


Acceptance of information communication technology-based health information services: Exploring the culture in primary-level health care of South Ethiopia, using Utaut Model, Ethnographic Study

Digital Health
Volume 8: 1–13
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DOI: 10.1177/20552076221131144
journals.sagepub.com/home/dhj


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Abstract

Introduction: In sub-Saharan African countries including Ethiopia, the acceptance of Information Communication Technology (ICT) in health is at the proof-of-concept level with a few unsustainable piecemeal of pilot projects. Thus, a desirable willingness of acceptance among healthcare providers is a paramount.

Material and Methods: Eight months elapsed ethnographic study design was conducted using participant observation and key informant interviews. The data were entered on Qualitative Data Analysis mine software version 1.4. The quotes and field notes were thematized. The Unified Technology Acceptance and Use Theory (UTAUT) is validated and used to generate new meanings.

Results: This study highlighted the different instances of technology acceptance. Although the primary-level healthcare (PLHC) providers displayed tendencies to accept ICTs-based health information services consistent with the UTAUT dimensions such as the degree of simplicity associated with performance expectancy, use/effort expectancy, facilitating conditions, social issue, individual variation, and organization culture there are instances that disputed acceptance. For instance, the gains in data quality and reporting secondary to the use of District Health Information System Two (DHIS-II) are not influenced by acceptance. Rather PLHC providers are burnt-out of additional clerical duties of filling data on the DHIS-2. Furthermore, ICT acceptance is influenced by individual variations and the unique culture of primary level facilities such as leadership commitment.

Conclusions: On this basis, we conclude that the willingness to accept ICT-based health information services at the primary level is not limited to those factors discussed in the UTAUT model.

Keywords

health care providers, ICT-based health information, primary-level health care, willingness to accept

Submission date: 4 May 2022; Acceptance date: 20 September 2022

Introduction

The healthcare system of a country is one of the pillars in determining a nation's success.¹ Thus, strengthening the sector via technology is paramount. Evidence suggested that most of the high-income countries have established a good and stable healthcare system with the help of Information and communication technologies (ICTs).^{2–4} Therefore, ICTs in the healthcare industry are widely used as digital and analog technologies that support the

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electronic capture, storage, processing, and share of information to promote health, prevent diseases, treat, and manage chronic illness, and so on.⁵⁻⁷

According to World Health Organization (WHO), the application of ICTs in health is not merely about technology.⁸ In a similar fashion, the report of health Canada and Mair and colleague pinpointed ICTs have the potential to reinvigorate access to health services, quality of care, continuity of services, and cost containment through the support of management systems, communication systems, computerized decision support systems, and information systems.⁹⁻¹⁰

As a recent technological advance in the field of medical service, the evolution of several varieties of ICT-based health information services has enabled real-time and intelligent customized services and leads the innovation in the medical service field across the world.¹¹ Thus, ICT-based healthcare services have brought encouraging results in the healthcare industry in general.¹² However, the research report of Agarwal and colleague in 2016 indicated that although many sub-Saharan African countries are mentioning ICT-based health information services as a tool for advancing health system, several are involved in the proof-of-concept level of unsustainable piecemeals of pilot projects.¹³

Despite all the difficulties and challenges in low-income economies, a few countries are trying to expense their meager resources on the application of ICT-based health information services due to the manifold benefits.¹⁴⁻¹⁶ More importantly, the vision of providing equitable, quality, and timely health services using ICT-based health information services has inspired the Federal Ministry of Health of Ethiopia and lead to the formulation of national-level ICT policy in health.¹⁷⁻¹⁹ However, the penetration of ICT-based health information services in the primary-level healthcare facilities is very low.¹⁵ Although a study conducted by Ref. 20 identified connectivity, content, and capacity as a crucial factor for the successful introduction of ICTs in the health sector of developing countries, various studies highlighted the significance of exploring healthcare provider's willingness to accept the technology.²¹⁻²³

According to Dillon and Morris²⁴ acceptance is the willingness within a user group to employ ICT for the tasks it is designed to support. Nowadays, many researchers have been interested in factors that explain the acceptance and use of different technologies in health care. Over the years, healthcare provider's acceptance of ICTs has been explored in the healthcare field using various theoretical models.²⁵⁻²⁸ Accordingly, the different theoretical models brought several factors to examine their effects on healthcare provider's acceptance of ICT-based health information services. For instance, the theory of reasoned action (TRA)²⁹ the unified theory of acceptance and use of technology (UTAUT),³⁰ the technology acceptance model (TAM)³¹ extensions of TAM,³² the theory of planned

behavior (TPB),³³ social cognitive theory (SCT),³⁴ the theory of interpersonal behavior (TIB),³⁵ and the model of PC utilization³⁶ were a few to mention.

