip members were keen to form the basis of a *Care2X change management team* that included the Head of IT, and care

providers/knowledge experts at HLH. This group would require the guidance of a *facilitator* to "put into action what has been learned".

- *Confidentiality of Patient Information* was a key issue as non-health care providers will potentially access the system.
- A *Unique Patient ID Card* was of considerable interest. The Arusha group brought back samples of Selian's unique patient ID card, which had been previously discussed with Administration and was part of the succession plan.
- *Improve OPD Patient Flow* by implementing a first-come, first-serve approach through an organized patient queue.
- *Participation of ELCT Health* was desirable to build on their knowledge and support.
- The Arusha group was eager to present their experience at a *Continuing Studies session*.

After the Arusha trip, the webERP facilitator and I met with the Care2X cadre to discuss the new reporting structure. They were told that the Project Group would work on the succession plans. In the meantime, the plan was for them to continue their work collecting statistics from patient files in the wards (6 cadre members) and to assist the Statistics Department to complete the 2007 statistics in the computer (2 cadre members). We asked the group to: work together on patient files to learn from each other and to expand their knowledge of patient diagnoses; continue basic computer skills classes and increase typing proficiency; continue English language lessons; increase their knowledge related to information collected by OPD: Billing, Pharmacy, Radiology, Registration, and Examination; and learn the Care2X program which required the ability to access the latest version of the program. The Care2X Arusha group and the Head of IT would guide the training process. A summary of this information was provided to Administration and emphasized that the cadre was a keen group that required follow-up.

What happened?

I left the environment in mid-May 2008 and returned to the environment for a two-week follow-up visit four months later (September/October 2008). I had limited contact with the research environment in the space between. Information I did receive was through email correspondence and the occasional phone call, and vacillated between the positive and the negative. On the one hand, I received a message from HLH administration two weeks after I departed that focused on progress: Western developers were being hired to work on the Care2X and webERP systems (in tandem); all hospital reports had been reviewed to determine redundancies and identify the reports that needed to be drawn from an inpatient module; and a virtual hospital was set up in the library to test the Care2X software. I was not told at that time that 18 additional people had also been hired as Care2X cadre members, less than two weeks after my departure, in anticipation of hospital-wide implementation.

On the other hand, I received correspondence that pointed to challenges in the environment. Reports of "the situation is even worse at the present time" and "I am the only one left" made me eager to return to the environment to explore the sustainability of the Care2X initiative. But there were some things that required immediate action and clarification while I was in Canada.

In July 2008, I received word from the Eye Clinic that administration said I did not inform them of the Eye Clinic diagnostic module. I was alarmed by the news as the diagnostic module had been a regular discussion topic with administration and the project group, and was identified for follow-up in the approved succession plan. I worked to reconnect (or newly connect) participants in the discussion, including administration, the new (temporary) on-site foreign IT expert, ELCT Health, the Eye Clinic, and distributed programmers. I summarized the Eye Clinic module development and attached the succession plan for follow-up. During this time, administration reminded the group that the Eye Clinic module could not be separate from Care2X itself, nor could programming be a product of uncoordinated efforts between distributed programmers. ELCT Health and distributed programmers confirmed their awareness of the module development and reassured administration that the new module was an integrated component of the Care2X system. What was particularly disheartening, beyond my own worries for my reputation, was the realization that the succession plan was not being followed. This was later confirmed when I returned to the environment and was told that the succession plan was not pursued "at all".

During my follow-up visit, I explored the status of the collaboration between HLH and Selian Hospital, the progress made on inpatient module development, progress made to resolve server issues, the evolution of the project management group, and the cadre experience.

Collaboration

Approximately 2 weeks after Selian's visit to HLH, the Haydom team traveled to Arusha to discuss webERP and Care2X with Selian. They established a joint collaborative steering committee. Both Selian and Haydom had their own committees but informed each other about needs. The group desired as common a product as possible, while acknowledging different needs. The products would look different in some areas. The program developers stayed at Selian for June, July, and part of August.

Collaboration between HLH and ELCT Health on Care2X and webERP generally ended at this time. While HLH supported creating something that could be used in other ELCT Hospitals, administration felt that too many agendas could halt progress towards programming. Rather than find something that would work with all hospitals simultaneously, HLH wanted to be able to create something for itself that could then be tailored for other environments.

> I think that it has to do with ownership and who do we think is running the program. So for many years, I suppose we were thinking we were in charge but in fact the programmers were serving a different project. They were serving the ELCT project…

> So then I think we decided in January [2008] that we had to actually take charge of this. [If] we want something to happen we're going to have to plan it ourselves… I don't think we realized how much more we had to take charge of it from the hospital side and then say thank you for your help to ELCT, we'll keep you informed…the really nice thing here is that ELCT have really accepted that and have appreciated it because it's a win-win situation if you think about it. You know the ELCT also do not have the resources to go into a hospital and sit with the hospital for days on end and pull people out of the hospital. There's no mandate. They would never have been able to come to Haydom and pull people out of their work and sit for two Saturdays to make a program that's going to be used in Marangu. The logic was, it just wasn't there. The whole management logic and priority setting issue [hadn't] been thought through. It was a good project and good people, but it was a type of project where you just needed to do a lot of dirty work. (Participant 7)

There were conflicting reports on how amicable the split from ELCT Health was. Some did not know the rationale for ELCT's discontinued involvement. The decision was not surprising, however, to one leader who commented that large and quick decisions were made by administration all the time in the environment.

Development of Care2X Inpatient Module

The inpatient module was under development when I returned to Haydom. No one had created this previously, so it was being developed from scratch. This also meant that no one had ever utilized it in a clinical environment, unlike the use of the OPD module in other hospitals.

> We're building up Care2X for the whole hospital and we're implementing it all at once. We're not starting slow this time. (Participant 7)

All inpatient modules were supposed to be ready by the end of December 2008. The hospital was planning on three weeks of system testing and training in December, with full implementation of Care2X inpatient and outpatient modules scheduled for January 1, 2009. Because of this Care2X implementation timeline, people would not take vacation in December.

Anticipated plans were that the paper record was to run parallel to Care2X, with cadre members entering information into the system as close to real-time as possible. For instance, at the Ward level, the doctor would do rounds, record information, and give the information to the cadre member(s) to be entered into the system. The administrative expectation was that the information would then be available in the computer within an hour or two of the information being written in the file. Laboratory information would be entered into the computer within minutes. Data entry would be done by a cadre member at one station, and viewed by laboratory staff at another station. The lab personnel would not enter data themselves, so they would have to continuously provide the cadre members

with the results. Over time, the cadre members could increase, or the laboratory staff could be trained to enter data. However initially, only cadre members would be permitted to enter data. The IT department needed to work with administration to determine where the location should be for each of the computers, to set up tables and Internet connections.

Reports would be automatically generated. Administration asked all offices, departments, and divisions to submit all internal and external reports (every piece of paper). The process officer scanned all the reports into his computer. All forms were reviewed for content and linked to specific divisions and departments [168]. Approximately 650 reports and forms were completed at HLH, and of these, nearly 300 reports and forms were tied to the information that could be provided through Care2X [168]. Administration, Division leaders, and department leaders sat down for two full Saturdays to review all the forms together. Not all department leaders were invited to these sessions. Discussion was dominated by a small number of expats. Approximately 60 forms were deleted because of overlap, but a substantial number of forms still remained. The programmers received instructions to program each report into Care2X. The forms were a challenge in terms of paper since some reports would still have to be completed by hand (e.g., MTUHA), but Care2X would handle the actual statistics. Internal reports could be printed out from Care2X. External reports would need paper copies completed.

Despite these many implementation plans, Care2X was not implemented in January 2009 as hoped. Server issues continued to plague implementation, which was further burdened by the development of inpatient modules that had not been previously tested. Despite an onsite IT expert offering to move Care2X from the old server (that does not permit remote access) to the new one (which does), he was discouraged from doing so by administration in favour of focusing on further developing the Care2X program. The 2008 Annual Report noted that HLH "spent the year to train and develop the concepts, and it will hopefully be implemented fully in 2009" (p. 12)[165].

Project Management group

After my departure, the decision tree created in April 2008 was used, essentially placing Care2X and webERP project decision-making with one administrator. In addition to these, 13 other projects required coordination [165] as most of the (foreign) leaders for those left the environment by August 2008. While administration was advised by project management members that more people were needed to run the projects, administration remained optimistic that things could continue.

The 2008 HLH Annual report lists the many projects and states:

> All of these projects have been coordinated through the special programme management with an emphasis on change management and leadership training in parallel activities. (p. 12)[165]

However, by the time I returned in September 2008, two people were left to manage all of the projects, as local project members were not generally active participants. At one point, one person was left in charge of all of the projects. Weekly project management meetings had ceased, with instructions to move forward projects perceived as administrative directives. Leadership training had also been discontinued, with administration citing too much work as the rationale.

Cadre

Less than two weeks after I left the environment, 18 new cadre members were hired in anticipation of Care2X expansion throughout the entire hospital. When they were hired, the focus was that all inpatient and outpatient modules would be implemented by July or August 2008. However, in September 2008, the Care2X program had not yet expanded beyond OPD registration, due to ongoing challenges with the server, the inability to make updates, and prioritization of the development of inpatient modules. Unlike the OPD modules that were in use in other hospitals, the inpatient modules needed to be fully developed and programmed, before they could be tested and implemented.

Weekly cadre meetings ceased after my departure. The Head of Statistics tried to meet with the Care2X group. He initially selected four people (by follow-up there were three) who met with him twice a month and carried information back to the larger group.

The Care2X cadre members did not have enough work to do. With 25 cadre members doing the statistics work that was previously managed by 8, there was not enough work to share. I was astonished to encounter one of the original cadre members pushing IV fluids between wards, shortly after my arrival. When I asked what her job was, she replied it was to work on Care2X. While cadre members did not clean the hospital, they were tasked with transferring patients and supplies to wards. Some wards and leaders were nicer to work for than others. Cadre members acknowledged that some people in the wards wondered who they were and what they were doing. The cadre members accepted this, because they needed to work in order to be paid. The hiring of more Care2X employees came as a surprise to some of the staff. One staff member commented that people should be used as intended when they are brought on during a time of financial constraint.

Administration was aware that there was not enough statistics work for the cadre to do in the hospital, and that they therefore helped out on the ward. The intent was to have Care2X cadre members in each of the wards once Care2X was up and running. In the meantime, the plan was that cadre members would learn basic computer skills, help out with statistics and in the wards, and later, learn Care2X. A few cadre members learned Care2X from women in OPD registration before the registration women went on Maternity leave.

A computer lab was set up by the IT department in the library to train the Care2X cadre. The intention was that this lab would become a virtual hospital, once the Care2X software was updated and available. The cadre would eventually register pretend patients into the Care2X system to see how the information linked. With the computers set up in the library discussion room, the space was no longer

available for other purposes. Not all of the 11 computers and 13 monitors were working.

The new cadre members did not have computer skills when they were hired. Computer training was held all day every Tuesday and Thursday. Classes were led by one of the original cadre members. There were initially two women leading the training, but one returned to school. The new cadre members were initially given structured computer training on the Internet, Microsoft Word, Excel, and PowerPoint. They were then generally left to learn in an unstructured environment. My first impression upon entering the room was one of the new cadre members closing a computer game as I walked past.

Figure 30: Care2X cadre training room

The new cadre members did an English exam before they were hired by administration. They therefore did not attend classes to improve their English because they were already fluent. This did not appear to be the case, however, when some cadre members struggled to understand when I spoke English to the group.

According to the cadre, there was no formal schedule for Care2X cadre members to know where and when they would work on statistics. This information conflicted with other information that indicated that cadre members had been assigned to specific wards. The first cadre members were training the second cadre on how to read the patient record and write statistics into the discharge books.

Two cadre members worked in the laboratory. They recorded information from the white order form to the in- and out-patient laboratory statistics books. These members also brought urgent requests from the ward and returned the results. They were taught by the Head of the Laboratory how to read the lab information needed for the statistics books. The laboratory received approximately 150-200 test requests from the OPD each day and about 70 inpatient test requests each day.

To set up the Care2X system in the laboratory, one cautioned that data entry required someone who understood laboratory work.

The Arusha Care2X group did not present their trip to continuing studies as planned, though a presentation was made in a CMT meeting. The group members had the background information to understand Care2X and were available as resources for practical clarifications, once the system was in use.

The hospital planned to implement Care2X hospital-wide January 1, 2009. The cadre members would need to learn the software before that time. One leader recommended that the computers should be set up and the software tested in the actual setting, rather than the computer lab, before formal implementation. Despite administrative plans, Care2X was not implemented beyond OPD registration in January 2009.

The next chapter discusses the results and includes a critique of the research methods.

Chapter 6: DISCUSSION

The previous chapter explored the questions: What is the context? What is the organizational strategy? What is the organizational culture? and What are the efforts to improve Care2X implementation?

This chapter begins with a critique of the methods I used during the field research period. It is followed by a discussion of the barriers and facilitators for change, an exploration of the dichotomy between local and expatriate power, and an examination of the convergence of cultures and strategies to support EHR implementation, and the implications for sustainability.

CRITIQUE OF METHODS

While I am proud of my initial research proposal, the reality of the hospital environment, and how that would apply to my research, surprised me. It is true that my proposal was designed to be responsive to the research environment; however, I did not appreciate in my cubicle office in Canada what that would look like. I arrived in the environment to find chaos between management and workers, and my proposal, so neatly conceived and internalized, looked rather daunting. The image that comes to my mind is the difference between applying paint to a wall with brush strokes, or with a spatter gun. I was immediately struck by issues that influenced my research: the language barrier, the aversion to consent forms, internal politics, the divide between workers and management, and many other issues described in the results.

I arrived in Tanzania with an idealistic view of engaging participants in building shared plans for change. This was difficult to achieve. The initial months were characterized by iterative problem definition and exploring the feasibility of what could be reasonably accomplished within the dynamic environment. I realized early that relying on a translator was problematic and acted as a barrier to me being able to integrate myself into the hospital and local communities. My role and situated perspective evolved over time as I slowly transitioned from an outsider to a quasi-insider. This transition was dutifully recorded in my ever-present journal. The research approach and mixed methods were integral for understanding Care2X implementation in context.

Idealism

I approached my initial research plan with great optimism and idealism. In my mind, I imagined engaging people in a participatory process to define, implement, and evaluate changes to improve Care2X implementation, and in doing so, build capacity for these efforts to be sustainable after my departure. Social change was on my mind.

I carried with me Tolstoy's quote about dispossessed serfs in Russia:

> I sit on a man's back, choking him and making him carry me, and yet assure myself and others that I am very sorry for him and wish to ease his lot by all possible means except by getting off his back. (What Then Must We Do? 1886)(p. sn38)[64]

Having read action research literature, I imagined my work would be straightforward, noble and empowering – a departure from the effects of Structural Adjustment Programs and donor imposed changes. But this idealism was not congruent with the environment itself. The experience of conducting research in Tanzania was new. I did not know processes and expectations, and looked to those around me for clues.

The immigration experience was my first of many milestones to advance my research, and was a humbling education:

> I found myself defeated by my lack of knowledge of the immigration process, and [after spending days in the sweltering building] the office was closing its gates to new customers. The anthropological appeal had worn off and I adopted the familiar pose of others around me, sitting dejectedly on the stone bench and staring at other people's shoes. (Kitson notes, March 2007)

It is fortunate, perhaps, that I approached my life itself as ethnographic research, and found humour in my own unknowing.

In the early days, my understanding vacillated between just within reach, and just beyond it. At first, I was only scratching at the surface, trying to gather basic information that would enable me to function in the environment and plan next steps. It was not a straight forward process as there are many layers to understanding and they do not necessarily reveal themselves in a logical, stepped manner; some layers revealed themselves quicker than others and it sent me on quests to understand the connections between. For every answer, there were new questions to explore. The most maddening one for me was: 'Why isn't this working?' and "this" was a moving target. I was researching in all shapes as my enquiries took me in circles and unceremoniously released me to dead ends. One participant empathized:

> The plan cycle is filled with endless amounts of small planning cycles. So like you've experienced, trying to figure out what the problem is, you have to plan that process as well. So you have to figure out what is the problem with figuring out what the problem is. (Participant 7)

This process not only led to discoveries about what is possible in the environment, but also led to the accumulation of things that would not work in a given timeframe and under specific circumstances. The environment was dynamic and problem-solving was context sensitive, affected by many variables and informed by multiple, and at times, competing perspectives and priorities.

Each initiative within the hospital shared change management issues, but largely faced them individually. I first raised this concern in October 2007 when the change management advisor arrived. I realized that there was a disconnect between my research and being included in meetings related to change management. I was aware that if we didn't communicate, we could work in different directions and fragment tenuous change initiatives further.

There was a sense of urgency in the environment to push forward large-scale change initiatives. Despite having my participatory research approach approved by hospital administration prior to arriving on site, I quickly felt the pressure to impose change on participants and "just get it done". During these times, I would reassert my commitment to a participatory process to improve Care2X implementation. While my perspective was tolerated by administration, buy-in for the approach was lacking. Others felt the same pressure:

> I hope I can make a big contribution in completing what I plan now. But of course people have to use it also. And that's why I think it's very important to let them make [the product]. I'm not going to do it. I'm going to facilitate it. And some people, well, don't think the same. They really think you have to push the process. But I think it can't be pushed. (Participant 19)

Little pockets of success with participation would give me hope, but the reality was that the environment was mired with challenges. Participation was important, yes, but not as important as change. And the hospital embraced change on a grand scale. It was a complex situation that made the concept of participation difficult to isolate, and the approach, difficult to maneuver. I therefore worked to understand participation itself in the environment, and the repercussions for the participatory approach, by building my understanding of organizational culture, strategy, and change management.

Language

While I had been told during my initial site visit in January 2006 that the people I would want to speak to spoke English, the reality differed. English is not spoken widely within the hospital, and even fewer people speak it outside the hospital gates. This had immediate implications for effective communication and self-reliance within the community. My first efforts, therefore, focused on learning Kiswahili, as well as greetings in the main tribal languages, Kiraqw and Kidatoga. Daily discussion improved my progress tremendously, as did my ability to mime words I did not know to make up for my lack of vocabulary. To this day, I have to fight the temptation to pause the conversation and tug on my left ear when I want to say the verb 'to hear' (*ku-sikia*).

My first real experience with a translator revealed some challenges I had not yet considered:

> There were a number of people there when we arrived. I felt a little bit...I don't know...awkward doesn't seem to be the right word...inadequate. That's the word. Inadequate for not being able to communicate on my own. All of a sudden I had this voice appendage and didn't know how to use it. I appreciate now how different it is between having a conversation with someone in a shared language and...not…I tried to think of 'the' perfect thing to say. I'd ask a one-sentence question, it was translated into many sentences, there'd be some animated discussion with my translator asking further questions and clarifying answers, more talk, some pointing and fluttering of paper and then a short translated response. How can that be? I'd be standing there, pen poised expectantly, eyebrows raised in interest and my face aglow...I don't think I'm exaggerating here...and then my pen would droop and I'd really, really try to understand what the hell they were saying. As if furrowing my brow in concentration would increase my understanding of Kiswahili." (Kitson notes, June 07)

I understand that this situation is likely due in part to my questions, and due in part to my translator. However, it made me realize that working with a translator to improve communication could actually be a barrier to fully understanding what people were saying. I wondered to myself: How can the language I use build trust but not influence people? How does not expressing myself directly (e.g., through an interpreter) change perceptions and meanings? I redoubled my efforts and concentrated on speaking Kiswahili with participants directly through daily interactions and practice.

Knowing Kiswahili was not only a valuable asset in terms of communicating with those individuals who do not speak English, but for earning acceptance within the environment. The Lonely Planet Swahili Dictionary became an extension of my hand and enabled me to quickly look up unknown words and formulate responses on my own. Mistaken words would have people in fits of giggles as I complimented someone's pretty potatoes (*viazi*) instead of their shoes (*viatu*), or asked for shoes for lunch. I found myself caught in faulty logic that told me correctly that *mayai* (pronounced "my eye") are eggs, but sometimes when I wanted to talk about eggs, I would think "my eyes" and then ask for *macho* (eyes) instead. Abby, my mischievous daughter, would chant *chupi* (underwear) in my ear when I wanted a *chupa* (bottle) and delighted when she heard me order two underwear of Coca-Cola in an Arusha restaurant. The staff behind the counter tittered and gaffawed: "Oh no", the manager said shaking her finger at me, "you've got the wrong kind of store. You should try Woolworths [a clothing store located in the same shopping complex]". Sharing laughter, even as a good-natured response to my own faux pas, bonded me to others and built camaraderie. After this extra effort, some participants who previously only spoke Kiswahili to me began responding in English.

Consent

The language barrier and awareness of how I might be perceived quickly led to the realization that the 3-page, Grade 12 level English consent form I had prepared in Canada was not appropriate for the environment. Not only are lengthy consent forms not standard in the hospital but also there is a language barrier. I wondered: What is the ethics of my consent form? How does one find a shared vocabulary? Where is the common ground between cultures? What can I do to facilitate this process? After some modification, the consent form was reduced to one page and the English simplified to a Grade 6 level. A member of the IT Department translated the new version to Kiswahili.

With consent form in hand, I was faced with the challenge of where best to begin. There was no formal orientation program for new researchers at the hospital; however, key resources identified themselves shortly after my arrival and provided me with the necessary information to take my first steps in the research environment and community.

My situated self

Stambach states in her thesis, *Lessons from Mount Kilimanjaro*, that

> the place of departure for any ethnographic study – like any educational journey – is always one's own situated perspective. (p. 28)[169]

My introduction to the environment was difficult in some respects because there was clearly a divide between workers and management and I was wary of how I would be perceived by both groups. Fetterman says,

> The trust the group places in the intermediary will approximate the trust it extends to the ethnographer at the beginning of the study. (p. 36)[124]

But I took what I could get, given my unsteady welcome to the environment, and gratefully accepted initial offers from local and expat workers and leaders to tour the community and hospital.

Not long after my arrival, a leader discussed with me the power and politics of positioning myself within the environment. I was one of many visitors at the hospital, and it was important to be seen as a contributing member. I was cautioned to not be perceived as management, as this could impact my ability to integrate with workers, regardless of position. I was told the foreigners might be seen as a threat to power, and that some local forces were working to undermine leadership. I was cautioned to not become part of the power game, and also encouraged to interview the people considered instigators of the power struggle issues. It was ironic that the leader would then immediately introduce me to one of the alleged instigators and explain to the worker how good it would be for me to learn from such a helpful and informed person. Just as I quickly learned how to battle my way to the front of an immigration queue, I too quickly learned how I could be set up to move someone else's power position forward in Haydom. But unlike the queue, I did not want to be part of this battle.

This interaction gave me much to consider in terms of how to position myself in the environment. I wondered how I would achieve not being perceived as management. I did a mental tally of the strikes against me: I was a visitor living on hospital grounds; I did not speak Kiswahili; and my daughter was playing with the MMD's children. All of these had implications for how I was perceived. I decided that the best approach was to build trust through transparency. I positioned myself as a student eager to learn from HLH and facilitate a participatory process for Care2X implementation. In the low-resource environment, my role evolved over time to include being a change agent, mentor, project coordinator, and member of the community. I continued to feel cautious however, and wrote, "I am aware that I might be seen as a vehicle in the hospital struggle" (Kitson notes, Sept 2007), in response to growing pressure to force change on participants.

My situated perspective changed over time. A challenge of conducting extended field research is the transition, over time, from outsider to quasi-insider. Certainly, I never felt truly a part of some groups; but those, perhaps surprisingly, were related more to 'cliques' that formed between expats living on the hospital grounds, more so than feelings of exclusion within Tanzanian circles. A challenge, and an opportunity, of informal discussions and interactions is the increased level of disclosure people have over time. My daily journaling helped me to understand this transition and put my research in context. The longer I was in the environment, the more friends and colleagues would disclose to me personally. While it is certainly the case that not everything I heard was related to my research, it was often related to the environment. I could never "unhear" what I was told; therefore, I worked to bracket the information. The extra information I was given was not used directly in the research, though it did increase my awareness and provide deeper insight; it coloured my world.

Methodology

The ethnographic approach enabled me to build an understanding of information systems by looking at the interrelation of technology and its social environment. Extended field research permitted me to explore strategy, culture, and context within the natural environment, over a period of time, with the people living the phenomenon. I regret not being able to stay longer, however, to see the bottleneck resolved. Defining the research scope took time as I explored over the course of months the feasibility of what could be accomplished in the chaotic environment.

Praxis, the interplay between theory and practice, was integral to the research process, as it allowed me to iteratively integrate theory and practice into research plans. The socio-technical and social interactionist theories not only help explain how the research unfolded, but also are reinforced by the research itself. The EHR implementation cannot be separated from the context and culture of the environment, nor from the people within the environment without losing its essence; the implementation of the EHR would not *be* were it not for the interrelation between it and the social environment. While each of these can be teased apart to a certain extent and discussed separately, as has been done

throughout this dissertation, to remove one or more of them in their entirety would result in an incomplete and rather incomprehensible research picture.

Socio-technical theory looks for fit between the technology and the environment. Technology here does not solely mean the EHR itself; rather, it includes paper-and-pencil technology, phones, Internet, and these are part of infrastructure, which blend into resources (like people), the location of the hospital, funding support, strategic plans, and the ability to make change in the environment, among others. There is a web that connects the technology to each of these and these to technology. Social interactionism theory is similarly rooted in the culture and context of the natural environment, over a period of time, with the people living the phenomenon. What I think is very important to emphasize here is that of the *natural* environment. We cannot gain a full picture of EHR implementation without understanding the environment within which it is to be implemented. Further, EHR implementation takes time. Change takes time. So it is essential to explore a longitudinal view of change through the people living the change to understand the process of change.

When I arrived on site, the hospital was working to identify who was working where, when, and in what position. Identifying participants was a challenge, in part due to differences in opinion between administration, the IT Department, and the former Care2X steering committee members about who should be involved. Participant identification was therefore an iterative process that reflected the expanding research enquiry to move beyond Care2X itself to understand underlying issues that influenced implementation. Some key people left the environment during the field research period and could not continue to be part of the implementation process.

