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Health workers' experiences of barriers and enablers in using m-health in the Kabarole district, Uganda

A qualitative fieldwork study

Master's thesis in International Social Welfare and Health Policy
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Abstract

This thesis aims to explore health workers' experiences with barriers and enablers in using m-health (mobile health) in health care service delivery in the Kabarole district of Western Uganda. The rapid increase of mobile phones in Uganda over the last decades offers many opportunities in providing primary health care services to those who need it most. Using m-health systems can increase access to quality and equitable health care. I evaluate two m-health systems: the mTrac system (mobile tracking) used for disease surveillance and the Enhance Visual Assessment (EVA) System, used for consultation between health care workers to diagnose cervical cancer.

The results are based on a three-month-long qualitative fieldwork study in the Kabarole district of the impact of m-health systems taken on the ground. The fieldwork gave me a better understanding of the pressure put on the health care system in a country with high birth rates combined with few resources. Lack of drugs and physicians and cases with epidemic diseases such as HIV/AIDS and malaria are putting pressure on the health care system, combined with unstable drug-stock levels. Doing fieldwork, semi-structured interviews, and participant observations in the natural setting of the participants gives you access and understanding of a social problem that is valuable, which contributed to the study's trustworthiness.

This thesis focuses on the two m-health systems' ability to promote Universal Health Care (UHC), a highly prioritized objective within the World Health Organization (WHO). Using the EVA system could help promote diagnosis for vulnerable groups such as women with HIV, who are more exposed to cervical cancer. Barriers of incomplete data when using mTrac could be met with proper training. While lack of drugs to enhance health equity met some barriers of incomplete data through the mTrac system, mTrac seems to have enabled more re-distribution of drugs between health service deliveries and reduced the drug stock-outs. Though drug stock-outs are not solved, and the barriers when diagnosing are not properly met, the use of the two m-health systems could come closer to UHC.

Oslo Metropolitan University
Faculty of Social Science
Oslo 2021

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List of abbreviations

ACTs	Artemisinin-based combination therapy
DHIS2	District Health Information Software 2
E-health	Electronic Health
eHMIS	Electronic Health Management Information System
EVA system	Enhance Visual Assessment 'EVA' system
HMIS	Health Management Information System
HPV	Human papilloma virus
M-health	Mobile Health
MoH	Ugandan Ministry of Health
mTrac	Mobile Tracking system
ICTs	Information and Communication technologies
ITs	Information Technologies
PEPFAR	The U.S. President's Emergency Plan for AIDS Relief
UNICEF	United Nations Children's Fund
VHT	Village Health Teams
WHO	The World Health Organization

1. Objective and background

Research objective

What are health workers' experiences of barriers and opportunities in using m-health (mobile health) in the health care service delivery in the Kabarole district, Uganda?

Background

In this background chapter I present why the objective is important, interesting and useful, how the Kabarole district of Uganda is a well-chosen case, and how the objective relates to previous research.

What is e-health (electronic health) and m-health and how is it related to health inequity?

Electronic journals, medical consultations online, and patient's opportunity to order consultations at their general practitioner online are all part of the e-health term. Generally, m-health is a subgroup of e-health, and involves the use of health related activities with the use of mobile devices such as tablets or mobile phones. Health workers use mobile phones and smart phones to register patients' health data. Patients with chronic diseases such as diabetics use tablets for self-measurement of their blood sugar, and health workers are using mobile devices with integrated smart phones to diagnose patients. Within primary care, the daily healthcare given by health workers, m-health also includes the use of mobile devices to register patients, make decisions about care, track patient's health, and communicating with patients and health workers by using mobile phones (M.B & Subashini, 2019; Nylenna, 2015 para. 1 & 3; Odendaal et al., 2020, p. 1). With the introduction and rise of e-health and m-health in the health care service delivery, it introduces both barriers and opportunities when health workers apply them in the health care service delivery.

The World Health Organization (WHO) defines e-health as:

> (…) cost-effective and secure use of information communication technologies (ICT) in support of health and health related fields, including health-care services, health

> surveillance, health literature, and health education, knowledge and research". (World Health Organization (WHO), 2011, p. 11)

In the WHO, e-health is set in a context with universal health coverage (UHC), which originated in the 2005 World Health Assembly resolution and states that e-health can help countries achieve UHC (WHO, 2016, p. 11). The WHO-definition is used in this thesis because it is analysing what the barriers and opportunities are in using this technology for health workers and whether it can contribute to quality and equitable health care, which eventually can lead to UHC. Health equity is related to health inequity, were health equity is seen when groups in society have equal and just access to health services. By equal and just access to health services, health equity is not only concerned on health, but also connected to issues of fairness and justice in social arrangements, since economic distribution impacts the role of health in people's life and freedom (Anand, Peter, & Sen, 2006, pp. 21, 22). Further, health is of a special kind, and therefore more important than inequalities in income, since the health of a person affects people's wellbeing and possibilities to fully function, as ill-health reduces the full possibility for a person to choose the life they want to live (Sen, 1985 in Anand et al., 2006, pp. 16, 17, 18).

This thesis is discussing what the barriers and enablers are in implementing two m-health systems, and whether they can contribute to quality and equitable access to health in Kabarole. Can the m-health services evaluated in this thesis contribute for quality and equitable access to health? Diseases that are avoidable and unnecessary can be treated. Health inequity deals with health inequality that is not only unnecessary and avoidable, but also unfair. So implementing health services can potentially lead to a more just allocation of resources (Anand et al., 2006). Health equity highlights that health is not only influenced by access to healthcare, but also public policies and social circumstances (Anand et al., 2006, p. 2). Disease surveillance through m-health systems can lead to quality and equitable health care, and in providing quality health care, it presupposes that the services given increase the livelihoods of people (World Health Organization (WHO), n.d.). However, a focus on the social context and circumstances is important in order to form the needed policies. Equity is also mentioned in the Ugandan National eHealth Policy, as a guiding principle in policy-making when providing equitable access to electronic health information and services (Ugandan Ministry of Health (MoH), 2016, p. 27). The Enhance Visual Assessment 'EVA'

system (EVA) which is used for cervical cancer screening, and are one of the m-health systems evaluated in this thesis, could be discussed in relation to equity, since it provides services to a group of patients were the social circumstances is affected by low-resource settings. Cervical cancer screening supported by the EVA system, could contribute to improved health care services of quality. As with the mTrac (mobile tracking) system, the second m-health program evaluated in this thesis – since health equity is not only influenced by access to healthcare, but also policies, the challenges and opportunities that health workers experience when using mTrac is interesting to discuss, since it is implemented by the MoH in all Ugandan districts. Whether the m-health systems lead to quality and equitable health care will be discussed.

M-health is a component of e-health, and is defined as "medical and public health practice supported by mobile devices, such as mobile phone, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices (World Health Organization (WHO), 2011, p. 6)".

The Global Observatory for E-health within the WHO has organised m-health programs into six categories:

> 1. Communication between individuals and health services (Health call centers/health care telephone helpline. Emergency toll-free telephone services)
> 2. Communication between health services and individuals (Treatment compliance. Appointment reminders. Community mobilization. Awareness raising health issues.)
> 3. Consultation between health care professionals (Mobile telemedicine)
> 4. Intersectional communication in emergencies (Emergencies)
> 5. Health monitoring and surveillance (Mobile surveys – surveys by mobile phone. Surveillance. Patient monitoring)
> 6. Access to information for health care professionals at point of care (Information and decision support systems. Patient records). (World Health Organization (WHO), 2011, p. 12)

What m-health services in Kabarole is this study dealing with?

This study is evaluating two m-health systems that health workers use in the Kabarole district. As mentioned earlier in relation to equity, the EVA system is a portable m-health device for cervical cancer screening, diagnosis, and treatment. The EVA system has an integrated smartphone, LED-lighting that visualize the cervix and contains of a lens that focuses on the cervix. It is Internet-connected, uses Bluetooth, and enables colposcopy-grade image (M.B &

Subashini, 2019, p. 118; Mink & Peterson, 2016, pp. 1, 2). Colposcopy is an instrument used for visual examination of the vagina and cervix (Merriam-Webster, n.d.-b). In this case, cervical cancer screening is done by visual inspection under acetic acid (VIA) combined with the use of the EVA system with cold coagulation treatment (Knowledge for change [K4C], n.d.).

The EVA system is part of the mobile telemedicine category, which involves consultation between health care workers. With 10.22 million women within the ages of 15 years and over at risk of developing cervical cancer in Uganda, and women with HIV who have a risk of 6 to 8 times of cervical cancer – there is a need to scale up cervical cancer screening of women (ICO/IARC Information Centre on HPV and Cancer - Uganda, 2018 in Knowledge for change [K4C], n.d.).

The second m-health system evaluated is mTrac, which is part of the diseases surveillance category, which is an SMS-based monitoring system for reporting of notifiable diseases, drug stock levels, and maternal and neonatal deaths. Every week, health workers use their mobile phones to submit cases of notifiable diseases, drug stock levels, and maternal and neonatal deaths (Ugandan ministry of Health (MoH), n.d.-a; Unicef, n.d.). Health workers use Health Management Information System (HMIS) papers, which are paper forms used to collect health information data. The goal is to address health delivery problems by receiving evidence about health clients (Wandera et al., 2019, p. 2).

Why is e-health and m-health important, interesting and useful?

The rapid increase of mobile phone penetration in African countries over the last decades offers many opportunities in delivering health care services to those who need it most. With nearly half a billion people subscribed to mobile services in Sub-Saharan Africa, and the rise of smartphones reaching 50% of total connections in 2020 (Apunyu, 2011, p. 1; GSM Association, 2020), there are many opportunities to provide healthcare services to people in remote areas and allow for access to health care. All around the world, there has been given attention to the field of m-health to improve health care (Heerden, Tomlinson, & Swartz, 2012, p. 393). Over 90% of the world is covered by a mobile network, and 83% of the World Health Organizations' (WHO) member states are having m-health programs (Skolnik, 2016).

Several of the United Nations (UN) agencies and international donors believe that the latest development in information and communication technologies (ICTs) could provide ways to transform health information systems and help policymakers with the data they need to make choices in the health sector that can reach the least disadvantaged (Huang, Blaschke, & Lucas, 2017, p. 2). African countries are employing e-health as a means to improve access to quality and equitable healthcare for disadvantaged and vulnerable communities. Nevertheless, most of the e-health and m-health solutions are funded by donors and do not work together to improve the health care services, as well as lacking sustainability (Kiberu, Mars, & Scott, 2017, p. 1 & 6). However, in Uganda, there has been a growth in the information and communications technology industry. Rural communities have seen opportunities in the growth of ICTs, which has seen results in healthcare in the area of disease control and prevention through disease surveillance (Kiberu et al., 2017, p. 1). Uganda is therefore a well-chosen case to study barriers and enablers ICTs. The use of the SMS-function with health information data in m-health programs help policy-makers in doing disease control and prevention.

M-health offers tools for activities such as disease surveillance, primary health data acquisition and analysis, support for community health workers, tele-consultation, tele-education, research, and patient management (Kiberu et al., 2017, p. 1). Using e-health can improve for access to healthcare for Ugandans by allowing doctors to consult and diagnose remotely, access patients' medical information, and provide district health information surveillance (Kiberu et al., 2017, p. 2). Using the mobile phone-based Enhance Visual Assessment 'EVA' system (EVA) to do cervical cancer screening on women is one way midwives and nurses in the Kabarole district is using m-health to receive assistance in diagnosing remotely to decide whether it is a positive or a negative result of the screening (Knowledge for change [K4C], n.d.)