Building on the research reports, we claim that the UTAUT is known as the most relevant and the most actively used model in technology acceptance studies in the healthcare domain.^{37,38} Also as argued by Gupta and colleagues,³⁹ UTAUT is a valid model to understand the acceptance and successful usage of ICT-based services in low-income countries. Therefore, this study aims to explore the primary-level healthcare provider's acceptance of ICT-based health information services using UTAUT model.

Methods and materials

The interpretivist research paradigm was applied based on the theoretical belief that reality is socially constructed. Therefore, ethnographic research design was employed to explore the acceptance of ICT-based health information services.

Settings and gaining access to a community

The primary-level healthcare facilities and healthcare providers found in South Ethiopia, Wolaita Zone such as, Bedessa District health center and Wolaita Sodo Town health center were considered purposefully because they are model facilities in performance. Furthermore, the selected health facilities have prior experience in piloting various ICT-based health information services and are similar to most of the PLHC facilities in Ethiopia. The principal researcher contacted various professionals in the field and attended informal meetings to select primary points of contact that facilitated access and assisted their understanding of the group.

Field study methods

The principal researcher framed considerable use of 8 months of participant observation and triangulated with a total of 30 key in-depth interviews in both study locations. The 30-key informants provided richly textured information, relevant to the phenomenon under investigation and no new information is elicited by sampling more units. As a pure observer, the researcher did not participate in the action (patient care) but stood back from the activities and play a neutral role as much as possible. Although the researcher is known and recognized by the study participants, the specific date and time of observation are not specified over the 8 months stay to reduce the Hawthorne bias. Descriptive field notes were taken to keep the track of observations. The initial cryptic form, shorthand, and quick descriptive notes are later expanded and formalized.

Data quality control methods

To maintain the quality, we followed the key steps advised by Treharne and Riggs.⁵⁶ The expanded and formalized field notes are written immediately after the fieldwork. The prolonged (8 months) engagement with participants and debriefing with the research assistant enhanced the credibility of the data in this study. Furthermore, in this study, the authenticity of the in-depth interviews was maintained by representing a fair range of differing viewpoints on the topic.

Data analysis

The reading, re-reading and analysis of observation data, and field notes were taken, and in-depth interviews were conducted starting from the field until the final themes' development. Qualitative data analysis mine software version 1.4 was used for further coding and analysis of data.^{40,41} Furthermore, a both deductive and inductive approach to analysis was performed to inform the patterns and themes

development. The UTAUT-based template was used for deductive analysis. The researcher re-read and coded the data points to decide the placement of quotations to the respective overarching themes. Conversely, selected and striking field notes and quotes were linked to the model.

Results

In this study, the data-based inductive analysis and model-based deductive analysis yielded additional factors on top of the well-known factors discussed in the UTAUT model. Thus, the newly proposed theoretical model reflects the deep-rooted factors necessary in determining the willingness to accept ICT-based health information services in the primary-level healthcare facilities context. These include performance expectancy, effort expectancy, facilitating condition, social influence, individual variations, and organizational culture. They were used as a pillar for the newly proposed model. Furthermore, the thick description of observation and interview findings was based on those themes (Figure 1 and Table 1).

