# An Exploratory Study on the Evaluation of eHealth Interventions in Uganda: Practices, Challenges and Insights

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# Abstract

Background: The application of information and communication technology is becoming more popular in healthcare management evidencing improvement of effectiveness, access, quality, and efficiency of the healthcare systems. With increased investment and implementation of eHealth across the world, there is a need to evidence its value. That is, its evaluation is required in order to get the most benefits out of them. To this end, this research study investigates the practices, challenges, and insights regarding the evaluation of eHealth implementations in Uganda. Methods: A qualitative approach was employed to conduct the study investigation with key eHealth implementers in Uganda considered as respondents to establish an understanding of their perspectives with respect to ehealth evaluation practices and challenges faced, as well as to derive insights from these perspectives in relation to the World Health Organization (WHO) understanding of digital health evaluation. Results: Results show that Uganda has implemented various eHealth initiatives; however less to none evaluation is undertaken, as it is not a key activity with most of the eHealth implementers. The focus is put on monitoring the ehealth initiatives' functionality and adoption rather than their outcome and impact. Conclusion: Accordingly, the study recommends the need for an evaluation framework following the WHO global digital health evaluation framework guidelines to elucidate the notion of evaluation, its characteristics, and measurement indicators regards the outcome and impact of ehealth implementations in healthcare and service delivery for Uganda's health system.


# Background

Across the world, healthcare systems are facing pressures to guarantee simultaneously accessible, quality, and affordable care. Healthcare administrators and policymakers are expected to select interventions that increase the quality and efficiency of services, care, and support high performance of health systems [1–3]. The application of information and communication technology (ICT) is becoming more popular in healthcare management and has proved to improve the effectiveness, access, quality and efficiency of the healthcare systems [4–7]. The WHO [8] notes that the application of eHealth is necessary if universal health coverage is to be realised. The increasing investment in eHealth has led to a need for evidence to prove that their benefits are realised from eHealth applications. Such evidence helps to establish the return on investment and value and guides future eHealth investment and adoption decisions. Evaluation for eHealth interventions helps to generate data that can be used as a basis for assessing whether observed changes in behaviour; processes or health outcomes can be attributed to the interventions [9, 10]. This paper provides results of an exploratory study conducted among key eHealth implementers in Uganda to investigate their practices, challenges, and insights regarding the evaluation of eHealth implementations.

### The Concept of eHealth and its Benefits

WHO defines eHealth as the use of information and communication technologies (ICT) for health [11]. WHO's eHealth definition accommodates a variety of medicine and public health including patient and

public health data management (electronic health records), provision of remote health care services (telemedicine/teleHealth), health information and services through mobile telephone technology (mHealth), health knowledge management and distant learning for health workers (eLearning), connection of medical devices (internet of things), and other areas like improved planning, organization, and management of health services, and more recently the management of large public health data [73].

eHealth applications allow communication between healthcare providers and their clients, and sharing of information and knowledge among healthcare providers [13]. The Internet has also been used for communication and it has contributed to better disease management [14, 15]. Learning from the developed world, sub-Saharan African and other developing countries are implementing ICT solutions as a means to improve accessibility to quality and equitable healthcare for poor and vulnerable communities [16]. In sub-Saharan Africa, the early use of ICTs in health was evidenced in the use of various mobile health solutions in multiple countries [17] and telemedicine in West Africa [18]. Currently, there is an increase in eHealth implementation on the continent and leading implementations including mHealth, eLearning, and telehealth. Social media, electronic health records and implementation of digital medical devices are also gaining popularity on the continent [8, 73].

There is much interest internationally in exploiting the potential of ICTs to improve healthcare [8, 19–21] because the proper use of ICTs in healthcare enable more efficiency in information processing and impact on access and quality of care [22–24]. Other examples of technologies that indicate eHealth can be the use of the Internet, which enables prompt communication of medical data, and smartphones, which enable clinical staff to have real-time access to patient's medical data on the mobile [25]. Research on eHealth in LMICs by Lewis *et al.* [26] indicated that ICT including video/photo cameras, computers, Global Positioning Systems, Personal Digital Assistants, phones (smartphone, cell phone, landline phone), radios, remote/portable diagnostic tools, smart cards, software, voice (e.g. VoIP, hotline), internet, text messaging, videoconference are used for extending geographic access, facilitating patient communications, improving diagnosis and treatment, improving data management, streamlining financial transactions, mitigating fraud and abuse, overcoming language barriers or using technology's appeal to attract more patients and greater attention.

According to [12, 26, 27], eHealth is very beneficial in the following ways; extending geographic access**,** empowering patients, improving epidemiology**,** facilitating patient communications, improving diagnosis and treatment, improving data management, streamlining financial transactions, mitigating fraud and abuse, and creating efficiency through lowering some categories of operational costs in healthcare delivery for example operational costs of clinical services through electronic medical records and administrative costs such as billing and processing claims [74,75].

## eHealth Implementation Challenges

Difficulties and challenges in eHealth implementation are an international phenomenon to all countries irrespective of their development status [28]. Some aspects that threaten ICT systems implementation in the health sector involve economic resources, income disparities, exorbitant costs of usage fees,

excessive costs for even rudimentary health information systems, lack of human trained resources, lack of governmental policies that address a well-defined health system that incorporates eHealth, cultural aspects and some resistance to the use of computers for health care processes [29], absence of rigorous evaluation research of such technologies on health outcomes [30], challenges in systems integration [31, 32] and other organizational barriers to health information technology uptake [33]. Scott & Mars [16] noted that for most developing countries, eHealth remains a proof-of-concept activity, with only modest value demonstrated within small pilot projects.