Uganda was also ahead of Norway in using m-health to do disease surveillance of the Covid-19 virus. The District Health Information Software 2 (DHIS2) platform was used to collect data, and track truck drivers traveling across borders with essential supplies, to help prevent new cases of the disease (dhis2, n.d.; Johansen, 2020). The Health Management Information System (HMIS) platform DHIS2, which is developed at the University of Oslo (UiO) with

Norwegian aid money, and supported by WHO, UNICEF, the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) among others, is the same platform that is being used in the disease surveillance application mTrac (Mobile Tracking) (Cummins & Huddleston, 2013) which is among the m-health programs being discussed in this thesis. Among the several possibilities with using m-health applications, the African region, has seen the broadest use of m-health in disease surveillance (WHO, 2011, p. 6).

One of the technologies studied in this thesis deals with cervical cancer. Uganda is ranked seventh among the countries in the world having the highest incidence of this cancer type (WHO ICO, 2010, September 15 in Knowledge for change [K4C], n.d.). A young population with high fertility rates, where half of the population is younger than 15 lays pressure on social health services (MOFPED, 2019, 23 Oct), nevertheless young population groups are more prone to use technology, and the health care system of Uganda is in access of several e-health and m-health programs, were the Ugandan government have given special attention to the use of them. The Ugandan Ministry of Health (MoH) have prioritized the use of e-health programs, and view the use of e-health policies as a key enabler in delivering good health (Ugandan Ministry of Health (MoH), 2016, p. 14).

There is a will to implement m-health programs to meet the health challenges, but there are few evaluations. Only 12% of all m-health activities in developing countries have been evaluated (Skolnik, 2016, p. 482). Most m-health applications in Uganda are part of projects run by non-government organizations (NGOs) that offer healthcare within particular communities in Uganda (Kiberu et al., 2017, p. 3). Implementations of digital health innovations have met some criticism for being small-scale and only focusing on small populations. Some concern have also been put on the enthusiasm for ICT, and on the assumption that "good" innovation will garnish and improve the health system challenges, without identifying what the health system challenges are and assess whether ICT can play a role in tackling these issues (Huang et al., 2017, p. 2).

Some of the barriers in the African region were operating costs, knowledge, infrastructure, and policy (World Health Organization [WHO], 2011, p. 66). In Uganda, some of the barriers are the lack of evidence of what works, and the lack of a readiness assessment of e-health services concerning physical infrastructure, technology equipment, user and managers' skills,

policies, regulations, and guidelines (Kiberu et al., 2017, p. 7). In the area of telemedicine, which is in the WHO-category of communication between health care professionals, lack of knowledge and skills, lack of policy, and resistance from health care workers were some barriers. In this thesis, health workers experiences with the MobileODT Enhance Visual Assessment 'EVA' system (EVA) will be discussed. One of the questions is whether they have experienced the same barriers.

Further, there is a growing occurrence of diseases such as cardiovascular diseases and cancers that account for over a quarter of deaths in the country (World Health Organization (WHO), 2017, p. 3). However, Uganda has reduced the proportion of people below the national poverty line by 50%, hence reaching the 2015 Millennium Development Goals' first target five years ahead of the deadline (United Nations Uganda, n.d.). To meet these health challenges, the landlocked country of Uganda, where 85% of the population lives in rural areas and is served by only eight physicians per 100 000 people (Uganda, n.d., p. para. 1), the country is eager to use m-health to meet some of these challenges. Together, these critical challenges and opportunities are interesting to study because they might help advise policy-makers on improving the use of m-health systems.

2. Methods

A qualitative research design is appropriate since the objective of this study is to explore the barriers and opportunities that health workers experience in using m-health applications in the Kabarole district. Qualitative semi structured interviews give thick descriptions, open-ended questions allows the participant to answer with their own words, which will increase the validity of the answers, and produce a rich understanding of the social and cultural context. Qualitative validity is one of the benefits in qualitative research designs, as it is based on whether the results are accurate from the standpoint of the researcher, the participant, or the readers of an account. As rich, thick descriptions give detailed results, combined with detailed descriptions about the setting and many perspectives about a theme, it makes the results richer and more realistic (Bryman, 2016, p. 392; Creswell, 2009, pp. 176-178).

The first interview guide was made for health workers working within my host organization who are working or have been working in a cervical cancer-screening project at a local health delivery service, who are using the mobile phone-based EVA. The second interview guide was made for health professionals who use mTrac on a daily basis, and the third interview guide was made for nurses and other health workers on e-health. I wanted a selection of professional backgrounds, which use m-health tools in Ugandan health care service deliveries. I also wanted participants who works with public health and is implementing e-health tools and learn about their views of barriers and opportunities in using the tools. Third, I wanted to interview nurses and doctors on their experiences of the possible barriers and opportunities in using e-health tools in the Ugandan health care service. The interview guides were made based on barriers found in previous studies examined in the literature review.

Semi-structured interviews helps the researcher keep an open mind about the contours of what hen needs knowledge about, to help concepts and theories emerge out of the data (Bryman, 2016). This helped me to understand the barriers and enablers in implementing m-health programs. Semi-structured interviews follows a set of questions and gives the researcher freedom to do follow up questions (Magnusson & Marecek, 2015, p. 62). I wanted the interview situation to be open, allowing the informant to freely share their experiences, but within the topics of barriers and possibilities in using m-health in their daily work life. The interview guide includes questions on how the m-health tools work and what the opportunities and challenges are with using m-health systems on the ground. Do they experience the same challenges that have been found in other studies? What do they see as opportunities in using these systems?

Oslo Metropolitan University (OsloMet) has a cooperation agreement with my host organization Knowledge for Change (K4C) in the field of study, which led me to Uganda. Initially, I was interested in what opportunity mobile phone technology offer in Uganda, and if it can help reduce unintended pregnancies, possibly by making contraception more accessible through health education towards adolescents. The topic was presented by my host organization through the cooperation agreement with OsloMet before arrival. On site, I learned that there were not many possibilities to get interviews on this topic. Through the cooperation agreement with my host organization in Uganda, I got on the ground experience

and first-hand knowledge of the Ugandan health care systems barriers and opportunities. I learned about the possibilities of mTrac and the mobile phone-based EVA, and decided to change my research topic.

Research design

This is a case study where I explored what contributes to m-health in the Kabarole district, Uganda. Case studies are crucial when you want in-depth understanding of a case, like questions as "what is the complexity and particular nature of the case in question?" (Bryman, 2016, p. 66). Choosing the health delivery service community in Kabarole as a case, a fieldwork, semi-structured interviews, and participant observation were all important and supplementary methods used to collect the data. Without the fieldwork on site, I would not get access to informants, and without participant observations, I would not get to know the cultural codes about how to do things within the health care system in the Kabarole district.

In order to understand the topic of study, and get a full grasp on the state of the art of m-health, a literature review was conducted before arrival (Bryman, 2016, p. 6). The literature review set the base for the study, informing me on what is known about the research area, and how previous research studied the topic in a critical way (Bryman, 2016, p. 8). A literature review was done using the keywords "contraceptives or family planning and mobile phone technology or m-Health and Africa" in all databases in EBSCO host, including Medline. The literature review was also comprehended with hand searching in the discovery search engine Oria on m-health and e-health in Africa, in order to get additional studies on what is already known on e-health and m-health. Kiberu et al. (2017) published a systematic literature review in 2017 on e-health in Uganda.

The barriers and enablers found in Kiberu et al. (2017) was useful in making my interview guide. They conducted a systematic review on barriers and opportunities to implementation of sustainable e-health programmes in Uganda. Since the systematic review was done between May and December in 2015, and completed in 2017, their data are probably still relevant for my collection of data in 2020. What promotes the use of e-health in Uganda is the use of large-scale e-health projects. They found that infrastructure, policy challenges and unsustainable e-health projects were barriers. In infrastructure, unstable power delivery was a

barrier. Routine reporting in the healthcare system when doing disease surveillance was improved, since the former paper-based system was replaced. Policy challenges were seen due to lack of guidelines on how to use telemedicine among others, insufficient know-how and skills of the use of it, and resistance to adjustment.

Huang et al. (2017) did a systematic review that became relevant for my interview guide. Kiberu et al. (2017) is also mentioned in Huang et al. (2017). As they published their review in 2017, their data are still relevant for my study in February and March 2020. They stress the need of knowing health system challenges and barriers before implementing e-health programs, which I will soon discuss.

Global Observatory for E-health published a survey on m-health in 2011, which became relevant in producing my interview guide, as well as understanding the state of art of m-health. Their results are based on the second global survey on e-health, which was published in 2009. Since it was the first time the Global Observatory for E-health within the World Health Organization (WHO) (2011, pp. 1, 67), published a survey solely based on m-health, it was crucial to use their data in understanding the context. As the survey was published in 2011, their data are still relevant for my study in February and March 2020. In 2011, the survey report described that cellular network coverage were growing, and the increase of broad coverage of mobile phones were acknowledged and seen as a opportunity to implement m-health programs. In Uganda today, both cellular coverage and Internet coverage is increasing, as the country is widely covered by 3G networks.

Besides the literature review, I included the Global Diffusion on E-health's survey report on how e-health programs can lead to Universal Health Coverage (UHC), which was published in 2016. As they published their survey report in 2017, their data are still relevant for my study in February and March 2020.

Choosing a deductive approach, basing my interview guide on previous studies with theories of barriers and enablers in using m-health, means that I could test theories found in previous studies on my participants. Whether the participants experience the same barriers and enablers as found in previous studies, will later be discussed. Using the toolbox of grounded theory,

which this study is inspired by, meant moving back and forth between data and theory, which is a research strategy in grounded theory. Grounded theory is a research method developed by Glaser and Strauss (1967) were coding and constants comparison of data is done (Glaser and Strauss, 1967 in Bryman, 2016, pp. 24, 567). Further, I used the steps of a thematic analysis to code, categorize and present the data. Thematic analysis is a method that identify, analyse, and interpret patterns of meanings ('themes') within qualitative data (Braun & Clarke, 2006; Clarke & Braun, 2017, p. 297). Instead of using an inductive approach suggested by a grounded theory approach, were data emerge out of theories, I found a deductive approach to be more appropriate to answer my research question.

Fieldwork

Three months of exploration during a fieldwork of the impact of m-health policies and projects was undertaken "on the ground". In addition, I was able to interact with people within my host organization, which consists of Ugandans with health worker background and within social work. Doing a fieldwork in the natural setting of the participants gives you an access and understanding of a social problem that is valuable.

The field study gave me knowledge that I wouldn't get by just doing the interviews. These interactions helped me to understand the social context. With this in mind, the health situation in Uganda became visible when I visited a health delivery service that has an immunization program for babies. Uganda has a young population, where the fertility rate is 5 children per women (The World Bank, n.d.). This became clear when I followed a health worker to a health delivery service, and helped them to do the paper-based reporting of the babies weight and their previous immunization vaccines. I received useful insight of how a Ugandan local health delivery service operates and the challenges they experience. This will be more thoroughly presented in the result chapter.

Those challenges, which are documented in different studies presented in the literature review, are challenges of infrastructure with power deliverance as well as challenges in other areas of infrastructure (Kiberu et al., 2017). The fieldwork gave me a better understanding on how much pressure that is put on the health care system when the birth rate is high and combined with few resources. Challenges in infrastructure are also seen in rural villages that

experience a long way to health services. Lack of drugs and physicians and cases with epidemic diseases such as HIV/AIDS, and infectious diseases such as malaria is putting a pressure on the health care system. Combined with unstable drug-stock levels and antimicrobial resistance in Uganda being in some cases 80% because of misuse and overuse, made me see a connection between the health care systems drug stock levels and how the m-health tool mTrac might help stabilize drug stock levels. The availability of antibiotics without prescription, with drugs given over the counter at unlicensed drug stores is a part of the problem. Health workers overprescribing drugs to patients for a variety of reasons is also leading to antibiotic resistance (Uganda National Academy of Sciences (UNAS), 2018; UNAS. CDDEP. GARP-Uganda. Mpairwe, 2015, p. 1; World Health Organization, 2020, 13 October.).