The methods: observation; informal discussion and interaction; meetings; email correspondence; interviews, and document review permitted rich and holistic descriptions to be drawn. I learned to listen not only to what was said, but also to what was not said. I learned through practice how to ask a question from multiple angles. I was critical of my own role and the influence of foreigners in the environment, and explored the issue of outsiders with local workers and foreigners alike. The sheer volume of materials, however, was daunting, and took a disproportionate amount of time to sort through once I returned to Canada.

Sustainability of efforts

I had come to Haydom to build shared plans for iterative improvement that could be sustained beyond my field research period. To that end, I: presented a participatory quality improvement approach to employees and administration; participated in leadership mentorship of the Division Leaders, in particular related to quality improvement models; facilitated connections between employees and outside support contacts; facilitated collaboration between Selian and Haydom Lutheran Hospitals; provided guidance to Care2X cadre members in weekly discussions of challenges and opportunities; and worked with participants to formulate recommendations and a succession plan, among others.

The next section explores the barriers and facilitators for change.

WHAT ARE THE BARRIERS AND FACILITATORS FOR CHANGE?

In many ways, the barriers and facilitators for change at HLH are confirmed by the literature review. I realized very early in the enquiry that the change management issues I was familiar with in Canadian healthcare settings are the same, or very similar to, what the rural Tanzanian hospital struggled with. That it was a low-resource environment with its own contextual conditions and limitations did not change what was at the core: the interplay of context, organizational culture, strategies, and the introduction of a new technology. The uniting of these to make sustainable change requires a comprehensive change management approach at both organizational and individual levels. Organizational readiness for change and change management is discussed below; whereas context, culture, and strategy are further drawn out and discussed in a subsequent chapter.

Readiness and change management

There was no comprehensive readiness assessment conducted prior to the selection and implementation of Care2X. This could have provided insight, for instance, into the reasons why previous participatory improvements to the paper-based patient record could not be implemented.

Change management begins at the conceptual level. There were many indicators that EHR implementation could be a challenge in the environment. Lorenzi [170] says that assessing an organization's readiness for change begins with looking at characteristics of past IT implementation, the balance of power between people and roles, how stable the organization is, and the level of pressure and stress within the organization. HLH had challenges with each of these.

Lack of readiness is tied to low motivation and difficulty working together.

> Complex innovations, such as electronic medical records, quality improvement programs, and open-access scheduling systems, entail collective, coordinated action by many interdependent individuals, each of who contributes something important to the change effort…problems arise when some interdependent individuals are motivated to implement the change, but others are not…When interdependence is high…what is important is not what I think I can do, or even what I think you can do, but rather what we think we can do together. (p. 425) [71]

Trust is important, not only to believe in the skills of others, but to believe that you yourself have the potential to make change, and also the necessary skills, resources, and opportunities to make change [71].

The hospital lacked a unified change management approach. While ELCT Health was interested in sharing their change management approach with the hospital, they were wary because of lack of administrative buy-in in the past. In a previous visit, administration interrupted ELCT Health's presentation on change management and indicated that HLH was done with that.

Change management refers to the process of moving from the current to the desired state within an organization. It begins with a shared vision for change and then empowering people through participation to attain the vision [4, 65, 85]. Leaders should extend encouragement and support to workers to strengthen desirable aspects of organizational culture [68, 97] (to support the strategy), and to challenge the status quo [100].

Lorenzi and Riley state:

> Change management should start early in a technical process, not in the middle of a crisis. When you are in the middle of a crisis, it is too late for change management; you are ready for crisis management. We have found that the following statement helps people to understand when to use change management: "when you are up to your midsection in alligators, it is too late to remember that your first objective was to drain (change management) the swamp!" (p. 201)[170]

Crisis (reactive) management within the hospital was reduced over time, in favour of a more proactive approach.

Implementation of an EHR is a continuous change process requiring a proactive response [27, 77]. Clear communication and feedback mechanisms can build support for change [4, 7, 65, 101]. It is important not to automate a bad system as it can enable errors to happen quicker [92, 171]. The pilot stage for the change is particularly important because, if you "skip from concept to full scale, even tiny and easily correctible flaws will destroy the innovation" (p.69)[172]. In pressing for hospital-wide implementation of both in- and out-patient Care2X modules, the pilot stage was circumvented.

In the Improvement Guide, Langley et al. describe the benefits of using the Plan Do Study Act (PDSA) approach to quality improvement to manage change [171], which is widely used in healthcare. Changes are categorized as first- or second-order changes. First order changes are made to maintain the current state (routine or reactive changes) with immediate (or shortly thereafter) impact. Administrative firefighting to deal with emergencies falls into this category. Second-order changes, however, improve the system beyond the current state and fundamentally change the system and how people work within it with a long-term impact. The changes in the organizational structure and Care2X implementation fall into this category. With both types of changes, knowledge is built by involving stakeholders in a process of planning, implementing, and evaluating small meaningful changes iteratively over time [171].

Gaining commitment to change includes: communicating why the change is being made and what it means for people; striving for consensus on how to implement the change; and publicizing the change. Creative thinking [77, 171] can be used to plan changes by: challenging the boundaries; rearranging the order of steps; challenging why the change is necessary; and removing maintaining the current system as an alternative [171].

It is important to ensure that staff has the right knowledge and skills to support EHR implementation [1, 81, 89, 104]. Training can be required to implement a change, particularly if the change is complex (for instance, when a new technology is introduced). The timing of the training is important as training that is provided too soon becomes lost if there is no opportunity to practice it, and training that is too late can make people feel overwhelmed and underprepared [171]. This was the case with the computer and limited Care2X software training at the hospital and within Arusha, as the skills gained could not be used in the environment due to implementation delays.

The barriers and facilitators for change are outlined below and an overview is presented in Appendix G.

Barriers to Change

The greatest barrier to change was that server issues, related to server access, and remote and local administration, could not be resolved for the duration of the field research period. As a result of the server issues, updates could not be made to the system, and Care2X could not be implemented beyond OPD registration. This had implications for the ability to examine data quality and software usability. The server issues identified a gap in knowledge and expertise for the local IT department to implement changes itself. While distributed programmers and ELCT Health rallied to provide distributed support while contemplating a locally sustainable solution, they were unsuccessful at resolving the issues. Ultimately, server access was inextricably related to trust and control, and there was no clear way to overcome these obstacles despite persistent efforts.

The hospital struggled with the transition from paper to electronic health records. In particular, the lack of a unique patient identifier meant that multiple records could exist for a single patient and not be unified for care. While Care2X generates a unique patient identifier, updates could not be made to the system to allow the number to be utilized. Although administration considered other experiences when selecting Care2X, the same consideration was not given to Care2X implementation experiences. There was a lack of learning from others' experience (for instance, ELCT Health and affiliated hospitals), as well as their own (the challenges within OPD Registration and successes of the Eye Clinic module).

Instead, the hospital administration struck out on its own, intent on forging its own implementation path. Succession plans and recommendations were requested by administration but immediately abandoned in favour of full hospital implementation, while the bottleneck (server issues) remained unresolved. This had implications for infrastructure and cost. Participation was hindered by the challenges of transitioning leadership, poor communication mechanisms, and an organizational culture unaccustomed to change.

This discussion begins with server issues, which were influenced by human resources, capacity building, leadership, sustainability, participation, and others, and in turn influenced the same. While each of these is discussed separately below with references to the literature, they are specifically drawn out here to illustrate

their complexity and pervasiveness in the environment. These issues are further drawn out in subsequent discussion sections related to the dichotomy of local and expatriate power, and the convergence of cultures and strategies to improve Care2X implementation.

Server issues

Server issues were the bottleneck for Care2X implementation and had a cascading effect. Because of the server issues, updates could not be made to the Care2X software, which meant: Care2X could not be implemented beyond OPD registration and learning could not be gained from other OPD areas that would utilize the system; no patients could be discharged from OPD registration, so no return patients could be registered in the system and useful (and reliable) statistics could not be collected; the Eye Clinic module could not be tested and implemented, and the Eye Clinic could not be used as an example of Care2X in use; usability and data quality issues could not be explored; participatory suggestions for design changes could not be implemented, which stalled the improvement process and resulted in lost momentum; and the unique patient identifier could not be implemented, which meant that multiple files continued to exist for individual patients across, and potentially within departments, and patient records could not be linked. Server issues also affected: infrastructure and costs; human resources and capacity building; and sustainability. The server issues identified a gap in knowledge and expertise for the local IT department to implement changes. But the problems went deeper still to reveal issues related to trust and power.

Server Access and Remote Administration

No updates were made to the Care2X software since its implementation in the OPD in January 2007. Care2X use was limited to OPD registration, and further limited to new patients only. The inability to discharge thousands of patients in the system meant that meaningful statistics could not be gathered from the system.

There is more than one server in use at the hospital, and these were backed up manually each week. The primary server was donated from Norway and was controlled off-site. The expat IT expert left the environment in August 2007 and there was no one to take his place to locally manage the servers and move forward the technical aspects of Care2X implementation. The IT department lacked the skills and knowledge necessary to know how to proceed with Care2X updates and testing. There was no readily available sustainable solution to this problem. We therefore agreed at the IT department and administrative levels that ELCT Health and distributed programmers would be engaged as off-site resources, with the intention that they update Care2X remotely as soon as possible, while exploring a more sustainable solution.

So began months of emails, phone calls, and SKYPE chat sessions to try to connect distributed programmers to the local server. Lack of transparent communication, uncertain problem identification, and issues of trust and control

dominated this problem. These issues were pervasive and undermined joint, but apparently unaligned, efforts to move forward the Care2X implementation.

The distributed server master was not eager to provide server access, in part due to receiving conflicting requests. While ELCT Health, distributed programmers, the IT Department and I worked to have the server issue resolved by requesting remote server access (with administration copied on correspondence), the server master also received separate administrative directions that contradicted these efforts, stipulating that access not be provided to distributed parties. The rest of the team was unaware of this conflicting message for several months. The situation led to mounting frustration, accusations, lack of trust, feelings of powerlessness, and confusion as we tried to understand the source of resistance.

Relationships became strained over time within the web of emails. Accusations of lack of constructive feedback and unnecessarily lengthy processes began in January 2008, along with requests for active and transparent communication. One said, "These issues clearly demonstrate the difficulty of being many people involved from different places in the world. We were told that this would not be a constraint if we chose to go for Care2X, but it very clearly is." Feelings were hurt.

The server master was eagerly anticipated to come to HLH and to personally resolve access issues and make updates to the Care2X software, but his trips to town continued to be cancelled. While we had anticipated him being on site in February 2008, no visit had been made by my follow-up site visit in October 2008. The expat IT expert that we borrowed from another hospital was tasked with connecting to distributed programmers and the server master, and transferring skills to local IT staff, but was unable to resolve the issues during his time onsite (April to June 2008). The barriers were described by an expatriate as an African phenomenon that things go slowly and not be resolved, despite nearly all of those involved being non-Africans.

Local administration

From the IT experts' perspective, the greatest hurdle to overcome, before any updates or new modules could be implemented, was to find a way to update and maintain Care2X remotely, and then train the local IT department to take over these activities. The HLH IT department was praised by the offsite expatriates for their existing knowledge, interest, and aptitude to learn: "[Local IT staff have] skill available and also a willingness to learn".

While they did not have the skills to handle the server and updates, ELCT Health and distributed programmers could not see a reason why the local IT team should not be provided with guidance to gain those skills. This could lead to a sustainable solution by building on local talent and providing limited remote assistance. One asked,

> Is there any reasons why nobody [in] the IT department has administrative permissions to the server(s) in Haydom? (July 2008)

The first step would be to ensure HLH had a usable system that could be administered locally. The current server configuration was considered by some IT

experts as needlessly complex and “impossible to maintain”. One recommended that the network and system be made “bushproof”, which means it should be robust, easy to administer, and fail proof. One worried that if there was a problem with Care2X (or webERP, the financial management system) in the future, how long could the hospital operate without it? How long would it take for someone from outside Haydom to arrive to fix the problem?

The complex system required simplification in order to be supported by the local IT team.

> All plans with c2x/WebERP are nice, but without [a] base layer (Network infrastructure, local staff) using the system is [Russian] roulette with 6 bullets in the revolver. In case of any problem, the reaction time MUST be as short as possible. [The] maximum [for] what can be accepted is less than 12 hours. Within this time the problem has to be solved. [It is] only possible with locals. (July 2008)

This refers to the front-end infrastructure only (like terminals). The core system (the server) should be available virtually all the time. Any downtime (best scheduled and announced ahead of time) was recommended to be less than 5 minutes.

As it happened, little server information was provided to the local IT team. There were many segments on the server set up by the server master, and the new configuration was considered by the local IT department as being more complicated than the previous set up. The server master did not provide a list of what was on each segment, just minor information on what the main ones were (e.g., webERP, Care2X). It was not clear who was in charge.

Follow-up

By follow-up in October 2008, the Care2X server had not been updated for two years. The Care2X system was not connected to system updates, and there had been several database changes (not just files) that needed to be executed. It was important to figure out what order the updates needed to be made to the Care2X database in order to migrate the information within the database to the latest version of Care2X. It was expected that the updates determination would take about one day, whereas, the access to the server was unknown (an automatic update could be made via distance, but server access would be required). Theoretically, the system migration from the old Care2X server to the new one could occur within one day for testing. Updates could also include implementation of the discharge button, which was needed to discharge all patients virtually waiting for a CO in the OPD; by September 30, 2008, this totaled 44,193 patients and the list was too long to be viewed. Access to the old server had to be modified to give distributed control. In October 2008, there was some success when it became possible to automatically back up the database on the old Care2X server, and to automatically discharge patients in the system at 4:00 am each day. This was considered a temporary solution until staff was trained on how to discharge patients daily from the Care2X OPD module.

No one system was considered by the new (temporary) expat IT expert as working properly (including mail, http, Voice Over IP, Uninterrupted Power Supply, etc.). These were attributed in part to lack of strategy and traffic planning, and inappropriate use of firewalls. The Internet connection was nearly "unusable" and the modem was not configured correctly. Once onsite changes were made, the satellite link became faster. Problems that some considered easy to solve were not resolved over the course of several months. The server master's advice did not permit a workable solution at the hospital level, and there was a lack of communication to plan a strategic solution.

Updates could not be made to the Care2X system because of the server configuration, and this was attributed to problems with remote administration. Care2X remained on a separate server, as access could not be granted to migrate the program to the new server. The problem appeared to be the desire for extreme server security. Onsite access to the server was required, as was knowledge of how to administer the system. Similar set up problems were not experienced at other hospitals where ELCT Health did the installation.

It was recognized that trust was an integral issue. While the new visiting IT expert was a Linux (programming) expert and knowledgeable about servers, he was not permitted access to improve the system. The situation was frustrating and was described by one distributed programmer as needlessly perplexing. The new server in Haydom (controlled in Norway) was not used for Care2X, and the system remained "locked", which meant people were unable to maintain it locally or remotely, nor could an implementation plan be formed. Rather than place blame, one distributed programmer suggested to look ahead to see how to solve the problems.

While an administrator acknowledged the visiting IT expert's frustration, it was stated that his role was not to solve the server issues, but to work on further Care2X programming. This was contrary to what the distributed and local IT experts were trying to accomplish, as this had been an important effort from November 2007 onwards, and had previously been supported by HLH leadership. A participant indicated that:

> We did agree in the end that they didn't need access to the servers to continue programming. There's no reason why they can't continue programming, even if the server issue hasn't completely been solved. (Participant 7)

One leader suggested that people could talk to each other to solve problems and that the greatest challenge might have been communication between the visiting IT expert and the server master, as their skills were fairly equal. It was further suggested that challenges can begin when people know a lot about the same thing and offer conflicting suggestions to improve the situation.

Data quality

Care2X could not provide up-to-date access to accurate health information for decision-making and reporting because updates could not be made to the system.

Data entry was in some ways timely (new patients could be registered in real-time), but it was incomplete, and this has implications for being able to make informed decisions and use information for reporting [1, 12, 60, 68, 93, 122]. There was limited data to explore since Care2X captured only new patient registration data, and the script to discharge all patients from the system (so that they could be entered as return patients) could not be implemented due to server issues.

Information between the paper-based and electronic registration data differed, including differences in surname, first name, father's name, and sex. This had implications for the ability to reliably retrieve patient information in the future. Registration staff recommended a change to the registration page so that name information could be entered more naturally into the Care2X system (first, middle, last name). Also, the implementation of a formal unique patient ID card, using the unique identifier generated by Care2X, was another way to improve future retrieval of patient information, as a card would specify the patient's name, date or year of birth, and other identifying information, along with the unique number. These changes could also not be implemented due to server issues.

The accuracy of the paper-based system was not known, which meant that definitive judgments on the accuracy of the electronic system could not be made. Lack of standard terminology and experience with ICD codes, combined with inadequate knowledge of disease classification, laboratory tests and results, and pharmaceutical information by Care2X cadre members raised a concern that, upon expansion to other areas, the information recorded into the system could be incorrect. This could have implications for patient safety [115].

> There is [a] danger that the use of ICT may expedite the dissemination of poor quality data that does not represent the actual situation. Once entered in the computer and disseminated through the Internet, this data of 'doubtful quality' will be automatically transformed to truth. (p. 196) [61]

While an audit of the paper-based system could have been conducted, resources were spent elsewhere in an effort to solve the server issues to make updates to the Care2X system.

The success of Care2X relies on having high quality data in the system, upon which to base informed decision-making. Rather than overwhelm users by collecting as much information as possible, it is preferable to collect the minimum amount of information necessary to complete the task at hand [60]. The hospital worked towards the opposite in the creation of the Inpatient Modules, with a focus on collecting all of the information that could possibly be anticipated as useful, in an attempt to avoid future modifications to the system.

Usability

Care2X was not demonstrated to be clinically or immediately useful during the field research period. Care2X did not demonstrate value because it could not be implemented beyond OPD registration, and basic statistics could not be drawn

from the system. This has implications for future acceptance and use of Care2X [7], as people are less likely to adopt a system that has not been proven clinically useful [99] or fails to quickly demonstrate usefulness [114] in ways that are important for those that collect the data [60]. It also has implications for sustainability [59].

The Care2X registration page was the only module in use, and the data quality check demonstrated that there were differences between the paper information recorded electronically and on paper, which could have implications for retrieving patient information at a later date. Registration staff had never discharged patients (meant to be a daily activity), and soon the task became too large to handle manually. By October 2008, over 40,000 patients were in the system virtually waiting to see a CO in OPD. These patients could not be re-registered as return patients until they were discharged from their first visit. A programming script was created in June 2007 to discharge patients all at once, but this could not be implemented until October 2008. Regular software updates could not be made to the system, nor could the name order change suggested by registration staff, despite a quick programming response by ELCT Health. These challenges meant that the interface and complexity of other modules could not be explored.

Human Resources and Capacity Building

The purpose of capacity building is to ensure that employees have the knowledge and skills necessary to carry out EHR implementation [1, 81, 89, 104], and other change initiatives. This requires a learning environment [82]. Human resources and capacity building problems included staff attrition, a shortage of trained healthcare staff, and overwork. These are considered challenges for EHR implementation [1, 65, 68, 97, 104, 108]. Alcoholism, lack of incentives, low motivation, perceptions of pay inequity, perceptions of training opportunity inequity, and rapid turnover of visitors, also contributed to the challenges in the environment. It would take time to solve these issues. In the meantime, there was a reliance on foreigners to fill gaps, for instance, as doctors, medical specialists, and IT experts.

There was a lack of people to replace those who left. At times, administration relied on the assumption that another visitor, not yet identified, would be available in the future to fill a gap in expertise. While some expatriates brought tools or concepts, developed frameworks, and implemented (or tried to implement) changes, they did not necessarily stay long enough to see the initiatives take root. This was the case for my work, when I left with no one in place to take over my role.

There was a lack of IT capacity and information management skills on site, including lack of basic computer and Care2X software skills, and experience with the analysis of health information collection and use. This had implications for the ability of workers to use the information Care2X collects to inform decision-making [4, 57, 61, 82]. This extended beyond potential users of the software or the information generated by Care2X to include the IT Department's lack of knowledge for how to implement changes to the system on the local server. This

issue was not solely related to a lack of knowledge, however, as it also involved issues of trust and control. A lack of IT expertise is not uncommon in resource-poor environments, and is a barrier to implementation [1, 3, 66, 67, 82, 95, 96, 109].

IT training was poorly timed and the adequacy of training was not tested; this can contribute to future knowledge barriers when Care2X is in use, and has implications for the quality and completeness of the data [60, 79]. Continuous learning was important [82] but did not continue over time (or there was less structure over time) as Care2X continued to be limited to OPD registration, and newly learned skills could not be practiced in earnest.

Transition from paper to electronic records

Paper-based systems

User acceptance improves if there is familiarity between a paper-based form and the information collected in the electronic system. It is not good practice to automate a poorly functioning paper-based system [92]. Challenges with the paper-based systems were not solved before Care2X implementation. The paper-based systems at HLH were not well functioning and efforts had been made, prior to my arrival, to improve the paper-based systems through participatory improvements. However, the implementation of these improvements was resisted and meant that sub-optimal paper-based data collection methods continued. Anecdotes circulated of nurses resisting the change, or administration holding back final approval. A well functioning paper-based system is a prerequisite to implementation of an EHR [92].

While a steering committee was formed to support EHR implementation, the benefits of good planning [58, 79] were not realized. By the time of the field research period, Care2X had already been implemented in OPD, and the steering committee, previously led by foreigners, had not met for several months. Participant selection was unclear, in part due to lack of communication and conflicting opinions. While a committee was eventually formed with people representing a variety of roles and responsibilities, it only met formally once due to the inability to resolve server issues, which became the bottleneck for Care2X implementation. The meeting that did occur revealed a gap between administrative priorities and all other participants, with reports and patient care emphasized as benefits respectively. The committee did not have independent power to proceed with implementation, but rather, appeared to be a forum for administrative plans to be communicated.

Lack of a unique patient identifier

A unique patient identifier can facilitate EHR implementation [91, 93] as it helps avoid duplication of patient information, and prevent incorrect patient identification [12]. HLH patients did not have a Unique Patient ID (PID), which would enable their health information to be unified. OPD cards did not carry any patient information beyond the temporary ID number assigned at the beginning of each year. Other outpatient departments, including the Eye Clinic, assigned their

own temporary patient ID numbers, which meant that more than one ID number could be assigned to an individual in a given year. Each of these departments kept their own patient files, which also meant that patient information could be held in multiple files at one time. There was the potential for multiple cards, for multiple departments, to exist within a single household, with no identifier to know whom each card belonged to. Furthermore, multiple patient records within the same department could exist for a single patient, for instance, if the patient forgot or lost his or her previous temporary ID card and the original patient file could not be located. Complicating this was the Inpatient Department's practice of not giving patients an ID card, but rather, requiring their name, and month and year of last visit in order to retrieve the discharge number that leads to their patient file.

Updates to the Care2X system would have permitted the computer-generated unique PID to be utilized by all departments (with access to Care2X) to file patient records, thereby enabling multiple records to be pulled together for patient care, as appropriate. Patients would have one card with their unique number written on it, that would then facilitate their identification at any of the patient registration points in the hospital when they were admitted for treatment. The patient would keep this card at all times. The unique PID card would standardize name spelling, and carry other identifying information, which could then be used as a reference to ensure the correct file was being retrieved; this could also help avoid duplicate files being created for the same person (for instance, if the name was entered incorrectly into the computer and the patient was therefore assumed to not exist in the system). It was generally agreed at all levels that HLH should have its own patient ID card; however, the initiative was set aside to deal with other issues related to Care2X implementation. While a card modeled on Selian's patient card was attractive, leaders within the hospital were also interested in other technologies like fingerprint scanners, barcodes, and photograph ID cards.

Learning from others' experiences

While the hospital considered others' experiences before selecting Care2X, further learning from these experiences was not embraced. There was a general aversion in HLH administration to learn from others' experience with Care2X implementation, despite the enthusiasm of ELCT Health, Selian and St. Elizabeth Hospitals to share strategies, knowledge, and skills. Learning from other's experiences can improve EHR systems [60, 90].

ELCT Health

ELCT Health was interested in sharing a change management approach with the hospital, but had some reservations because of lack of administrative buy-in in the past. The approach is outlined in their Change Management Guide [173], which describes 14 steps to EHR implementation. These 14 steps are:

1. Initial contact;
2. Demonstrations and detailed discussion to enable informed decision-making;
3. Entering into a formal relationship with clear expectations of support;

4. Audit and definition of requirements to form an initial activity plan;
5. Train staff on basic Information and Communication Technology (ICT) skills and Health Management Information System (HMIS) and issue certificate of completion;
6. Collect and analyse critical data for a joint workshop and leadership training;
7. Prepare leaders for a participatory approach;
8. Hold a joint participatory workshop to build ownership and formulate a detailed implementation plan;
9. Implement HMIS;
10. Initial trial period to get familiar with HMIS and solve problems quickly through ELCT support;
11. Transfer from the manual to fully computerized HMIS with immediate ELCT support;
12. Distance support and trouble shooting;
13. Evaluate the implementation and draw out lessons; and
14. Wind-up activities.

When ELCT Health had previously been onsite, administration disrupted their change management presentation and indicated that HLH was done with change management. Despite this previous experience, administration supported an ELCT Health-led change management seminar for Care2X at HLH. Unfortunately, delays ensued when the selected date coincided with administrative travel plans. By the time the seminar was revisited, along with a new request for a two-week needs assessment on site, ELCT Health no longer had the human resources capacity to come to the hospital. Once their HR capacity increased at a later date, ELCT Health offered to come to Haydom at their own expense to offer support and mentorship. In the meantime, they were eager to provide distributed support to help make updates to the Care2X system and create and modify modules for clinical use.