## An Overview of eHealth Implementations Evaluation

The concept of *evaluation* can be defined as a systematic and objective assessment of an intervention that aims to determine the fulfilment of objectives, efficiency, effectiveness, impact, and sustainability [34]. Yusof *et al* [35] point out that the questions of why (reason for conducting an evaluation), who (which stakeholders' view is being evaluated), when (which phase of system development life-cycle is being evaluated), what (aspects of the system are being evaluated), and how (choice of the research approach) need to be answered upon undertaking an evaluation. WHO [10] further defines evaluation, as measures taken and analysis performed in order to assess the interaction of users or a health system with the digital health intervention strategy, or changes attributable to the digital health intervention. Throughout the implementation of eHealth initiatives, their evaluation is required in order to get the most benefits out of them [36, 37]. Related to evaluation is monitoring. Though in most cases monitoring and evaluation are conducted concurrently, the two concepts are different in the context of measuring performance and impact of eHealth implementations. WHO [10] emphasizes that *monitoring* is the routine collection, review, and analysis of data intended to measure implementation progress for an eHealth initiative, and results into adjustments in intervention activities necessary to maintain or improve the quality and consistency of the eHealth deployment. In contrast, *evaluation* measures changes in outcome and impact that are attributed to the eHealth initiative. WHO [12] observes that monitoring and evaluation of eHealth implementations plays an essential role in demonstrating the progress that a country is making towards the development of its national eHealth environment. Lau & Kuziemsky [9] note that an eHealth system covers not only the technical ICT artefacts but also the socio-organizational and environmental factors and processes that influence its behaviours, so they argue that the scope of eHealth evaluation can cover the entire life cycle, which spans the planning, design, implementation, use, and maintenance of the eHealth system over time; and that depending on the life cycle stage being evaluated, there can be different questions raised.

Evaluation of eHealth implementations is a challenging undertaking [9, 38, 39]. There are a few published evaluations on eHealth implementations [6, 30, 40–43] especially in the developing countries [39]. The difficulty is because such evaluation does not focus on technology only but often needs to consider how the technology components interact with other processes in the eHealth implementation [44], which in turn broadens the scope of the evaluation [45, 46]. Secondly, the evaluation takes place in a complex healthcare setting that involves multiple stakeholder categories (such as patients, clinicians, administrators, IT specialists, funders) on top of legislation, social, political and economic environments

[47]. This poses challenges to the evaluation since different stakeholders present different expectations and perspectives of a successful eHealth implementation, which may lead to conflicting evaluation criteria, and require multiple study designs and evaluation methods [38, 48, 49]. eHealth evaluations are also resource-intensive and are always hampered by insufficiency of resources like time, funding, human resources, and subject participants [38].

Notwithstanding the challenges, eHealth evaluation efforts are worth undertaking [50]. Implementers and countries that have evaluated their eHealth implementations have benefited from the knowledge about results of the implementations in the respective programmes [9] and this knowledge base helps to inform decisions on policies, practices, and research [51]. In Europe, the topic of impact assessment as well as evaluations for eHealth had gained considerable momentum by 2011 to an extent that half of the countries had designated a specific body/institution that was responsible for eHealth evaluation activities. Various Canadian eHealth evaluation studies evidenced positive benefits from the implementation of electronic medical records and drug information systems [52–54], and such helped to answer questions concerning whether there was sufficient value for money on Canadian electronic health records investments which were earlier raised in 2009-2010 performance audit reports by the Auditor General of Canada and six provincials auditors' offices [55]. In 2010 Canada's International Development Research Centre (IDRC) conducted an evaluation of its 25-eHealth projects funded between years of 2005 and 2010 in 28 countries in Africa, Asia and Latin America and the Caribbean (LAC). The projects (50% from Africa, 28% from LAC, and 16% from Asia) focused on contributing evidence and knowledge about how to use technology to help solve health challenges through either the use of eHealth tools to tackle one or more specific challenges, or general health systems strengthening. The evaluation results showed contributions of the projects in the regions and informed IDRC's future programming in eHealth research [56]. Evaluation done for the United Kingdom's implementation and adoption of the nationwide electronic health records system indicated limited visible benefits for clinicians and patients, and it guided the eventual closedown of the initiative [57–60]. An assessment that sought to find out the successes and challenges of eHealth in Africa and developing countries [61] indicated that most of the initiatives lacked documentation and proper evaluation hence their overall success was uncertain, but led to recommendations that would guide future implementations to do well. All the above cases communicate how eHealth evaluation has been given attention in some countries and how the evaluation results have been useful to inform decisions.

## Status of eHealth in Uganda

Uganda, like most developing countries, has employed eHealth applications to improve healthcare delivery and public health [16]. The growth in ICT created a fertile environment for new innovations whose application into the Uganda health industry has yielded positive results, especially in disease control and prevention through disease surveillance [62]. Some of the famous eHealth systems implemented in Uganda include DHIS2 which supports routine health data reporting from the district level to the national level [63], mTrac an SMS, USSD and web-based data collection tool for health workers at district health centers to submit weekly HMIS reports related to disease outbreaks and stock outs of essential medicines

[64], and OpenMRS an electronic medical records application to support records management functions especially in HIV-care health facilities [63] among others.

Although Uganda experiences various eHealth projects, most of them are pilot projects, operated in silos and lack sustainability [64, 65]. For example, there were approximately 23 of 36 mHealth initiatives in 2008 and 2009 that did not move beyond the pilot phase [66]. Such situations have been criticized as '*pilotitis*', an expression of dissatisfaction from donors and governments because of the isolated eHealth initiatives that are successful in one context, but not rolled out [67]. With such a large number of uncoordinated pilot projects, the Government of Uganda imposed a moratorium on new eHealth activities, which demanded new eHealth initiatives to be approved on condition that they met the existing Ministry of Health requirements [68]. The National eHealth Policy and Strategy [69] were also developed to guide the development and implementation of eHealth in the country.