What opportunities and challenges health workers are dealing with, became clear when I spent time with Ugandan health workers and researchers in my host organization, who were working on a project to reduce antibiotic resistance in health care deliveries. Gaining knowledge on these issues, gave me contextual knowledge on what m-health tools can offer for disease surveillance. Having conversations with them, it gave me contextual knowledge on what disease surveillance can help reduce. As discussed in the use of real time data reporting of diseases, m-health tools used for disease surveillance could decline the quick stock out of drugs. This will be more fully presented in the result chapter.

These interactions and experiences helped me to make a better interview guide than what it would have been without these insights. The fieldwork also helped me to make connections. It was challenging as it took quite a lot of time to get interviews, but after visiting a local health care service delivery and two other health care service deliveries during observations and talking with nurses, midwifes and Ugandan researchers in my host organization, the snowball sampling started to roll.

Sampling

My participants were recruited with help from my host organization, who gave me access to participants, using a purposive sampling method. The participants were connected with reference to the goals of the research, namely barriers and opportunities in implementing e-

health in the Kabarole district. In addition to health workers in the data department working with mTrac on a daily basis, I also recruited health workers working with the EVA system, and third a selection of someone with a macro-perspective who are implementing e-health tools. I sat down with researchers and workers within the organization, and talked with them about my research question and discussed my interview guide with them.

Since I was present on site, I could use a snowball sampling method when meeting the participants. As described in Bryman (2016, p. 202), using the snowball method meant connecting with my participants who were all relevant for my research objective. The participants were all health workers from local and public health delivery services. I wanted to collect data on the social context and their experiences on barriers and opportunities in using these tools in the Kabarole district. In addition, I got in contact with a public health supporter, who is working on supporting hospitals with computers and training them in using m-health tools in the health care services.

Thematic analysis

I here present the process behind the semi-structured interviews and participant observations and how they were analyzed with a thematic analysis approach.

Semi-structured interviews

I conducted six semi-structured personal interviews. The interviews were produced in March 2020, were two interviews were done with health workers working with the EVA. Three interviews were done with data reporters who use mTrac, and one interview with a public health supporter. Gaining ethical clearance from large-scale organizations before the interview was challenging. While calling and sending e-mails, and getting declined for access to interview public health workers in one large-scale organization, I decided to focus my study on two m-health programs. Having an interview with one public health specialist and trained doctor gave me comprehensive descriptions and the participant shared vividly of enablers and barriers of m-health and e-health programs in Uganda.

After every interview, arriving at the house, I started making notes on my assumptions. I made themes from every interview that came to mind, and followed up on interesting insight from the participants by looking for new literature on m-health and searching for government documents. I made memos, as suggested in a grounded theory approach, on every participants interview guides, re-making my research questions as new insight came to mind. At the end of the research process in Uganda, I made tables with enablers and barriers were ten themes were identified at the beginning, compromised to six themes in the end back in Norway.

The semi-structured personal interviews were transcribed in Norway, were I listened to the recordings several times while transcribing them. After transcribing the interviews, I read all the interviews several times to get an overview of the data. When analysing qualitative data, using thematic analysis as a method is interested in identifying, analysing, and interpreting patterns of meaning or themes (Clarke & Braun, 2017, p. 297). When making tables I was interested to figure out if infrastructure challenges found in other studies still were meaningful themes to include in today's social context of Kabarole district in western Uganda. Like challenges of infrastructure. Is power supply still an issue as described in Kiberu et al. (2017, p. 2) systematic review? Using thematic analysis is helpful in analysing qualitative research, because it is a flexible method. Since I was exploring what opportunities and challenges that are found in Kabarole district, when using m-health programs, the method of thematic analysis provided me with a flexible approach (Clarke & Braun, 2017, p. 297). Several themes were doodled down in memos on my computer. These memos were made under my research questions in a document on my computer. Themes were written on a document under research questions that were made and changed as new perceptions came along. The memos were eventually made into more concrete themes that were chosen as relevant, which were discussed with other researches. Combining grounded theory with a thematic analysis approach was useful. Since I was living with a co-student at the K4Cs house, I could discuss my memos with her as well as other employees who have contextual knowledge. Themes were discussed with possible participants, who were not interviewed, as they were too involved in my projects as employees at K4C. Since I changed the research objective, going from m-health tools in using health information towards adolescence, a thematic analysis was useful as it is flexible. When using thematic analysis, I re-wrote the assumptions made in the memos on every participants interview guide, and inside the tables of the thematic analysis, as

new perceptions on enablers and barriers came to mind. At the last stage, ten themes were compromised to six themes, which will be presented in the results and discussion section.

Participant observation

Being on site, I could do participant observations. I did two participant observations at local health delivery services. Participant observation is a qualitative method were you partake or observe the activities that your participants do. Besides personal semi-structured interviews, participant observations might be the most prominent method in qualitative research. Participant observations are closely linked with ethnography. Ethnography is a strategy of study were the researcher interacts with a cultural group in a natural setting over a prolonged period of time were the qualitative method of inquiry includes, primarily, observational and interview data. It includes several data collection activities were the ethnographer follows the recipe of those activities – and among these recipes, participant observation is an important one. While doing the observations, researchers take field notes on the behavior and activities of the individuals. Beforehand, the researchers develop some probe questions to what they need to know (Bryman, 2016, p. 493; Creswell, 2009, pp. 30, 168). The method provides some benefits over qualitative interviewing, such as seeing through others eyes by being in the social context and setting of the participants, so that the participant observer can collect data on the reasoning between behavior and context. During participant observations, those behaviors' while conducting two participant observations, were seen when a health worker showed me how to use the EVA system to do cervical cancer screening. As it is with other qualitative research methods, it is a chance of getting biased if the researcher think the tool is good, and *want* the tool to work well – however, letting biases or assumptions go, and seeing through other's eyes, as described in Bryman (2016, p. 493), means that the researcher's immersion in a social setting could make the researcher better equipped to see as others see.

Though they were not participants, living in an environment where there were volunteers who worked as health workers in other K4C-projects, spending time with them, and hearing about their experiences in their everyday work lives were also a part of understanding the social context. As Creswell (2009, p. 169) points out, researchers often engage in several observations during the qualitative study. Being in the Kabarole district for a period of time and living in the house of K4C, I followed the social context of Ugandan health care workers,

by spending time with them weekly. During the research process, health care workers who were involved in K4C-projects often came by, and so, I often interacted with health workers who were involved in projects that took place in the natural setting of health workers. Such project is the 'The Cervical Screening Project', initially funded by nurses who were former elective placements, and saw the need for a service that provided cervical cancer screening of women. Included equipment here was the use of the EVA system (Knowledge For Change (K4C), n.d.).

Before and during participant observations, observations provide some accounts to consider. Besides seeing through others eyes, those accounts are sensitivity to context, the understanding of the language and different slangs or expressions that can occur, flexibility as it is more likely to uncover unexpected topics, and access to the setting, to mention a few (Bryman, 2016, pp. 493, 494). During the fieldwork, being flexible to unexpected topics was an advantage and part of my research design, as I wanted to explore barriers and opportunities in using m-health tools. That flexibility were shown, when a research assistant at K4C recruited a data reporter from the local health delivery center. The data reporter arrived at the K4C-house, and the research assistant introduced me to mTrac. Then, I introduced my research project and told the data reporter that I was interested in exploring challenges and opportunities in using m-health tools – the data reporter told me about mTrac. From there on, I decided to explore on challenges and barriers with mTrak.

I will now present the participant observations at the local health delivery services. Available and assessable health care is provided at the local health delivery service I did observations at. In preparing for the participant observation, I reflected on the sensitivity of context, and what questions to ask before going there. Going to a local health delivery service, it was important to be sensitive to context. This means mapping out the social context of people's behaviors, so that the associations between context and behavior is not artificial, and to prepare for probe-questions to ask while doing the observation. Creswell suggests making an observational protocol for collecting observational data (Bryman, 2016, p. 494; Creswell, 2009, p. 169). Doing a literature review beforehand, was part of mapping out the social context of Uganda. Knowing beforehand that there is a lack of physicians, I was interested in knowing whether this were the case at the local health delivery service (Kiberu et al., 2017, p. 2).

How did I prepare before doing the participant observations? I brought a notebook, which was sectioned into paragraphs beforehand with titles on what I wanted to know. Knowing that I wanted to explore what m-health tools have to offer. I asked what devices they use and if they use m-health tools. Then I followed up with asking how the equipment and how the tools works. The first time was for an introduction of the service, and what services they are offering. Curative and preventive services are offered at this health center. I followed health worker 1 there, and spent the day there. English is the official language spoken in Uganda, while they also have other languages. Beside English, the other languages spoken are Rutoroo, Rukigya and Runyankore (Utlendingsforvaltningens fagenhet for landinformasjon (Landinfo), 2008, p. 16). A central part of the health delivery service is providing services of maternal health, and also reproductive health services, such as giving out condoms and providing HIV/AIDS care. The health worker at the cancer-screening project is involved at the health service delivery. The health worker showed me around. Every Friday, health workers at the local health delivery service provide neonatal care for newborns. Parents do not have to pick an appointment, and they show up to get immunization vaccines.

I also went to another local health delivery service that offers the same services as the first and spent a whole day there getting a tour of the local health delivery service. Health worker 1 uses the EVA system to do cervical cancer screening. Talking with the health worker about the routines, while being explained on the use of the EVA system device gave me a better contextual knowledge on the social circumstances around how the device is used. Seeing open spaces with hospital beds that were not at use made me aware of challenges in the health care system. After getting back to the K4C-house, the thematic analysis started when making field notes about the notes that were written, were I wrote down all the assumptions on implementing mobile telemedicine – these also contributed to detailed thick descriptions, which were discussed about with K4C employees. Themes such as customer's rights, patient involvement, health education, and empowerment were in the end narrowed down to diagnosis. Notes on m-health systems in the health care service deliveries were also written. Further, the notes with assumptions were re-written on memos, and narrowed down to themes, which will be presented in the results section.

Ethics

Ethics and protection of the participant's privacy in qualitative research is crucial, and was evaluated at every step of the research process. This was done every time before reaching out to a possible participant. During the collection of materials, and reaching out to participants, it was challenging to balance the role of researching and collecting data during the fieldwork. But I do not think I violated ethical principles dealing with harm to participants, lack of informed consent, invasion of privacy, or deception (Knowledge For Change (K4C), n.d.). As (Bryman, 2016, p. 135) says, ethical implications can occur when you are doing a participant observation, and is challenging because you have to invest your personal capabilities as a person, in order for it to be successful. Balancing the ethical implication during the fieldwork, and while doing the participant observation, was something I evaluated before and after arrival at K4C.

In getting access to informants, I gained important knowledge on how principles of ethics affect the research process, and the ethical dilemmas that can appear. Those were seen while getting access to participants in large-scale organizations. The principle of whether there is harm to participants, was something that I had in mind at all given time, which meant not interviewing participants who had the risk of loosing their jobs or were ethical clearance were lacking from their work places. A suggestion to future students, who is going to conduct fieldwork in vulnerable communities, is to evaluate the ethical principles extensively at the beginning of the research project, and ask where the host organization has ethical clearance from. Nonetheless, the Ugandan researchers at the host organization on site met some questions I had on ethical dilemmas. I reached out to the Ugandan researchers working there on issues related to privacy and informed consent, and evaluated the ethics and protection of the participant's privacy at every step of the data collection.

How did I protect the participant's privacy?

Ethical clearance was first applied and approved from the Norwegian Research Centre (NSD), were it was reported that the selection of participants would not share sensitive information. Certain data were not collected and presented due to recognition, and because it could be traced to individuals. During the fieldwork, I changed my research topic, and with help from

my supervisor and the counsellor at NSD, I applied for a new ethical approval, which again was approved.

Every participant got an information sheet with information about the research project. They got information about the research question, the purpose of study, and contact information on the person responsible for the study, and my contact information. It was important to make it clear how their privacy will be protected. The recordings were handled confidentially. After the interview, at the end of the day, the recordings were copied into an encrypted storage device, and deleted from the portable device. The recordings were transcribed, and the personal information de-identified. The audio recording files, field notes, and transcriptions were assigned a pseudonym. The processing of personal data in this project is in accordance with the data protection legislation handled by the NSD. All participants could withdraw from the interview at any given time – also after the interview was done.