Selian and St. Elizabeth Hospitals

At Selian Hospital/Arusha Town Clinic ("Selian"), the vision for the Care2X system was for quality patient care. Care2X was fully implemented in OPD Registration, Laboratory, Pharmacy, and Billing and was used by laboratory technicians, pharmacists, nurses, and Clinical Officers. However, staff did not immediately adopt Care2X when it was first implemented in 2004; it became effective when an IT expert was hired in 2007 to supervise Care2X use on a daily basis. It was important to have a policy that outlined expectations for use. It took insistence, motivation, and training for the system to be accepted; certificates were motivation for staff to take computer training. The same people that IT had to convince to use the system became the ones who later said it was a lot easier to use than the old paper-based system. In each of the departments, information was

entered directly into the computer. While a paper-based system initially ran in parallel to the electronic system, the electronic system was later the only one used.

At St. Elizabeth Hospital in Arusha, the ELCT Health IT and Change Management team worked with staff and management to come up with an implementation approach. They began with basic computer knowledge and then trained staff on Care2X. Staff received certificates for attending the computer course. If people left after receiving computer training, the training process began with someone else to fill the gap. ELCT met regularly with St. Elizabeth to share experiences and challenges. This helped for making changes at the hospital. Care2X was implemented in St. Elizabeth's OPD registration in August 2007, and it was picked up effectively by October 2007. Care2X then expanded to other areas. By 2008, as in Selian Hospital, Care2X was running in OPD registration, Laboratory, Pharmacy, and Billing and utilized by laboratory technicians, pharmacists, nurses, and Clinical Officers to varying degrees. An administrator at St. Elizabeth followed up Care2X use and discussed potential problems with people.

Rather than follow a similar approach as recommended by ELCT Health, and St. Elizabeth and Selian Hospitals, HLH administration indicated a desire to strike out on its own and do things differently. This included the determination to hire a cadre of employees to run Care2X, and to abandon staged implementation in favour of hospital-wide implementation. HLH administration asserted that the hospital needed to learn differently and to not accept what others have done as something that would necessarily work within the environment. Given the problems implementing Care2X updates, the hospital was unable to move beyond OPD Registration during the field research period.

While the Arusha group (the group of HLH employees who traveled to Arusha for Care2X training) valued their administration-supported Care2X learning opportunity, they did not move forward with their plans to create their own IT and change management team, nor did they present their experience to continuing studies, as hoped. With the Care2X implementation stalled, the momentum was lost over time, as was the knowledge and enthusiasm gained from the Arusha trip.

Sustainability

There was no proactive strategy to address the sustainability of Care2X and the succession plan and recommendations were not followed.

The cadre's structured program, formal schedule, and meetings ceased, and the members (now numbering 25) lacked direction for how to spend time. Some leaders did not understand why cadre members were wandering around the wards in search of work. The cadre members did tasks unrelated to Care2X and statistics (for instance, moving patients and supplies) because there was not enough statistics or Care2X-related work to go around. Division Leadership training ended at this time as well. The Arusha group did not present work as planned, nor did they form their own IT and Change Management team.

Administration felt pressure to get things done immediately, and that meant a reliance on filling the gaps with foreigners, rather than investing in building capacity over time so that locals could lead the initiative. A core issue for EHR sustainability is to have local staff support and maintain an EHR through knowledge and skills [57, 77, 82, 91, 104] gained through capacity building in a learning environment [25, 67, 77, 82]. This was the bottleneck. Responsibility was not passed to the local people, and continued to be managed by local or distributed foreigners. There was no project manager to take my place and a lack of action to cultivate local learning and build IT capacity so that local expertise could support Care2X. This goes beyond understanding how to use Care2X, to being able to troubleshoot, and make updates.

Design

EHRs should support workflow [85, 97] and user routines [1, 25], but there was a lack of effort to explore these for Care2X implementation. The opportunity was lost to test out how workflow could be changed by staged implementation in the OPD. Further, the focus was on solving a management problem (reports), instead of health care professional priorities (patient care). It is important to focus on reasons why people should use an EHR, rather than focus on technical aspects, in order to gain buy-in for the implementation [121].

While sharing module development with Selian could be considered a facilitator, it took time and resources away from solving the bottleneck – the server issues which halted OPD implementation progress. The hospitals were moving ahead at a different pace. Selian already had years of experience with Care2X in OPD before working on an inpatient module. Selian was also moving to an in-city (Arusha) fully networked hospital with IT built into the workflow and patient care systems. HLH did not have these. Unlike Selian, with a focus on Care2X for clinical care, HLH was focused on reporting. While Selian had a close connection to ELCT Health (which was locally located), HLH was distancing itself from ELCT Health.

Participatory customization can increase motivation when suggestions can quickly be translated into results [67, 97, 99]. This is what we were trying to achieve with the OPD, when ELCT Health modified the registration page in June 2007, based on user recommendations, within two weeks. Unfortunately, the changes could not be checked by the IT expat before he left on vacation, nor could it be done when he returned for a short period of time before leaving the environment permanently. By October 2008, the updates were still not made to the registration page. The inability to implement Care2X beyond OPD registration represented a lost opportunity to assess paper and electronic health information flow, based on patient movement through the system. In addition, participatory design changes to the OPD registration module, as well as distributed design efforts to create the Eye Clinic modules, could not be tested.

The inpatient module had to be created from scratch, which meant that no one had tested or utilized the system. The hospital went beyond providing the minimum information for decision-making to an ambitious plan to have all the information

that they could need in the system rolled out at once. This approach is contrary to literature which recommends the minimum amount of information be used for the system, to keep it simple and relevant [56, 60]. Adequate testing helps implementation [65]. However, only three weeks of training and system testing was planned before going live with both the IPD and OPD modules. This would not provide adequate time for changes to be made to the software, if necessary. These plans were optimistic given that local Care2X experience was limited to an incomplete OPD registration process.

Infrastructure and Cost

Despite efforts from 2006 onwards to install a stabilizer, there was nothing reliable to prevent power spikes from potentially harming equipment. Power outages can result in lost information and the need to reenter information into a computer, if it has not been saved locally or to the server. In addition, the computers were plagued by viruses, which took the IT Department's time and expertise to repeatedly remove, and spoke to system security [60].

While low-cost solutions are encouraged [85, 99], efforts to implement low cost solutions to improve paper-based health information collection were unsuccessful, in part due to resistance from administration and nurses. In fact, at times financial decision making appeared to be less about cost and more about control. For instance, ELCT Health's initial offer to come to HLH and implement Care2X through a tested change management process, free of charge, was declined.

Expenditures were a matter of priority within the hospital. The cost of paper was cited by administration as a consideration against nursing process; whereas spending occurred freely on the prioritized integration of Care2X and the financial management system, webERP. Costs included hiring eighteen additional cadre members in May 2008 to operate a system that was not implemented during a time of financial constraint. At the time of their hire, administration had projected full hospital implementation within a short timeframe. Instead, Care2X implementation remained stalled and the cadre members divided their time in unstructured computer classes, non-skilled labourer positions (e.g., moving patients), and sharing the discharge statistics that previously was handled by 8 people (there were 25 cadre members at the time of follow-up). At this time, programmers were hired to create an inpatient module from scratch that could not be implemented. Training and time were other commodities for EHR implementation [12, 65, 68, 97], as was the potential to have to pay for someone else to come to Haydom to fix Care2X due to the lack of onsite knowledge and skills.

There were also opportunity costs of spending money on EHR implementation rather than other areas of the hospital [68]. The funds to hire cadre members could have been spent elsewhere, for instance, to pay for essential supplies or additional nursing staff. The creation of a 'virtual hospital' and computer training centre in the library, rather than using the computer lab at the nursing school, meant that the remainder of hospital staff could no longer use the library discussion room.

Failure to provide the IT department with the knowledge and skills to locally update the Care2X system continued the reliance on foreign expertise.

Participation

Participation can build support for change, and balance shared decision-making with consensus, time, and negotiation [4, 102]. Participation was hindered by lack of confidence in local knowledge and skills, lack of human resources, and poor communication mechanisms. Lack of local capacity building limited local engagement and reinforced the reliance on foreigners to lead change initiatives themselves.

In some respects, there was an illusion to participation. At times there was the impression that people were asked to provide input to decisions that had already been made, and their ideas were placed into preexisting categories. Other times, participation was hampered when participant views were inconsistent with top management opinions and plans. Traditional deference to authority, power and politics, and paternalistic approaches can hinder participatory processes from achieving their goals [27, 86, 103, 106, 107].

Urgency was an issue when it came to using participation within the environment. Administration agreed that it was easier to engage people in participation in some settings or situations than in others. It was more difficult to engage people in iterative participatory processes for large-scale hospital-wide initiatives requiring immediate action, than it was for small initiatives involving a small group of people.

Before the project management internal control wheel (quality improvement process, Figure 12) could be implemented, it appeared that the deliverables had to be completed first. This gave the impression that participation and buy-in processes would only be placed fully in effect after the hospital transformation was complete. While there were efforts to engage people in participatory processes to inform the hospital transformation, it was unclear if these processes were truly participatory, or a top-down approach to make people feel they were engaged in a bottom-up exercise. At times, discussion in stakeholder meetings that was inconsistent with management vision was overruled in favour of another, sometimes authoritarian approach.

Projects were primarily led by foreigners. While some local employees were also part of the Project Management group, they did not regularly attend, in part due to the pressure to engage in other work activities. This can limit local buy-in for change [4]. People were not necessarily empowered to make decisions, and some project leaders felt that they could not move forward initiatives without fear of having decisions overridden. Some meetings occurred informally and led to exclusions sometimes. It was not unusual for opportunistic meetings to occur at HLH, and if project leaders were not present, the meeting might continue without pause, and decisions later communicated directly or discovered indirectly.

Care2X and eventually all other projects were placed under administrative power as expat leaders left the environment. Local people were not actively engaged in

project management, and project group meetings generally ended once the majority of expats departed.

Leadership and Communication

Hospital leadership was in transition. Not only was there a new Managing Medical Director spearheading hospital transformation, but also a change in hospital elected positions (Nursing Officer in Charge, School Principal), the departure of key leaders (Union Leader, Head of Human Resources, Previous School Principal), and the hiring of Division Leaders. The latter involved changing reporting patterns in an effort to bridge the gap between workers and management.

The environment suffered from conflict between workers and management, lack of transparent communication, and difficult task delegation. Underlying this was the absence of a shared vision to build support for change, which could facilitate implementation support [4, 65, 85]. While participation was an opportunity to build buy-in for the hospital transformation, it was generally reserved for the expanding leadership group, rather than other employees, in part due to the sense of urgency to create immediate change through multiple initiatives within a short period of time. Instead, expatriates were involved to lead initiatives and to fill existing gaps in knowledge and skills. Accountability was generally lacking in the environment, and culturally people were threatened by criticism and losing face. Delegation was difficult as people preferred shared tasks. Trust and mutual understanding was difficult to achieve in the environment, and made it challenging to predict behaviour [172].

Sala was used as a place to communicate changes, but the setting did not permit questions to be asked. One leader commented that it does not help very much to explain policies and changes because "the more you explain, the more they think that they're being fooled." The leader explained further that people could become suspicious if a lot of explaining is required to justify a change. Rather, trust was achieved through peer-to-peer understanding, beginning with one or two leaders and filtering down through a network of people beneath them to spread understanding throughout the hospital. But this approach had its challenges as messages could change over time as they were transmitted through a peer-to-peer network. Others suggested that the best way to communicate change was through large group meetings to deliver the message, and then smaller, targeted meetings that permit questions and answers. While regular meetings were held in some departments, they were not necessarily perceived as productive by attendees. At times, expats dominated the conversation and expressed impatience and frustration of having local employees not actively contribute to the dialogue. Neither of these approaches (peer-to-peer and large meetings followed by smaller ones) was regularly used at the hospital.

Clear communication and feedback mechanisms can reduce uncertainty and build support for change [4, 101], whereas the opposite can become a barrier for EHR implementation [7, 65]. Poor communication and feedback mechanisms plagued the hospital environment. While transparency has the potential to build trust

[174], this seemed to be avoided in some respects. Rather, a filter-down method of informal communication was used at times for relaying important information throughout the hospital, for instance, related to training opportunities or the resignation of top leaders. The lack of concrete information and feedback led to rumours and speculation. This hampered change efforts as people had a tendency to resist those things that they did not understand. People wanted to know what the change meant for them and feel that they had some control.

Facilitators for Change

Despite these challenges, employees were enthusiastic to participate in improving the Care2X system, and appreciated the opportunity to learn from others' experiences. Workers valued being asked their opinion. Distributed Eye Clinic module development was a success, and initial cadre members were able to provide much appreciated statistics assistance. Despite an inadequate number of UPSs and the presence of non-functioning computers, an adequate infrastructure existed to expand Care2X beyond OPD registration. In addition, the hospital transformation supported long-term goals of strengthening desirable aspects of organizational culture and improved priority setting, which could lead to future sustainability and scalability of the Care2X system.

This section explores the facilitators for change and includes: participation; learning from others' experience; design; leadership and communication; human resources and capacity building; infrastructure; and sustainability and scalability.

Participation

Shared decision-making requires compromise and consensus [4]. This was part of the local culture, and therefore lent itself well to participatory processes. Shared decision-making became a more formal process with the introduction of the Division Leaders. It was hoped that this increased participation would help bridge the gap between workers and management.

Workers were enthusiastic to improve the Care2X system by providing input to potential improvements, which in turn could build ongoing support for change [4]. In particular, they were eager to provide insights into their work and how that could be improved. The IT Department was similarly enthusiastic to help with Care2X testing and training, as was ELCT Health; unfortunately, this was not realized because of the inability to make updates to the Care2X system and expand implementation outwards. In the meantime, the Eye Clinic benefited from collaborative design and development with ELCT Health, the inpatient module was developed in collaboration with Selian Hospital, and weekly cadre meetings, while they lasted, enabled cadre members to come together and share their experiences. The formation of the Project Management group was a positive step towards unifying disparate change efforts through activity coordination, regular progress updates, and group discussion; however, these projects were generally run by expats who were largely set to leave the environment within a 6 month period of project group formation.

Transition from paper to electronic records

The hospital was proceeding with both paper and electronic systems, which helps manage change [1, 94].

Learning from others' experience

Learning from others' EHR implementation experiences can produce better systems [60, 90]. ELCT Health regularly offered to provide distributed support. This was supplemented by the offers of St. Elizabeth and Selian Hospitals to provide guidance to HLH on their experience implementing Care2X. The Arusha trip in May 2008 provided attendees with the opportunity to learn from each of these organizations and make connections with IT experts and people in their peer groups. Attendees were better able to visualize opportunities to improve processes at HLH after the Arusha trip. In the short visit, they were able to observe issues related to work and communication flow, and knowledge and skills. This enthusiasm returned with them to HLH.

The Eye Clinic served as an example of how a well-functioning, and iteratively improved, paper-based system could be automated for electronic data collection. The Eye Clinic worked closely with ELCT Health to develop an Eye Clinic module based on Excel spreadsheets and was a model for change. Unfortunately, we were unable to test the newly created Care2X Eye Clinic modules during the field research period.

Design

Care2X is an open-source software which can be adapted to suit the hospital's needs [12, 98, 99, 117] while potentially minimizing the cost compared to proprietary software [2]. This can help ensure that Care2X is a good fit for the environment, and match local needs to the system itself [60, 81, 118].

Sharing resources can improve EHR implementation [60, 90].The collaboration with Selian Hospital to share resources, including the creation of a joint collaborative steering committee, enabled Western developers to be hired to program the Care2X inpatient module. HLH made attempts to collect locally relevant data by reviewing their reports and eliminating redundancies, which could facilitate future adoption of the system [61]. This information was then provided to the programmers to incorporate into the Care2X modules.

ELCT Health recognized the Eye Clinic as a motivated group (and potential Care2X champion) at HLH and was supportive of creating a module as an integrated component of Care2X with administration's approval. The Eye Clinic module was based on familiar paper-based forms that had already undergone previous positive quality improvement processes, and demonstrated usefulness for decision-making. This can facilitate EHR implementation [175]. The use of locally relevant data [61], paired with a focus on clinical care [120] has the potential to improve decision making. The Eye Clinic considered patient flow prior to module development. Therefore, the Eye Clinic modules were built around a system that works with screens mimicking the familiar paper forms. Iterative improvements were made to the module in development through

distributed communication. Radical changes in system design can be problematic [116]. The Eye Clinic was working to avoid introducing radical change to the clinical environment.

Leadership and Communication

Under new leadership, the hospital was working to document previously undocumented practices, and continued to invest in training MDs and AMOs for future work at HLH. Division Leaders were provided training to gain leadership and information management skills in order to help drive hospital initiatives and improve communication between workers and management. These skills are important for EHR implementation and use [4, 82].

Human Resources and Capacity Building

Onsite IT support was available to teach basic computer skills, and employees were enthusiastic to learn. The original cadre members were set up in a structured program to learn computers (including basic software and typing skills), and English, and to devote time to statistics. Weekly meetings were a forum for teambuilding and improved communication, and enabled members to discuss work and support each other, identify issues, and make improvements. This kind of participation can help build support for EHR implementation and identify opportunities to improve [1, 4, 84]. It was the intention that software skills would be added once the server issues were resolved. There was the potential to build a team of people who could lead the Care2X implementation.

Cadre members engaged in statistics work after it was discovered that no 2007 statistics had been entered into the computer. A Clinical Officer (CO), Ward leader, and the Head of Medical Records gave mentorship on patient records. There was an enthusiastic response as the CO was able to have time released to see patients. Information was initially reviewed by the CO for data quality. The initial cadre members and the Head of Medical Records then trained remaining cadre members on reading the patient record to expand outward into other departments.

Infrastructure

Internet connectivity, space, and hardware (like computers) were available to expand Care2X throughout the hospital, which helps alleviate some of the challenges of EHR implementation and associated future costs [1, 3, 68]. The IT Department was able to facilitate the expansion of Internet connections required at each of the future Care2X stations, once those were determined. While there was an unstable power supply, which could hinder EHR implementation [3, 60, 61, 66, 91, 97, 98], power outages were handled by a reliable generator that automatically responded as soon as a power outage was experienced. Uninterrupted Power Supplies (UPS) were on some of the equipment to protect from data loss as well.

Sustainability and Scalability

While sustainability was not considered a short-term priority, there was evidence that sustainability as a long-term consideration was being supported through

strategic planning. The implementation of a new leadership level has long-term implications for sustainability, as does, for instance, training doctors.

Hospital transformation itself was meant to lead sustainability in the future. Care2X has the potential to fit into these plans, if the hospital culture changes over time from one of tradition and paternalism, to information and participation. It is possible that Care2X modules tailored for HLH (or created for HLH) could be utilized by other hospitals, which speaks to its potential scalability [5, 60], in particular, when brought to other hospitals by ELCT Health.

The next chapter explores the dichotomy of local and expatriate power, and the grey area in between, and how that influences Care2X implementation.

THE DICHOTOMY OF LOCAL AND EXPATRIATE POWER, AND THE SPACE BETWEEN

When I arrived in the environment, I was looking for a starting point within the chaos: a unifying factor that brought diverse groups together. The sala in which employees stated there was a gap between workers and management, and Mama Kari's impassioned speech that followed, left me not only with a sense of division between groups, but also a unifying factor: we were together on Tuesday. It's not a lot to go on, but it's a start. Certainly, that experience was the catalyst for me to think critically about the divisions and unifications between groups, and how my very presence could influence the environment. Does my existence on site help or hinder? Underlying Care2X implementation efforts were issues related to power. I wondered, why do expatriates have so much power to influence local Care2X implementation? And, how can locals be empowered to lead this initiative? I was not alone.

There exist dichotomies of power, the ability to influence behaviour or events, between and among different groups. Robert Chambers points out that dominance can be achieved through: speech (for instance, speaking in another language (like outsiders speaking English), dominating conversations); behaviour (non-verbal cues of impatience, for instance); accessories (for instance, differences in uniforms); and associates (those people you associate with) [176]. While "powerful professionals can impose their realities" (p. 76)[176], resistance is a tool that anyone can use to take control back from another group. Resistance can not only undermine the strategies of the powerful by using such weapons as feigning ignorance, not speaking up, or arguing [177], but, as the discussion below will show, can be used by all groups, locals and expatriates alike, in a bid to claw back power in the non-confrontational environment.

This chapter focuses on the dichotomy of local and expatriate power. A dichotomy is defined as "a division or contrast between two things that are or are represented as being opposed or entirely different". This definition describes a polarity between two opposing forces that do not overlap. What I like about this definition is that it includes those things that are represented as being different, and to me this brings in perceived differences, even when in reality they may not exist.

Who are the locals and the expatriates, and how does the space between connect them? For the purposes of this discussion, locals are defined as those people who are permanent residents of Haydom and members of the local community, including non-Tanzanians. Expatriates are defined as those people living outside their native country and working at HLH for a limited duration, and those living in their native country (including Tanzania) providing distributed, or targeted onsite, support; in effect, "outsiders". In the space between are opportunities to enable locals to take control of EHR implementation through unified and sustainable actions.

My discussion below begins with a summary of local and expatriate power, and includes limitations to power, and how these influence sustainable Care2X

implementation. I then focus on capacity building and participation as potential means to reduce local reliance on expatriates and increase local engagement to lead Care2X implementation. These changes require a critical look at the convergence of organizational culture and strategy to unify disparate efforts and build shared plans for change. This section concludes with a look at relinquishing power and extending trust.

Local power

Workers

Local workers know the culture and context of the environment, and long-standing employees have valuable historical knowledge. This is particularly important when processes have not previously been recorded.

Skilled health-care professionals were crucial; there was a lack of local skilled health professionals onsite, so it was in the hospital's best interest to keep them, particularly since there was no one readily available to replace those that left. The hospital could not compete with the benefits of working at a government hospital, and its location in the bush meant there were less opportunities for those who chose to work in Haydom than in a larger town. The program to have nursing students work at the hospital to pay off their tuition was cancelled, so there were far fewer nurses than in previous years.

Workers vehemently defended their positions, albeit in a non-confrontational way. Resistance was a powerful tool and included: not showing up for work on time; not taking responsibility for work; working slowly; not responding to reports; curtailing processes by meeting in small groups; raising unrealistic job demands; the formation of factions; and giving sermons as thinly veiled political statements in sala. Even the nursing students engaged in resistance, staging a hunger strike and refusing to return to classes when the Church-elected leaders were announced. While students were sent home for two weeks, the effect of their strike was powerful and included a delay in the announcement of the Division Leaders.

Tension increased when information and participation was withheld. One local worker said,

> I heard [a leader] saying [that] we have some tough decisions to make and we shouldn't be worried about making enemies…I would fundamentally disagree with that. I would say, yes, there will be some tough decisions to make, but we should try to do everything we can to explain to people, and discuss with them, and put the problems in front of people so that they don't end up being our enemies. Because it's very hard to work with, you know if we've made everybody our enemy, how can we then work with them? How are we going to then get them to work happily and positively and put in extra hours?

Another related,

> There was a misunderstanding when a leader said that the 'managers manage people'…If I say, "I will manage you", it feels like returning to colonialism. "We will manage the work together with you", is a better way to express things, because it communicates that the management cannot do work without the workers.

Local workers arguably have the greatest power over successful Care2X implementation as the system will fail if they don't use it. Even if Care2X is imposed, workers could still find ways to resist. EHRs should support workflow [85, 97] and become integrated into user routines [1, 25], and who better to inform that than the workers themselves? EHR implementation relies heavily on users' willingness to use the technology [67, 68]. If users refuse or underutilize the system, then resources are wasted and the initiative will not be sustainable [70].

However, there were limits to power as there was a lack of support to maintain Care2X using local resources, in particular related to building capacity and extending trust to handle server issues. Had this bottleneck not existed, there was the potential to have local workers actively participate in Care2X implementation and improvement.

Management

Local leaders and administrators have power because as top-level management, they regularly make decisions concerning the hospital that have implications for external and internal stakeholders. Decisions dealt with strategy formulation (strategic direction, collaborations), personnel issues (hiring, firing, rewards, repercussions, training), financial issues (budget, funding), projects (committees, meetings), change management (communication), and external and internal reporting (funders, Ministry of Health, HLH), among others.

There was some disagreement, however, in management views of communicating change, from aversion:

> [Staff meetings make things worse and it does not help to explain policies and changes]. I don't know why, but I think people have a perception of a car salesman. The more you explain, the more they think that they're being fooled.

to a desire to share openly:

> I think it's important that it starts from the bottom. I think they should be included on an early stage. And it's so important because the custom here is telling things again and again and again. And there will always be people who will [not have] heard this.
>
> The best place is meeting with the people. That's the best way because you get a dialogue with them. But in the salas, it's only the

> announcement. It's not a dialogue…people get most of the information daily from the sala.

In terms of Care2X implementation, management ultimately led the initiative, formulating implementation strategies, hiring personnel, and directing distributed programmers to program inpatient modules before the bottleneck was solved. Ambitious, but unachievable, timelines were set with the hope to drive the initiative forward.

Resistance was a source of power and included deciding what and how to communicate and curtailing processes by meeting in small groups. Administration resisted learning from others' experiences in favour of forging its own path. In doing so, it was distancing itself from the support of ELCT Health, and taking control of EHR implementation as a hospital initiative. The hiring of the Care2X cadre was done in my absence, and went against participatory plans that were built with Division Leaders, and the IT and Personnel Departments. Interestingly, none of these groups questioned the hiring of the cadre members when the directive came from top management. Further, administration resisted participatory succession plans and recommendations in favour of an alternate approach, pushing forward plans for hospital-wide implementation of outpatient and inpatient modules within an ambitious timeframe, and hiring 18 additional cadre members less than two weeks after I left the environment.

Expatriate power

Expatriates have power because they have sought after resources that could be useful in the low-resource environment; these include money, knowledge and skills, and time. The pressure to get things done immediately increased administrative reliance on foreigners to get the job done themselves, but in doing so, further embedded reliance on them. Expats fill a gap in knowledge and skills, but only temporarily.