# Methods

We used a cross-sectional survey [70] to investigate the perspectives regards practices and challenges faced in eHealth implementations' evaluations. The authors through consensus with the following interview guide topics developed the guiding interview questions; the use of eHealth in organisation activities; organisation practices, motivations and challenges in eHealth evaluation; performance indicators for eHealth evaluation; and existing tools and resources for supporting eHealth evaluation. A semi-structured approach with a mixed questionnaire that included both closed and open-ended questions about the institutions' experience in implementation and evaluation of eHealth initiatives was used during the interviews, and it allowed an opportunity for probing more information and seeking clarification where necessary.

Between June 2018 and November 2018, face-to-face semi-structured interviews were conducted with twenty-two (22) key informants from eighteen (18) key eHealth implementation stakeholder institutions in Uganda. Informants from the same institution belonged to different departments with differing practices regarding eHealth implementation. Among the institutions included the Ministry of Health and other policy makers, development partners, implementing partners, research/academic institutions, and health facilities; with each institution having the possibility of belonging to more than one category as showed in figure 6. The institutions were selected using a combination of purposive and convenience sampling. Initially, the Ministry of Health (MoH)'s Division of Health Information (DHI), which is the custodian of eHealth and health information management in Uganda, was contacted to recommend the key eHealth implementing institutions to participate in the study. Out of the twenty-seven (27) recommended institutions, three (3) were not contacted due to limitations to access their offices and contact details in the data collection period. Entry contacts to twenty-two (22) institutions were contacted, where we explained the study objectives and asked them to nominate their most appropriate staff that were involved in eHealth implementation or evaluation to participate in the study data collection exercise. Of the twenty-two contacted, eighteen (18) institutions responded positively and nominated a staff to

provide data to the researchers. Four (4) institutions did not participate because the nominated staff did not provide to the researchers their respective interview appointments.

Verbal consent to participate in the study was obtained from twenty-two (22) participants in eighteen (18) institutions, and face-to-face interviews were conducted on separate days at scheduled time at each participant's place of work. The first author (JA) conducted the interviews in English, each lasting between 60 - 90 minutes. Participants' responses were recorded verbatim as written extensive notes. Responses on each question were reviewed with each of the participants to ensure that no wrong data was carried over; and more field notes were also written immediately after each interview. Notes taking was used rather than voice recording to eliminate prospective participants' fears that their recorded experiences and opinions might be listened to and evaluated or judged, and this facilitated a relaxed active engagement between the researcher and each participant.

The analysis of the interviews was done using the thematic content analysis approach [43] where both authors/researchers (JA and JN) read all the notes to familiarise themselves with the text, then identified codes, and categorised the codes and developed themes from the collected data. Quantitative information about the resultant codes and other quantitative responses were analysed using SPSS (Statistical Package for the Social Sciences) software. Feedback on the field findings was then shared with the MoH's DHI for review and identification of any obvious outliers in the collected data. The DHI did not identify any outliers; as such the findings presented in this paper reflect the true practices in eHealth implementation and evaluation in the country.

# Results

A total of 22 interviews were conducted in 18 institutions. Out of the 22 respondents, 17 (77.3%) were males and 5 (22.7%) were females. Most of the respondents 12 (54.5%) were in the age bracket of 31-40 followed by 6 (27.3%) in the age bracket of 18-30 and 3 (13.6%) in the age bracket of 41-50. The respondents included a diverse range of cadres including programme managers, monitoring and evaluation officers, health informatics specialists, software developers, statisticians, and IT systems administrators.

### The use of eHealth

All participants mentioned that their organisations use eHealth in their health-related activities. With 'great extent' meaning very high rate, 'certain extent' meaning medium rate and 'very small extent' meaning very low rate, 91% of the respondents indicated to be using eHealth to a great extent while only 9% indicated to be using eHealth to a certain extent in their activities (Table 1). Data collection and reporting 9 (41%) was the most common area of eHealth application followed by data analysis 4 (18%) and others as shown in Figure 2 (see Supplementary Figure 2 online). In addition, DHIS2 12 (54.5%), mTrac 9 (41%) and Family Connect 5 (22.7%) were the most used eHealth systems as shown in Figure 1. Some of the responses (quoted verbatim) from the participants included;

*"We use information systems in basically all of our services provision; stores, general clinic, laboratory, finance and procurement, etc..."* – Participant 22

*"… to a great extent. We have introduced electronic systems to process and disseminate results e.g. SMS, ODK data collect"* – Participant 21

*"We use ICT to a certain extent. We use it in communications with mobile phones, internet, etc.; data collection; data analysis and use with DHIS2, MTrac, iHRIS, OpenMRS, EMRs etc"* – Participant 1

*"eHealth is used to a great extent, for example with the use of DHIS2 to support reporting of routine health services from districts, use of MTrac based on rapid sms for surveillance and medicines management, use of HRIS to manage human resources for health"* – Participant 12

**Organisation practices and motivations for eHealth evaluation**

Most participants reported that their institutions put efforts to evaluate the performance of eHealth, but also some organisations do not. 50% of the participants indicated that their organisations put efforts to a great extent, 18% to a certain extent, 23% to a very small extent and 9% not at all (Table 2). Looking into reasons for conducting the evaluations (Figure 3), checking functionality of the eHealth initiatives was the most reported reason by many participants (32%). Participants also provided that institutions also conducted evaluation of eHealth because it is a requirement by funders, to keep track of changes in user requirements, to identify gaps in system functionality, and to streamline partners' approaches to eHealth implementation. Examples of respondents' feedback included;

*"… I think to a great extent, because we conduct these evaluations throughout the implementation of the systems. We conduct the evaluation because one, it is a requirement from our donors, secondly, evaluations help to quickly document achievements, and also capture user feedback. Internal evaluations contribute to our marketing strategy for the systems"* – Participant 2