Validity discussion: using 4th Generation Evaluation techniques

Reviewing the validity of the study is crucial in order to investigate whether the study evaluated what the study was meant to study. By doing a literature review, talking with researchers before and after arrival about the state of art of e-health and m-health, I could test my assumptions on the opportunities and challenges in Kabarole, with them. This is referred to as internal validity, were I was testing whether my observations and theoretical ideas were appropriate (Bryman, 2016, p. 390). By living near the office of K4C I could reach out to them to discuss with them whether it was a connection between concepts and observations. As Bryman (2016, pp. 8, 390) describes, reliability and validity is connected with whether you are observing, identifying, or "measuring" that what you say you are.

Measuring validity in qualitative research differs from how validity is measured in quantitative research studies, as it means something else. Qualitative validity means that the researcher checks whether the accuracy of the results are true by implementing certain procedures, while qualitative reliability is about indicating that the researcher's approach is consistent across different researchers and different projects Bryman (2016, p. 8). In establishing that my results were reliable, I read through the transcripts several times. By listening carefully to the recordings, in order to transcript everything the participants say, I

had to rewind several times, so that the transcripts were written right. While doing interviews in Kabarole, I made sure that concepts and themes presented to the participant during interviews was the same throughout the interviews. Having three interview guides for every selection of participants, and consistently using them for the groups of selection, though with probing questions, was a way of making sure that the research approach was consistent throughout the research process.

Writing memos was also useful in reviewing the validity of my results. Comparing data and making memos about codes and their definitions is useful to make sure that there is not a drift in the definition of codes, or a shift in the meaning (Gibbs, 2007 in Creswell, 2009, p. 176). I made sure that the meanings of the codes were the same while coding the transcript, and I wrote memos while coding. By doing a thematic analysis beside this, I wrote notes in the tables using the same code, so that there were consistencies throughout the use of codes. Being on a fieldwork, I could also read through my field notes if there were confusion to a word that was coded, so it would hold the same meaning throughout the coding process.

An aspect of qualitative research designs is the use of open-ended questions in semi-structured personal interviews. They give validity that quantitative methods such as surveys cannot give, since the participants can use their own words. Quantitative research studies are interested in testing hypothesis on social phenomenon's, meaning that quantitative methods are testing if the predictions that the researcher makes about the expected relationships among variables holds truth (Creswell, 2009, p. 177). In qualitative research studies – whether the use of validity is a good measure is discussed. The meaning of measurement and validity is often something else in qualitative research studies than in quantitative research studies (Creswell, 2009, p. 127). It is argued that reliability, validity, and generalizability, are different from what holds quality in the thorough toolbox of qualitative research methodologies. Generalizing results in qualitative research studies are used in a limited way due to the fact that qualitative methods are not interested in generalizing results to individuals, sites, or places, but rather that validation is found in the actual descriptions and themes made in the context of a specific site (Mason, 1996, p. 21 in Bryman, 2016, p. 389). Hence, developing ten themes as I did in Kabarole district, after completing all the interviews were compromised to six themes in the end, and related to the social context and objective of study.

As themes were written down on memos, thereafter, themes were written down under research questions that was made and changed when new information was known. Validation can, for instance, be reviewed through the detailed descriptions in field notes. These notes allows for a better understanding of the social context. Qualitative research methods such as thoroughly conducted observations, personal semi-structured interviews, and fieldwork notes do give validity. Themes were written down on memos, and new literature was read again, which gave more validity to the results. This gave me a better understanding of the barriers and enablers to focus on among themes in the thematic analysis, which added validity.

Since I wrote field notes with detailed encounters of participant observations, developed themes that were minimized to six in the end – the validity of the study increased. All details during the research process are part of qualitative validity. Being on site was an advantage. By being on site, I was able to follow up on new information received on mTrac. Such information was part of the disease surveillance application that was not as known for the users in Kabarole district, as mentioned before the hotline function (Creswell, 2009). This will be presented in the result chapter. Nonetheless, if I would have collected data from Norway through personal semi-structured interviews, with participants recruited through K4C, the study might have been less valid. Being on site was an advantage for the validity of answers. Nonetheless, consistency in the data collection, how the data is presented, through facts, and a systematic account of how these results were analysed and collected is what gives validity.

In Kabarole, I could have used a mixed-methods approach, were I did a quantitative survey on how many people in the district that know about the possibility to use the hotline function of mTrac. But with the amount of time, and the Covid-19 pandemic affecting the collection of data material, there were not much time. Quantitative research methods such as surveys, already holds the answers, so measuring validity of results is trickier because of validating whether the answers given by the participants are valid. The participant answering a survey question could for instance have another answer in mind, than the ones given as survey answers. An issue could be the forming of the right research questions, and whether the questions would capture a good result with valid answers (Cummins & Huddleston, 2013, p. 60). Because of the restrains of the thesis, and lack of time in ensuring that survey questions

would be valid and meet the objective of study, I found qualitative research methods to be more appropriate in answering the research question.

Guba and Lincoln (1989) use different evaluative criteria's than validity and reliability by asking: Are the results trustworthy? Trustworthiness includes determining whether the results holds credibility, transferability, dependability, and conformability. I have decided to include these evaluative criteria's when I'm discussing my results, and whether previous barriers and enablers were trustworthy within the social context of barriers and enablers in Kabarole district. Within each criteria, there are resemblances to quantitative research, though Guba and Lincolns' perspectives differ from the quantitative view that there are absolute truths about the social world (Brock-Utne, 1996, p. 10). Although my thesis is not presented thoroughly through constructivist eyes, I find the evaluation criteria's from the constructivist methodology that Guba and Lincoln (1989) present useful. The social world in the constructivist methodology is made out of created realities. This means that the created realities do not exist outside of the persons that hold the realities. The created realities are not part of an objective worldview that exists apart from the person that construct them (Bryman, 2016, p. 390; Guba & Lincoln, 1989, p. 143).

Guba and Lincolns' (1989) 4th Generation Evaluation is a form of evaluation in which the claims, concerns, and issues of stakeholders serve as organizational foci – meaning that what qualitative researchers evaluate is based on what information that is needed, within the constructivist paradigm (Guba & Lincoln, 1989, p. 143). Stakeholder claims are about whether participants who, as (Guba & Lincoln, 1989, p. 50) puts it, sometimes willy nilly are being evaluated. The consequence is that these participants could be at risk when being drawn into evaluation. When doing a fieldwork study in the Kabarole district and collecting data on the challenges and opportunities that health workers meet when using m-health tools – I often got in contact with possible participants. Balancing the role between research and free time was challenging, but was something I had in mind and evaluated throughout the research process by following principles of ethics – which worked as a tool throughout the research process so that participants would not get willy-nilly evaluated. As a professor in the topic of Qualitative Methods and Research Design at OsloMet ones said, "Qualitative research can be

messy". Thus, 4th Generation Evaluation insists that interacting with humans in a manner of respecting their dignity, their integrity, and their privacy is crucial when evaluating.

Within the constructivist methodological perspective, the outcomes of evaluation are not descriptions of the way things really are Guba and Lincoln (1989, p. 14). Meaning that the results that I ended up with after completing semi-structured personal interviews, participant observations, and doing fieldwork in Kabarole district are not solely facts, but created through an interactive process that involves the evaluator, and the stakeholders that participated. I will now present the four evaluative criteria's.

Credibility

In evaluating if the results are trustworthy, credibility helps evaluate whether there is confidence in the truths of findings. Credibility has resemblance to internal validity, which is borrowed from quantitative research. Internal validity is if there is a match between the researcher's results and the participant's results. Establishing if the research holds credibility is about ensuring that members of the social word who were studied is included in confirming that the researcher has understood the social word of the participants (Guba & Lincoln, 1989, p. 12). In this case, credibility as a concept is used to evaluate if my data produced in Kabarole is presented as they were told, with the same meaning, as presented to me through my semi-structured interviews. By being on site, on fieldwork in Kabarole district, I gained contextual knowledge on what kind of opportunities and challenges that are met when using m-health. This gives my data credibility as I gained knowledge on the social world of my participants.

This technique often equals as respondent validation or member validation. It is a process whereby the researcher presents her results to the participants with an account of the results. There are several ways in doing so. Collecting a group of people within an organization that is connected to your data material is one technique. The researcher share to a group of people or organization some of his or her writing's and get feedback on whether they are credible (Bryman, 2016, p. 390; Guba & Lincoln, 1989; Robert Wood Johnsen Foundation, n.d.). Which was something I initiated at the house in Kabarole. By having weekly meetings with K4C on questions regarding our research, and living in K4C's house with the office in-house,

I could discuss my results with K4C if I had any reflections. In this way, I could get feedback from the same organization that initiated the measure to use the EVA in cervical cancer screening. When using credibility as a concept to evaluate your results, the focus is on the match between the constructed realities of the participants (stakeholders), and those realities that the researcher acquire from the results, and that are represented by the evaluator and attributed to various stakeholders (Bryman, 2016, p. 390).

When doing fieldwork, five techniques are acquired. Those are (1) Prolonged engagement, (2) Persistent observation, (3) Peer debriefing, (4) Negative case analysis, and (5) Progressive subjectivity. Being engaged on site, to overcome misinformation, is about ensuring that there is not any misinformation on what you are researching. Immersing yourself in, to understand the context's culture, is part of the technique (Guba & Lincoln, 1989, p. 237). Three months of exploration in Kabarole let me to immerse myself in the social context of health workers everyday life. By being there, it gave me an advantage to engage myself with K4C's everyday life. Being on site, I could get the necessary trust from participants. For instance, I conducted one interview with a participant at K4C. Since the participant was close to use everyday, I decided not to include the data material, as it would not be credible. However, presenting my results to the participant was useful in order to prevent any misinformation. As presented earlier, visiting the local health delivery service, made me understand the social context of Ugandan health care workers. Nonetheless also spending time every day with the organization, engaging with other volunteers who work at health delivery services, was part of the prolonged engagement.

The technique of persistent observation means doing sufficient observation. When doing the sufficient observation, the evaluator "identify those characteristics and elements in the situation that are most relevant to the problem or issue being pursued and (to focus) on them on detail" (Guba & Lincoln, 1989, p. 237). Combining this technique with prolonged engagement provides depth when collecting data (Lincoln & Guba, 1986a, pp. 303-304 in Lincoln & Guba, 1989, p. 237). Since I was doing participation observations, I was able to observe and combine these insights with the data material collected through personal semi-structured interviews. As described earlier, by visiting a local health delivery service, I was able to observe and engage in an immunization program. Combining the contextual knowledge I got at the local health delivery service, with other information gathered through

personal semi-structured interviews is making the researchers evaluate whether findings are trustworthy. With new information, this technique helped me to focus my research objective, and decide which themes that were most relevant. More on that in the results chapter.

The third technique within evaluating credibility is peer debriefing. Engaging with a disinterested peer, in extended and extensive discussions of ones findings, conclusions, tentative analysis, and, sometimes field stresses is done while using this technique. Using someone who has no contractual interest in the situation is done to evaluate if the results are credible. All participants were asked if they had any suggestions to questions I could have asked them in the end. This is also part of evaluating if the results are credible. It is also done to evaluate whether the questions asked in the personal semi-structured interviews were asked to cover what the participants saw as challenges and opportunities in using the m-health applications.

The fourth technique within evaluating credibility is negative case analysis. Revising working hypotheses, to develop and refine a set of given hypothesis (or parts of them), until it accounts for all known case, resemblance statistical tests for quantitative data (Guba & Lincoln, 1989, p. 237). Since qualitative research methods are not interested in holding answers, but rather discover and explain social patterns, this was not a technique I fully implemented. Since I was on a fieldwork, I went over my assumptions with two employees at K4C, sort of testing my hypothesis on assumptions I had on my research objective.