Expatriates had control in many ways including: leading committees and projects; dominating meeting discussions; bringing their own ideas of how improvements could be made in the environment; mentoring skills; and choosing what and how to communicate, including curtailing processes by meeting in small groups. Foreigners could carry favourable and unfavourable messages back to their respective organizations. Further, local expatriates were set apart from the local community as they lived on hospital grounds and employed locals to work in their homes. Expats could resist local practice and exert their own beliefs within the environment, refuse to follow local directives, and challenge the status quo (for instance, when they and their Tanzanian colleagues went into the supplies warehouse when administration was away to take supplies). Some local expats were favoured by, and adamantly supported, administration (the "yes-men"); while others were rather unlike this group.

Local management turned to expatriates to provide guidance and assistance for Care2X implementation, due to a lack of local IT knowledge and skills. There was constant engagement of distributed and local expatriates trying to find distributed solutions that circumvented reliance on local IT staff.

Expatriate power was not equal within their group, any more than locals or administrators were all equal within their peer groups. Expatriate power depended in part on where you came from, how long you were staying, which organization(s) you were connected to, your skill set, your approach to the environment, and your fluency with the local or expatriate language, among others. It also depended on your alignment with key leaders and workers who may or may not identify with your opinions.

Expatriates ("outsiders") who lived outside Haydom but were resources for the Care2X system further expanded the reach of power and control over the EHR. This group was divided between those who wanted to retain absolute power and control over Care2X implementation matters, and those who wanted to provide mentorship and short-term distributed support until local people could take over the initiative (as quickly as possible). These sub-groups had matching sub-groups (both local and expatriate) in Haydom.

Expatriates held divergent viewpoints on making change happen at the hospital. Some cited local unwillingness to make change:

> I think the problem with that is of course we could use time to [teach locals] and this process is about learning as well…But I think they are not willing to learn. They don't have pride of work as we are used to in our countries. And they don't have a willingness to learn.
>
> Things Take Time here in Tanzania…Local people don't work.
>
> You find if you discuss leadership or staff issues with other expats in Tanzania, I think you will find most of them, if not all of them, will be complaining about the lack of initiative within Tanzania, with Tanzanians…And sometimes it's deeply frustrating because it looks so obvious to a Westerner that it's a problem.

While others pointed to challenges with hospital strategy:

> Challenges are deadlines. But really, a lot of the deadlines were not realistic.
>
> Well the challenges are, you have a lot of these white people here right? And they're used to leading other white people. But you can't use that technique here. It's going to take much longer…you really have to be patient and do not expect things to happen too quick. I see them trying to bring in too many things at one time and that will only backfire.

There was a power hierarchy and associated power struggle within the expat community itself, where expatriates on site could struggle to retain control of their work when other newcomers arrived; essentially filling a gap that does not exist and displacing another expat. This could happen when expatriate skill sets

overlapped and there was lack of planning for how they might fit into the hospital environment.

There was no orientation program for expats, which could prepare them for the differences in cultures and strategies between Haydom and their respective organizations. Nor did they necessarily know before coming to the hospital what could be accomplished within a given timeframe, let alone, what was achievable at all. They could be perceived by some as a benefactor, and further entrench a feeling of colonialism within Haydom. They could be perceived by others as a threat to power. Expatriates could have their decisions overruled by administrators or resisted by locals, and their work was not sustainable if they did not pass their skills to locals. Even then, there was no guarantee that projects would flourish.

The space between

The above discussion illustrates the challenge of separating local and expatriate power. These distinctions, however, are useful when examining the balance of power between locals and expatriates for implementation of Care2X.

The discussion also demonstrates that locals and expatriates did not always operate at opposite ends of the spectrum. Rather, there was a grey area that linked the space between the two and blurred delineation. Unifying factors drew individuals and groups from both sides towards each other, and were largely related to the convergence of cultures and strategies to support change through capacity building and participation; these require a leap of faith to extend trust and relinquish power.

Capacity building

The purpose of capacity building is to ensure that employees have the knowledge and skills necessary to carry out EHR implementation [1, 81, 89, 104], and includes basic computer and software training [57, 67, 70, 82, 91], as well as information and change management skills [4, 57, 61]. Expanding human resources and building capacity costs money [12, 68], but the investment may be offset by the decreased reliance on foreigners to temporarily fill gaps, and the potential to increase the sustainability of projects by encouraging local leadership.

Capacity building was supported at HLH for multiple initiatives, including the training of: Division Leaders to manage change and information; the Care2X cadre, to learn basic computer skills, English language, and the patient record/statistics; and the Arusha Group, to learn the Care2X software, make connections with peer groups, and tour clinical environments within which Care2X is in use.

However, there was a lack of local knowledge and skills for the IT department to test, update, and implement Care2X; this is not an uncommon barrier to EHR implementation [3, 66]. A key component of EHR sustainability is to ensure that local workers have the knowledge and skills to maintain the EHR [57, 82] using local resources [91, 104]. Failure to provide the IT department with the

knowledge and skills to locally manage Care2X continued the reliance on foreign expertise in general, and the server master, in particular.

Distributed programmers and ELCT Health rallied to provide distributed support while contemplating a locally sustainable solution. They could not see why the local IT team should not be provided with the skills to handle the server and update: "Local crew are the heroes, if not, the mission WILL fail." This speaks to sustainability of implementation efforts, as the hospital's location in the bush means that a locally sustainable solution is more practical than continually involving outsiders to manage Care2X. The IT department was recognized by distributed IT experts as having the aptitude and willingness to learn. Without the appropriate knowledge and skills, however, the IT department could not participate meaningfully in Care2X implementation.

Participation

Urgency was an issue when it came to using participation within the environment. Administration agreed that it was easier to engage people in participation in some settings or situations than in others. It was more difficult to engage people in iterative participatory processes for large-scale hospital-wide initiatives requiring immediate action, than it was for small initiatives involving a small group of people. Whether or not one should implement Care2X was not open for participatory discussion; it was an integrated component of the organizational strategy.

Power and power relations and their impact on participation are embedded in social norms and cultural practices [178]. Participation can build support for change and balance shared decision making with consensus, time, and negotiation [4, 102], increase motivation through participatory customization [67, 97, 99], and support sustainability through participatory teamwork and collaboration [77, 99]. Paternalistic approaches, however, can hinder participation and prevent understanding of the local reality [86, 106, 107].

> [Locals] are very dependent on consensual decisions on the one hand [and] on the other hand they're very scared of authority figures. They will do what they're told. They'll really resent it but they will do what they're being told…Consensus building probably works best, and the problem then of course is that it's very time consuming. (Expatriate)

Traditional deference to authority can make participation difficult as workers might feel constrained by what they can say in a particular context [179] and agree with those higher in power [27, 67, 103]. This can reinforce, rather than challenge, existing power relationships [180]. Engaging people in participatory processes may happen to lend legitimacy to decisions that have already been made and give the illusion of participation, when in fact, they are "a means for top-down planning to be imposed from the bottom up" (p. 60)[181].

In his paper on the tyranny of participation in information systems [179], Heeks describes seven different types of participation that are not ideal:

- Veneered participation is when the organization gives an untrue impression of participation in order to, for instance, please funders who want participation for a project the organization may find is not viable to actually engage people in participatory processes. In reality, there may be a top-down, authoritarian approach.
- Inequitable participation is when participation does not actually act as an equalizer for inequalities.
- Skewed participation is when people are selected to participate in a project, but the people selected are already powerful, which skews participation away from engaging the marginalized.
- Indicative or token participation is when people are invited to meetings, but do not actually participate in participatory outcomes.
- Bureaucratic participation is a "checklist approach" to participation in which a representative from each group is present for decision-making, but may not have to participate and may not make an impact on the task at hand.
- Resource-deficit participation is when resource-poor environments engage people who may already be burned out from overwork. This can also refer to a deficit of knowledge to be able to take in information, and build, implement, and evaluate a plan for change.
- Finally, inefficient participation, is when resource costs, in terms of time, effort, and money, are not taken into consideration. "In practice, participation – which can be a substantial consumer of time, effort and money – may be far less efficient than a well communicated top-down decision that could be equally acceptable to most stakeholders." (p. 8) [179]

Arguably, each of these types of participation can be difficult to avoid within a resource-poor environment, from: pressure to engage people in participatory processes to prioritize donor-requested changes (veneered); involving expatriates in leading committees when locals have no time to do so (inequitable); involving leaders in decision-making (skewed); forming a steering committee with people that do not have the background to meaningfully engage in solving problems (indicative, bureaucratic, resource-deficit); and involving people in high-level strategic plans (inefficient).

Administration considered participation a tool that should be used with caution and consideration. Participation for participation's sake was not outwardly supported. Indeed, I was referred to the book, The Tyranny of Participation [182] by a leader during my early days in Haydom. Instead, priority setting and the accountability for reasonableness was put forward as a preferred approach to help manage scarce resources.

> Priority setting is an ongoing thing, all the time, everywhere…the more limited your resources are the more set your priorities basically, and the more challenging it becomes to do priority setting in a good

> way. I think the concept applies to any level of priority setting. And I think we are implementing it in the hospital. (Local)

There are two main criteria: making sure things are fair and more accountable. Within this concept is "accountability for reasonableness". This means that decisions have to be made through a fair, thoughtful, and transparent process, and that decision-makers have to be accountable for the decisions they make, and constantly assess decisions to ensure that they are relevant [183].

Participatory spaces

Participatory spaces are not neutral as they bring with them existing power relationships and other dynamics that can strengthen, rather than weaken, inequalities between participants [177, 184].

> Spaces come to be defined by those who are invited into them, as well as by those doing the inviting. People move between domains of association in everyday life in which the ways they come to be seen by others, and see themselves, may be strikingly different, with implications for the extent to which they are able to influence and indeed act as agents in particular spaces. Someone who is voluble and assertive in one setting may be silenced in another; someone looked up to with respect in one sphere may find themselves patronized and even derided in another. The mutual impingement of relations of power and difference within and across different arenas conditions possibilities for agency and voice. For no matter how equitable the intentions that inform the creation of an arena for participation might be, existing relationships cannot be simply left at its boundary; rather, the traces of these relationships, and of previous experiences in other spaces, continue to exert an influence on what is said, and what is sayable, within any given space. (p. 80) [177]

The lines of inclusion and exclusion are dynamic.

There is a continuum of spaces from closed spaces (decision making is closed and does not welcome wider participation); to invited spaces (where people are invited to participate in a new space); and claimed or created spaces, where those with less power take decision making space from or against those in power [185]. Each of these existed at the hospital. The claimed or created spaces were frowned upon by administration as hallway meetings could join workers together in resistance. However, administration and expats regularly engaged in this practice as well, for instance, excluding project members from ad hoc meetings. These practices led to distrust and misunderstandings and embedded poor communication.

Relinquishing power and extending trust

Having the appropriate knowledge and skills, and engaging in participatory planning is not always enough. Even the distributed programmers with the right knowledge and skills, and engaged in a collaborative process, were unable to

make changes to solve server issues. This problem can be linked to relinquishing power and extending trust.

> Leaders enable others to act not by hoarding the power they have but by giving it away. (p. 18)[174]

Trust is having confidence in another person and their capabilities. It is strengthened by transparency [174] and is the root of participatory decision-making [184]. Distrust is difficult to overcome once it has become entrenched in the culture [174]. Those things that build trust can depend on what the group or individual values. For instance, workers at HLH valued transparency, communication, and actions matching words; whereas, management valued action competence, initiative, and leadership. These were not so unlike each other, as they ultimately could lead to trust, but were expressed in different ways.

How am I implicated?

My goal was to engage people in a participatory process to define, implement, and evaluate changes to improve Care2X implementation, and in doing so, build capacity for efforts to be sustainable after my departure. This goal was not realized. In the urgent environment, I quickly felt administrative pressure to just get things done myself. I resisted.

Do my best intentions bring me closer to the middle of the spectrum that lies between locals and expatriates (outsiders)? Perhaps not. The environment wasn't ready for a participatory approach when I arrived. In the end, there was no one to take my place, and the participatory succession plan and recommendations were not supported, and therefore, my efforts to build capacity and pass leadership on to locals were not sustainable. As I discuss in the upcoming chapter on Lessons Learned, had I better knowledge of the environment beforehand, I would have known my attempts were poorly timed and would be in some ways, futile. A year after the field research began, I felt that things were finally coming together to support participatory Care2X implementation, but I was out of time.

The final section explores the convergence of cultures and strategies in the environment, and their influence on sustainable Care2X implementation.

THE CONVERGENCE OF ORGANIZATIONAL CULTURE AND STRATEGY AND IMPLICATIONS FOR SUSTAINABLE CHANGE

A convergence is "a coming together from different directions, especially a uniting or merging of groups or tendencies that were originally opposed or very different". I was initially struck by divergence in the environment, and found myself actively seeking out the areas where culture and strategy converged. It was not an easy process. I wrote, "the challenge here is trying to pull together all of these realities which are like mini alternate universes and trying to find some consistency" (Kitson notes, Oct 2007).

When I arrived, the organizational culture and strategy appeared as random as puzzle pieces dumped out of a box. Over time, the chaos in the environment became less pronounced and one could see the pieces slowly assemble, unfortunately, without the benefit of a reference to envision how the puzzle would look in the end. When I left, the puzzle was incomplete and little islands of unified pieces existed, disconnected from the whole. But it was an improvement: the deconstruction of the hospital gradually transforming into a reconstructed picture of what it could become.

This section begins with an exploration of how context, organizational culture, and strategy influence change (in this case, Care2X implementation). It continues with examples of where organizational culture and strategy are aligned to support EHR implementation efforts (Eye Clinic), and where they lack alignment (server issues). The section concludes with the implications for sustainability.

The influence of CONTEXT on Care2X implementation

Care2X implementation was only one of many change projects within the transitioning environment. The hospital transformation introduced changes to the organizational structure, leadership, and the strategic plan, among others, within an environment entrenched in history. Lack of human resources and essential supplies competed with internal and external pressures to improve the management of health information. These spoke to the climate for change (organizational readiness) to concurrently implement Care2X.

Strong history embedded certain expectations related to leadership and change that made change difficult. The MMD was the third generation of Olsen leaders at the hospital, following in the footsteps of his father (who led for 44 years) and grandfather as only the third leader at the hospital in over 50 years. Artifacts of the Olsen legacy are throughout the hospital and the community, and include the: Dr. Olsen Outpatient Department; Dr. Olsen Secondary School; Dr. Olsen Cup (football); Dr. Olsen Sikuku (holiday); and Mama Kari Maternal/Child Health Centre.

Historical context is institutionalized over time and can be difficult to change [84]. Hospital transformation challenged tradition through transitioning leadership (the new MMD, elected leaders, top leader resignations), and introduced a new layer of management (Division Leaders) through the new organizational structure. Further change initiatives included identifying core hospital values, defining

objectives and strategies for the new 5-year plan, understanding work processes, improving internal systems, building accountability mechanisms into hospital processes, creating a personnel office, and others. These competed with other priorities including the lack of health-care professionals and essential supplies.

Context is redefined when a new information system is introduced [80]. The hospital wanted to improve the collection and use of health information for internal and external reports by implementing Care2X. HLH administration felt further donor pressure to improve information and change management systems [160]. While donors would not fund the EHR, funding agency reviewers recommended that Care2X implementation, which was already underway, be made a priority to improve decision-making, gain staff support for change, and demonstrate accountability [160].

This setting speaks to readiness for change, which is further influenced by the organizational culture and strategy.

The influence of ORGANIZATIONAL CULTURE on Care2X implementation

The organizational culture was in transition.

HLH as a whole did not have a participatory culture or information culture, though some smaller units did possess these (like the Eye Clinic and Laboratory). The culture of tradition did not embrace innovation, design, or accountability, which made change initiatives difficult to achieve. Nor did it have a learning environment, which is important for EHR implementation [82]. Changing organizational culture takes time and may not be a successful endeavor. The lack of a change management plan further exacerbated the problem.

While criteria to hire Division Leaders pointed to the type of culture administration wanted (motivation, action competence, loyalty, continuous learning), there were many other references (discussions, interviews, meetings, and documents) to changes in organizational culture including: task-oriented to goal-oriented culture (nursing duties) [162]; accountability and trust; and accountability for reasonableness. Further, a culture shift is required when transitioning from a paper-based to electronic system [186]. This type of change takes time as the EHR is accepted and institutionalized (success), or rejected (failure) [28].

The hospital lacked a shared vision for change, which is essential for change management [4, 65, 85]. Multiple concurrent changes, combined with a lack of transparent communication, lack of involvement in decision-making, and historical ties to how things were previously done, caused people to take back control where they could, as a way to resist change. Implementation of low-tech solutions to improve the collection and use of health information proved challenging within the environment and caused some to wonder if high-tech solutions (like Care2X) would fare any better. A well-functioning paper-based system is a prerequisite for EHR implementation [92].

Further complicating change initiatives were competing priorities amongst workers, administration, and foreigners. Having an adequate number of trained health employees (nurses, in particular), essential supplies, equitable financial compensation, and training opportunities were key issues of importance for employees. Staff members were keen to improve patient care, whereas the administrative focus was on processes, indicators, and the new organizational structure. This was true for Care2X itself, with health care providers enthusiastic to improve patient care, and administration driven to improve report generation. Different groups valued empowerment, sustainability, and shared decision-making differently.

Expatriates added an additional dimension to hospital culture, as they were apparently empowered to proceed with their own projects and goals after passing an initial vetting process at the administrative level. Expats brought with them their own perceptions of time, priorities, and success, and this led at times to mutual frustration and misunderstandings with locals. At times, expats appeared to confound initiatives and disrupt routines, as work was reallocated to accommodate their presence.

On the other hand, aspects of the organizational culture supported change. Workers were enthusiastic to improve the Care2X system by providing input to potential improvements, which in turn could build ongoing support for change [4]. Shared decision-making can also build support for change and requires compromise and consensus [4]; these were part of the local culture, and therefore lent themselves well to participatory processes. Shared decision-making became a more formal process with the introduction of the Division Leaders. It was hoped that this increased participation would help bridge the gap between workers and management.

Some smaller departments, particularly the Eye Clinic and the Laboratory, had an information culture that supported change through participatory planning and assessment. This helped to motivate people and address opportunities and challenges as they arose. Leadership was very close to the workers and was shared in many ways. People were given responsibility and understood through actions and words that they were valued. Both the Eye Clinic and Laboratory were used as examples in Continuing Studies sessions of how to improve the collection and use of health information at HLH, and to reorganize processes through participatory planning respectively.

Motivation

Motivation was a challenge in the environment, not only to adopt change initiatives, but also to engage in routine work. How to motivate people was a difficult problem to solve. While some thought that financial incentives would provide motivation, others believed it could be achieved by making people feel valued, providing encouragement, involving people in decision-making that impacts their work, and simplifying work processes. People were not motivated to take on extra work when overtime was replaced by allowances for many of the employees.

Repercussions for poor work were generally unknown in the environment, in part due to a cultural aversion to confrontation. But perhaps even more so due to the lack of skilled labourers on site. It was difficult to fire people when there was no one to replace them. Some people felt that problems were so bad in certain areas that administration had given up on their department and left them to struggle without the hope of improvement.

People may not be motivated to change unless you can demonstrate that the change will result in reduced or simplified work, or that the change will work. Hospital-wide change implementation without demonstrated usefulness posed a problem. Even with Care2X specifically, there was no model of a working program. Both the Eye Clinic and OPD had the potential to help in that respect, had the problems been solved with the server updates and staged implementation been permitted.

The influence of STRATEGY on Care2X implementation

Planning was a challenge within the environment. When I arrived, there was administrative firefighting (the act of addressing an emergency situation) to deal with constant crises. This was a reactive, short-term approach, in the midst of proactive, long-term change initiatives.

While administration initially supported staged implementation, these plans were later abandoned after server issues continued to delay expansion. Instead, there was pressure to pursue fast-tracked hospital-wide implementation of Care2X, in both in- and out-patient departments. This plan meant that stakeholders and other resources were stretched across departments without the benefit of learning from the potential OPD and Eye Clinic experiences, once the bottleneck was solved. In a way, the problem was envisioned by administration as EHR implementation going too slow, rather than addressing the issue of why there were delays. In the urgent environment, delays were a cause of stress. New ambitious timelines were set that did not convey the urgency of the task, as much as it magnified the impossibility of it within the given timeframe.

With parallel large-scale changes in leadership, organizational structure, and other prioritized projects, the hospital embraced change on an overwhelming scale, with limited progress made towards some of the goals. Stakeholder ideas not linked directly to administrative vision faced the possibility – or perception – of unilateral rejection and negative political implications.

Drucker says, “When the noise level rises, it’s a sign of discomfort. Your organization structure and the reality of your operation aren’t congruent anymore. Then you need a change in your structure” (p. 114-115)[172]. The new organizational structure was one of the key changes for moving towards long-term strategic goals. It introduced a new layer of management to bridge the gap between workers and administration. Goals included increasing participation in decision-making and encouraging wider ownership of the hospital. The hospital was trying to strengthen positive aspects of organizational culture, for instance, by strategically hiring Division Leaders who demonstrated desirable traits (motivation, loyalty, willingness to learn, accountability).

The introduction of Division Leaders changed reporting structures. Division leadership training, while it lasted, enabled Division Leaders to gain leadership, communication, and information management skills, which were important, not only to bridge the gap between workers and management, but to manage and measure care. These skills are important for EHR implementation and use [4, 82]. Capacity building is important to ensure that people have the necessary knowledge and skills for EHR implementation [1, 81, 89, 104]. While capacity building was provided in general to health care workers, there was an absence of leadership-supported capacity building for the local IT department, which could enable them to reduce reliance on foreigners for Care2X implementation.

There was a lack of a shared vision to build support for change, which is important for facilitating EHR implementation [4, 65, 85]. However, the project management group helped to centrally coordinate projects, and build support for change by aligning resources, skills, and strategic plans. The benefits were short-lived, however, as project leaders were primarily expats set to leave the environment within 6 months of the group's creation.

Alignment

The Eye Clinic is an example of where organizational culture and strategy for implementation of Care2X are aligned. In terms of culture, there was strong, participatory leadership and effective communication within a learning environment. The Eye Clinic developed an information culture over time, collecting and using health information for decision-making, and improving their paper-based system over time. The Eye Clinic staff and leader met regularly to identify challenges and opportunities to improve their work practices. These were also opportunities to share food and tea, and build camaraderie. These practices are cited by Robert Chambers as a way to transform organizational culture [176].

The Eye Clinic was enthusiastic to implement Care2X and this excited ELCT Health as they recognized the clinic as a potential champion for change. The modules were based on well-functioning paper-based forms, so no radical changes were introduced. The clinic's awareness of patient- and work-flow aided the process to envision how the electronic system could be used in the environment. Staged implementation was planned. The strategy to have distributed programmers send back screen shots and weblinks via email, in lieu of the server issues, meant that iterative improvements could be made to the module development within a short timeframe.

Unfortunately, the server issues halted the Eye Clinic module implementation.

Lack of alignment

Despite pockets of success, there was a general lack of alignment between organizational culture and strategy. This is understandable, given the deeply entrenched, historical organizational culture built over 50 years, in an environment where urgent, large-scale change initiatives were underway. It will take time to change the culture of HLH, and there is no guarantee for success.

There was little aligned between the strategy to implement Care2X and the organizational culture to support it. Care2X was just one of many large-scale, concurrent change initiatives at the hospital, and lacked a change management plan to ensure that the resources were in place to support it. Instead, delays indicative of problems in the system led to more aggressive timelines in an attempt to push through barriers. In anticipation of hospital-wide implementation, 18 additional cadre members were hired in a time of financial constraint to use a system that could not been implemented. Meanwhile, opportunities to build on favourable aspects of organizational culture, like employee enthusiasm to use the system, were lost in the bottleneck.

Langley et al. advise to "direct changes that involve technology at a bottleneck" (p. 84)[171]. However, in the case of the Care2X implementation, server issues were the bottleneck. By no means were server issues limited to the technology itself, but rather, to the willingness to relinquish power and build local capacity to take over Care2X implementation. There was a lack of agreement between key participants on how to resolve the issue, and poor communication between the groups increased the space between them. Had the bottleneck been resolved, it is possible that alignment could have been achieved by building on the enthusiasm within OPD and the Eye Clinic, with success spreading outwards through small, meaningful changes, and demonstrated system use.

Implications for sustainability

A key to sustainability is the alignment of organizational culture and strategy to support change (in this case, Care2X implementation) through a unified approach [4, 88]. Implementation problems can arise when there are a lack of mechanisms for local sustainability [81].

Despite some favourable aspects of organizational culture and strategy, Care2X implementation efforts were unsustainable, based on the field research period. Care2X was not demonstrated to be clinically or immediately useful, implementation plans were not participatory, and the IT department was not provided with the knowledge and skills to lead the implementation locally. There was a lack of a change management plan and a shared vision to support the change. There was no proactive strategy to address the sustainability of Care2X and the participatory succession plan and recommendations were not followed.

But one must not overlook that the immediate intention was not to find a sustainable solution, but rather, to implement first and worry about sustainability later. The hospital was trying to keep going, and any movement forward, even if it circumvented the resolution of the bottleneck, was considered progress. In the resource-poor environment, administration expressed a concern that if the hospital had to worry about sustainability and having all the resources in place first, then nothing would get done. In the end, little did get accomplished due to endemic power and trust issues and lack of sustainable planning.

Sustainability of Care2X will take time to achieve and requires a concerted, unified effort. Hospital transformation is meant to lead sustainability in the future.

Care2X has the potential to fit into these plans, if the hospital culture changes over time from one of tradition and paternalism, to information and participation.

Chapter 7: CONCLUSION AND RECOMMENDATIONS

This research asks: *How can we improve the implementation of an Electronic Health Record within a Tanzanian clinical environment?* To answer this, I explored the context, organizational culture, and strategy of the hospital, and the efforts to improve Care2X implementation. Further, I provided a critique of my methods, discussed the barriers and facilitators for change, and described how context, organizational culture, and strategy influence implementation of an EHR. From these, I was able to draw out the influence of expatriates on implementation efforts, the roles of participation and capacity building, and the implications for sustainability. Each of these is summarized below and followed by recommendations.