*"Evaluations are part of our quarterly activities and at baseline before implementing mobile tools. We do baseline evaluations to determine capacity needs, user attitudes, and challenges to be solved by the mobile tools ..."* – Participant 18

*"We conduct evaluations to a great extent. We go ahead to deploy our staff onsite where the initiatives are implemented"* –Participant 3

*"… evaluations are conducted to a certain extent and mostly during implementation stages. As the Ministry, our main interest is to streamline how different partners implement eHealth solutions so as to eliminate uncoordinated, fragmented, and duplicate systems"* – Participant 4

*".. to a very small extent because we do not normally conduct performance evaluations, but we sometimes want to ensure proper flow of system functionality to meet user requirements"* – Participant 17

*"… may be to some extent. We especially evaluate the system before implementation during user acceptance testing to ensure the system works as expected. The evaluation also reduces complaints from users"* – Participant 10

### Indicators monitored during eHealth evaluation

Participants reported various indicators that are currently considered during evaluations, most reported indicators being system availability, system response speed, interoperability, usability, scalability, and availability of human resources to implement the eHealth initiatives as shown on Figure 4 (see Supplementary Figure 4 online). Among the participants, 9 (41%) did not mention any indicators because their organisations did not conduct evaluations or they did not have a practice of using indicators for evaluation. Below are some of the responses from participants;

*"… Most of the initiatives are user-centered, so we look out for usability indicators"* – Participant 8

*"We normally evaluate functional and non-functional requirements of the system. Functional requirements are evaluated through checking the functionality of the system and then validation rules on the data. Then some of the non-functional requirements evaluated are system's interoperability capacity with other systems, cost implications for implementing the system, security, scalability, and sustainability of the system"* – Participant 6

*"… Mainly we pay attention to functionality to ensure that the system functions as expected"* – Participant 10

*"…. system functionality, data use, impact, human resource capacity, and ICT infrastructure. We also use USAID Measure tools …"* – Participant 14

*"We assess availability of the computing infrastructure, internet access, capacity of the health workers and staffing levels"* – Participant 11

*"… We needed to assess value for money …. What additional value does the eHealth initiative bring? … and is this additional value worth the additional costs?"* – Participant 13

*"The indictors we monitor depend on what aspects of the work process you are evaluating …. "* – Participant 20

*".. We assess system availability and its usage. We also assess availability of a champion to lead implementation on the operation site"* – Participant 2

*"… We only developed the electronic database and dashboard and trained health facility trained staff, and the project even ended but we did not evaluate implementation of the initiative…"* – Participant 15

*"… Apart from comparing system functionality with initially specified user requirements, we do not conduct any other evaluation on the systems we deploy. Mainly our aim is to ensure that the systems*

*function well to support the work done by users"* – Participant 17

## Challenges in eHealth Evaluation

The participants reported a wide range of challenges they face during evaluation of eHealth initiatives. The most reported challenges and limitations that affect eHealth evaluation included limited skills/capacity among the evaluation teams, lack of standard procedures on eHealth implementation and evaluation, limited documentation about the eHealth initiatives, limited resources in terms of time and money, unharmonised interpretation of eHealth performance indicators and stakeholders' negative attitudes as shown in Figure 5 (see Supplementary Figure 5 online). Some of the participants' responses are below;

*"We cannot be sure that all the eHealth systems in any category e.g. EMRs have been assessed because we do not have a comprehensive list of what systems exist in the health sector"* – Participant 7

*"…. We have challenges related to interpretation of evaluation indicators because we do not have them categorised and made more specific, so different stakeholders understand and interpret some indicators differently…."* – Participant 2

*"There is lack of clear indicators to show contribution of ICT initiatives to the sector wide service delivery. We also lack a clear mechanism of performance evaluation"* – Participant 12

*"We face challenges like limited resources in terms of time and money, limited expertise more so in the area of data analysis"* – Participant 20

*"Some users fear that evaluations will expose their low performance so they end up giving impressive feedback that is not objective during the evaluations. And also as the evaluation teams, we do not have a standard to follow while conducting evaluations, so every time we need to conduct an evaluation we put in much effort to plan for it from scratch"* – Participant 18

*"There is no standard procedure to guide on when and how frequent to do evaluations …… there is a problem of unharmonized indicator interpretation and this leads to misinformation…"* – Participant 1

*"Most of the teams have negative attitude towards evaluation of systems hence few individuals remain willing to participate in this… and it becomes a one man's show …."* – Participant 1

*".. there is no enough documentation of these initiatives, so trouble comes when individuals leading their implementation leave the organisations where the initiatives are being implemented … evaluating an initiative without any background information is difficult …"* – Participant 3

*"… some of the data collectors bring wrong data that is unusable, so they need more training …"* – Participant 19

# Discussion

**eHealth practices** – Results as showed in Table 1 indicate that all the institutions apply eHealth practices in some ways in the country [64, 65]. In addition, results as showed in Figure 1 and 2 indicate that there are various areas of eHealth applications although fewer institutions use each; in other words, eHealth implementation in Uganda is not integrated but operated in silos [65]. Regards conducting eHealth evaluation, the results showed in Table 2 indicate that only 50% of the respondents conduct eHealth evaluation to a great extent, while the rest 50% conduct it to a small extent or not at all. This implies that there is no concerted culture of eHealth evaluation in Uganda. Looking into the reasons why evaluations are conducted (see Figure 3), most of the respondents provided reasons that are related to ensuring proper functionality of the eHealth initiatives. This is also reflected in the indicators measured in Figure 4, where system availability, response speed, interoperability, usability, scalability, and availability of human resources to implement the eHealth initiatives are the most measured indicators. The World Health Organization [10] and WHO & ITU [12] categorise such indicators as process and output indicators that provide information and insight on the adoption of an eHealth initiative, and are more suitable for monitoring eHealth initiative implementation; however, they do not necessarily evaluate the performance of the eHealth initiative. This implies that even though more respondents conduct evaluations on their eHealth implementations, they majorly monitor eHealth deployment, functionality, and adoption rather than measuring the outcome and impact that result from the eHealth implementations. Uganda is not the only country suffering the challenge of having weak eHealth evaluation mechanisms. According to the World Health Organization's observations in its Global Observatory Survey on eHealth of 2016 in which 112 WHO member states participated, though there was a reported rapid growth in implementation of eHealth initiatives in the member states (109, 87%), very few member states (16, 14%) conducted the evaluation of their initiatives. The Eastern Mediterranean region and the South-East Asia region had the highest percentages of countries that conducted evaluations, while in terms of the World Bank income groupings; the high-income countries reported the highest percentage of countries that conducted evaluation of the initiatives [8].