The fifth technique includes progressive subjectivity. When monitoring the evaluator's own data collection it is obvious that when collecting data, the evaluator do not go into the situation with a blank mind. (Guba & Lincoln, 1989, p. 238) suggest including this technique to ensure that that the evaluator's construct does not hold privilege. This is done to check that the evaluator does not collect data material in accordance to what the evaluator might expect to "find", or seems to become "stuck" on an assumption, before actually collecting the data. The last technique includes member checks. This is similar to peer debriefing, as your including your participants into your assumptions on what your evaluating – or as Guba and Lincoln puts it, your testing "hypothesis, data, preliminary categories, and interpretations with members of the stakeholding groups". This is the most important step to evaluate if the results

are credible, as you are testing whether your interpretations – or constructions – are in balance with those constructions of your participants. They include, assessing how the participant were reacting to a question, or by offering certain information. Further, it includes the participant the chance to interpret or correct the errors of answers. Participants get a chance to offer additional information – at the end of all my personal semi-structural interviews, I asked my participants if they had anything to add according to what we have talked about, or any suggestions to what I could have asked. Member checks also include a chance for the participants to judge the overall adequacy of the interview itself, and also confirm data details. While categorizing the data material in Norway, I asked one participant a follow-up question to get additional data. Member checks are done so that the constructions that are collected from participants are those that have been presented by the respondents in your research project. Evaluating credibility by doing member checks allows you to check that there are no misrepresentations of what the participants have shared Guba and Lincoln (1989, p. 238).

Transferability

Does my results have applicability in other contexts? Transferability is parallel to external validity or generalizability, borrowed from quantitative research methods. Nonetheless, in (Guba & Lincoln, 1989, p. 241) checking the applicability in other contexts is replaced by an empirical process for checking the degree of similarity between sending and receiving contexts. An important technique when evaluating transferability are thick descriptions, first used by the anthropologist Gilbert Ryle, and further elaborated by Clifford Geertz (1973). Guba and Lincoln (1989, p. 241). Checking similarity of contexts is done by producing thick descriptions. Conducting a fieldwork, being in the Kabarole district for a time period, doing personal semi-structured interviews, and participant observations – allowed me to produce rich accounts of the social context (Guba & Lincoln, 1989). As I was collecting data on m-health' barriers and enablers in Uganda and health workers experiences with these, the results produced out of the Kabarole district could be applicable for other similar health systems and contexts. Since this study is based on previous literature, complemented with semi-structured interviews, observations, and fieldwork – that produce thick descriptions with details of the results, context, and insights, the study may be applicable in other contexts. As noted in (Guba & Lincoln, 1989, p. 241; Robert Wood Johnsen Foundation, n.d.), the goal of transferability for constructivists is to develop all possible hypotheses for *this study,* and set

out a wide and careful description of the time, the place, the context, the culture were these hypotheses are essential.

Dependability

Moving on, whether results are trustworthy is concerned on whether there is stability of the data over time. Guba and Lincolns' (1989) dependability resembles reliability, from quantitative research methods. When evaluating dependability, it excludes changes that occur because of methodological decisions over time by the evaluator. Yet changes in methods do challenge the reliability of data. A strength in qualitative research methods is that you can develop new assumptions or interpretation in the research process as new data and information occur along the way. As noted in Guba and Lincoln (1989, p. 242), methodological changes and shifts in constructions are expected in the research process when the research designs' goal is to receive refined constructions. It is a characteristic within qualitative research, that you can change research questions as you go along the way – so, when evaluating using the concept of dependability, such changes and shifts are part of a maturing data collection process. When using this technique, two kinds of issues are explored. How is the process an established, trackable, and documentable process, and second how are various data collected actually confirmable? Such questions help evaluate whether data collected are credible and trustworthy, and transparent so that outside reviewers of the evaluation can sightsee the process, judge the choices made, and understand the scope of factors in the context that led to the choices made by the evaluator.

Conformability

Conformability includes evaluating that your research holds a degree of neutrality, and that results are not shaped by the researcher's bias, motivation, or interest. As with examining objectivity, conformability wants to assure that data, interpretations, and outcomes of inquiry are based in contexts and persons apart from the evaluator (Guba & Lincoln, 1989, p. 242; Robert Wood Johnsen Foundation, n.d.). Conformability is done to evaluate the inquiry, so that the results presented are not made out of the evaluators imagination, as Guba and Lincoln (1989, p. 243) put it. When evaluating the data material, results, and analysis – using conformability techniques helps for the data material to hold an amount of neutrality. By

doing conformability audits, borrowed from fiscal processes, the techniques are applied so that data can be tracked to their sources, and the logic used to assemble the interpretations are coherently structured and used throughout the case study. This technique also evaluate the trustworthiness by ensuring that the logic throughout the case study, presented in interpretations are coherent and explicit throughout the case study.

Processes are borrowed from the fiscal audit were they are concerned on the transferability of the accounting processes. Though, the difference is that in the qualitative research process, the data collector is concerned with the quality and appropriateness of the data collection process. As written on in the part of the validity of study, consistency is important. Using techniques from conformability is done to ensure that consistency and so, the dependability audit asks whether data; numbers, facts figures and constructions presented are part of the original sources Guba and Lincoln (1989, p. 243). When evaluating the disease surveillance application mTrac and the EVA, building assumptions, results, and analysis on facts is part of evaluating the conformability, and whether the research holds neutrality, so that the results are not build on the researcher's bias, motivation, or interest.

3. Results and discussion

This section will first present and discuss the thematic analysis. Thereafter, this section will relate the thematic analysis to Guba and Lincoln's two methodological concepts credibility and transferability, since they were the most important concepts. Lastly, the concepts of equity and quality access to health care will be analysed.

The thematic analysis

By a focus on barriers and enablers of the m-health technologies in mind, the thematic analysis identified six themes: Incomplete data, drug stock levels – distribution of essential medicine, training, maintaining internet access, disease surveillance, and diagnosis. The content of the themes were first presented in a table of enablers, barriers, notes, and theories.

During the thematic analysis I first identified ten themes, but by merging I ended up with six themes. The grounded theory presented in the methods section, were useful in discovering patterns in the data. To get an overview of the data collected through personal semi-structured interviews, memos were written on every participants interview guide with assumptions, and further developed into new memos as new data and insights on the themes became focused. For instance, it meant going back and forth between data, and checking information received through observations. Field notes contributed to thick descriptions of the social context, which added an understanding of the health systems barriers and enablers. This chapter also discuss the results in relation to the research objective: What are the barriers and challenges in using m-health in the Kabarole district, and how does it allow for access to quality and equitable health care?

The ten themes were real time data – better surveillance over diseases in the country, personal data Storage, Internet connection, lack of drugs, infrastructure, empowerment, usability, health education, patient involvement, and customers right's. The two themes incomplete data and drug stock levels – distribution of essential medicine were merged and developed from the themes real time data – better surveillance and lack of drugs. As more discoveries were done on the possibilities of using mTrac, there were other themes that I could have focused on in my results – as the usability of m-health tools, for instance. However, I decided to focus on drugs, as it is a crucial resource in health care deliveries, and was mentioned by several participants. Challenges of unstable drug supplies at health facilities were also a theme that was mentioned by researchers at K4C, and a challenge talked about among participants. During the participant observation unstable drug supplies were talked about. By using mTrac, drug stock levels of tracer medicines are being reported, which are essential medicines that meet prioritized health care needs of the population (Demessie, Workneh, Mohammed, & Hailu, 2020, p. 83). However, incomplete data was a barrier when data reporters collected health information from hospital wards, and were mentioned several times. As access to drugs were mentioned among health workers as a resource that were lacking, and is a vital health resource in all health care systems – access to regular drug stock levels were focused on. But, participants also mentioned that there were a clearer distribution of drug stock levels, and that mTrac enabled distribution of drugs to health care deliveries.

Training was chosen as a theme as it could enable a better use of m-health systems, and further give quality and accessible care to patients. Training can be given in several ways, and is the process of learning the skills that is needed to do a particular job or activity (Cambridge Dictionary, n.d.). Training emerged as a theme out from health education, with memos written on disease surveillance, and became focused on when interpreting patterns in the data. Training was also mentioned by participants, and linked to other themes such as medical education, in relation to the use of mTrac in health deliveries. However, previous barriers of policy challenges with lack of guidelines in how to use telemedicine, which the EVA system is categorized within, met barriers of insufficient know-how and skills in how to use it (Kiberu et al., 2017, p. 4). This seemed to not be the case with the EVA system, though a barrier when data reporters use the mTrac to collect health information is incomplete data, which could be met with proper training.

Diagnosis is a theme that was narrowed down from health education and customer's rights. Diagnosis is crucial in health systems and delivery of health services, and is done by identifying diseases from its signs and symptoms (Merriam-Webster, n.d.-c). By evaluating how the EVA system works, and how it enables the diagnosis of a patient when used for cancer screening – diagnosing could have enabled health education towards patients on cervical cancer, and enabled trust between the health worker and the patient. Writing memos on health education were done since health workers who used the EVA system mentioned how the tool is used to educate patients on cervical cancer. The use of the EVA system could have enabled trust between the health worker and the patient, and strengthen the nurse-patient relationship. Required trust involves the patient feeling secure, and trusting that the world is a safe place to be, and that someone helps when they are in need (Eide, H. og Eide, T. 2010 in *Hvordan kan sykepleier skape god relasjon med pasienten basert på tillit?*, 2014). For instance, looking into the barriers and enablers by using the EVA system in cancer screening, one theme and enabler that came to mind was patient involvement, and empowerment. In this context, empowerment is defined as a process of behavioural change, which leads to patients becoming more knowledgeable, taking control over their disease, and treatment (Nielsen & Johannessen, 2019, p. 55). When writing themes in memos, I had the chance to go back and read literature that was relevant for these themes, and such literature were literature on trust between the nurse and the patient.

When using m-health tools, maintaining Internet access is crucial. Maintaining Internet access emerged out from two themes: Internet connection and infrastructure. Firstly, memos were written on infrastructure. As infrastructure covers several areas, such as power supply, Internet access – and connection, they were narrowed down and focused on maintaining Internet access, since maintaining Internet access was a barrier when using the EVA system. In maintaining Internet access, barriers such as unstable power delivery occurred while doing participant observations, when using the EVA system. Power delivery were a barrier discussed in Kiberu et al. (2017, p. 2). However, there were some contextual differences between health delivery services. Access to power supplies were not a huge challenge at the public health delivery service, and Wi-Fi connection were free, but at smaller health deliveries such as the local health delivery service there were no access to Wi-Fi-connection – the EVA system were, for instance, carried to the K4C house, that, as mentioned, experienced problems with maintaining internet access due to unstable power.

Diseases surveillance were chosen as a theme, since it rose out from the theme real time data – better surveillance over diseases in the country, as well as usability and, personal data Storage. Usability measures how well users in a specific context can use a product to achieve a defined goal (Interaction Design Foundation, n.d.). In this case the mTrac-program. As the themes were studied through memos and made their way to the thematic analysis – they were all part of possible barriers and enablers, since they were seen in the patterns of the data. Disease surveillance is public health surveillance where health-related data is collected, analysed, and interpreted to control diseases, and prevent outbreaks (Kiberu et al., 2017, p. 1; World Health Organization (WHO), n.d., p. para. 1). Data reporters track diseases through mTrac weekly. One barrier that was found in previous studies was sustainability, and was linked to how m-health programs lacked sustainability, as they were small-scale (Huang et al., 2017; Kiberu et al., 2017). However, the mTrac system is a large-scale program implemented in all districts. In disease surveillance, costs were an enabler as it was cheap to implement the SMS-service in the public health service deliveries, as well as in the local health service delivery.

Incomplete data

Incomplete data was a barrier when data reporters used the mTrac system to collect health data from the wards in health service deliveries. Data reporter 2 at a public health service delivery does weekly data collection on ward. When collecting the health information, incomplete data were mentioned as a barrier.