CONCLUSION

Critique of methods

My idealistic notion to engage people in a participatory process to improve health information collection and use was incongruent with the reality of the environment. The flexible research approach, theories, and mixed methods enabled me to be responsive to the ever-changing environment, and to explore issues as they arose. I therefore embraced iterative problem definition through participant engagement and explored ways to improve. While this might sound neat and contained, it was actually a very messy process as I overcame the unanticipated language barrier and researched in all directions. As my understanding increased, so did the enquiries. My situated perspective changed over time from outsider to quasi-insider and new challenges arose as I became more integrated in the environment. Keeping a journal was integral to understanding the changes over time. While my efforts were unsustainable at the research site, I nevertheless left with a holistic, multi-faceted understanding of a complex environment.

Context

Hospital transformation characterized the environment for the duration of the field research period. A new organizational structure changed reporting paths in an effort to bridge the gap between workers and administration. The leaders themselves were changing: the Managing Medical Director had recently replaced his father who had led the hospital for 44 years; Church-elected positions resulted in a new Nursing Officer in Charge and Principal of Haydom School of Nursing; the prior Principal, Head of Human Resources, and Union Leader resigned; and Division Leaders were instated in support of the organizational structure.

The hospital was working on a new strategic plan, which included identifying core hospital values, formulating new goals, and defining objectives to meet the goals. There was a strong sense of urgency in the environment, as the hospital worked towards improving financial and health management systems and alleviating internal and external pressures to improve hospital processes. These activities were set against a backdrop of scarce resources within a community of

want. Improving the collection and use of health information through the introduction of an Electronic Health Record was only one of many large-scale projects, in an environment where low-cost, low-technology solutions could not be implemented.

Strategy

Initial Care2X implementation plans were to learn from the experience of expanding outwards from the Outpatient Department's registration window to other outpatient services: Laboratory, Pharmacy, and Billing. This staged implementation would provide the opportunity to engage people in a participatory process to iteratively improve Care2X and understand how patient information linked between departments. Instead, a bottleneck appeared when server issues precluded updates to be made to the system. This led to an alternate strategy to push forward implementation of both out- and (not yet created) in-patient modules hospital-wide within a short timeframe, with the hope that the bottleneck would resolve itself over time.

An initial cadre of data entry clerks was hired to operate a system that was not running. In the short-term, the cadre proved useful by taking over the task of entering patient information in discharge books from the Clinical Officers. However, with the new push for hospital-wide implementation of both in- and out-patient Care2X modules, a second cadre was hired, bringing the number from 8 to 25. Without the Care2X system in place, the cadre was too big to support the work available to them, and they spent their time divided between unstructured computer classes, sharing the statistics work previously done by a third of the cadre members, and engaging in unskilled labour during a time of financial constraint.

While the creation of a Project Management group provided much appreciated structure to the various large-scale change management projects running concurrently at the hospital, its success was short-lived; the projects were primarily run by foreigners, set to leave the environment within a 6 month period. Over time, the responsibility for Care2X implementation was placed under administrative control. A collaborative relationship was developed between Selian Hospital in Arusha and HLH in order to share the programming costs of creating a Care2X inpatient module, and to share knowledge to link it to the webERP financial management system.

Culture

The dominant culture was one of tradition; this is a difficult foundation for large-scale changes in an environment unaccustomed to change. It was not that people were unwilling to change, however, it depended on priorities. The lack of a shared vision magnified divisions between and within groups. Expatriates (outsiders) exacerbated this by bringing new norms, values, and beliefs to the environment. Counter cultures may have existed to work against proposed changes.

Leadership was in transition and received varying levels of support. Existing communication and feedback mechanisms supported distrust and

misunderstandings rather than openness and transparency. Low motivation was regularly cited as one of the greatest challenges in the environment. It was unknown what rewards would result in increased motivation. Lack of repercussions both exacerbated the situation (by a lack of consequences) and also improved it (by not having to deal with people who had lost face). Depending on the circumstances, everyone resisted change of one type or another, in one way or another.

Efforts to improve Care2X implementation

Outpatient Department registration was the only place to have Care2X implemented for the duration of the field research period. While participatory changes were made to the software, the updates could not be implemented because of server and related issues. Useful statistics could not be collected from the information outpatient registration was collecting, as no patients had been discharged from the system for nearly 2 years.

The Eye Clinic was eager to improve the collection and use of health information by implementing Care2X. The clinic had previous positive experiences with change and had iteratively improved their data collection sheets over time. Programmers were able to quickly create an Eye Clinic module as an integrated component of the existing Care2X system. ELCT Health hoped that the Eye Clinic would serve as a champion for change; unfortunately, the same server and other issues that plagued the Care2X outpatient module affected the Eye Clinic as well, and the module could not be implemented.

Medical Records, within the Inpatient Department, experienced some success when the Care2X cadre was able to release Clinical Officer time by entering patient information from patient charts into the discharge books. While an inpatient module was created in collaboration with Selian Hospital, it was not implemented during the field research period.

Plans for sustainability

In many ways, sustainability was a broad, long-term goal at the hospital: the new organizational structure; the hiring of the Division Leaders to improve communication; training local doctors and Assistant Medical Officers; and work on the strategic plan, among others, were meant to lead to long-term, sustainable improvements. The Care2X initiative, however, was unsustainable. The participatory succession plan and recommendations were not followed. Instead, an alternate approach circumvented, among others, resolving bottlenecks, staging implementation, and building capacity to manage the system locally, in favour of a push for hospital-wide implementation of a system that had never been tested.

Barriers and facilitators for change

The barriers for change were largely centred around change management issues. Because Care2X was stopped at the bottleneck, we were unable to explore many issues, including data quality and usability. The server issues revealed a gap in knowledge and expertise as the local IT department was unable to make updates

to the server itself. These issues revealed deeper areas of concern related to trust, power, and the reliance on expatriates to solve local problems.

The hospital struggled with the transition from paper-based to electronic records, including a lack of a patient identifier, which meant that multiple records could exist in multiple departments for a single patient. There was a lack of learning from others' experience once Care2X was implemented in Outpatient registration. Despite the preparation of participatory succession plans and recommendations in anticipation of my departure from the hospital, these too were set aside in favour of an alternate, administrative-driven approach. Plans were formulated to push forward Care2X implementation hospital-wide within a short time frame, which had implications for infrastructure and cost. Transitioning leadership, poor communication and feedback mechanisms, and traditional organizational culture hindered participation.

Despite these challenges, there were also facilitators for change. Employees were eager to participate in improving their work, provided design suggestions for Care2X, and appreciated opportunities to learn from ELCT Health, and St. Elizabeth and Selian Hospitals. The development of an Eye Clinic module through iterative emails, screen shots, and web pages was a success, and initial cadre members were able to provide support to the statistics department. There was adequate infrastructure to support Care2X in terms of computers and a steady power supply. Finally, hospital transformation supported long-term goals of improved priority setting and strengthening desirable aspects of organizational culture. These have the potential to lead to a sustainable and scalable Care2X system in the future.

Dichotomy of local and expatriate power and the space between

There exists a dichotomy of power between locals and expatriates, and between sub-groups within. Each has the ability to influence behaviour or events, and each uses resistance, individually and in groups, in an effort to maintain or regain power within the non-confrontational environment.

For the purposes of this enquiry, I drew out locals and expatriates specifically to draw attention to issues related to capacity building and participation. Expatriates are only a temporary fix to fill gaps in knowledge and skills, but sometimes the only option that a resource-poor and reactive environment is able or willing to consider. Capacity building and participation can build sustainable support for local project management. However, these are not enough. Providing locals with the knowledge and skills to perform their jobs, and involving them in participatory planning, does not necessarily result in a sustainable outcome. Extending trust and relinquishing power, and accepting trust and responsibilities are integral for local management to have a chance of success.

Convergence of organizational culture and strategy and implications for sustainable change

The context, organizational culture, and strategy influenced the implementation of the Care2X system. Care2X was only one of many large-scale projects in the

transitioning environment. These changes were set against a backdrop of a strong history that embedded expectations for how things were done at the hospital, and these were difficult to change. The organizational culture embraced tradition; changing the organizational culture will take time and there is no guarantee of success. Division Leaders were hired to not only strengthen desirable aspects of organizational culture, but also to bridge the gap between workers and management. There was a lack of a shared vision, but this would potentially improve as administration moved from reactive to proactive planning over time. In the meantime, there was no unified approach.

Understanding individual and organizational readiness for change can inform plans to build support for change. A change management plan can help align organizational culture and strategy to support sustainable change. Building support for change begins with an understanding of the organizational culture and strategy, and the identification of challenges and opportunities to unite the two. This alignment can lead to sustainability, whereas, lack of alignment impedes it. The hospital was working to change the organizational culture to be aligned with strategy; this included hiring Division Leaders who exemplified the qualities the hospital administration desired: the ability to motivate others; action competence; skills to do their jobs; and loyalty to the hospital. In terms of Care2X implementation, the Eye Clinic, with its information culture, good communication mechanisms, and small, team-driven environment presented the greatest opportunity for sustainable Care2X implementation and use. The Laboratory was similarly positioned to be a champion for Care2X adoption. Server and other related issues, including reliance on expatriates and issues of power and control, represented a lack of alignment in the environment, however. These not only led to a bottleneck of activities which precluded the opportunity to make updates to the system and expand outwards through staged implementation, but also impeded proactive planning to sustainably support Care2X locally.

Change should not be perceived as a one-off activity, but rather, as a continuous and iterative opportunity for quality improvement. To move forward, it is important to: understand the influence of context, organizational culture, and strategy on Care2X implementation; formulate a change management plan that supports implementation efforts through the alignment of culture and strategy; and build upon facilitators for change while improving barriers.

RECOMMENDATIONS

The moot point

While my primary recommendation, to *not* implement Care2X, is a moot point since the implementation of Care2X is a non-option in the hospital environment, it is worth noting here.

The hospital was not ready for this type of large-scale change. There was a lack of shared vision, sustainable planning and capacity building within the resource-poor environment. The traditional organizational culture did not support change, and this was further exacerbated by a reliance on outsiders to lead the project, and an

aversion to relinquishing power and extending trust for local employees to do the same. As a change project in its own right, administrators and healthcare (and other) professionals valued Care2X differently: administration emphasized the benefit of an EHR for reports; whereas care and other providers emphasized patient care. There was a lack of connection between priorities to unite divergent viewpoints and create a shared vision.

At a high level, Care2X was overshadowed not only by the many large-scale, simultaneous change projects at the hospital, but also by the desire for essential human resources (nurses, other trained healthcare professionals) and essential supplies (gloves, reagents, etc.). There is an opportunity cost to implementing an EHR when basic needs are not being met. Low-cost, low-tech solutions could have reduced the strain on resources with the potential to immediately benefit patient care and improve the collection of patient information for reports. While participatory efforts had been made prior to my arrival to improve the paper-based health information system, efforts to implement the changes were unsuccessful. This was an important cue that large-scale, high-tech solutions could be similarly plagued by an inability to implement change.

Were the hospital to start from scratch, I would recommend that they revisit the low-cost, low-tech changes they had been working towards. These include implementing: a new inpatient sheet that gives more space for care provider notes; a drug sheet for inpatient care; a surgery checklist to make sure that patients are prepped for surgery at the designated time; and nursing process (which requires a change from task- to patient-allocation). Further, additional low-tech solutions presented themselves during the field research period and included implementing a unique patient ID card, which is a prerequisite for EHRs, and changing patient flow so that the patients in the Outpatient Department are seen on a first-come, first-serve basis. The hiring of the initial cadre, though unable to engage in their mandate to operate Care2X when it was not implemented, identified an opportunity to use their skills elsewhere; by being trained to interpret the patient record, they were able to release Clinical Officers from having to record patient information into the discharge books. The hiring of a statistics cadre, therefore, could be useful for freeing clinician time and improving data collection for report generation.

Building positive experiences with change, developing an information culture, automating a good paper-based system, sustainable planning, continuous participatory quality improvement, and reducing reliance on outsiders by relinquishing control, extending trust, and building capacity can provide a strong foundation for EHR implementation in the future. The recommendations, below, and the lessons learned (Chapter 8) take these into account.

Before any changes occur, however, it is important to assess individual and organizational readiness for change. Lack of motivation, distrust in individual and collective skills and abilities, pressure, stress, and instability, among others, are indicators that the hospital was not ready for the change.

Staged implementation

Staged implementation is divided into the following recommendations: engage in continuous assessment through participant engagement; pilot implementation; understand the impact on work-, patient-, and communication-flow; and address data quality and security.

Engage in continuous assessment through participant engagement

Continuous assessment through participant engagement is important to improve system implementation. It includes participatory discussions (and feedback), and the iterative process of planning, implementing, and evaluating small, meaningful changes. Building upon previous successful change initiatives and identifying champions for change (for instance, within the Eye Clinic and Laboratory) can help build support for change. Before expanding to other areas, the hospital should achieve full implementation in the OPD to learn how information is linked and to identify major challenges and opportunities to improve. A unique patient identifier is required to link patients to their health records.

Town halls are a viable way to bring people together from all roles and build a shared understanding of the strengths and weaknesses of the existing system and engage people in a dialogue for how to improve the system. This can begin with the questions, 'How is health information collected and used? What's good about it? What's not so good?' This provides the foundation from which additional dialogue can occur: What changes can we make immediately? What changes will take more time? What resources are needed to accomplish these goals?

It is not good practice to automate a poor system. Functioning paper-based forms, that have been through quality improvement processes and have demonstrated usefulness, can be translated electronically. The HLH Eye Clinic experience demonstrated how Excel spreadsheets of paper-based forms lend themselves well to programming into an EHR. Email and screen shots quickly and adequately permit iterative modifications to be made to EHR programming to improve the quality of the module, even when the programmer is located off site.

It is important to ask why things are done, and how they can be improved. It can be difficult to break free of the traditional way of doing things and challenge the status quo, particularly when people have limited exposure to different clinical environments, which could help them to better envision other possibilities. It was exciting, for instance, when the Arusha group returned from tours of Selian and St. Elizabeth Hospitals as they were able to see how favourable aspects of outpatient registration at the other hospitals could be implemented at HLH.

Exploration of usability issues refers to working with participants to identify challenges with Care2X in terms of ease of use and usefulness. Improvements could be made to both paper-based and computer-based practices, workflow, and others.

Pilot implementation

Pilot implementation of the EHR is important as it can identify challenges and opportunities before expanding outwards. This learning experience is crucial as it

helps inform the implications of EHR implementation on workflow, communication flow, patient flow, and patient care, among others. Bottlenecks, like the server and related issues, can stop everything in its tracks and have a cascading effect on the rest of the implementation process. Identifying and solving bottlenecks in a piloted stage is preferable to skipping the pilot and encountering a bottleneck during large-scale full-hospital implementation.

Understand the impact on work-, patient-, and communication-flow

Knowledge of work-, patient-, and communication-flow refers to understanding the current system and assessing changes related to the Care2X implementation. Some things required further thought. For instance, inpatient discharge files were assigned a discharge number and followed a particular associated process for filing records. This changes when a unique patient identifier is assigned to the patient files (e.g., the assignment of discharge numbers could become an obsolete practice).

Work- and communication-flow will change as a result of the Care2X implementation. It is important to understand what those changes will look like and to iteratively improve the implementation process once the computerized system is introduced. This requires communication between the project facilitator and Care2X change management team. Opportunities can also be made to the patient flow. For instance, OPD patient flow could be improved. Once OPD patients are registered, they are given their patient files to hold on to while waiting. The patient gives his or her file to a Clinical Officer (CO). The challenge with this is that patients are not part of an organized queue and rush to the CO door when it is opened. Instead, the patient file could be placed in a stack by the registration staff so that patients are called first come, first serve. The CO could then take the chart and call the patient name to see each in turn.

Address data quality and security

Data quality checks are important to ensure that the information entered into Care2X is accurate and useful. Both paper-based and electronic health information systems should be run in parallel until data quality is assured. Patient safety issues arise when drug and laboratory information is entered into Care2X, so data quality checks, training on specific pharmaceutical and laboratory information (if necessary), familiarity with the patient record, and mentorship are important.

Care2X cadre members enter patient record information into discharge books, and this information is used by the Statistics Department. To increase accuracy of statistical information: the information needs to be accurate in both the patient chart and discharge books; printing should be legible; and knowledge experts should provide mentorship to Care2X cadre members.

Patient confidentiality issues have to be addressed. Care2X data entry clerks should not be located in the same office as the COs for patient confidentiality and comfort. In addition, patient information should not be shared with anyone, unless

it is directly related to work. Anyone accessing patient information should be asked to sign a confidentiality agreement.

Human resources

Human resources is divided into four parts, though each overlap the other. The recommendations are to: designate a project facilitator; build local capacity; and reduce reliance on expatriates, relinquish power and extend trust.

Designate a project facilitator

It is important that there is a designated project facilitator to support Care2X implementation. When I left, there was no one available to take over the Care2X implementation within the Project Group. Dividing tasks between remaining project group members could be a challenge for understanding the "full picture". Suitable backgrounds for a project facilitator could be project management, change management, and IT and/or health informatics backgrounds. The project facilitator should report weekly on implementation progress and discuss ongoing next steps.

Build local capacity

Building Information Technology capacity (expanding local talent) is essential for the sustainability of Care2X. Capacity building should include: leadership and change management skills to lead the EHR project locally and make iterative participatory improvements; knowledge of medical terminology to reduce the likelihood of errors in the system; and information management skills to use the information for informed decision-making. These help develop an information culture.

Information can be difficult for a data entry clerk to interpret, particularly related to patient prescriptions. It is therefore preferable that a Care2X data entry clerk/secretary be located in the OPD dispensary so that questions related to medication can be answered before the information is entered into the computer. Registration and billing modules do not have this medical terminology problem. Care2X cadre members will not necessarily be located everywhere there is a computer. Basic computer skills should be taught to other individuals so that they can access and view, for instance, lab orders. Finally, care providers in each of the departments using Care2X should have knowledge of the Care2X software in order to provide assistance to the data entry clerks (e.g., to provide clarification about patient care). Care2X data entry clerks can be mentors to new users.

Expanding Care2X data entry clerks refers to having people who use information from the system, enter information into the system. Data entry clerks differ from the Care2X cadre, as they are existing *care providers* who should learn to enter information into Care2X and use the information over time, with the mentorship of Care2X cadre members. A basic computer skills training program was designed and can be used for future training. If new employees are required, hire people with Form 4 to 6 education level. Desirable qualities have been identified as: a willingness to stay in Haydom after computer/Care2X training; science

background; confidence; English proficiency; and computer proficiency or aptitude to learn computer skills.

Care2X data entry clerks are required for OPD expansion in: Reception (to register and discharge OPD patients); Billing (to view and enter billing information and payments; OPD Dispensary (require mentorship on difficult to interpret patient prescriptions); OPD Laboratory (computer should be located here to view lab orders. No Care2X data entry person necessary); and Clinical Officer secretaries (to enter lab orders, xrays or other non-drug order data entry and diagnosis. The CO secretaries would be the centre of communication for the COs to notify them when patient lab results are available).

The ELCT Health IT and Change Management team has experience with change management processes and implementation. The group has offered to come to Haydom and provide mentorship at their own expense. They were eager to see implementation success and could provide useful guidance and assistance to help tailor Care2X to suit hospital needs. This requires an openness to other ideas based on experience. I recommend building upon the success of the initial Arusha trip by sending the Head of IT to Arusha for onsite mentorship and training. While some of the actual processes between organizations differ, the underlying theories are similar.

Reduce reliance on expatriates, relinquish power, and extend trust

Failure to provide locals with the right knowledge and skills increases reliance on expatriates to fill the gaps. It is important, therefore, to decrease reliance on foreigners by building local capacity. In particular, locals should be provided not only with basic computer and software skills, but also information management skills, and the technical skills to implement and maintain the EHR over time, using locally available resources. This takes a proactive approach to planning to ensure that there are not only the resources that are needed *now*, but to also plan for the resources to be in place *later* to reduce the likelihood of project disruption and increase the chances of sustainability.

Building capacity is not enough, however, to reduce reliance on expatriates. It also requires leaders to relinquish power and extend trust to locals. There is a fine balance between empowering locals to implement an EHR within a resource-poor environment and empowering expatriates to do the same. Leaders have to be willing to give locals the tools to lead projects, and locals have to be willing to accept these responsibilities.

The final chapter explores the lessons learned.

Chapter 8: LESSONS LEARNED

This final chapter begins with a discussion of the lessons that can be drawn from the experience to inform other low-resource clinical environments, and supplement the recommendations in the previous chapter. It continues with my experience of searching for answers in the literature, and the discovery that, as an outsider, I was part of the problem. The paper ends with a plan for knowledge translation, a summary of the significance of the research, and some final words.

What can be drawn from this experience to inform other low-resource clinical environments?

Perhaps you recognize your own organization in the description, or perhaps even recognize yourself. What kinds of things should you think of when considering EHR implementation? Certainly, EHRs have the potential to improve health information collection and use. But conversely, they also have the potential to worsen it. EHRs are not a panacea for improving health systems.

The previous chapter discussed: the influence of organizational culture, strategy, and organizational culture; aligning organizational culture and strategy through a change management plan; exploring low-cost, low-tech solutions; staged implementation including: engaging in continuous assessment through participant engagement; pilot implementation; understanding the impact on work-, patient-, and communication-flow; and addressing data quality and security; and human resources including: designating a leader; building local capacity; and reducing reliance on expatriates, relinquishing power, and extending trust. Embedded in these are, among others: building on positive experiences of change; strengthening positive aspects of organizational culture; iterative, participatory quality improvement; and the like. These should all be taken into account when considering EHR implementation.

Before getting caught up in the recommendations, however, the first question to ask when considering implementing an EHR is: *is it necessary?*

While there may be pressure to improve the quality of health information collection and use for decision-making, there are ways to improve without implementing an EHR. This begins with asking more questions: How is information collected and used now? What is good about it? What's not so good? What can we do to improve? What can be done now? What will have to wait? These are a good starting point, particularly when you are in a low-resource environment.

From these, sustainable, participatory plans for change can be created. It is difficult to make plans that require more resources than are on hand; therefore, try to make plans for the resources you do have on hand. Through creative thinking, it is possible to identify local and other sustainable resources (e.g., collaborations, mentorship with other hospitals) that can support the improvement of health information collection and use. While human resource scarcity can be a problem, turning to outsiders to fill gaps is not a long-term solution as it requires continuous reliance on people outside the organization to contribute to projects.

Self-sufficiency, when possible, is preferable as it can lead to sustainable solutions.

EHRs take resources (money, human resources, time, energy) away from other priorities. Resources can be spread too thin when there are multiple change projects happening concurrently. Donors can contribute to this problem when they place undue pressure on a hospital to make changes before the support systems or personnel are in place. Prioritization is difficult in this environment if many things are deemed urgent. One should question if the benefits of investing in an EHR are greater than investing the resources in other initiatives to improve patient care. It can be very difficult to back out of a bad decision, once a large investment has been made.

As a researcher

There are a number of things I would change. Were I to do it again, assuming I had this wealth of knowledge I gained to draw from, I would have spoken the language, known the environment, and been aware of reverse culture shock (the shock of returning to your home country). I would not change the research approach, nor my awareness of situated perspective. Even the knowledge that I was part of the problem and contributing to the hospital dynamics and resisting, when I felt necessary, is not enough to make me want to change the experience itself. It was a rich, tangible, incredible learning experience, for which I will always be grateful.

Searching the literature for answers

I should have taken the early warning signs more seriously when I was in Canada. I would read articles on EHR implementation (some of which are referenced in this paper) and wonder what participation and resistance actually looked like. Over time, these words read like catch phrases that begged expansion. I did not feel that I could glean enough detail from the articles to know how to achieve participatory EHR implementation without having to go through the experience myself. In part, this is true. You cannot really get a feel for it without experiencing it. But still, I felt a nagging regret each time I read an article that described a success implementation effort and after, let's say, 5 years the efforts were sustainable. 'There must be something missing here', I'd think to myself while trying to read between the lines. 'It can't be that easy. What of the false starts and incomprehensible finishes? I know change takes time, but what does that time look like? What were the unspoken details that reveal the heart of the matter?'

Once on site, I appreciated the gap between the idealistic vision I had created from what I had read, and the harsh reality of the environment. I intended, in part, for my research to not only help the research site, but to fill a gap in Health Informatics and evaluation literature in Sub-Saharan Africa. But after getting to the environment, I realized that I was standing in my own gap of knowledge to know how to function within the inherently messy process of change itself. This harkened back to my first impression of poverty during my initial visit to Tanzania. Reading about poverty is very different from seeing it, and even more

so, from experiencing it. So I found myself arrived in an unknown environment with a list of steps and catchphrases that did not prepare me for the chaos I was seeing.

There is no Google search for "I'm trying to engage people in a participatory process to improve EHR implementation and nothing is happening". I know. I've tried. It's not that the preparation I had done beforehand was entirely unhelpful. There were some things that were absolutely invaluable that I was able to draw from – a strong foundation. The experience of completing previous graduate work on change management was a tremendous help, as were all of my research methodology courses and books I had accumulated. This was enough for an enquiry, but I wanted to make sure that I was forming a full picture: not one anchored in a silo of knowledge. While my pre-departure reading was rather broad and included health informatics, change management, poverty, and ethics literature, I expanded my depth and breadth of reading to include gender issues, community development, participation, colonialism, and the like. I felt if I was not walking around with my voice recorder, journal, and Swahili Dictionary, I was at home gleaning what I could from the Internet and raiding the MMD's and matriarche's bookshelves. In the end, it was the experience, paired with the literature that led me to puzzle out the situation. This process of linking practice and theory, and ongoing reflexivity, was an essential process to conducting the research. There is a gap between these two in the literature and more stories of lived experiences, and how that relates to theory, are important to inform health informatics research projects.

My initial literature review, Chapter 2, is a good example of exactly the kind of information that comes up short. I have lived it in the research environment. The information itself is sound and I drew from it theoretically throughout my field research experience. It is presented in a very organized, and almost clinical way that removes all emotion from it, even though we're dealing with people and change – which can be a very emotional thing. While carefully crafted, the literature review itself does not provide much hands-on guidance in terms of the actually problems I encountered, unlike this dissertation as a whole. In the end, from the hundreds of articles I reviewed prior to coming to the research site, resistance, issues of power and control, and the challenges of using expatriates (outsiders) were lacking in my search for answers, and those were the things that caused the most consternation.