**eHealth evaluation challenges** – Most respondents reported limited skills/capacity among the evaluation teams, lack of standard procedures on eHealth implementation and evaluation, limited documentation about the eHealth initiatives [61], and un-harmonised interpretation of eHealth performance indicators [9]. Other challenges reported by more than one respondent included limited resources (finances and time) to promote eHealth evaluation activities, unavailability of the definition of impact evaluation indicators [38] and stakeholders' attitude about the evaluation [71]. The challenges faced by implementers in conducting an evaluation of eHealth initiatives are more attributed to the fact that the country had no guidelines for eHealth implementation and evaluation, and implementers had not yet put efforts to building capacity that is relevant for the evaluation of eHealth implementations [38]. Though the country's National eHealth Policy and Strategy [69] was developed and launched in 2017, all existing eHealth initiatives in the country were implemented with no national guidance being followed. Worse still, there were no detailed guidelines for evaluating eHealth initiatives in the country.

**Insights learned from eHealth implementations evaluation** – From this study, we learned that implementers in Uganda undertake more of "monitoring" activities for their eHealth implementations as compared to their evaluation. That is, the implementers understood that such monitoring activities and efforts could also be used to evaluate the impact and contribution of the eHealth implementations to the main programme objectives. This coincides with observations in Otto *et al.*, [72] where only very few cases had their impact evaluation done out of the twelve eHealth cases studied across sixteen African countries. In their study, only Ethiopia's FrontLineSMS and Malawi's CommTrack were evaluated for impact; while for Uganda, both its RapidSMS and MTrac FM were not evaluated [72]. Following guidance by WHO & ITU [12], activities and efforts for eHeath evaluation should consider observations and measurements beyond the process and output indicators to also consider outcome and impact indicators for each of the eHealth implementation/initiative in question. In order to improve the practice of eHealth evaluation in Uganda, efforts are needed to support changing implementers' perspectives on eHealth evaluation; the key effort being the development of an eHealth evaluation framework that will define the notion of *"evaluation"*, its characteristics, and the indicators that should be measured with regards to the performance and impact of eHealth implementations in healthcare and service delivery for Uganda's health system.

# Conclusions

In this study, we share findings from the exploratory study on eHealth evaluation practices and challenges faced in Uganda. We learned that Uganda had implemented various eHealth initiatives that had not followed any national eHealth implementation guidelines, the national eHealth policy and strategy had just been recently developed in 2016 to regulate and guide eHealth implementation in the country. We also learned that most of the eHealth implementations were actually "monitored", an activity that was erroneously used as "evaluation" of these initiatives. In other words, the process of evaluating the outcome and impact attributed to eHealth initiatives had not been a key activity with most of the eHealth implementers. This could be attributed to the fact that the country did not have guidelines on impact evaluation for eHealth implementations; as such, the eHealth implementers majorly monitored eHealth deployment, functionality, and adoption.

Notwithstanding the above challenges and lessons learned, the research findings can play a vital role in terms of providing the baseline situation on which health leaders and policymakers as well as the eHealth implementers can set improvement targets and action plans for strengthening and sustaining eHealth in Uganda. Accordingly, following the guidance of the national eHealth policy and strategy, there is need for the development of an eHealth evaluation framework, evaluation indicators and guidelines for using such a framework, which then can be used to evaluate the outcome and impact of eHealth implementations in the country. Additionally, we advocate for the creation of awareness of the need to plan for eHealth evaluation in addition to monitoring activities during the planning of eHealth implementation programmes. The authors/researchers are already using insights from this study to inform the development an eHealth evaluation framework that will guide comprehensive evaluation of eHealth interventions in Uganda.

# Declarations

### Ethics Approval and Consent to Participate

The study was approved by the Makerere University School of Computing and Informatics Technology Higher Degrees Research Committee and also accepted by the Ministry of Health Uganda. Verbal consent was obtained from all the participants since collected data was treated as anonymous and any quotes reported were not linked to the specific informants.

### Consent for Publication

Not applicable.

### Availability of data and material

The materials/articles used in this review are available upon request from the corresponding author.

### Competing Interests

The authors declare that they have no competing interests.


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### Authors' contributions

Both authors JA and JN worked together to develop the study protocol, administering it and analysing the data collected. Both authors JA and JN developed the full manuscript.