> (…) we find when there is some data missing and you know when like, us in the data record, definitely you don't report on something that is not there, you just report on something that is documented. So actually there is incomplete data. (Data reporter 2)

Incomplete data hinders that the accurate health data is being sent to the MoH. However, one issue have been the reporting of incomplete data. Because of system problems, messages were sent twice, and there were issues when messages were texted, due to the service:

> When the system is down. You can send a message and you find that it is overloaded, over worked, the system like… The message doesn't come. Doesn't go, the messages you sent doesn't go, and the feedback not coming back very fast. It delays. (Data reporter 3)

As described in the method section, data reporter 3 was the participant who introduced me to mTrac. While showing it me, there were some issues when sending the codes with health information through mTrac. This contributed to health data being sent twice with incomplete data.

Training

The data reporters who used mTrac were trained and monitored on how to use it, however one barrier is the collection of health data from the wards. For instance, barriers of incomplete data sent through the mTrac-program could be enabled through training:

> Yeah age. You don't know whether it's a female. You don't know the name. You go back to read the name. You find out that the names are similar. You get like confused. You're like whom shall I, whom can I ask. Incomplete data to the government. But through care, ease and training, I think it will improve. (Data reporter 2)

As presented above, data reporters meant that when they collect health information through mTrac – the information collected is sometimes inaccurate. Data reporter 2 thinks people could improve:

> I think people could improve, if they get to know the importance of data. Continuous medical education. Like, you call them, and like you put them in a hall, and you start training them like about the importance of data. (Data reporter 2)

The participants believed that the importance of training when implementing m-health is essential, and it affects the use of the programs. As data reporter 2 mentioned, continuous medical education or training of the importance of data could enable more accurate data being reported to the MoH – which again could enable more precise decision-making, and policies. If health workers could learn more about the importance of data, it could be improved:

> And maybe they can change and they can know the importance of data. Cause for me when I go to collect data, and they find something missing, definitely that's inaccurate data, so maybe talking to the nurses on ward and giving us a positive response. But … talks to them when I find something is not straight I told them and I say: what's happened here. Why is this person not having age. Why is this persons diagnose is not documented. (Data reporter 2)

As with the EVA system which is done in cancer screening treatment, health worker 2 meant that: "(...) They don't know it, unless when you can carry out a training on mothers, a training on health workers, those who do cancer cervix, you train them how to use it (Health worker 2)". Health worker 2 used to work with the EVA system, but is now working in another project at a public health delivery service. Also health worker 1, who uses the EVA system in cervical cancer screening, meant that training is crucial, when learning the EVA system and how to use it.

Through participant observations, I followed health worker 1 to a local health delivery service and health worker 1 showed me how the system is used. However, training were not the most occurring barrier when the EVA system were used in cervical cancers screening, but when health worker 1 sent the pictures there were barriers of maintaining the internet access, so that the images could be sent for diagnosis by a doctor abroad. By having open-ended questions during the semi-structured interviews, training were a theme that occurred at the end of the interview after asking if there were anything else I should have asked. Health worker 1 points out that "Not everyone would be able to use it, but in case they are trained, they are able to use it and they would love it (Health worker 1)". After arriving in Norway, I followed up with a question of what kind of training and health worker 1 suggests that: "Hopefully what you can do is train health workers things concerning the computer training, then they can have much knowledge on IT (Health worker 1)".

Maintaining Internet Access

Another barrier health workers met when using m-health were maintaining Internet access. However, this was different among health workers who used the EVA system, and the data reporters who used mTrac. Maintaining Internet access was not a barrier when using mTrac since it is used through sending text messages, were a barrier maintaining Internet access

A public health reporter who works to support health deliveries said:

> mTrak is relatively simple to use. So, mmm, challenges are not really related with usability. Challenges are related with structure with the things like availability, you know Internet, availability of data, availability of airtime, you know. (Public health supporter)

Barriers of maintaining Internet access became visible when doing a participant observation. I observed health worker 1 sending the pictures through the EVA system. Pictures were sent to a doctor abroad who helps to do the diagnosis. While sending the pictures, maintaining Internet access were sometimes a barrier, which meant that sending the pictures, took time. Infrastructure challenges were seen in maintaining Internet access. Being on a fieldwork, made me realise what the challenges were when using the EVA system. By being on a fieldwork, living in the K4C house, health worker 1 often came by inside with the EVA system device at the end of the day to send the pictures.

> (…) it's a matter of the connection of the wifi, and you get the information. Someone very far from you can get the information still, when you connect it on wifi and you send the information. (Health worker 1)

As health worker 1 describes, it is a matter of Wi-Fi-connecting in enabling the use of the EVA system.

Drug stock levels – distribution of essential medicine

Drug stock levels – distribution of essential medicine are a challenge in the Ugandan health care services with drug-stock outs, and the distribution of essential medicine. Drug stock-outs is defined as having less stock of medicines in public health care facilities, than required for patients, which is controlled by national guidelines (MOFPED, 2015, p. 1). In Kabarole district, health deliveries receive drugs from the National Medical Stores (NMS), however a challenge is some individuals from the NMS who store drugs in order to sell them illegally (National Medical Stores, 2021). Lack of drugs was a barrier mentioned by data reporters and

health workers: “It’s really painful because you see, I would have tried my own means, maybe give this drug, but it’s nowhere, it’s out of stock (Health worker 1)”.

How does it work? Drug stock levels of tracer medicines are being reported towards the District Health Officer, who review, verify, and approve the data submitted by data reporters. Further, trends on drug stock levels and disease incidence are viewed by the district bio-statician and Health Management Information System (HMIS) officers (Ugandan ministry of health (MoH), n.d.-b). At hospitals an important health resource in health delivery services are drugs. When health workers and data reporters in Kabarole use mTrac to report epidemic diseases and outbreaks of epidemic diseases, they also report on drugs that are out of stock, and drugs that are available. Several health workers mentioned how drug stock levels were low and that there is “(…) a challenge of patients prescribing themselves drugs. Whereby, they do self-medication (Health worker 2)”.

One feature on mTrac is the possibilities to use a hotline function were people can text service delivery complaint to an anonymous SMS-hotline if there is lack of a drugs and absenteeism of an health worker, for instance, in order to improve accountability (Cummins & Huddleston, 2013). The reason behind this is that the health delivery services has an obligation to accept responsibility, and act on it when being noted on the matter (Merriam-Webster, n.d.-a). However, by being on site, and doing the participant observation – this was asked about, but either health worker 1 or health worker 2 knew about the hotline function.

However, with the implementation of mTrac, it has reduced the stock-outs of the artemisinin-based combination therapy (ACTs), making ACT, the drug that is used to treat malaria more available through redistribution. After implementing mTrac, stock-outs of the ACTs decreased from 25% to 14% (Huang et al., 2017, p. 7). Meaning that there was more ACT accessible to patients. As data reporter 2 notes, there have been challenges of health workers treating before testing, which contributes to drug stock levels being reduces with drug stock-outs.

> If it’s not tested positive, either for them, they go ahead and give antimalarial, before testing the person with either RDTs. Because you know, RDTs is very possible for them to use, eh, on ward. Because at times over the weekend you know, our labs are closed. But they always give them RDT-tests, so that if as so they get a suspect of malaria, before they treat, they should first test. (Data reporter 2)

The issue of giving out antimalarial drugs before testing is a challenge. In the area of disease control, when using mTrac, a barrier is incomplete data. When using mTrac, health workers are sending health information to the government with information on drug stock levels, with information on tracer medicines. Drug stock levels are being controlled through surveillance, which means that the MoH, can get real time data on which policies to develop.

The lack of evidence based e-health and m-health programs in Uganda, and other African countries have been pointed out and discussed (Huang et al., 2017; Kiberu et al., 2017; Skolnik, 2016). Evidence-based programs are programs that are proven through extensive research (Cambridge Dictionary, n.d.-a). However, the implementation of mTrac is a large-scale program that is implemented in all districts of Uganda, and has enabled a tool for disease surveillance on all levels to meet barriers of reduced drug stock-outs. Implementing mTrac enabled the government with health information that made them aware that it was several cases of malaria.

The use of mTrac in disease surveillance help stabilize drug stock levels at health delivery services and reduce drug stock-outs, so that health delivery services have access to drugs when delivering health services. The use of m-health in the Kabarole district of Uganda might have improved the distribution of essential medicines. When there is lack of drugs, health workers cannot provide the essential care and treatment needed. Barriers with lack of drugs were met with a re-distribution of drugs:

> They do a re-distribution of drugs. For those ones who are lacking drugs. They do a redistribution so the system… Cause like, the head of department, they write you and you come and pick. When there is a shortage. We keep sharing so that the community is helped. (Data reporter 3)

Disease surveillance

As data reporter 1 told me, after introducing mTrac to a hospital in the Kabarole district, the government has given out malaria nets for one population group that have had more incidents of malaria.

> Our highest incidents are not its not malaria. It has gone down. Mosquito nets were issued out. Typhoid is not much here. Other conditions. On a weekly basis you see like 40 malaria cases, which is not much, but when I had just come, we used to report like 150 in one week. (Data reporter 1)

Disease surveillance may have enabled policy-makers at the health ministries to know were to allocate health policies. Data reporter 1 also elaborated on why the malaria-cases reduced, which is connected to the "test and treat" policy with malaria rapid diagnostic tests (RDTs) (Ugandan ministry of health (MoH), n.d.-c, p. para. 20; World Health Organization (WHO), 2017 28 April).

> About 40 per week now. I think actually this is the reason why, originally what would happen is that they were treating clinically, the cases were treated clinically. But now the government came up with a policy of 'test and treat'. You only treat positive cases. That's why the number has reduced. And even then out of the 40 that we see, so 70% come from the camps, from the refugee camps, I think a lot of mosquitos that side. So the 70 % that is coming from the camps. 30% from the districts around. (Data reporter 1)

As the public health reporter said the goal with mTrac is: *"That is the main importance for mTrak. It allows for quick response (Public health supporter).* Disease surveillance through mTrac enables the decision-makers to reach out to Kabarole, when there is an outbreak of diseases. As a data reporter 3 told me, in a case of Ebola, the district is fully alert.

> It's good cause in cases of like Ebola, the district is fully alert and something is taken up like a condition in cases of Ebola or some other diseases. (Data reporter 2)

> Disease surveillance… It helps in that the condition easily is reported on immediately, because if I report on this condition immediately, something must be worked on. Especially like these serious conditions like Ebola. Maybe something else… So, when I report on them, immediate action must be taken on. (Data reporter 2)

The possibility of real-time reporting makes the government attentive, and so the use of m-health in the Kabarole district of Uganda could allow for better access to health care services, allowing the government to receive crucial health information in order to make health policies. As data reporter 2 said, the health government follow up on outbreaks of diseases. Before implementing mTrac in 2011, they were delivering hard copies of the disease surveillance from Kabarole to the capital of Kampala (Kiberu et al., 2017) Getting the documents took a lot of time. Replacing the former paper-based system with mTrac has enabled the documents reaching the health ministries faster. Disease surveillance has been enabled replacing the former paper-based system were documents were getting lost or misplaces:

> (…) Getting those documents takes a lot of time so, because you have to wait for someone coming to Kampala and you put them on the back and on the back again, it

> can get lost or misplaced, so it was really hard to deliver hard core piece to the district. (Public health supporter)

By implementing mTrac, the ministry of health now receives health data digitally. In Kabarole district at the public health delivery service, they can get responses from the health government faster.