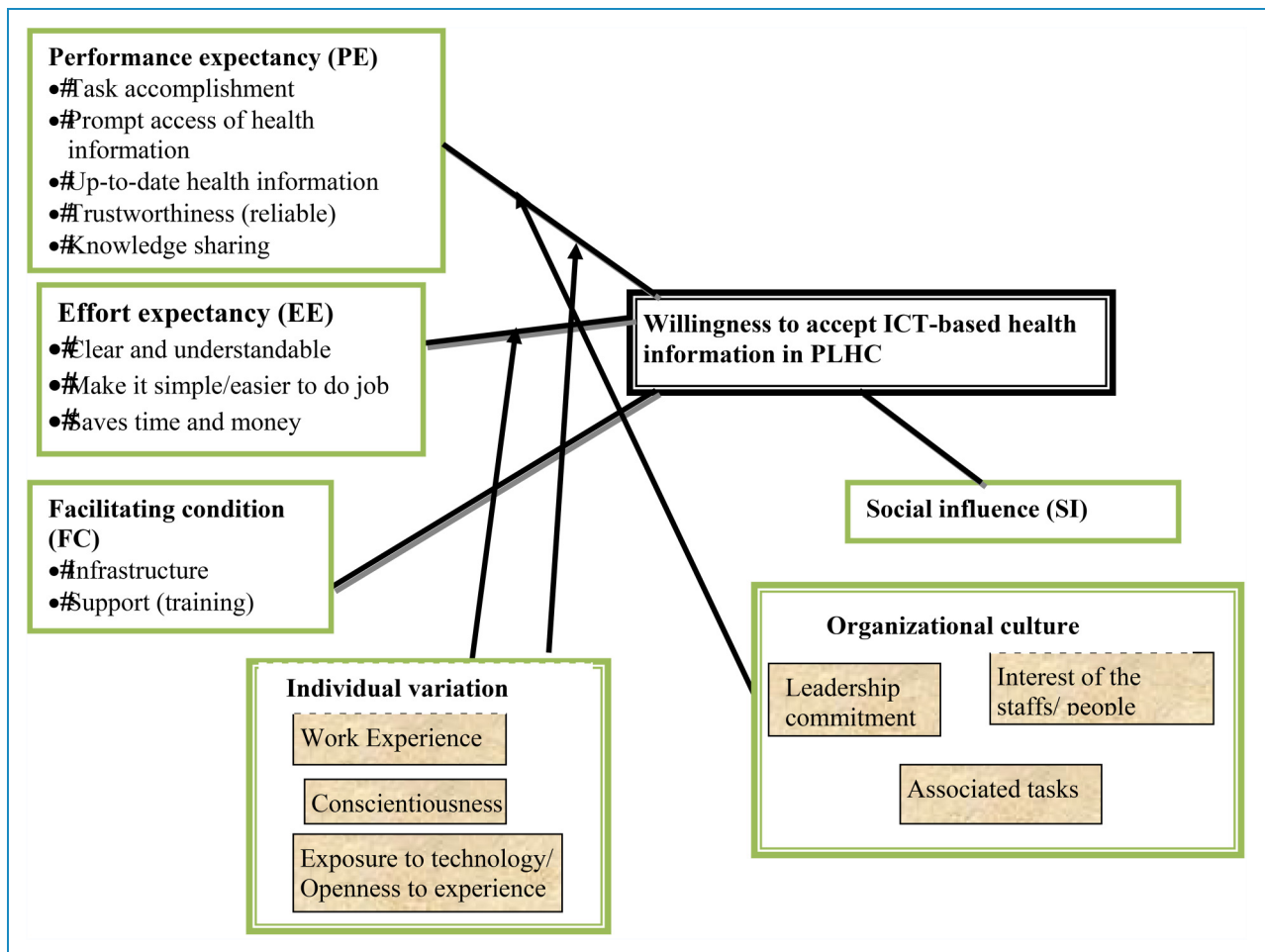


Figure 1. Proposed theoretical model (Source: Adapted from UTAUT model of Venkatesh et al., 2003).

Table 1. Definition of variables used in the proposed UTAUT theoretical model.

Variable	Definition of this study
Performance expectancy	In this section, the performance expectancy is operationalized as used is the degree of belief of the HCPs has ICT-BHIS such as DHL, eHealth, mHealth, telemedicine, telecare, imaging, DHIS2 will help them maintain aspects of their health care practice that pertain to the diagnostic, treatment, preventive and promotive, and management task.
Effort expectancy (EE)	In this study, specifications for the effort expectancy (EE) variable resulted in three indicators measuring the degree of ease associated with ICT-BHIS of HCPs for PLHC
Facilitating condition (FC)	In this study, facilitating conditions refer to informal or formal activities or functions to assist HCPs in using an ICT-based health information service effectively.
Social influence (SI)	This study defined social influence as the degree to which those others (family, friends, colleague) believes either positive or negative will affect someone to use the ICT-based health information service
Individual variation	In this study, the individual difference among HCPs working in the PLHC facilities is the ways in which healthcare providers working in the PLHC settings displayed differing behavior and tendencies to be thorough, organized, careless, and perseverance.
Organizational culture	PLHC organization tends to adopt the ICT-based health information service if the consistency with their culture, horizontal structure, and working for the common goal of treating patients.