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# Tables

**Table 1:** The use of eHealth

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | To a great extent | 20 | 90.9 | 90.9 | 90.9 |
| | To a certain extent | 2 | 9.1 | 9.1 | 100.0 |
| Total | 22 | 100.0 | 100.0 | | |

**Table 2:** Extent of eHealth Evaluation

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | To a great extent | 11 | 50.0 | 50.0 | 50.0 |
| | To a certain extent | 4 | 18.2 | 18.2 | 68.2 |
| | To a very small extent | 5 | 22.7 | 22.7 | 90.9 |
| | Not at all | 2 | 9.1 | 9.1 | 100.0 |
| Total | 22 | 100.0 | 100.0 | | |

# Figures

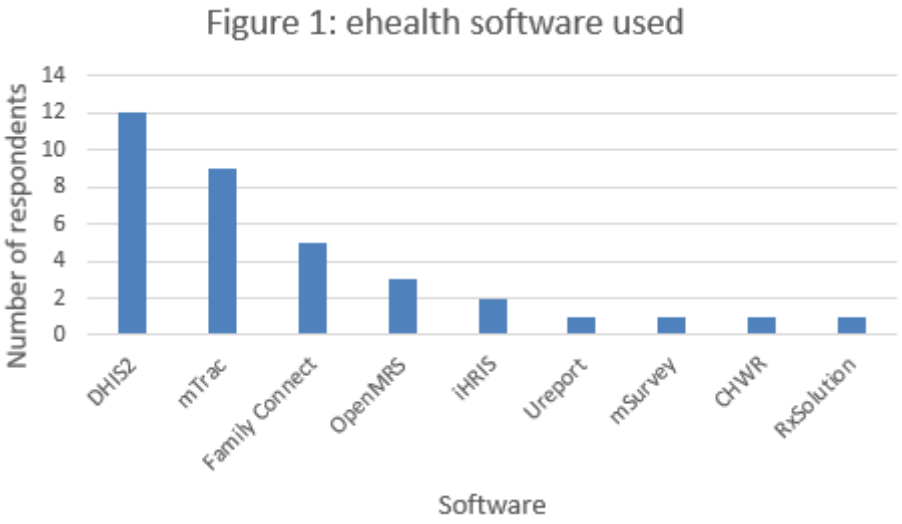



**Figure 1**

eHealth software in use in Uganda's health system.

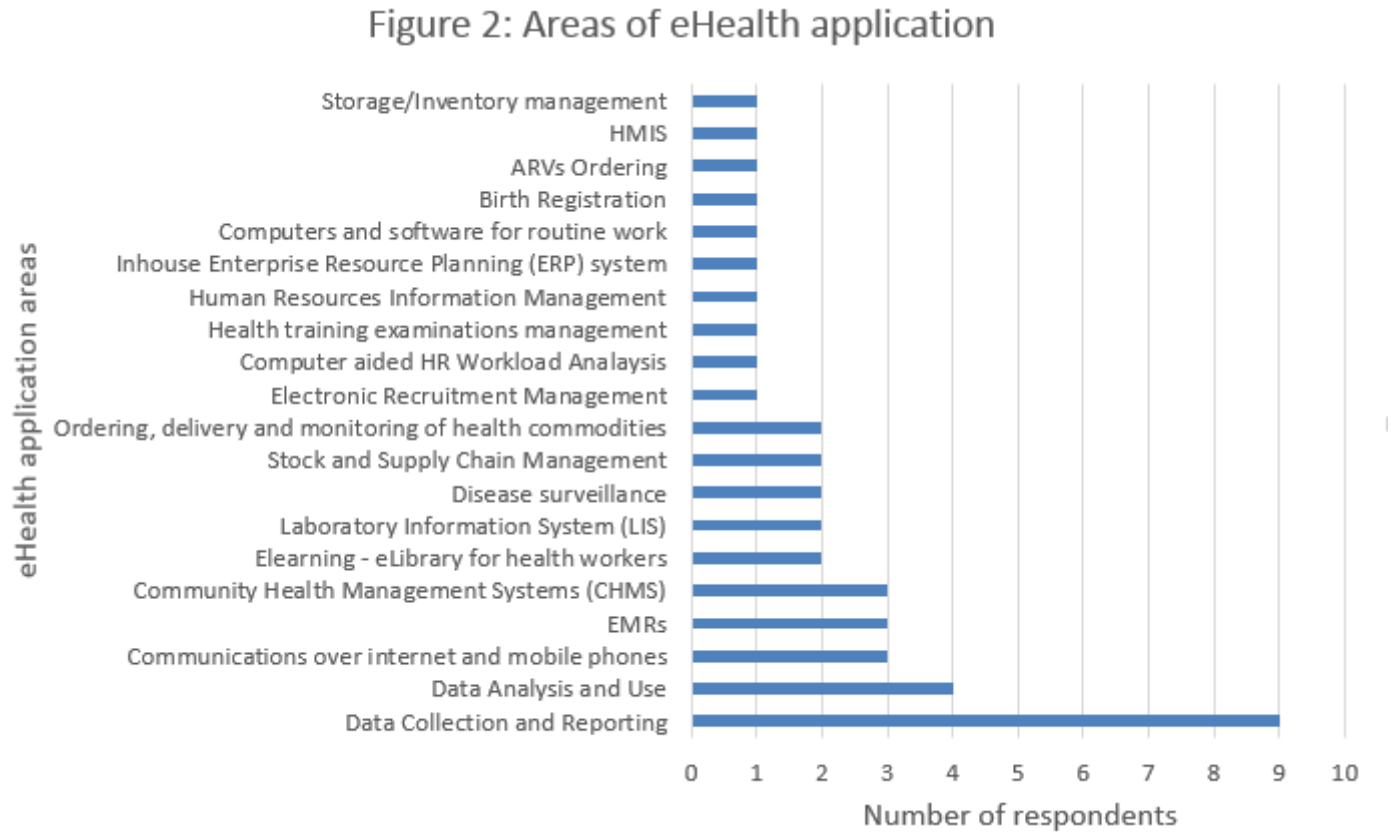
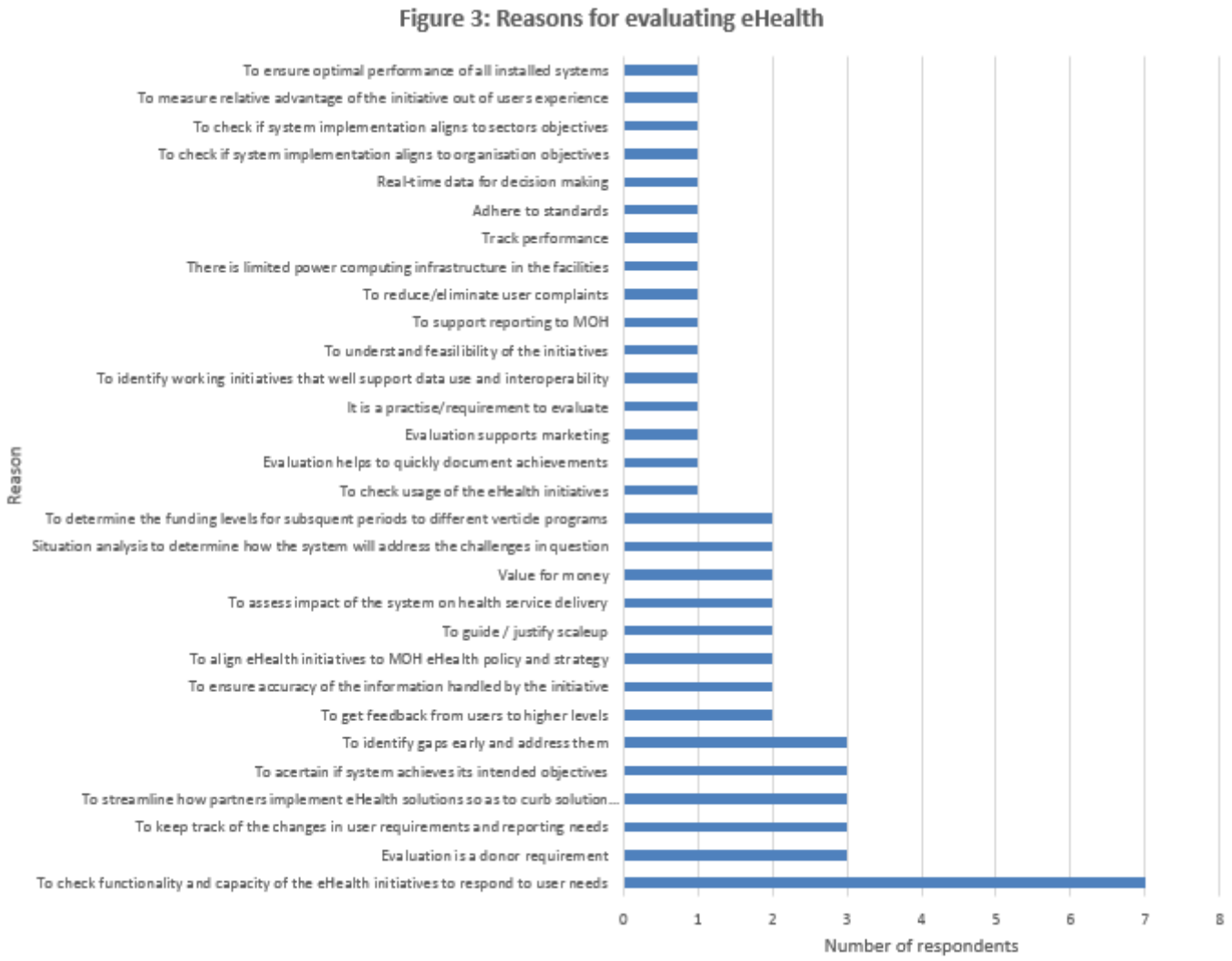