> (…) Cause' now the health force can be planning on evaluate those suspects of a disease. They plan, they know how many they are going to work on, so it makes everything work faster. (Public health supporter)

With mTrac there seems to have been some improvements. Though, there is a challenge with having several systems instead of one system:

> For us to have a system, we have so many systems, at times which are not connected, which are doing different things so at the end of the day we're reporting the same information in different systems. And it wastes a lot of energy, time, resources, and yet we could just put information in one system and it sends the information to all the other systems. (Public health supporter)

What the public health supporter points out, is also discussed in Huang et al. (2017). Several piloting m-health and e-health programs are a barrier. As the public health supporter discusses, there are many system, which are not connected. This is also mentioned in the Uganda National e-health strategy, that the e-health services are not interoperable and that the services are not integrated (Ugandan Ministry of Health (MoH), 2017, p. 17). Lack of sustainability as described in Kiberu et al. (2017, pp. 1, 6), with e-health and m-health services not working together to improve the health care services is something the public health supporter saw as a barriers. He suggests developing one system:

> For instance, it captures the details, which are captured ones or modified, if they change, but then it captures the particular for that visit, than the next visit and the next visit. Now. That information in the system, is almost the same information that is for instance put in DHIS2. In summarized form. It's summarized and put in DHIS2. That is the same information that is put in the mTrac usually. Usually, that it saves. So, those systems and so many other systems that are there. If they… make them function in a way that it communicate with each other so that I put the information ones in the EMR. It's an efficient way with a notifiable disease, that mTrac automatically sends an SMS the other side and the people get it. (Public health supporter)

Diagnosis

Access to health care through m-health, when using mobile telemedicine, can offer help in diagnosing the patient when there is a lack of physicians (Ugandan Ministry of Health (MoH), 2016). At a local health delivery service, health workers are using the EVA system when doing cervical cancer screening. Health worker 1 explains how the EVA system is used:

> It's like a phone. Has a camera. There are questions here about the patient. You click in, you put the password to open it. You go to the app in it called EVA, then there are details about the patient. There is name, age, village, how many children, nationality, if they are married or single, the social economic thing. Then after filling in the details, there is another part of the image where there is a camera, you take the picture, most times, of the cervics then you got the proposition after taking the picture. Then your asked if your happy with the picture you took, you say yes, you click yes. (Health worker 1)

Health worker 2 used to work with the EVA system at a local health service delivery, but now works in a public health service delivery. When health worker 2 used the EVA system the pictures were sent abroad.

> The pics you were not sure of, cause there is some cervix that are somehow confusing. It somehow confuses you, whether it's negative or positive. So, we used to send those pics. (Health worker 2)

During the participant observation at the local health delivery service in Kabarole, while learning about the EVA system and being told how health worker 1 use it, the health worker also talked about patients with HIV and how they are more prone to receive cervical cancer. By integrating cervical cancer screening at the HIV section of the health delivery service, health workers and village health technicians (VHTs) were mentored to sensitize, as in making them familiar with the service (Cambridge Dictionary, n.d.-b), and refer the women with HIV for screening. By doing this, they were able to increase the number of HIV positive women in the screening (Knowledge for change [K4C], n.d., p. 8). With cervical cancer being the most common cancer type in East-Africa – there is a need for more cancer screening services. Health workers 2 also suggest implementing the cancer screening service with the EVA system at the public health delivery service, which could reach more patients.

But what enables the diagnosis of a patient when using the EVA system? Sending a picture of the patient's cervix to a physician abroad, health worker 1 talked about how working in the K4Cs Community-Based Intervention to Improve Cervical Screening-program, health educated women. Using the EVA system could have enabled more patient care, and made it

easier for the health worker to do deliver health care. As health worker 1 said: "We just show the patient that the cervix is ok (…) The patient get a chance to see which problem are they looking on (Health worker 1, a local health care service delivery)". This may enable trust between the patient and the health worker, and the patient believing her diagnosis and accepting care. The use of the EVA system combined with a community outreach seems to have enabled more care for patients.

> Mothers have liked it a lot because it helps them (…) when you show her a pic that this is your cervix, this is how it look like, and maybe you're having cancer or your safe. So it gives her confident that I'm safe because I saw it with my naked eye. (Health worker 2)

As health worker 2 described, using the EVA system and seeing the picture act like a confirmation, and helps in doing the right diagnosis.

> Actually, first of all us as health workers. First it easen our work, it easen our work, because as I told you. I think that tool is helping, it takes pics and another thing, it gives some good light for easier view of a client. Like, after. Before cancer, and after. After screening. Before screening and after screening. So, it eases our work as health workers. Another thing. It helps you to do the right diagnosis. Instead of just your naked eyes. And you tell someone that your having this and this. It somehow helps. In making diagnosis. And another thing. Under the state of the patient. Under the state of a patient… It acts like a confirmation to her. (Health worker 2)

It can be argued whether there is a claimed knowledge building in using the telemedicine device, EVA, where the women can see a picture of the cervix. As health worker 2 says, the patient confirms her diagnosis, and it may have enabled more trust in the care and diagnosis that is given. What promote the use of mobile health is not a solely use of mobile health tools, such as the EVA system, but using it combined with other measures, such as when health workers are working around in the local communities making people aware of cervical cancer. The aim of using the EVA system in the community outreach project was to provide patient care and increase the number of women who attend cervical cancer screening. When using the EVA system, they take a picture of the cervix and the patient is able to see a picture. Health workers said that it enabled more knowledge and awareness on cervical cancer, when they can see an image of the cervix.

4th Generation Evaluation: credibility and transferability

Are the results trustworthy within the social context of barriers and enablers in the Kabarole district, and is there confidence in the truths of findings? Within credibility, there are five

techniques, (1) Prolonged engagement, (2) Persistent observation, (3) Peer debriefing, (4) Negative case analysis, and (5) Progressive subjectivity. Prolonged engagement is a technique within credibility that was useful. Being on-site on a fieldwork enabled me to understand the barriers and enablers in using the EVA system. For instance, in evaluating whether the results were credible, the technique, prolonged engagement, was used while spending time with health workers and volunteers involved in K4Cs projects – which also made me gain trust from the participants who used the EVA system. Doing semi-structured interviews in the Kabarole, instead of interviewing through phone calls, made the answers credible as I understood better the health systems barriers and opportunities and gained the necessary trust through face-to-face interviews. During the Friday meetings, cervical cancer screening was often discussed, and by being on fieldwork, I often saw health worker 1 carrying the EVA system device to the K4C house. I could get more insights from the health worker on the daily routines while using it – and such a barrier was sending the pictures. Since the patient can see the image, the theme of trust often came up, so I believe the results to be credible. The claimed knowledge building and empowerment among the patients was also a theme discussed among K4C researchers – and is also documented by the use of it in other contexts (M.B & Subashini, 2019). Barriers of insufficient know-how and skills in how to use telemedicine (Kiberu et al., 2017, p. 4), were not a barrier when health worker 1 used the EVA system. However, in enabling the use of the EVA system, there were infrastructure challenges with the power supply, so maintaining Internet access became a barrier.

The second technique within credibility is persistent observation. By being on-site, on fieldwork, I focused on drug stock levels – distribution of essential medicine instead of the usability of m-health programs, since the lack of drug stock levels was mentioned during the fieldwork. Using the persistent observation technique in evaluating credibility, I focused the study on drug stock levels with the barriers of drug stock-outs. While doing participant observation at the local health delivery service, observing and engaging in an immunization program, the theme of drug stock levels was mentioned. Researchers at K4C also talked about how lack of drugs was an issue. In identifying the characteristics that are most relevant to the problem, I found drugs to be crucial since drug stock-outs were mentioned as a barrier in delivering health care, and health worker 1 talked about that when delivering care, there could

be times when there were no access to drugs. This contributed to the development of the theme drug stock levels – distribution of essential medicine.

Using the peer debriefing technique to evaluate the results credibility, participants were asked if they believed that the semi-structured interview covered what the participants saw as challenges and opportunities in using the EVA system. Health worker 1 thought that training was crucial before implementing the EVA system for health workers. Training in information technology (IT) (Merriam-Webster, n.d.-d), was seen as needed among health workers before implementing the EVA system.

Are the results transferable to other contexts? The results are transferable to other similar contexts. With cervical cancer in the East African region being the most common cancer type (Wu et al., 2020, p. 1), and neighbouring countries experiencing epidemic diseases such as malaria, HIV/AIDS, the results are seen as transferable. The EVA system was also rolled out in Kenya, where there was raised awareness around cervical cancer (Mink & Peterson, 2016). Barriers of incomplete data together with the lack of evidence-based e-health and m-health systems are also a challenge within other low middle-income countries in Africa (Skolnik, 2016).

Quality and equitable access to health care

As stated in the objective and background, the WHO is in favour of UHC because it can lead to quality and equitable health care. Health is of a special kind and is more important than income when it comes in reducing inequalities (Anand et al., 2006). Equity is about fairness and justice, and inequalities that are possible to get rid of are unnecessary inequalities. What do my enablers and barriers about these two health systems tell us? The barriers show that there is still a lack of drugs to improve health equity, but that mTrac has enabled a decrease of drug stock-outs in the Kabarole district. The applied training needed can promote more accurate real-time reporting of health data through the mTrac system, and meet barriers of incomplete data. While the enablers show that the use of the EVA system has enabled diagnosis of cervical cancer with a community out-reach (Knowledge for change [K4C], n.d.), and can promote quality and equitable health care services to disadvantaged groups – if

combined with other strategies, such as a community out-reach. In the future, it is needed to overcome these barriers in order to reach more equity in health, given the aim of UHC.

Why is m-health important, interesting and useful, and can m-health systems lead to quality and equitable healthcare access in Kabarole? M-health systems are necessary since the implementation of the technology is cheap and available. With high numbers of epidemic diseases such as malaria, HIV, typhoid, and women with HIV being more exposed to cervical cancer, implementing m-health technology such as the EVA system can make cervical cancer screening more assessable for the uptake of patients. Cervical cancer, caused by the human papilloma virus (HPV) (Nakisige, Schwartz, & Ndira, 2017, p. 37), affects vulnerable groups in Kabarole, such as sex workers with HIV, but is a disease that can be treated. Malaria is also treatable and avoidable with ACT. However, due to social circumstances, with drug stock-outs of ACT, health workers sometimes do not have access to treat patients with drugs. Sen in Anand et al. (2006, p. 28) argues that it is important to focus on health equity than income equity, and reduce inequalities in health than inequalities in income. He claims that when determining a person's health, it is affected by several different details besides the social and economic factors, such as personal disabilities, individual proneness to illness, and epidemiological risks – and that these factors need to be taken into account when developing health policies in order to reduce health equities. For instance, with malaria in Uganda being an epidemiological risk, being highly endemic in 95% of the country (Kibira et al., 2021, p. 2), having this in mind when policy-makers develop health policies, can contribute to reduce health inequities. When the mTrac system provides a re-distribution of drugs, as described by data reporter 3, when there is a lack of ACT, mTrac is contributing to reduce the health inequalities with access to drugs. With the implementation of mTrac in Uganda, the stock-outs of ACT were reduced (Huang et al., 2017, p. 7), making drugs stock levels more accessible. But there are still challenges with drug stock levels. Quality and equitable health care is also affected by the social circumstances. If people do not have the means to attend cervical cancer screening or experience a long way to health services, it reduces their chances to live healthy and free lives. Or for instance, when they reach the hospital, and they experience drug stock-outs and have to pay for the equipment (Anderson et al., 2017).

When discussing equity, it is possible to have different points of views for what equity and issues of fairness means when explaining the reasons behind the barriers and enablers that is found in Kabarole. A liberalist would claim that the individual must take responsibility for their own health, were people cannot expect the state to help them. While a conservative would claim someone deserve health services more than others, and that those who try, the deservedly in need, should be given help, instead of those with health problems caused by themselves. Whereas, the egalitarians on the left side – the social-democratic/socialist perspective, claims that regardless of reason, those who are worst off shall be helped (Alesina, Cozzi, & Mantovan, 2012; Girvetz, Minogue, Ball, & Dagger, n.d.). Using the social-democratic/socialist perspective within health equity, it will mean to help those who are worst of – those with the poorest health. And the EVA system does meet vulnerable groups in Kabarole, for instance, female sex workers with HIV who are more exposed to cervical cancer. In this way, the use of the EVA system could come closer to UHC, if enabled with training and better maintenance of the Internet. If Kabarole could make the EVA system more assessable at public health service deliveries in combination with strategies that is focused on reaching vulnerable population groups, it could make cervical cancer screening more available, and thus lead to UHC.