I was part of the problem

This research has concluded, in part, that expatriates were part of the problem. Imagine my dismay when I observed that early on during my field research. The hospital's mantra is "Visitors are a blessing", but this is only partly true: it is a double-edged sword. On the one hand, visitors bring with them much needed knowledge, skills, money, and enthusiasm, among others. They bring new techniques and ideas, norms, values, and beliefs. In a resource-poor environment where planning is reactive, newcomers can, however, be used as a means to continually plug holes, and distract from the need to plan locally and sustainably.

On the spectrum of experience, mine ranged from appalling to outstanding, depending on the time and circumstances. I vacillated between feeling marginalized as: a Canadian; a woman; a researcher; a Caucasian to feeling empowered as: a leader; a sister; a mother; a mentor; a member of the community. I was caught in the same fight as everyone else, resisting those things I did not think were right, and trying to take back power. The longer I lived at the research site, the more difficult it became to not be drawn into the fight – to not take sides – particularly when I was engaging with people all the time and experiencing oppression myself.

In the end, I do not know if it is a question of whether my presence helped or hindered. It sort of just *was*. I was in the environment, contributing to the dynamics of the organization, trying to fit a square research project in a round hospital. I worked to align my enquiry with the research site and in doing so, unearthed a wealth of information and experience to share with others. Berg [16] asks, what is success? Even though my research project was poorly timed and my efforts futile; even though I had little influence in making change; even though I felt I let people down when I could not help them implement the participatory changes they contributed to; I am left with a very good story, and one that we can all learn from. And really, what could be better than that?

Speak the language

I regret not having a working knowledge of Kiswahili before arriving to the research site. I felt an immediate disadvantage, as I could not communicate the most basic information from greetings to food purchases. My reliance on a translator was short-lived as it was an additional barrier to being able to engage in active and direct communication with front-line staff. There is tremendous value in being able to engage people in conversation in their own language and within their own community. I therefore developed a working knowledge of Kiswahili and limited knowledge of Kiraqw during the field research period. I also learned to simplify the English I spoke to non-native speakers, and to adjust my presentations and written materials as well.

Some of the language issues were caused by my lack of knowledge of the environment. While I had been told the people I would want to converse with spoke English, it was not the case. I did not find out until entering the environment that many people took formal Swahili language lessons in Tanzania, Kenya, or within their own school program in their respective countries before coming to Haydom. It is important to explore these things before arriving at the research site. This can be difficult if the information is not shared freely by the site, or if you are unsure what questions you need to ask.

Know the environment

There was so much work to do, it was like plugging holes in a dam. The constant external pressure and urgency to move forward EHR implementation in a resource-poor environment made it difficult for me to initially define not only the scope of my research, but also the scope of my self. I did not have adequate knowledge of the environment beforehand, nor did I pilot my approach. Defining

scope can improve when there is knowledge of the local environment, and the research approach has been piloted. It takes time to orient yourself to the environment and understand what is possible within it.

Were I to do it again, I would have spent more time in the environment before beginning the research proper, in order to better understand what could be accomplished within the dynamics of the hospital and within the given timeframe. In some ways, my arrival was too soon: participatory planning was an essential component of what I had set out to accomplish within an environment that struggled with participatory processes. In other ways, however, this research gave me the opportunity to explore the challenges of participatory EHR implementation within a transitioning environment.

Penetrating the surface to understand what lies beneath takes time. In my initial visit, I was courted by the hospital as a person with specialized skills who could potentially contribute to the environment. I was presented with a 'clean house' and did not realize until I first set foot back into the environment, that I had formed an idealized version of the hospital in my head that conflicted with the reality of the situation. The bubble burst immediately and it was with a heavy heart that I spent my first day in Haydom. I no longer had to be courted: I had already arrived and did not feel welcome in the unfamiliar environment.

Upon our arrival, we were given a home too small to accommodate our family. Almost immediately, doubts surfaced on how to improve the situation. Newton's third law applied: for every time we were told by the decision maker that there were no other homes available, an equal and opposite reaction of expat eye rolling and pointing to the free units around us occurred. Contradictions were abundant as the rules that applied to us did not apply to others already on site or arriving thereafter. This became a disappointing reoccurrence throughout the stay, and was accompanied by an uncertain nagging in the back of my mind that we did not have the same value as other families. Perseverance was key to learning to manoeuvre the expat hierarchy and set realistic expectations over time.

Be flexible

Flexibility is key, not only with personal, but also with research challenges. The reality of the environment can differ from the best-laid plans. Having a flexible research approach to explore new enquiries that emerge, can lead to exciting discoveries even when, in my case, the enquiry on the influence of expatriates implicated my own involvement in the environment. Having a sense of humour and appreciating irony helps to alleviate the stress inherent in a new and chaotic environment.

Be aware of situated perspective

It is important to be aware of how your situated perspective can change over time, particularly with extended field research. In my experience, I moved across the spectrum from outsider to quasi-insider. Not only was there a change in how I perceived the environment, but in how others perceived me. Journaling was invaluable for being able to document and reflect on the transition. People

disclosed more to me over time as I became accepted in the environment, and this created dilemmas for me as a researcher when unsolicited information related to my research was disclosed in friendship. I could never unhear the things I was told. The cumulative stories became part of my personal story.

Similarly, it was invaluable for me to be aware of how my presence influenced the environment and to be critical of my own role. This self-awareness ran as a constant dialogue in the back of my head and led to my enquiry of the influence of outsiders in general within the environment. To be critically self-aware meant acknowledging how my differences could be perceived by others, from where I lived on site, to my language, education, country of origin, gender, and others.

There was a lot of distrust in the environment, and differing opinions about how I should position myself. The best way forward for me was to treat others as I would like to be treated, in a genuine and transparent way to help build trust and avoid misunderstandings.

Do not underestimate reverse culture shock

The adjustment to life in Canada was certainly not immediate. I found myself speaking English slower than I used to, in part because my thoughts came to me in Kiswahili. Sometimes it felt laborious just to get the words out, as if my tongue was trying to remember how to form them, or had become too big for my mouth. Similarly, I could not understand people who spoke English quickly. I'd furrow my brow in much the same way I initially had in Tanzania when people were speaking Kiswahili, and I'd really try to understand what they were saying.

I found myself feeling disconnected from my environment from lack of constant engagement within it. I had felt in Tanzania ever-present and aware, from the texture of the rough ground beneath my feet, to the dazzling array of colours in the landscape and people's clothing, and the sound of greetings in various languages. I must admit that my constant vigilance in the Tanzanian environment for local wildlife stayed with me for some time after my return. My peripheral vision would pick up innocuous sticks on the sidewalk, and I would find myself catapulted by my reflexes into mid-air, leaping over them as if they were snakes. The greatest difficulty I had, however, was the loneliness of an empty house: I missed my Tanzanian family and my Tanzanian home. That feeling of loss made it difficult for me to focus on how to bring together the 14 months of notes, recordings, emails, photographs, and the like to form a cohesive account of the research experience.

Knowledge Translation

So how can these lessons be communicated to others, and further, how can others bring the results into practice?

Knowledge Translation (KT), sometimes referred to as evidence-based practice, is an important part of the research process and is a change management process in itself. Even if I can get the information to *the people*, there has to be a conscious uptake and application of that knowledge…and that's a difficult thing. A flickering worry crosses my mind as I contemplate the challenges of change. This

KT plan follows with the hope that even those who do not like my conclusion will appreciate the research behind it, and that the information will be adopted into practice in less time than it took for Dr. Lind's treatise on the prevention of scurvy to be picked up by the British Navy. As luck would have it, the very framework that I introduced in Chapter 3 was originally made to explain the influence of organizational culture and strategy on implementation of evidence-based practice, and so I therefore know that the message, audience, and source of the information have to be aligned. But this can be very individual- or organization-specific.

My key messages are that: EHRs are not a panacea for improving health systems and low-cost, low-tech solutions should be explored; expatriate involvement in low-resource environments are a double-edged sword as they can decrease reliance on local resources, but they increase reliance on outside resources; EHR implementation requires a concerted, proactive approach to organizational readiness and change; and the research methodology provides essential insights into change management and should continue to be employed. My target audiences are: the research site and participants; low-resource clinical environments; academia; community developers; funding and research organizations; and policy makers/government.

It is important that the research be accessible. To reach the *research site and participants,* the research will be provided to HLH and ELCT Health as a dissertation, and an Executive Summary in simplified English. I will discuss the research with ELCT Health and engage their assistance to have the research reach other East African Hospitals (given their location and connection to East African hospitals and their engagement in EHR change management). This approach will also help reach *low-resource clinical environments*. To reach this audience, I will also publish in accessible, online English language journals that are free to view. To reach *academia*, I will publish in health informatics, change management, and methodology themed journals and present the results at meetings and conferences. A copy of the dissertation will be sent to the University of Dar es Salaam's computer science department (Tanzania), and the Centre for International Health at the University of Bergen (Norway). *Community developers* will also be reached through journal publications. My *funding and research organizations*, both within Canada and within Tanzania, will receive a copy of my dissertation as well as my publications over time. Reaching *policy makers/government* may be accomplished through journal publications; however, participant organizations, universities, and funding and research organizations will also be connected to this group, so the information may also reach them formally and/or informally through those routes. I hope to be able to engage in an active dialogue with interested parties, rather than have the information flow in one direction. This may include emails, phone calls, and face-to-face or distributed meetings.

My research will resonate in different ways for different people. I have brought a large part of myself into the discussion, because for me, it is the stories that I remember. These stories will be drawn out and tailored for the particular message, audience, and source of communication with the aim of being topical, relatable,

and perhaps most importantly, memorable and repeatable. Stories are meant to be shared.

Significance

This research provides a rich and holistic case study description of EHR implementation efforts within a transitioning resource-poor clinical environment. This case study expands and generalizes theory including health informatics and evaluation, qualitative research, human resources, cultural sensitivity, and community development. The rich case description can also be combined with other case studies to enable comparisons across settings.

This ethnographic case study helps fill a gap in existing literature of EHR implementation in Sub-Saharan Africa. While some lessons echo Western and African literature, others provide deeper insight. In particular, this research teases apart the influence of expatriates within the clinical environment, and issues of trust, power, and control. Further, it presents the researcher's lived experience, which can inform other researchers interested in working within similar environments.

This research identified opportunities to further explore health informatics and other change management projects within resource-poor clinical environments. In particular: how resistance presents itself; the dichotomy between local and expatriate power, and the power struggles within and between groups and sub-groups; and sustainability issues including extending trust and relinquishing power.

Final Words

There is a Swahili saying that goes, "*Haba na haba hujaza kibaba*"; it means, "little by little the pot is filled". I like this very much. A water analogy has haunted me from the time I started compiling this paper. Literally and figuratively, my research experience mirrored the seasons: I began my research in dry season and established my footing in the hospital and community; over time, the sky gathered clouds as I gathered information and scratched the surface to reveal what was beneath; by the time the rains came, there was turmoil in the environment as new leaders, unexpected resignations, and the new organizational structure brought large changes; during this time, the Eye Clinic stood firm as an "eye" in the storm, and held promise for the implementation of Care2X; as the water receded, we were left with some positive outcomes including the creation of the Project Management team, a devoted group of Division Leaders, and the hiring of cadre members to improve the collection of statistics. But then it was time for me to leave, and while I had traveled full circle to dry season again, I knew I needed more time.

In my mind's eye, I can picture it now: the truck carrying us away down the hard, dry road towards home, the dust kicked up by the tires and settling slowly, and all of my work, gathered together drop-by-drop with those I worked with tipped onto the ground and soaked up by the parched, red earth. What I accomplished was just a drop in a very large bucket. Despite all of my idealism that refuses to leave my

heart regardless of what my mind says, the realism of the environment was much more harsh than I had anticipated. That I was unable to make the sustainable change that I had set out to accomplish is unfortunate, but not unreasonable. It is my hope that this research will resonate with those trying to accomplish change in the face of messy, unpredictable processes. Even if the environment is not ready for change, steps can be taken so that, little by little, it will be.

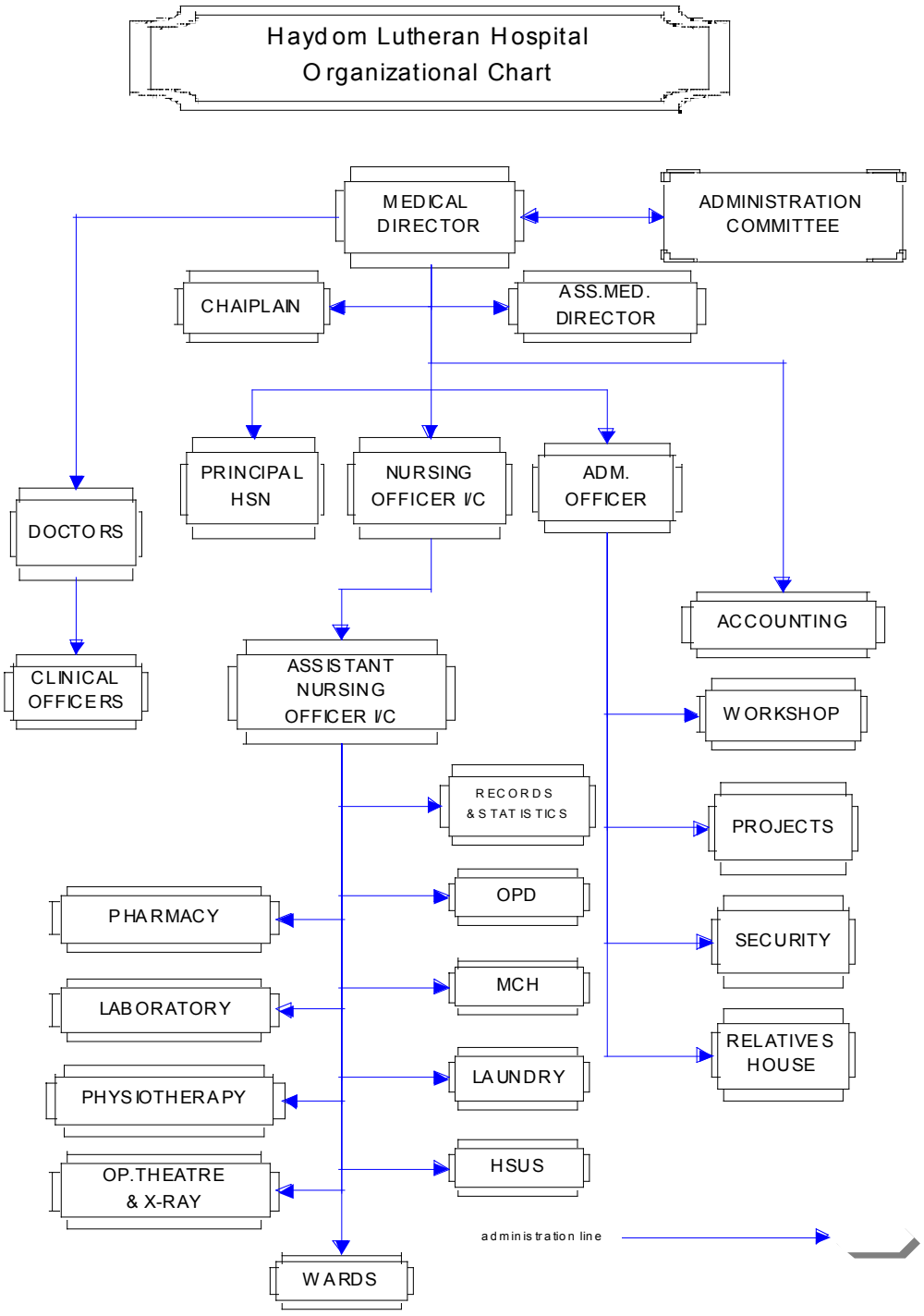
The journey for the researcher is an individual one, and *haba na haba* I became full.

Appendix A: Timeline of events

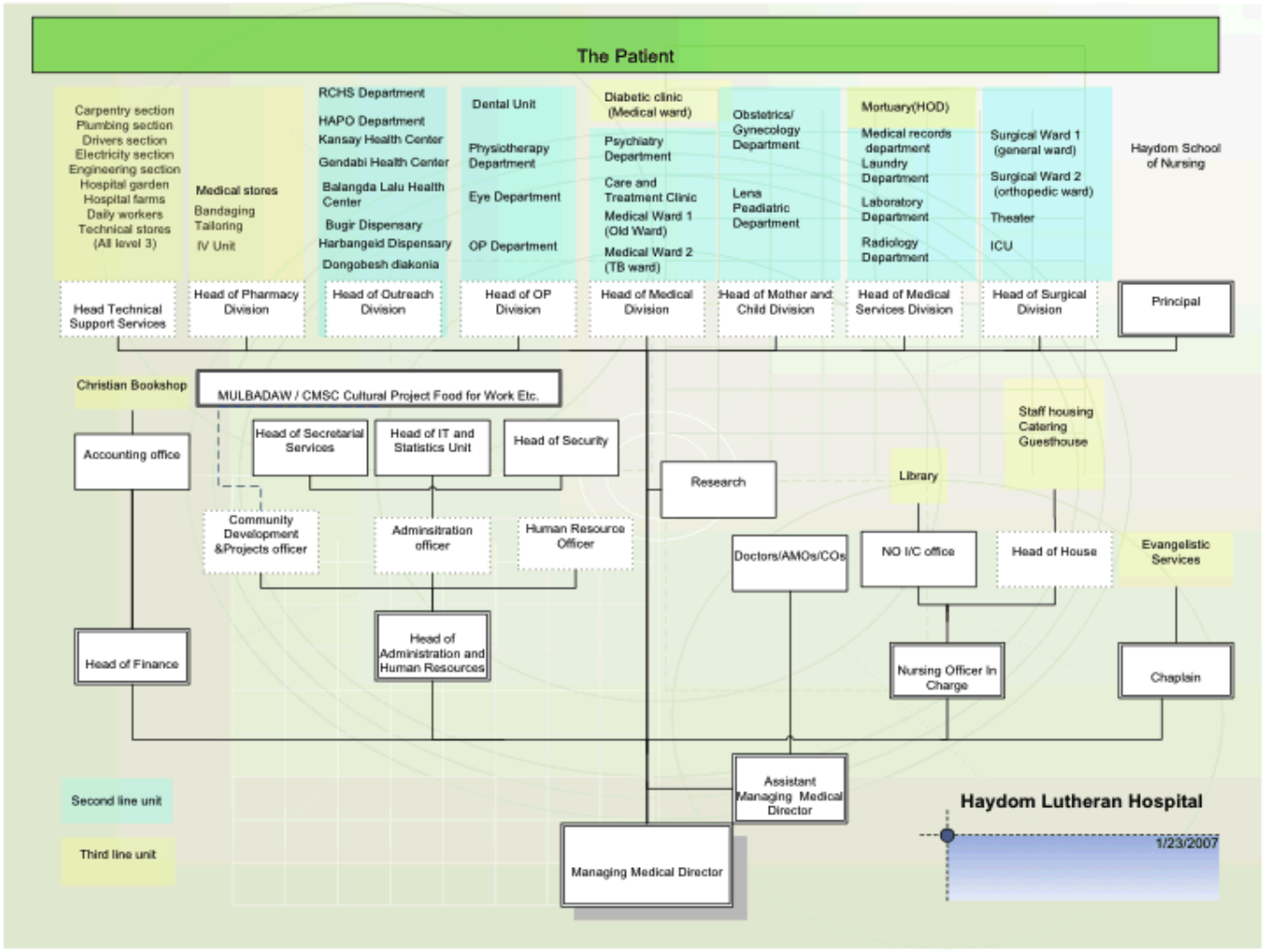
	2007												2008								
Description	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**
Care2X implemented in OPD																						
OPD registration programming																						
OPD data quality check																						
Eye Clinic module programming																						
Town Halls																						
Church-elected leadership decisions																						
Church-elected leadership announcement																						
Leadership resignations																						
Division Leadership inaugeration																						
Project Management Group formation																						
Expat IT expert leaves HLH																						
Borrowed IT Expat																						
Temporary IT Expat																						
Hiring of data cadre #1																						
Hiring of data cadre #2																						
Hiring of inpatient module programmers																						
Selian/HLH collaboration formalized																						
Arusha Trip (Care2X training)																						
Succession plan and recommendations																						
Work to resolve server issues																						
Field research																						

Appendix B: Old and new organizational charts

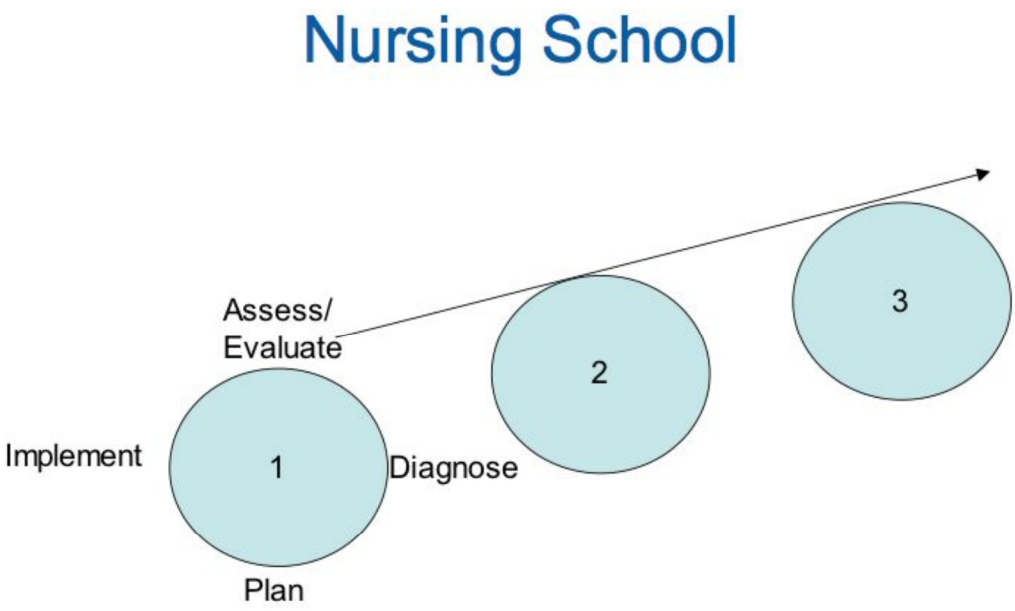
Organizational chart – pre-November 2007 (p.59)[152]

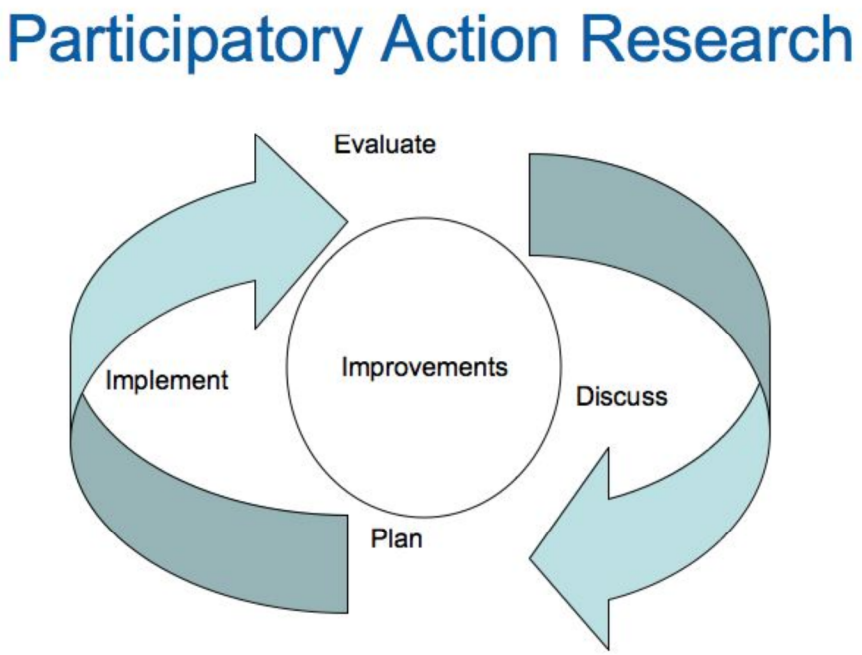


Organizational chart – post-November 2007 (p.22)[165]

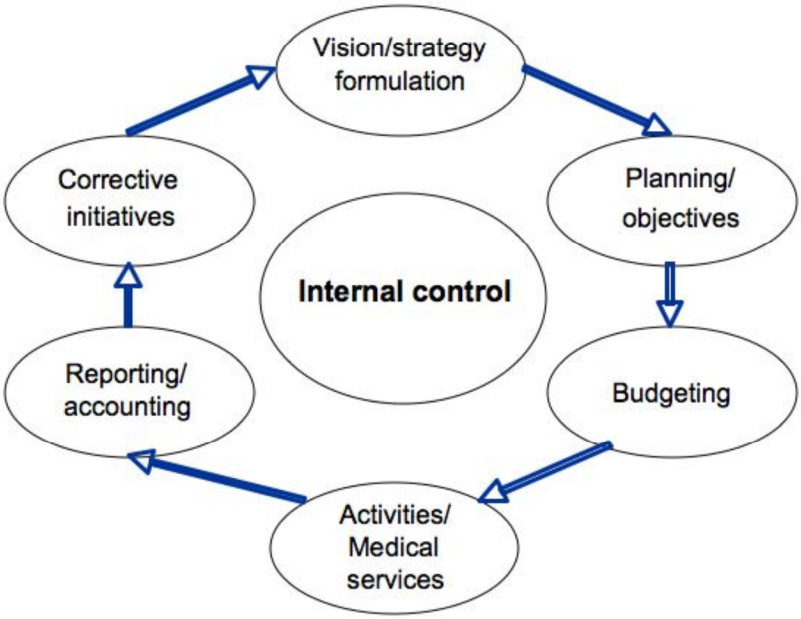


Appendix C: Examples of improvement models at HLH





Internal Control Wheel



Appendix D: Succession Plan

Names have been replaced by "facilitator" or listed broadly by role in "Responsible" column.