Theme 1: Performance expectancy of ICT-based health information service

In this study, healthcare providers working in the primary-level healthcare facilities of Woliata Zone have a mixed conception and believe towards using ICT-based health information service and related gains in job performance. The ICT-based services noted (either used or planned to be implemented) in the

primary-level healthcare facilities include but are not limited to electronic medical records, m-health, telemedicine, SmartCare, District Health Information System two (DHIS-2), data warehouse, Healthnet, digital health libraries, decision support systems, and offline and online mobile based medical applications.

The willingness of healthcare providers to accept the ICT-based health information services for gains in job performance was varied contingent on the following sub-themes that emerged inductively, including task accomplishment, prompt access to health information, up-to-date health information, trustworthiness, and knowledge sharing.

Sub-theme 1.1: Task accomplishment. Throughout the field stay observation and interviews of various healthcare providers working in the PLHC facilities, we (the researchers) have learned that healthcare providers are continuously doing a certain task either individually or in a team in order to finish it in a way that ensures success. For instance, a head of health center said as follows:

With or without data people make decisions. But you can make an informed decision when we have data. As to me DHIS-2 made information available at the tip of our fingers. With one click you will have the information to guide your decisions. (Head of health center 1)

The above analysis reflects how ICT-based health information services such as DHIS-2 facilitate the routine tasks of healthcare providers in a better manner. Thus, there is demonstrated willingness to accept such technologies for gains in job performance. Ironically, another key informant reflected as follows:

The use of new technologies such as DHIS-2 and mobile based medical applications reduced my productivity. For example, before, the introduction of DHIS-2 personally I provide family planning services for more than 14 clients. However, after the system introduced in our health center my productivity reduced by half. Because I am wasting my time while feeding data. (Midwife 4)

The above explanation indicates the tension in organizational productivity in terms of data completeness and reporting versus individual healthcare providers' productivity (number of patients treated).

Sub-theme 1.2: Prompt access to health information. Although there are challenges to access ICT-based health information due to poor connectivity and electric power outage in the PLHC settings, several healthcare providers were observed while they are referring to various types of mobile-based medical application to quickly access the needed health information at the point of patient care. (Field notes 4, 7, and 9: 18 February 2019)

However, a key informant commented that:

Different types of ICT enabled tools such as DHIS-2, Healthnet, and electronic medical records potentially give us the ability to access health information anywhere, regardless of our location and access it any time. (Medical Doctor 2)

Sub-theme 1.3: Up-to-date health information. Healthcare providers were demonstrated their willingness to accept ICT-based health information services such as digital health libraries and access to a broadband internet connection to access up-to-date health information in the vicinity of the PLHC facilities. For instance, one of the key informant reflections is summarized as follows:

The practice of medicine and disease patterns in the community is ever changing. Therefore, we, health professionals working in the frontline need to have access to strong internet connection to base our day-to-day decision on the most recent health information. (Clinical Nurse 4)

Sub-theme 1.4: Trustworthiness. In the field observation, it was noted that most of the healthcare providers prefer paper-based health information as a reliable source, such as standard treatment guidelines, manuals, and standard operating procedures developed by authorized bodies like the ministry of health. In one of the informal meetings (coffee break):

Health officer 2 said: There are plenty of reliable sources available online.
 Medical Doctor 1 asked: Do you know that anyone can create a website.
 Pharmacist 2 said: There is no gatekeeper to make sure that online health information is reliable.
 Health officer 2 commented: Working out which ICT based health information is trustworthy is not always easy task.
 Medical Doctor 1 summarized: If we have access to government-endorsed health websites and mobile-based medical applications we can access reliable information and that will enhance our performance. (Field note 30: 9 November 2020)

Sub-theme 1.5: Knowledge sharing. Healthcare providers working in the PLHC facilities were willing to accept ICT-based health information services such as DHIS-2, Telemedicine, and electronic medical records because, they witnessed DHIS-2 has facilitated documents management, big data storage, access of information, dissemination, exchange, and sharing of information. For instance:

In our health center we are sharing various types of reports, indicators, charts, and maps using DHIS-2 software. (BSc, Nurse 5)

I wish we could have scanned all medical records of the patient and clinical notes; so that we can share patient information using computers. (Medical doctor 4)

The above analysis indicates, there is a potential to facilitate knowledge sharing among healthcare providers in the PLHC if there is the development of ICT-based health information services.