It is important to have in mind that besides the m-health technology being implemented, the health workers (with the data reporters included) are the main backbone behind any health system and must also be prioritized with the necessary funding and resources in order to provide quality care – those who use the technology should also be included when making the systems and policies with the necessary process of learning how to use the m-health systems with applied training. When discussing health equity – the social arrangements of the society affects both the health worker and the patients. Still, reducing health inequalities is not easy. The Black Report's from the 1980s in Great Britain – one of the first studies that disclosed how hard it is to reduce inequalities in health, showed that it does not help to allocate a lot of money, because people's health and wellbeing is also affected by behaviour (Townsend, Davidson and Whitehead, 1986 in Bartley, 2017). In preventing ill health in the population, irrespective of social background, it is also important to implement policies that provide for a healthy lifestyle.

How does this apply to the two m-health systems evaluated in Kabarole? Besides providing access to health care services with the EVA system to provide cervical cancer and enable diagnosis, or implementing mTrac in disease surveillance to collect health data, it is also important to change the norms (Bartley, 2017). For instance, we have the technology available with mTrac, were implementation costs were low and the only thing needed are health worker's mobile phones, but then there are certain barriers that hinders the use of mTrac – such as incomplete data, which could be met with proper training.

Concluding remarks

The research objective is important to explore since m-health can contribute to access to quality and equitable health care services. The starting point for my discussion was the WHOs argument that health care should be universal. The m-health programs contribute for diagnosis, and in disease surveillance. However, there are still some barriers. The problem is not solved without the availability of drugs, which is still a barrier that remains, but mTrac and EVA could contribute to UHC, since this type of technology is cheap and available, and have the potential to reach widely, and to vulnerable groups.

Limitations and advantages

Having six participants was a limitation when exploring health workers' experiences with m-health systems. Gaining access to the field was difficult, and I worked hard during the sampling process in finding participants that were relevant for my research objective. Nonetheless, staying in the Kabarole on a fieldwork for three months, on site, close to the local health delivery service was an advantage, as it allowed me to emerge myself in the social context of the participants. By being on site, I learned a lot, which ensured the methodological trustworthiness in line with the chosen methodological approach in a better way, which is demanding in a master's project.

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Appendices

Appendix 1: Request letter with informed consent form

Do you want to participate in this study:
The barriers and possibilities of eHealth in Uganda

This is a question to you whether you want to participate in a study were the goal is to conduct research on the barriers and possibilities of eHealth in Uganda, and in particular how mobile enabled tools such as mTrak and other tools work on the ground.

Invitation to participate
My name is Mariel N. Sand Nwosu, and I'm a master student at Oslo Metropolitan University (Oslomet) in Norway, were I'm enrolled at the master program International Social Welfare and Health Policy. I'm collecting data from health professionals' experiences with eHealth and mHealth in Uganda. I want to hear your opinions and thoughts about your experiences as health professionals, and your experiences of the use of mobile enabled tools connected to the health care delivery.

I would like to invite you to participate in this study. Before you decide, it's important that you have read and understood this informed consent. It gives you information about the study, what the study is about, that you participate voluntarily, and that you can withdraw your consent at any given time if you decide not to participate – also after given an interview.

Ask me if you have any questions, or if you want more information. It will also be possible to go through this informed consent form with me, before you decide to participate or not.

Purpose of the study
This is a research project/study.
The purpose of the study is to assess what eHealth has to offer for health professionals in Uganda, and the possibilities and barriers of eHealth on the ground. Further, I want to conduct research on how mTrak is being used on the ground and evaulate it based on experiences from prevous studies.

Why are you asked to participate?
You have been invited to participate because you are a health professional or you are affiliated with work connected to the area of study.

Who is responsible for the study?
Simon Innvær, Associate Professor at Oslo Metropolitan University (Oslomet) in Norway, is my supervisor and project leader of this research project.

How will you be interviewed?
You will be interviewed once, either at the office at Knowledge for Change at Kagote, or a place you choose. The interview will last around 1 hour, and a recording device will be used. The recordings will be handled confidentially. The recordings will be immediately copied to an encrypted storage device at the end of the day, and deleted from the portable device. The recordings will then be transcribed and your personal information will be de-identified, meaning that your name, the audio recording files, field notes, and transcriptions will be assigned a pseudonym. Other personal information regarding your work, where you live, information about your children or family will be de-identified.

You will not be recognized in the study, and we will treat you personal data based on your consent.

It is voluntary to participate, and there is a possibility for you to withdraw from the study
It is voluntary to participate in the research project. If you want to participate, you can sign the consent declaration on the last page. You can withdraw at any time, without telling me the

reason. If you decide to withdraw, you can demand to have your personal information deleted, unless the information is already used in analysis or scientific publications. If you later wish to withdraw, or have any questions, you can either message me on +4797731241, on WhatsApp +4797731241, or on e-mail s188167@oslomet.no

All your personal information will be de-identified, and there are no negative consequences if you don't want to participate or if you decide to withdraw.

Accommodation/payment
There will be no accommodation/payment to those who are interviewed.

What are the benefits of participating in this study?
More evaluation on eHealth in Uganda and the challenges and opportunities for how it works on the ground, could be one of the benefits of participating in this study. I can't promise that the study will help you directly, but the information from the study may be used by other researchers or health professionals and may contribute to the implementation of eHealth in Uganda.

Data Storage and Management
All data resulting from semi-structured in-depth interviews will be audio recorded with a recording device. The recordings will be immediately copied to an encrypted storage device at the end of the day, and deleted from the portable device. The recordings will then be transcribed.

All of my participants will have their personal information de-identified, meaning that the names of the participants, their audio recording files, field notes, and transcriptions will be assigned a pseudonym. Information that may be used to later identify an individual will be removed, alongside with the specific community I will be working in. Field notes will be locked in a closet and data will be stored on a password and username protected computer. I will just use the information for the purposes described. The processing of personal data in this project is in accordance with the data protection legislation, and will be treated confidentially. The participants will not be recognized, and their personal data will be treated based on their consent.

What happens with your information when the study is ended?
The research project is officially ended 30th of May 2021, but personal data about you will be de-identified early when transcribing the interviews. The recordings will immediately be uploaded at the end of the day, and deleted from the portable device.

Where can I find more information about the study?
If you have any questions regarding the study, or wish to use your rights regarding your personal data, feel free to contact me.
Mariel N. Sand Nwosu
Master student at Oslo University College (Oslomet) in Norway
E-mail: s188167@oslomet.no
Phone number: +4797731241 (Also on WhatsApp)

I will ask you to sign the informed consent declaration form if you wish to participate.

Best regards,

Mariel N. Sand Nwosu

Master student at Oslo Metropolitan University (Oslomet)

International Social Welfare and Health Policy

Consent form

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant_____

Signature of Participant _____

Date _____

Day/month/year

Appendix 2: NSD Approval

NSD NORSK SENTER FOR FORSKNINGSDATA

NSD sin vurdering

Prosjekttittel

The barriers and possibilities of eHealth in Uganda

Referansenummer

446626

Registrert

15.01.2020 av Mariel Nkechi Sand Nwosu - s188167@oslomet.no

Behandlingsansvarlig institusjon

OsloMet – storbyuniversitetet / Fakultet for samfunnsvitenskap / Institutt for sosialfag

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Simon Innvær, simoinn@oslomet.no, tlf: 99038241

Type prosjekt

Studentprosjekt, masterstudium

Kontaktinformasjon, student

Mariel N. Sand Nwosu, s188167@oslomet.no, tlf: 97731241

Prosjektperiode

18.02.2020 - 30.05.2021

Status

16.03.2020 - Vurdert

Vurdering (2)

16.03.2020 - Vurdert

NSD har vurdert endringen registrert 12.03.2020.

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet med vedlegg den 16.03.2020. Behandlingen kan fortsette.

Det ble lagt til nye utvalg og tilsvarende intervjuguider. Informasjonsskrivene har blitt oppdatert.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er

avsluttet.

Lykke til med prosjektet!

Kontaktperson hos NSD: Simon Gogl

Tlf. Personverntjenester: 55 58 21 17 (tast 1)

20.01.2020 - Vurdert

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet den 20.01.2020 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

MELD VESENTLIGE ENDRINGER
Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:
https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 30.05.2021.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER
NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER
Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).
NSD vurderer at informasjonen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER
NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og eventuelt rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Kontaktperson hos NSD: Simon Gogl
Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Appendix 3: Semi-structured personal interviews

Interview guide with nurses working on cervical cancer project using an m-health device

Introduction

Thank you for taking out time of your schedule to meet me. Do you want any coffee, tea or water?

1. How old are you?
2. How did you start as a midwife/doctor/nurse?
3. When did you start working as a …?
4. What is your role as a midwife at the clinic?
5. What do you think are the most challenging health issues in Uganda?
6. How is your work with the cervical cancer screening project?
7. What is it called?
8. How does it work?
9. Who do you send the pictures to?
10. Do you send it to the health government?
11. Why do you think this is important in your work?
12. What would you do if you didn't have the device? How did you do it before?
13. Have there been any challenges with this device?
14. Would health workers, all of them, be able to use the devices if applied, or do they have any information in case it was applied?
15. What is your opinions in general – do you think there are other areas in your daily work where you could have used apps or other mobile tools to easen the work in your daily health care delivery?
    (What is your opinions on using electronic processes and communication in your daily health care services? Do you have anything else like the)

16. Has there been any other initiatives from the government or any other organization in implementing tools like the ada?

What do you think about these questions?

17. Do you think those who are responsible should do anything about this, in implementing mobile tools or other e-health initiatives in the daily health care service?

18. What do you think about my questions?

19. Do you have anything else to add according to what we have talked about, or any suggestions to what I should ask?

16. Do you have any suggestions to other people I can talk with?

Interview guide with nurses and other health workers on e-health

Introduction

Thank you for taking out time of your schedule to meet me. Do you want any coffee, tea or water?

1. How old are you?
2. How did you start as a midwife/doctor/nurse?
3. What is your role as a …… at the hospital/clinic?
4. What do you think are the most challenging health issues in Uganda?
5. What is your opinions on using electronic processes and communication in your daily health care services?
6. Do use any application or any other technical devices in your work to send or store information?
7. How do you think it would help or not in your hospital?
8. How is the disease surveillance at your hospital? Do you track them in any way?
9. At another hospital they uses a smartphone for cervical cancer screening: How would you like it if it was something like mTrak or other apps in your daily life when working as a ….?
10. What do you think would be the challenges with implementing an app or technical device in your everyday work at the hospital?
11. Do you use mTrak at your hospital?
12. Would health workers, all of them, be able to use the devices if applied, or do they have any information in case it was applied?
13. What do you think about my questions?
14. Do you have anything else to add according to what we have talked about, or any suggestions to what I should ask?
15. Do you have any suggestions to other people I can talk with? (recording off)

Interview guide on mTrac

Introduction
Thank you for taking out time of your schedule to meet me. Do you want any coffee, tea or water?

1. How old are you?
2. How did you get this position?
3. When did you start working with this?
4. What is your role as a ….. ?
5. How did you start working with mTrak?
6. What is mTrak? And who started mTrak?
7. How do you use mTrak?
8. - Prob q: What concrete do you do when…?
9. In what way is mTrak useful?
10. What would you do if you didn't have mTrak?
11. What do you think are the most challenging health issues in Uganda?
12. Why is mTrak important?
13. What are the opportunities with mTrak?
14. What are the challenges with mTrak?
15. How does mTrak help the disease control?
16. How does mTrak help the disease surveillance?
17. How was the government getting data on diseases before mTrak?
18. Are every district in Uganda using mTrak?
19. What do you think about my questions?
20. Do you have anything else to add according to what we have talked about, or any suggestions to what I should ask?
21. Do you have any suggestions to other people I can talk with? (recording off)