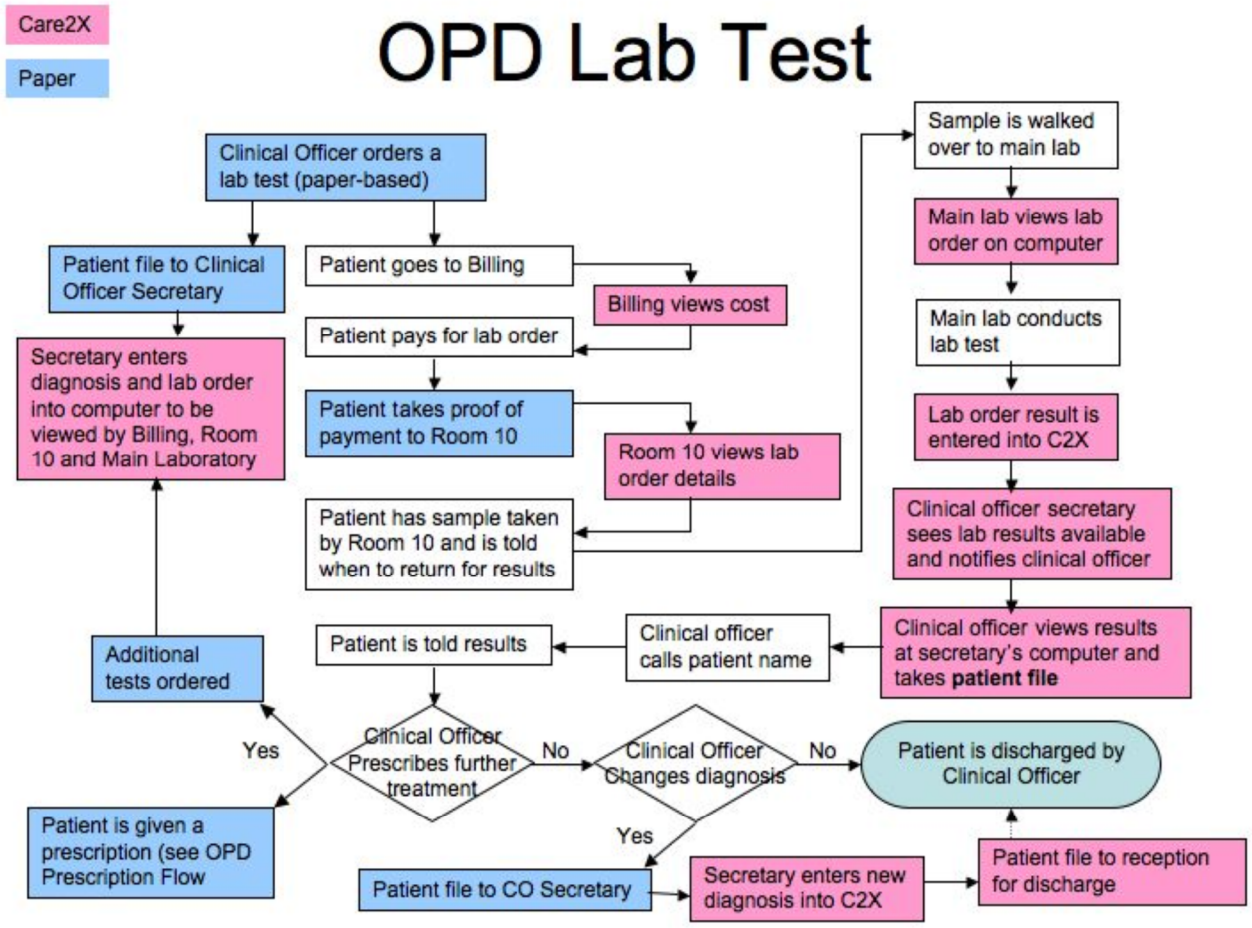
Description	Detail	Responsible (# of individuals in brackets)	Outcome/Goal	Timeline (2008)
Care2X Development (initial review) and Testing (facilitators identified)	Server access and Care2X update plan	Visiting computer advisor (1); Out-of-country resource (2); HLH Administrator (1)	Ensure that [identified individuals] can move updates from HLH server to testing and production modes.	Week of May 19
	Review Registration updates (registration page: unique patient ID, drop-down menus, first-middle-last name, script to discharge all patients to date).	Visiting computer advisor (1); Out-of-country resource (2); Visiting researcher (1)	Test Registration page to ensure drop-down menus and name order change and script to discharge all patients to date, are functional.	Week of May 5
	Review Pharmacy module development and move into testing phase	HLH IT (1); HLH Pharmacy (1); HLH Cadre (2)	Test Pharmacy module for readiness	Week of May 12
	Review Laboratory Module development and move into testing phase	HLH IT (1); HLH Laboratory (1); HLH Cadre (2)	Test Laboratory module for readiness	Week of May 12
	Review Radiology Module development and move into testing phase	HLH IT (1); HLH Radiology (1); HLH Cadre (2)	Test Radiology module for readiness	Week of May 12
	Test Eye Clinic Module (this could include updates from CVS server for continuous and fast review and testing of development modules)	Visiting computer advisor (1); HLH IT (1); HLH Eye Clinic (1); Offsite programmer (1); ELCT Health (1)	Ongoing testing of Eye Clinic modules currently under development ([identified individuals] have been working on this to date)	Ongoing
	Additional modules (inpatient) according to Project Management groups (HLH and Selian)	Out-of-country resource (1); ELCT Health (1); HLH IT (1); HLH Cadre (all); HLH knowledge experts in applicable wards (e.g., Clinical Officer)	Additional module testing before implementation.	Ongoing

	Implement Care2X Registration changes in OPD and in Eye Clinic	Visiting computer advisor (1); Visiting researcher (1)	Make "live" updates made to the Care2X system in July 2007.	Week of May 5
Care2X implementation (facilitators identified)	Implement Pharmacy Module (requires ongoing surveillance)	HLH Pharmacy (1); HLH Cadre (all); HLH dedicated project facilitator (1); HLH Project Group	Make "live" Pharmacy Module.	Week of May 19
	Implement Laboratory Module (requires ongoing surveillance)	HLH Laboratory (1); HLH Cadre (all); HLH dedicated project facilitator (1); HLH Project Group	Make "live" Laboratory Module. Data entry clerk will enter paper-based lab orders and results.	Week of May 19
	Implement Radiology Module (requires ongoing surveillance)	HLH Cadre (all); HLH dedicated project facilitator (1); HLH Project Group	Make "live" Radiology Module. Components to be determined.	Week of May 19
	Implement Eye Clinic Module (requires ongoing surveillance)	HLH Eye Clinic (1); HLH Cadre (all); HLH dedicated project facilitator (1); HLH Project Group	Make "live" Eye Clinic Module to be used to enter patient eye assessment, diagnoses, and treatment.	When the modules have completed testing phase.
	Additional module implementation	Out-of-country resource (1); ELCT Health (1); HLH IT (1); HLH Cadre (1)	Staged implementation - continuous assessment to improve problems before expanding use.	TBD
	Confidentiality Agreement	Visiting researcher (1); HLH Finance (1); Visiting computer advisor (1)	Acknowledgement of the confidentiality of patient health information. After initial review, [identified individual] has agreed to get a copy of KCMC's confidentiality agreement.	Week of May 5

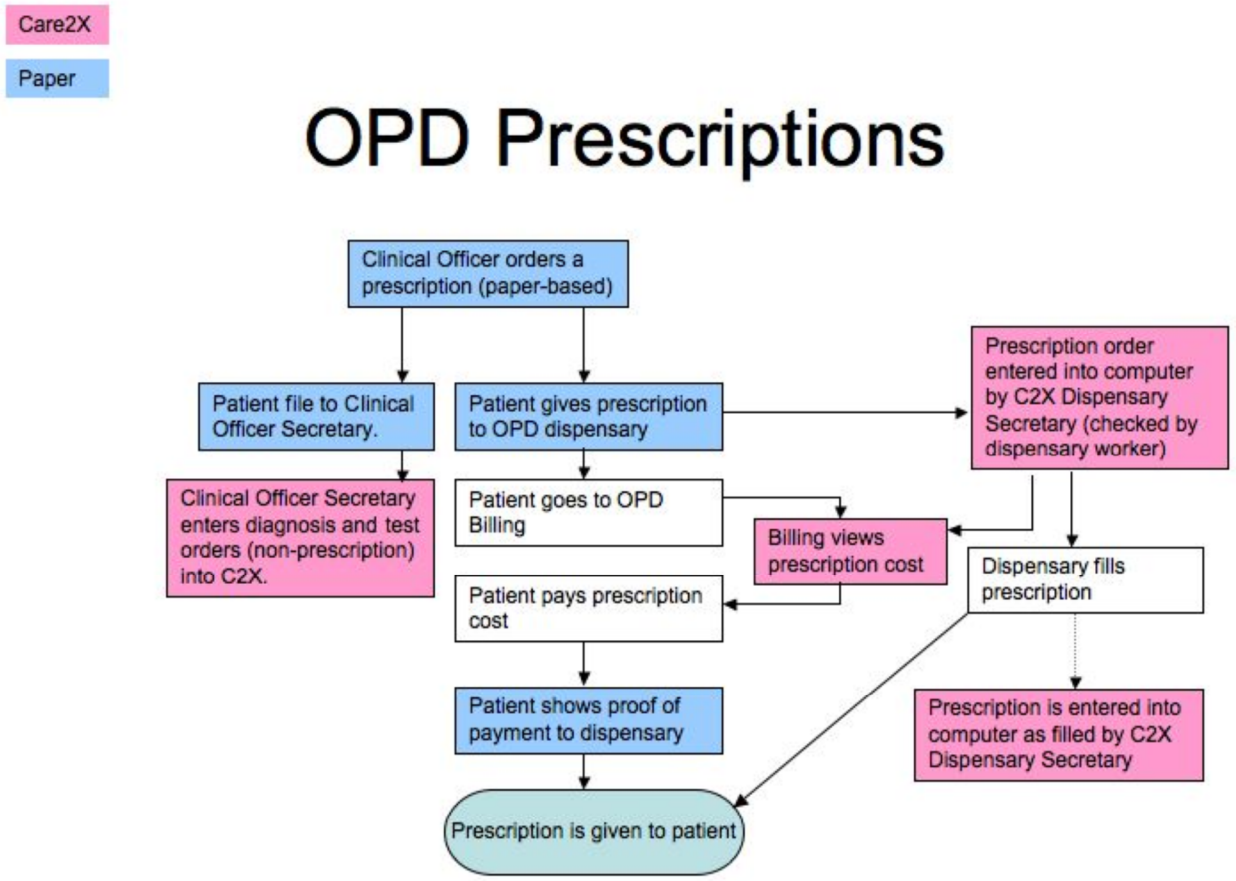
Care2X Cadre Trainng	Arusha trip: Care2X software training and site visit (Selian, St. Elizabeth)	ELCT Health IT and Change Management Team. Participants: HLH Cadre (2); HLH IT (1); HLH Clinical Officer (1); HLH Pharmacy (1); HLH Laboratory (1)	Care2X capacity building, opportunity to make connections with Care2X users in Arusha	May 6 - 9
	Plan and facilitate cadre computer training. Assess ongoing needs and adapt training accordingly.	Visiting computer advisors (2); Visiting researcher (1) (will provide training program to date to IT Department and Visiting computer advisor)	Gain basic and advanced computer-skill proficiency.	Ongoing
	English class	English teacher (1)	Gain proficiency in English language.	Ongoing
	Care2X training (including training OPD registration to discharge patients at end of day and re-register return patients)	HLH IT (2); HLH Cadre (2); HLH Clinical Officer (1); HLH Laboratory (1); HLH Pharmacy (1)	Gain proficiency with Care2X software.	From May 12 onwards
	Review weekly Care2X cadre training reports	HLH Administration (1); Visiting computer advisor (1)	Ensure that Care2X cadre is gaining knowledge and improving individually.	Ongoing
	Statistics (enter patient chart information into various books and into computer system). Provide mentorship to Care2X cadre.	HLH Statistics (1); HLH Cadre (4); HLH Ward Leader (1); HLH Clinical Officer (1)	Increase knowledge of patient chart for both paper-based and electronic systems.	From April 28
	Weekly Care2X cadre	Visiting computer advisor (1); HLH Statistics (1)	Discuss challenges and opportunities in work	Ongoing
Project Group Meeting	Discuss Care2X progress towards deliverables	Visiting computer advisor (1)	Share Care2X experience and plans to improve.	Ongoing
	Discuss webERP progress towards deliverables	Visiting computer advisor (1)	Share webERP experience and plans to improve.	Ongoing
Server	Trouble-shoot server-related issues	Visiting computer advisor; Out-of-country resource (1); HLH IT (1)	Address server issues, as needed.	Ongoing

Computer Assessment and Maintenance	Assess newly acquired computers and prepare them for use.	HLH IT (1); Visiting computer advisor (1)	Ensure new computers are ready for use.	Ongoing
	Remove viruses from Nursing School computers	HLH IT (2)	Ensure Nursing School computers are virus-free.	Week of May 12
Statistics	Assist [Statistics individual] with entering statistics into computer	HLH Statistics (1); HLH Cadre (all)	Record statistics electronically for reports.	From April 25
	Enter patient record information into discharge book (inpatient)	HLH Clinical officer (1); HLH Ward Leader (1); HLH Cadre (1)	Record statistics into books for reports.	From April 28
	Collection and analysis of reports for Care2X reports	Visiting computer advisor (1); Out-of-country resource (1); HLH Process Advisor (1); Visiting researcher (1)	Identification of report outputs that can be done with the existing Care2X system, and areas that need to be expanded. Secure existing reports from [Selian Hospital].	16-May
IT Capacity Building	Assess needs and build capacity within the IT Department	Visiting computer advisor (1)	Increase capacity for IT.	Ongoing
Infrastructure Assessment	Plan and report on requirements for networked computers in Care2X and webERP locations throughout the hospital.	Visiting computer advisor (1) (assessment); HLH IT Dept (set-up)	Ensure readiness for Care2X and webERP implementation in hospital departments.	From May 5
	Plan and report on hardware and software requirements for lab to participate in telemedicine program	Visiting computer advisor (1) (assessment); HLH IT Dept (set-up)	Ensure readiness for telemedicine in the laboratory.	From May 5
Unique Patient Identifier (ID number taken from Care2X)	Discuss fields for unique patient ID card	Visiting Researcher (1); HLH Administration (1); HLH Medical Records (1)	Review Selian Unique Patient ID card for modification.	Week of May 5
	Decide on fields for unique patient ID card	HLH Core Management Team	Approval of HLH Unique Patient ID card format for use in all departments.	May

Appendix E: OPD Laboratory Tests patient and communication flow



Appendix F: OPD Prescriptions patient and communication flow



Appendix G: Barriers and facilitators for change

Data quality	**Barriers** • Information did not match between paper-based and electronic system • Could not provide up-to-date access to accurate information • Updates could not be made to the system • Captured only new patient data • No unique patient ID card • Did not know the accuracy of the paper-based system • Lack of standard terminology • Lack of experience with ICD codes • Inadequate knowledge of disease classification, laboratory tests, and pharmaceutical information • Lack of resources to explore data quality • Attempt to collect as much information as possible • Server issues	**Facilitators** • Data quality check • New patients could be registered in real-time • OPD staff recommended changes • Programming changes made in timely manner
Usability	**Barriers** • Not demonstrated to be clinically or immediately useful • Did not demonstrate value because implementation in OPD registration only • Basic statistics could not be drawn from the system • Differences between paper and electronic system • No patients could be discharged • Server issues	**Facilitators** • Eye Clinic modules developed from well-functioning paper-based forms

Human Resources and capacity building	**Barriers** • Staff attrition • Shortage of trained healthcare staff • Overwork • Alcoholism • Lack of incentives • Low motivation • Perceptions of pay inequity • Perceptions of training opportunity inequity • Rapid turnover of visitors • Reliance on expats to fill gaps • Lack of people to replace those who leave • Expatriates not necessarily around long enough for change initiatives to take root. • No facilitator to take over my role. • Lack of IT capacity and information management skills: lack of basic computer and Care2X software skills, lack of experience with information analysis • Lack of local knowledge to implement Care2X changes on local server • Poorly timed training • Training adequacy not tested • Continuous learning discontinued • Newly learned skills could not be practiced • Server issues	**Facilitators** • Expatriates have potential to bring tools, concepts, frameworks, and implement change • Onsite IT support to teach basic computer skills • Employees enthusiastic to learn computer skills • Cadre members freed CO time from statistics • Weekly cadre meetings built teamwork and improved communication • Statistics training provided to cadre members by CO, ward leader, head of medical records • Cadre members learned to interpret patient record • Cadre members passed skills on to other cadre members

Transition from paper to electronic records	**Barriers** • Challenges with paper-based system not solved prior to EHR • Participatory changes to improve paper-based systems could not be implemented • Resistance to change • Steering committee did not meet because server issues delayed implementation • Unclear participant selection for steering committee (lack of communication, conflicting opinions) • Gap between administrative and worker priorities • Administrative aversion to learning from others' experience • Inability to update system • Lack of a unique patient identifier • Multiple temporary ID numbers issued to patients • Potential for multiple patient files to exist for individual patients • Updates could not be made to the system • Lack of administrative buy-in for change management • Abandoned staged implementation in favour of hospital-wide implementation • Momentum lost over time • Server issues	**Facilitators** • Regular offers of distributed and onsite help from ELCT Health • Offers of help from St. Elizabeth and Selian Hospitals • Administration supported Arusha trip • Arusha trip connected peer groups, IT experts, visualize opportunities to improve processes • Eye Clinic a model of how well-functioning paper-based forms could be translated to electronic module • Cadre helped with statistics
Sustainability and scalability	**Barriers** • No proactive strategy to address sustainability • Succession plan not followed • Recommendations not followed • Cadre meetings ceased • Lack of direction for cadre members • Not enough work for cadre members (Care2X not implemented) • Administration felt pressure to get things done immediately • Reliance on expats to fill gaps • Lack of investment in building local capacity to lead Care2X • Responsibility held by local or distributed foreigners • Server issues • Division Leader meetings ceased	**Facilitators** • Sustainability a long-term consideration in strategic planning (e.g., Division Leaders, doctor training) • HLH modules could potentially be used for other hospitals

Design	**Barriers** • Lack of simplicity • Trying to do everything at once (reports) • Lack of effort to have Care2X support workflow and user routines • No staged implementation • Focused on solving management problem (reports) instead of healthcare professional priorities (patient care) • Inpatient module development took time and resources away from solving the bottleneck • HLH distanced itself from ELCT Health • Lost opportunity to assess paper and electronic health information flow • Could not test participatory changes • Inpatient module had to be created from scratch • Went beyond minimum information for decision making to ambitious plan • Inadequate time planned for training and testing • Server issues	**Facilitators** • Sharing module development with Selian hospital • ELCT Health programmers responsive to requested changes • Care2X can be adapted to meet HLH needs • Attempted to collect locally relevant data • Eye Clinic a motivated group • Eye Clinic module based on familiar paper-based forms that had been through quality improvements • Successful distributed communication to program Eye Clinic modules
Infrastructure and cost	**Barriers** • No power stabilizer • Computers plagued with viruses • Efforts to implement low-cost improvements were unsuccessful (resistance) • Additional cadre members hired during time of financial constraint to operate a system not in use • Unrealistic timelines • Programmers hired to create an inpatient module from scratch that could not be implemented • Potential to have to pay someone to come to HLH to fix Care2X • Opportunity costs - money could be spent elsewhere (supplies, nursing); library discussion room used as 'virtual hospital' • Reliance on expatriate knowledge and skills • Server issues	**Facilitators** • Internet connectivity • Space • Hardware • Reliable generator • IT department capability to set up computers and Internet

Participation	**Barriers** • Inability to make updates to Care2X • Project Management group generally run by expatriates • Lack of confidence in local knowledge and skills • Lack of Human Resources • Poor communication mechanisms • Lack of local capacity building limited local engagement and reinforced reliance on expatriates • Illusion of participation • Traditional deference to authority • Power • Lack of trust • Urgency • Lack of empowerment • Some meetings excluded key members • Lack of local engagement in project management • Project meetings ended after 6 months • Server issues	**Facilitators** • Compromise and consensus (shared decision-making) part of culture • Instatement of Division Leaders • Workers keen to improve Care2X • IT Department and ELCT Health keen to help with Care2X testing and training • Eye Clinic collaborative design and development with ELCT Health • Collaboration with Selian Hospital • Weekly cadre meetings • Project Management group formation
Leadership and communication	**Barriers** • Lack of transparency • Lack of feedback mechanisms • Differing views on the value, mode, and content of communication • Hospital leadership in transition • Conflict between workers and management • Difficult to delegate • Absence of a shared vision for change • Lack of worker participation • Reliance on expatriates to lead initiatives and fill gaps • Lack of accountability • Culturally people threatened by criticism and losing face • Trust and mutual understanding difficult to achieve • Difficult to predict behaviour • Potential for expats to dominate meeting discussion • Filter-down informal communication • Rumours and speculation • Resistance • Server issues	**Facilitators** • Instatement of Division Leaders • Participation extended to Division Leaders • Documentation of practices • Investment in training MDs and AMOs • Division Leadership training

Bibliography

[1] Electronic Health Records: Manual for Developing Countries. 2006 [cited 2008; Available from: http://www.wpro.who.int/NR/rdonlyres/5753F8CF-8A78-4639-BEFC-F0EE9B3CBA0A/0/EHRmanual.pdf
[2] Clifford GD, Blaya JA, Hall-Clifford R, Fraser HS. Medical information systems: A foundation for healthcare technologies in developing countries. Biomed Eng Online. 2008;7:18.
[3] Ouma S, Herselman M. E-health in Rural Areas: Case of Developing Countries. International Journal of Biological and Life Sciences. 2008;4(4):194-200.
[4] Grimm NA. The Influence of Organizational Culture and Strategy on Implementation of Evidence-based Practice within a Clinical Environment. Victoria, BC: University of Victoria; 2005.
[5] Braa J, Monteiro E, Sahay S. Networks of Action: Sustainable Health Information Systems Across Developing Countries. MIS Quarterly. 2004;28(3):337-62.
[6] Robey D, Boudreau M-C. Accounting for the Contradictory Organizational Consequences of Information Technology: Theoretical Directions and Methodological Implications. Information Systems Research. 1999;10(2):167-85.
[7] Doolin B. Power and resistance in the implementation of a medical management information system. Information Systems Journal. 2004;14(4):343-62.
[8] Maull R, Brown P, Cliffe R. Organisational culture and quality improvement. International Journal of Operations & Production Management. 2001;21(3):301-26.
[9] Wilson N. Creatures of culture. Hospitals and Health Networks. 2001;75(5):82.
[10] Davies H, Nutley S, Mannion R. Organisational culture and quality of health care. Qualitative Health Research. 2000;9(2):111-9.
[11] Kaplan B. Evaluating Informatics Applications - Social Interactionism and Call for Methodological Pluralism. International Journal of Medical Informatics. 2001;64(1):39-56.
[12] Fraser HS, Allen C, Bailey C, Douglas G, Shin S, Blaya J, et al. Information Systems for Patient Follow-Up and Chronic Management of HIV and Tuberculosis: A Life-Saving Technology in Resource-Poor Areas. J Med Internet Res. 2007 Oct-Dec;9(4).
[13] Mbarika VW, Okoli C, Byrd T, Datta P. The Neglected Continent of IS Research: A Research Agenda for Sub-Saharan Africa. Journal of the Association for Information Systems. 2005;6(5):130-70.
[14] Musa PF, Meso P, Mbarika VW. Toward Sustainable Adoption of Technologies for Human Development in Sub-Saharan Africa: Precursors, Diagnostics, and Prescriptions. Communications of the Association for Information Systems. 2005 April;15(33):31.

[15] Yin RK. Case Study Research. 2nd edition ed: Sage Publications, Inc. 1994.
[16] Berg M. Implementing information systems in health care organizations: myths and challenges. International Journal of Medical Informatics. 2001;64:143-56.
[17] CIA - The World Factbook - Tanzania. [cited 2009 July 10]; Available from: https://www.cia.gov/library/publications/the-world-factbook/geos/TZ.html
[18] 2007/2008 Human Development Report - Tanzania (United Republic of). [cited 2009 July 10]; Available from: http://hdrstats.undp.org/countries/country_fact_sheets/cty_fs_TZA.html
[19] Poverty Eradication. [cited 2009 July 12]; Available from: http://www.tanzania.go.tz/poverty.html
[20] Cutter CH. Africa World Series. 39th ed. Harpers Ferry, WV: Stryker-Post Publications 2004.
[21] African Socialism. Stanford, California: Stanford University Press 1964.
[22] Hyden G, Karlstrom B. Structural Adjustment as a Policy Process: The Case of Tanzania. World Development. 1993;21(9):1395-404.
[23] National Health Policy: Ministry of Health, United Republic of Tanzania; 2003.
[24] Chiduo A. A leap in the Health Sector Reform path. [cited 2009 July 10]; Available from: http://www.idrc.ca/en/ev-8393-201-1-DO_TOPIC.html
[25] Kimaro HC, Nhampossa JL. Analyzing the Problem of Unsustainable Health Information Systems in Less-Developed Economies: Case Studies from Tanzania and Mozambique. Information Technology for Development. 2005;11(3):273-98.
[26] Kimaro HC, Sahay S. An Institutional Perspective on the Process of Decentralization of Health Information Systems: A Case Study from Tanzania. Information Technology for Development. 2007;13(4):363-90.
[27] Smith M, Madon S, Anifalaje A, Lazarro-Malecela M, Michael E. Integrated Health Information Systems in Tanzania: Experience and Challenges. The Electronic Journal on Information Systems in Developing Countries. 2008;33(1):1-21.
[28] Kimaro HC, Nhampossa JL. The challenges of sustainability of health information systems in developing countries; comparative case studies of Mozambique and Tanzania. Journal of Health Informatics in Developing Countries. 2007;1(1):1-10.
[29] Proposal to Strengthen Health Information Systems: United Republic of Tanzania Ministry of Health and Social Welfare (MoHSW).
[30] ICTs in Health in Tanzania: World Health Organization, Global Observatory for eHealth; 2006.
[31] National Information and Communications Technologies Policy: The United Republic of Tanzania Ministry of Communications and Transport; 2003 March 2003.
[32] Health Sector Strategic Plan III - July 2009 - July 2015: Partnership for Delivering the MDGs: United Republic of Tanzania Ministry of Health and Social Welfare.