Theme 2: Effort expectancy

The acceptance of ICT-based health information services in the PLHC facilities was found to be dependent on the degree of simplicity associated with the use. More specifically, healthcare providers demonstrated acceptance of technologies as a tool that ease effort put forth at work (simple/easier to navigate and do the job), clear and understandable, and saving time and money.

Sub-theme 2.1: Simple/easier to navigate and do job. Healthcare providers expressed their rejection of technologies that are new and require intensive training for operation. Moreover, the field observation discerned that healthcare providers are fearing of the unknown (new technologies) and do not try in the healthcare facilities. For example:

I prefer technologies such as telemedicine and electronic medical record because they are not stressing while I am using; like the old version of DHIS-2. (Medical laboratory technologist 1). Other professionals also commented like:

Due to the screen layout to color, style, icons, input and output displays; my interaction with the current new version of DHIS-2 is simple, effective and hassle-free as compared to the earlier version. ... I am motivated to use it. (Midwife 4)

For me what matters most is the systems user-friendliness. For example, if you have a user-friendly and easy to navigate health information source with fair content it is okay. However, if you have too much content [comprehensive] and hard to navigate no healthcare provider will use it. (Medical doctor 2)

Sub-theme 2.2: Clear and understandable. In this study healthcare providers expressed their willingness to accept ICT-based health information services so that they know how it works and what it is. On several field observation occasions, it was well noted that healthcare providers

accept technologies that are clear and understandable. For instance, discussion between the district ICT focal person and health informatician:

The health informatician working in the health center raised the need for consistent and tailored training on DHIS-2 and electronic medical record. Further commented like, health-care providers are willing to accept technologies such as mobile based medical application and electronic collections of medical texts, because they understand it, and they know how it works. (Field note 7: 29 March 2020).

Sub-theme 2.3: Saves time and money. In this study, health-care providers expressed opposing and conflicting viewpoints concerning this sub-theme. Although a majority of the professionals expressed their willingness to accept technologies because they save time and money, significant numbers opposed this idea. For instance, the formal meeting of all staff members:

The meeting was officially opened by the head of the health center. And the agendas of the meeting were described. One of the agendas was about the performance of electronic health records and DHIS-2 implementation and the need for equipping and maintaining the health center with ICTs.

- Participant 1: We should learn to improve ICT operations in communication and information sharing, file management, and other aspects because technology saves time and money.
- Participant 5: As to me, acquiring technological tools in our health center is expensive, but most of you think technology investments turn out to be the cheapest. Thus, I don't agree.
- Participant 8: I am thinking of the application of technology in other sectors like education. I believe the startup cost is high. That is why we don't have enough computers or tablets to use.
- Participant 4: Hopefully, all of you agree that we will accept technologies that are saving time and money. Therefore, think of the DHIS-2 and Electronic Medical Record; truly speaking it minimized the extra costs and wastes that would have been made on manual processes. (Field note 21: 12 April 2019)

Theme 3: Facilitating conditions

Healthcare providers working in the PLHC facilities have demonstrated their willingness to accept ICT-based health information services when all the necessary facilities,

tools, equipment, and assistance are provided to support their use.

Sub-theme 3.1: Infrastructures. In this study, it was observed that the existing ICT infrastructure and technical support in the form of training are poor. For instance, from the field observation, it was noted that:

In both observed PLHC facility, there are several rooms like, medical record room, finance room, adult out-patient department, pediatric out-patient department, pharmacy, laboratory, mental health, maternal and child health, emergency, chronic care unit and so on. However, the necessary facilities and equipment such as hardware (Servers, Data Centers, Computers, Routers, and Switches), software (Software Apps, Operating Systems), and Networking (Local Area Network (LAN) and Wireless Local Area Network (WLAN)) are lacking. There are few computers in the medical record room, DHIS-2 room, and administrative office. Even though, network cables are installed the ethernet switch is damaged and there is no broadband internet connectivity. However, there is unstable wireless network connectivity. (Field note 3: 6 March 2019). See (Figure 2).