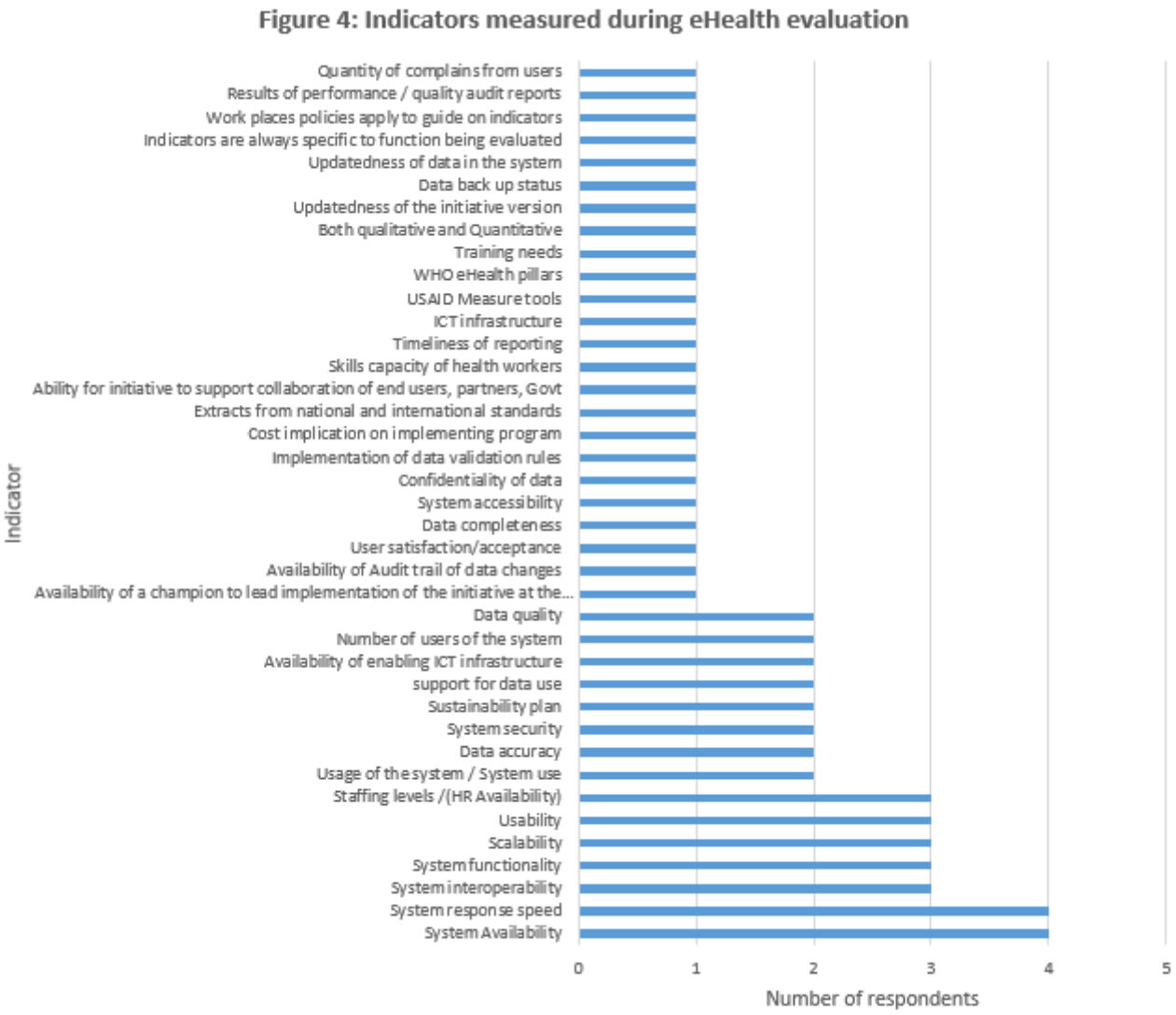

**Figure 2**

Areas of eHealth use.



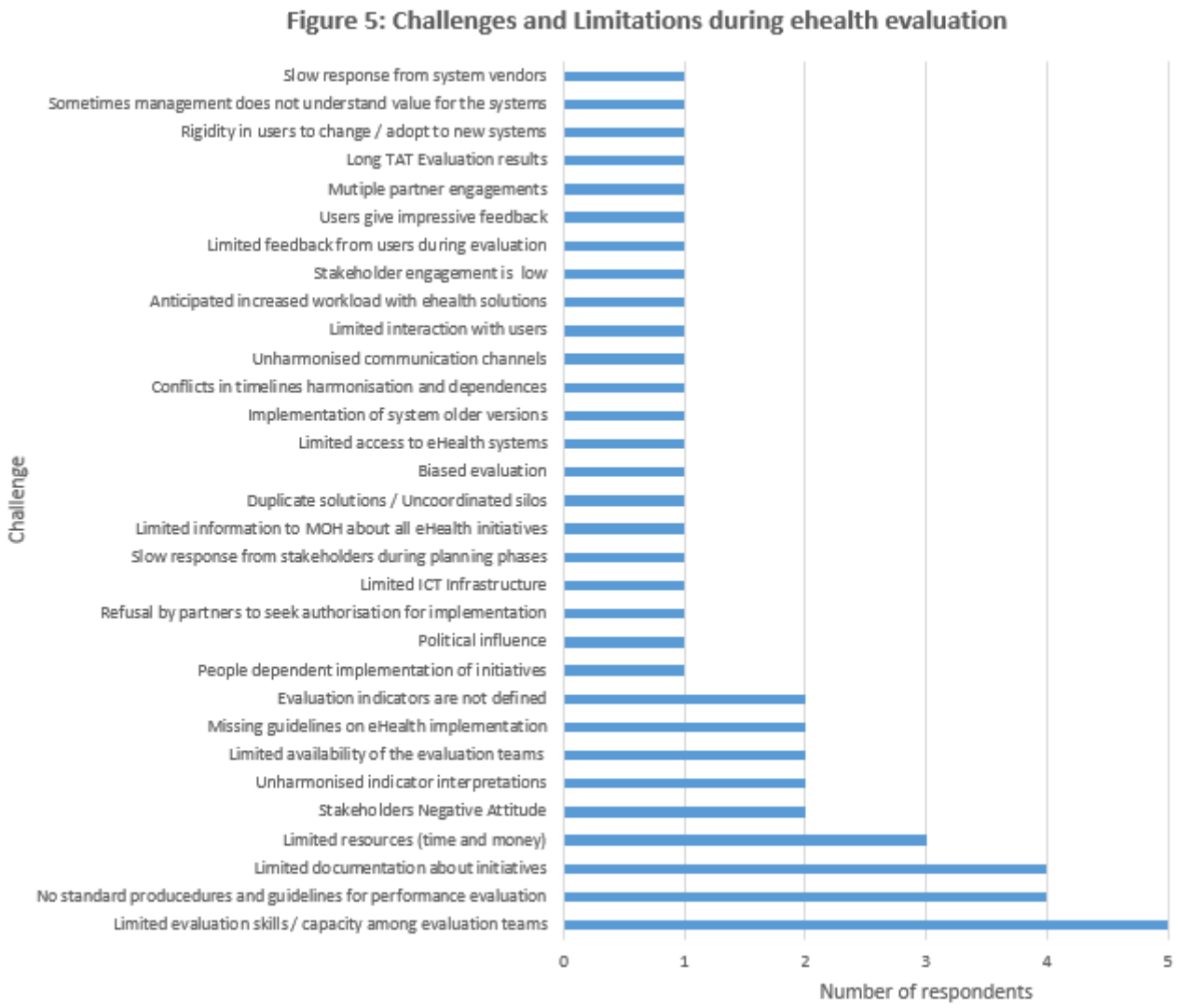

## Figure 3

Reasons for evaluating eHealth.




## Figure 4

Indicators measured during eHealth evaluation.




## Figure 5

Challenges and limitations during eHealth evaluation.