[33] Mpenzwa E. Overview of ICT Initiatives and Research Priorities, COSTECH. *e-2010 eChallenges*. Warsaw, Poland 2010.
[34] ELCT Health Department at a Glance. [cited 2009 July 10]; Available from: http://health.elct.org
[35] Why Care2X for Hospital Information System. [cited 2009 July 10]; Available from: http://health.elct.org
[36] Care2X Hospital Information System. [cited 2009 July 10]; Available from: http://www.care2x.com
[37] Risk, Vulnerability and Impact: Integrating Modern and Traditional Strategies - Final Draft. Haydom, Tanzania: Haydom Lutheran Hospital; 2002 March 2002.
[38] History. [cited 2009 July 10]; Available from: http://www.haydom.no/history.aspx
[39] Haydom Lutheran Hospital Annual Report. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital; 2007.
[40] Facts of the Culture Center. [cited 2009 July 10]; Available from: http://www.haydom.no/facts_culture_center.aspx
[41] Under the Acacia Tree: Same dance - different drums. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2008.
[42] Information is collected in the following manner. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2006:3.
[43] Planned Implementation of Care2x. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2006:4.
[44] Care2x Workshop Summary (and thoughts on implementation). Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2006:2.
[45] Smits HL, Leatherman S, Berwick DM. Quality improvement in the developing world. International Journal for Quality in Health Care. 2002;14:439-40.
[46] Ojo T. Communication Networking: ICTs and health information in Africa. Information Development. 2006;22(2):94-101.
[47] Wootton R. The possible use of telemedicine in developing countries. Journal of Telemedicine and Telecare. 1997;3:23-6.
[48] Kitua AY, Mashalla YJ, Shija JK. Coordinating health research to promote action: the Tanzanian experience. British Medical Journal. 2000 Sept 30;321(7264):821-3.
[49] National Strategy for Growth and Reduction of Poverty (NSGRP): Vice President's Office, The United Republic of Tanzania; 2005 June 2005.
[50] Siringi S. Tanzania rail crash highlights lack of medical resources for disasters. The Lancet. 2002 July 6, 2002;360(9326):65.
[51] Pfeiffer J. International NGOs and primary health care in Mozambique: the need for a new model of collaboration. Social Science & Medicine. 2003 Feb;56(4):725-38.
[52] Nolen LB, Bravemen P, Dachs NW, Delgado I, Gakidou E, Moser K, et al. Strengthening health information systems to address health equity challenges. Bulletin of the World Health Organization. 2005;83(8):597-603.

[53] Stumbling around in the dark. Bulletin of the World Health Organization. 2005;365(9476):1983.
[54] AbouZahr C, Boerma T. Health information systems: the foundations of public health. Bulletin of the World Health Organization. 2005 August;83(8):578-83.
[55] Juma P. What does an affordable and sustainable 21st-century African health system look like?: IDRC; 2006.
[56] Koppar AR, Sridhar V. A Workflow Solution for Electronic Health Records to Improve Healthcare Delivery Efficiency in Rural India. *International Conference on eHealth, Telemedicine, and Social Medicine*. Cancun, Mexico: IEEE 2009.
[57] Hannan TJ. Hope for HIV in Africa: Observations by an Eldoret Journeyman. MedGenMed. 2006;8(1):46.
[58] Williams F, Boren SA. The role of the electronic medical record (EMR) in care delivery development in developing countries: a systematic review. Informatics in Primary Care. 2008;16:139-45.
[59] Rotich JK, Hannan TJ, Smith FE, Bii J, Odero WW, Vu N, et al. Installing and Implementing a Computer-based Patient Record System in Sub-Saharan Africa: The Mosoriot Medical Record System. J Am Med Inform Assoc. 2003;10(4):295-303.
[60] Fraser H. Implementing electronic medical record systems in developing countries. Informatics in Primary Care. 2005;13(2):83-95.
[61] Simba DO, Mwangu M. Application of ICT in strengthening health information systems in developing countries in the wake of globalisation. Afr Health Sci. 2004 Dec;4(3):194-8.
[62] Safran C, Rind D, Davis R, Ives D, Sands D, Currier J, et al. Guidelines for management of HIV infection with computer-based patient's record. The Lancet. 1995;346(8971):341-6.
[63] Bates DW, Cohen M, Leape LL, Overhage JM, Shabot M, Sheridan T. Reducing the Frequency of Errors in Medicine Using Information Technology. J Am Med Inform Assoc. 2001;8:299-308.
[64] Lown B, Bukachi F, Xavier R. Health information in the developing world. The Lancet. 1998;352:34-8.
[65] Lorenzi NM, Riley RT. Managing Change: An Overview. Journal of the American Medical Informatics Association. 2000;7:116-24.
[66] Godlee F. Can we achieve health information for all be 2015? The Lancet. 2004;364(9430):295-300.
[67] Kimaro HC, Titlestad OH. Challenges of user participation in the design of a computer based system: the possibility of participatory customisation in low income countries. Journal of Health Informatics in Developing Countries. 2008;2(1):1-9.
[68] Summary Learning Report 2007 Health projects Tanzania: "Gathering reliable and accurate reports for planning purposes". Methodology. 2007 July 16.
[69] Adam L, Wood F. An investigation of the impact of information and communication technologies in sub-Saharan Africa. Journal of Information Science. 1999;25(4):307-18.

[70] Lewin K. Action research and minority problems. Journal of Social Issues. 1946;2:34.
[71] Weiner BJ, Amick H, Lee S-YD. Conceptualization and Measurement of Organizational Readiness for Change: A Review of the Literature in Health Services Research and Other Fields. Medical Care Research and Review. 2008;65(4):379-436.
[72] Burnett S, Benn J, Pinto A, Parand A, Iskander S, Vincent C. Organisational readiness: exploring the preconditions for success in organisation-wide patient safety improvement programmes. Quality and Safety in Health Care. 2010;19:313-7.
[73] Voelker R. Conquering HIV and Stigma in Kenya. Journal of the American Medical Association. 2005 July 14;292(2):157-9.
[74] Tierney WM, Rotich JK, Smith FE, Bii J, Einterz RM, Hannan TJ. Crossing the "digital divide:" implementing an electronic medical record system in a rural Kenyan health center to support clinical care and research. Proc AMIA Symp. 2002:792-5.
[75] Mavimbe JC, Braa J, Bjune G. Assessing immunization data quality from routine reports in Mozambique. BMC Public Health. 2005;5:108.
[76] Braa J. The Struggle for District-Based Health Information Systems in South Africa. The Information Society. 2002;18:113-27.
[77] Jacucci E, Shaw V, Braa J. Standardization of Health Information Systems in South Africa: The Challenge of Local Sustainability. Information Technology for Development. 2006;12(3):225-39.
[78] Parent F, Coppieters Y, Parent M, Viens A. Information Technologies, Health, and Globalization: Anyone Excluded? J Med Internet Res. 2001;3(1):e11.
[79] Furuholt B, Ørvik TU. Implementation of information technology in Africa: understanding and explaining the results of ten years implementation effort in a Tanzanian organization. Information Technology for Development. 2006;12(1):45-62.
[80] Mosse EL, Byrne E. The Role of Identity in Health Information Systems Development: A Case Analysis from Mozambique. Information Technology for Development. 2005;11(3):227-43.
[81] Hanmer LA, Roode JD, Isaacs S. Modelling the Effect of Limited or Vulnerable Resources on the Use of Computerised Hospital Information systems (CHISs) in South Africa. Information Technology in Health. 2007;130:299-309.
[82] Kimaro HC. Strategies for Developing Human Resource Capacity to Support Sustainability of ICT Based Health Information Systems: A Case Study from Tanzania. The Electronic Journal on Information Systems in Developing Countries. 2006;26(2):1-23.
[83] Aarts J, Peel V. Using a descriptive model of change when implementing large scale clinical information systems to identify priorities for further research. International Journal of Medical Informatics. 1999;56:43-50.
[84] Mosse E, Nielsen P. Communication Practices as Functions, Rituals and Symbols: Challenges for Computerization of Paper-based Information Systems. The Electronic Journal on Information Systems in Developing Countries. 2004;18(3):1-17.

[85] Brender J, Ammenwerth E, Nykanen P, Talmon J. Factors influencing success and failure of health informatics systems -- a pilot Delphi study. Methods of Information in Medicine. 2006;45(1):125-36.
[86] Alvarez AS. Towards an interpretive integrative framework to conceptualise social processes in large information systems implementations. Information Technology for Development. 2003;10:233-47.
[87] Davis D. Meeting the Challenge of Change. American Journal of Otolaryngology. 1996;17(6):364-7.
[88] Bush M, Lederer AL, Li X, Palmisano J, Rao S. The alignment of information systems with organizational objectives and strategies in health care. International Journal of Medical Informatics. 2009;78:446-56.
[89] Fenenga C, de Jager A. CORDAID-IICD Health Programme Uganda: Health Management Information Systems as a Tool for Organisational Development. The Electronic Journal on Information Systems in Developing Countries. 2007;31(3):1-14.
[90] Mukama F. A study of health information systems at local levels in Tanzania and Mozambique improving the use and management of information in health districts. Oslo, Norway: University of Oslo; 2003.
[91] Hannan TJ, Rotich JK, Odera WW, Menya D, Esamai F, Einterz RM, et al. The Mosoriot medical record system: Design and initial implementation of an outpatient electronic record system in rural Kenya. International Journal of Medical Informatics. 2004;60:21-8.
[92] Kamadjeu R, Tapang E, Moluh R. Designing and implementing an electronic health record system in primary care practice in sub-Saharan Africa: a case study from Cameroon. Informatics in Primary Care. 2005;13(3):179-86.
[93] Fraser H, Jazayeri D, Nevil P, Karacaoglu Y, Farmer PE, Lyon E, et al. An information system and medical record to support HIV treatment in rural Haiti. British Medical Journal. 2004;329:1142-6.
[94] Lober WB, Quiles C, Wagner S, Cassagnol R, Lamothes R, Alexis DRP, et al. Three Years Experience with the Implementation of a Networked Electronic Medical Record in Haiti. AMIA Annu Symp Proc. 2008;2008:434-8.
[95] Chandrasekhar CP. Information and communication technologies and health in low income countries: the potential and the constraints. Bulletin of the World Health Organization. 2001;79(9):850-5.
[96] Braa J, Macome E, Mavimbe JC, Nhampossa JL, ca Costa JL, Jose B, et al. A Study of the Actual and Potential Usage of Information and Communication Technology at District and Provincial Levels in Mozambique with a Focus on the Health Sector. The Electronic Journal on Information Systems in Developing Countries. 2001;5(2):1-29.
[97] Fraser H, Blaya J, Choi S, Bonilla C, Jazayeri D. Evaluating the impact and costs of deploying an electronic medical record system to support TB treatment in Peru. AMIA. 2006:264-8.
[98] Allen C, Manyika P, Jazayeri D, Rich M, Lesh N, Fraser H. Rapid deployment of electronic medical records for ARV rollout in rural Rwanda. American Medical Informatics Association Annual Symposium; 2006; Washington, DC; 2006. p. 840.

[99] Mamlin BW, Biondich PG, Wolfe BA, Fraser H, Jazayeri D, Allen C, et al. Cooking Up An Open Source EMR for Developing Countries: OpenMRS - A Recipe For Successful Collaboration. American Medical Informatics Association Annual Symposium; 2006; Washington, DC; 2006. p. 529-33.
[100] Carroll J, Edmondson A. Leading organisational learning in health care. Quality and Safety in Health Care. 2002;11:51-6.
[101] Goodman J, Truss C. The medium and the message: communicating effectively during a major change initiative. Journal of Change Management. 2004;4(3):217-28.
[102] Evans MG. Evaluating computerised health information systems: We are still getting information technology wrong. British Medical Journal. 2003;327(19 July):163-4.
[103] Saebo J, Titlestad O. Evaluation of a Bottom-up Action Research Approach in a Centralised Setting: HISP in Cuba. 37th Hawaii International Conference on System Sciences; 2004; 2004. p. 1-11.
[104] Odhiambo-Otieno GW. Evaluation criteria for district health management information systems: lessons from the Ministry of Health, Kenya. International Journal of Medical Informatics. 2005;74:31-8.
[105] Heeks R. The Tyranny of Participation in Information Systems: Learning from Development Projects. Manchester, UK: Institute for Development Policy and Management; 1999.
[106] Alvarez AJS. Challenges to Information Systems Implementation and Organisational Change Management: Insights from the Health Sector in Ecuador. The Electronic Journal on Information Systems in Developing Countries. 2004;16(6):1-16.
[107] Bailey C, Pang T. Health information for all by 2015? The Lancet. 2004;364:223-4.
[108] Jani JV, Jani IV, Araújo C, Sahay S, Barreto J, Bjune G. Assessment of routine surveillance data as a tool to investigate measles outbreaks in Mozambique. BMC Infect Dis. 2006;6:29.
[109] Idowu B, Adagunodo R, Adedoyin R. Information technology infusion model for health sector in a developing country: Nigeria as a case. Technology and Health Care. 2006;14:69-77.
[110] Davison R, Vogel D, Harris R, Jones N. Technology Leapfrogging in Developing Countries - An Inevitable Luxury? The Electronic Journal on Information Systems in Developing Countries. 2000;1:10.
[111] Gray H, Sanzogni L. Technology Leapfrogging in Thailand: Issues for the Support of eCommerce Infrastructure. The Electronic Journal on Information Systems in Developing Countries. 2004;16.
[112] Kushniruk AW, Patel VL. Cognitive and usability engineering methods for the evaluation of clinical information systems. Journal of Biomedical Informatics. 2004;37:56-76.
[113] Nielsen J. Ten Usability Heuristics. 2005 [cited 2011 January 14, 2011]; Available from: http://www.useit.com/papers/heuristic/heuristic_list.html
[114] Tolentino H, Marcelo A, Marcelo P, Maramba I. Linking Primary Care Information Systems and Public Health Vertical Programs in the Philippines: An

Open-source Experience. American Medical Informatics Association (AMIA); 2005; Washington, DC; 2005. p. 311-5.
[115] Kushniruk AW, Triola MM, Borycki EM, Stein B, Kannry JL. Technology induced error and usability: The relationship between usability problems and prescription errors when using a handheld application. International Journal of Medical Informatics. 2005;74:519-26.
[116] Silva LO. Risky but Effective Improvisations in Managing Information Systems. The Electronic Journal on Information Systems in Developing Countries. 2001;5(5):1-11.
[117] Forster M, Bailey C, Brinkhof MW, Graber C, Boulle A, Spohr M, et al. Electronic medical record systems, data quality and loss to follow-up: survey of antiretroviral therapy programmes in resource-limited settings. Bull World Health Organ. 2008 Dec;86(12):939-47.
[118] Aarts J, Peel V, Wright G. Organizational issues in health informatics: a model approach. International Journal of Medical Informatics. 1998 October;52(1-3):235-42.
[119] Allen C, Jazayeri D, Miranda J, Biondich PG, Mamlin BW, Wolfe BA, et al. Experience in Implementing the OpenMRS Medical Record System to Support HIV Treatment in Rwanda. MEDINFO 2007; 2007 August 20-24, 2007; Brisbane, Australia; 2007.
[120] Mamlin BW, Biondich PG. AMPATH Medical Record System (AMRS): Collaborating Toward An EMR for Developing Countries. AMIA Annu Symp Proc. 2005;2005:490-4.
[121] Littlejohns P, Wyatt JC, Garvican L. Evaluating computerised health information systems: hard lessons still to be learnt. British Medical Journal. 2003 Apr 19;326(7394):860-3.
[122] van der Meijden M, Tange H, Troost J, Hasman A. Determinants of Success of Inpatient Clinical Information Systems: A Literature Review. Journal of the American Medical Informatics Association. 2003 May-June;10(3):235-43.
[123] Were MC, Mamlin BW, Tierney WM, Wolfe B, Biondich PG. Concept Dictionary Creation and Maintenance Under Resource Constraints: Lessons from the AMPATH Medical Record System. AMIA Annu Symp Proc. 2007;2007:791-5.
[124] Fetterman DM. Ethnography: step-by-step. 3rd edition ed. Thousand Oaks, California: SAGE Publications, Inc. 2010.
[125] Chiasson M, Reddy M, Kaplan B, Davidson E. Expanding multi-disciplinary approaches to healthcare information technologies: What does information systems offer medical informatics? International Journal of Medical Informatics. 2006:9.
[126] Freire P. Pedagogy of the Oppressed. London, England: The Continuum International Publishing Group Ltd. 1970.
[127] Baskerville RL, Wood-Harper TA. A critical perspective on action research as a method for information systems research. Journal of Information Technology. 1996;11(3):235-46.
[128] Stringer E. Action Research. 2nd ed. Thousand Oaks, CA: SAGE Publications, Inc. 1999.

[129] Luckett S, Ngubane S, Memela B. Designing a Management System for a Rural Community Development Organization Using a Systemic Action Research Process. Journal of Systemic Practice and Action Research. 2001;14(4):517-42.
[130] Karsh B. Beyond Usability: designing effective technology implementation systems to promote patient safety. Quality and Safety in Health Care. 2004;13(5):388-94.
[131] Meyer J. Qualitative research in health care: Using qualitative methods in health related action research. British Medical Journal. 2000;320:178-81.
[132] Øvretveit J. Formulating a health quality improvement strategy for a developing country. International Journal of Health Care Quality Assurance. 2004;17(7):368-76.
[133] Øvretveit J. Improving the quality of health services in developing countries: lessons for the West. Quality and Safety in Health Care. 2002;11:301-2.
[134] Yin RK. Case study research: design and methods. 4th edition ed. Thousand Oaks, California: SAGE Inc. 2009.
[135] Montealegre R. A case for more case study research in the implementation of Information Technology in less-developed countries. Information Technology for Development. 1999;8(4):199-207.
[136] Fetterman DM. Ethnography. 2nd ed. Thousand Oaks: SAGE Publications 1998.
[137] Silverman D. Qualitative method and sociology. Aldershot: Gower 1985.
[138] Herr K, Anderson GL. The Action Research Dissertation: A Guide for Students and Faculty. Thousand Oaks, CA: Sage Publications, Inc. 2005.
[139] Mason J. Qualitative Researching. 2nd ed. Thousand Oaks: SAGE Publications 2002.
[140] van Manen M. Researching Lived Experience: Human Science for an Action Sensitive Pedagogy. 2nd edition ed: University of Western Ontario, The Althouse Press 1997.
[141] Allen M, Currie LM, Bakken S, Patel VL, Cimino JJ. Heuristic evaluation of paper-based Web pages: A simplified inspection usability methodology. Journal of Biomedical Informatics. 2006;39:412-23.
[142] Kaplan B. Addressing Organizational Issues into the Evaluation of Medical Systems. Journal of the American Medical Informatics Association. 1997;4:94-101.
[143] Winter R, Munn-Giddings C. A Handbook for Action Research in Health and Social Care. London, England: Routledge 2001.
[144] Yin R. Case Study Research Design and Methods. Thousand Oaks, CA: SAGE Publications, Inc. 2003.
[145] Denzin N. The Art and Politics of Interpretation. In: Denzin N, Lincoln YS, eds. *Handbook of Qualitative Research*. Thousand Oaks, CA: SAGE Publications, Inc. 1994:500-15.
[146] Stake R. Case Studies. In: Denzin N, Lincoln YS, eds. *Handbook of Qualitative Research*. Thousand Oaks, CA: SAGE Publications, Inc. 1994:236-47.

[147] Ammenwerth E, Iller C, Mansmann U. Can evaluation studies benefit from triangulation? A case study. International Journal of Medical Informatics. 2003;70(237-248).
[148] Altheide D, Johnson J. Criteria for Assessing Interpretive Validity in Qualitative Research. In: Denzin N, Lincoln YS, eds. *Handbook of Qualitative Research*. Thousand Oaks, CA: SAGE Publications, Inc. 1994:485-99.
[149] Richardson L. A Method of Inquiry. In: Denzin N, Lincoln YS, eds. *Handbook of Qualitative Research*. Thousand Oaks, CA: SAGE Publications, Inc. 1994:516-29.
[150] Objectives and Challenges. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2008.
[151] Wahlstedt A. Creating a sustainable organisation at Haydom Lutheran Hospital of The Evangelical Lutheran Church of Tanzania, Mbulu Diocese. Norway: Sørlandet sykehus HF; 2004 July 7.
[152] Haydom Lutheran Hospital: Same Dance Different Drums - 5-Year Strategic Plan 2002-2006. Mbulu Diocese ELCT: Haydom Lutheran Hospital; 2001 June 2001.
[153] Haydom Lutheran Hospital Organizational Development - Status pr nov 2007 for Helse Sør-øst. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2007.
[154] Haydom Lutheran Hospital Seminar with Health Centers. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2008.
[155] Svensen E. Recruitment and Selection at HLH: Examples from recruitment of division leaders. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2007.
[156] Slocum R, Wichhart L, Rocheleau D, Thomas-Slayter B, Editors. Power, Process and Participation: Tools for Change. London, UK: ITDG Publishing 1995.
[157] Olsen Ø. Workplan 2008 - Summary of main strategies. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital; 2007 Dec 2, 2007.
[158] Strategy Seminar Core Management Team: Katesh, 18-19 Jan 08. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2008:24.
[159] Identifying values that underpin HLH objectives. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital; 2008 January 23.
[160] Mæstad O, Brehony E. Review of Haydom Lutheran Hospital: External Review Contracted by the Royal Norwegian Embassy, Dar es Salaam. Bergen, Norway: CHR. Michelsen Institute; 2007.
[161] Haydom Lutheran Hospital Internal Control Systems Audit Report. Dar es Salaam, Tanzania: Baker Tilly DGP & Co.; 2007 September.
[162] Haydom Lutheran Hospital Objectives. 2007 [cited November 2007]; Available from: http:www.haydom.no
[163] Tuastad T. First quarter evaluation of care2x implementation. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital; 2007 March 22.
[164] CMT - meeting 14.03.08 - An introduction to the project framework - 2008. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2008.

[165] Haydom Lutheran Hospital Annual Report 2008. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital; 2008.
[166] Haydom Tips. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2005.
[167] Svensen E. Activity reports at HLH: Why? - Presentation at Sala. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2007.
[168] Reports and Forms by Division. Mbulu, Manyara, Tanzania: Haydom Lutheran Hospital 2008.
[169] Stambach A. Lessons for Mount Kilimanjaro: Schooling, Community, and Gender in East Africa. New York, NY: Routledge 2000.
[170] Lorenzi NM, Riley RT. Organizational issues = change. International Journal of Medical Informatics. 2003;69:197-203.
[171] Langley GJ, Nolan KM, Nolan TW, Norman CL, Provost LP. The Improvement Guide: A Practical Approach to Enhancing Organizational Performance. San Francisco, CA: John Wiley & Sons, Inc. 1996.
[172] Drucker PF. Managing the Nonprofit Organization: Principles and Practices. New York, NY: Collins Publishers 1990.
[173] Health Facility Management Information Systems (HMIS) Change Management Guide. Arusha, Tanzania: ELCT Health; 2008 January 31, 2008.
[174] Kouzes JM, Posner BZ. The Leadership Challenge. 3rd ed. San Francisco, CA: John Wiley & Sons, Inc. 2002.
[175] Lungo J. The reliability and usability of district health information software: case studies from Tanzania. Tanzania Journal of Health Research. 2008;10(1):39-45.
[176] Chambers R. Whose Reality Counts?: Putting the First Last: Intermediate Technology Publications 1997.
[177] Cornwall A. Spaces for transformation? reflections on issues of power and difference in participation in development. In: Hickey S, Mohan G, eds. *Participation: From Tyranny to Transformation?* New York, NY: Zed Books, Ltd. 2004:75-91.
[178] Cooke B, Kothari U. The Case for Participation as Tyranny. In: Cooke B, Kothari U, eds. *Participation: The New Tyranny?* New York, NY: Zed Books, Ltd. 2001:1-15.
[179] Heeks R. The Tyranny of Participation in Information Systems: Learning from Development Projects. Manchester, UK: Institute for Development Policy and Management; 1999.
[180] Kelly U. Confrontations with power: moving beyond 'the tyranny of safety' in participation. In: Hickey S, Mohan G, eds. *Participation: From Tyranny to Transformation?* New York, NY: Zed Books, Ltd. 2004:204-18.
[181] Hildyard N, Hegde P, Wolvekamp P, Reddy S. Pluralism, Participation and Power: Joint Forest Management in India. In: Cooke B, Kothari U, eds. *Participation: The New Tyranny?* New York, NY: Zed Books, Ltd. 2001:56-71.
[182] Cooke B, Kothari U, Editors. Participation: The New Tyranny? New York, NY: Zed Books, Ltd. 2001.

[183] Daniels N, Bryant J, Castano R, Dantes O, Khan K, Pannarunothai S. Benchmarks of fairness for health care reform: a policy tool for developing countries. Bulletin of the World Health Organization. 2000;78(6):740-50.
[184] Hailey J. Beyond the Formulaic: Process and Practice in South Asian NGOs. In: Cooke B, Kothari U, eds. *Participation: The New Tyranny?* New York, NY: Zed Books, Ltd. 2001:88-101.
[185] Gaventa J. Towards participatory governance: assessing the transformative possibilities. In: Hickey S, Mohan G, eds. *Participation: From Tyranny to Transformation?* New York, NY: Zed Books, Ltd. 2004:25-41.
[186] Longano BA. Evaluating computerised health information systems. British Medical Journal. 2003;327(19 July):163.