Sub-theme 3.2: Support/training. On several occasions, the researcher has observed different informal talks and briefing held on issues of ICT application in a health facility as part of awareness creation to attract the use of ICT-based health information services. Regarding the provision of technical assistance, a key informant commented that:

On top of the incomplete and insufficient ICT infrastructure, there is no trustworthy support system that assist us to use even the existing ICT-based health information services. (Pharmacist 2). In contrary, the Zonal ICT expert said

We are insisting HCPs to use the different health ICTs. We organize training to build the capacity. However, we have limited resource to provide consistently and notified this to the regional health bureau. (Zonal ICT head)

Theme 4: Social influence

In this study, social influence is one of the validated constructs found to be linked with the willingness to accept ICT-based health information services. Furthermore, it was clearly observed that individual HCPs acceptance behavior is influenced by important others such as colleagues, Telegram group, professional association, close friends, and so on. For example,

... usually, the head of health center motivates me to use the DHIS-2. He [The head] frequently tells me the experience of other health centers improvement in the data quality



Figure 2. A picture depicting the only damaged ethernet switch found in the compound of PLHC (Photo taken by the principal investigator, 3 October 2019).

and management after the implementation of DHIS-2. I respect his viewpoints and willing to use the system soon. (Medical laboratory 3)

Throughout the field observation it was learned that there are strong relationships and connections among the community, health post, and health center to facilitate the implementation of Electronic Community Health Information System (eCHIS) workflow. Health extension workers were observed while socializing and networking with the health center worker and the client using their eCHIS mobile applications and web-based monitoring portal. This social fabric is working in terms of text messaging. Text messaging has created a form of communication and allowed health extension workers and other staff to deliver tailored services for households and individual clients. For instance, the following field sketch map depicts how the social fabric influence the health extension workers to use the eCHIS consistently (Figure 3).

From the above analysis, the health extension workers in the PLHC settings are formally and informally influenced by health center workers, eCHIS focal person in the district, and the clients. Those social circles are found to be important for the health extension workers and positively influence the acceptance and use of the eCHIS technology.

Theme 5: Individual variations

Individual difference among HCPs working in the PLHC facilities is the ways in which HCPs differ from each other. Every member of the PLHC facilities has their way of behavior. For instance, it was noted that: a few HCPs are open to experience new things whereas the majority prefer to stick with things they know and want to maintain their comfort zones. The other HCPs are conscientious and exert effort to excel in what they do. In nutshell, it was observed that individual variation shaping the willingness to accept ICT-based health information services in PLHC facilities studied. More specifically, conscientiousness (self-efficacy), openness to experience, and work experience are

emerged as important dimensions linked to acceptance of ICT-based health information services.

Sub-theme 5.1: Conscientiousness. Healthcare providers working in the PLHC settings displayed differing tendencies to be thorough, organized, careless, and perseverance. Depending on these tendencies a few HCPs observed while they are striving to excel and tidy up in what they do. For instance,

The health officer working in the chronic disease care department arrives to his office early in the morning. He usually likes to tidy up his office and perform his routine duties based on the business score card plan developed by the health center. He is organized and careful on things he does. (Field note 11: 13 May 2019)

Further on in-depth interview the health officer reflected as follows:

... I was assigned to this department after attending training. The health center has a strategic plan to advance the chronic care department. Thus, I don't jump into things without thinking. Regarding ICT based health information services, personally I don't bet on the importance of technology and willing to accept. (Health officer 3)

Another informant augmented as follows:

... If not always, I can say usually, as a professional serving the community, I am committed, attentive, and exert effort to the task. However, I found it difficult to trust a few healthcare providers working as team. For example, a couple of professionals assigned to work in a team by the head of health center. Our job is to create a digital link between unique identifier and information about households and individuals using eCHIS, to prevent duplicate. Despite my effort to finalize the job, we were not able to manage based on the schedule. Finally, my performance

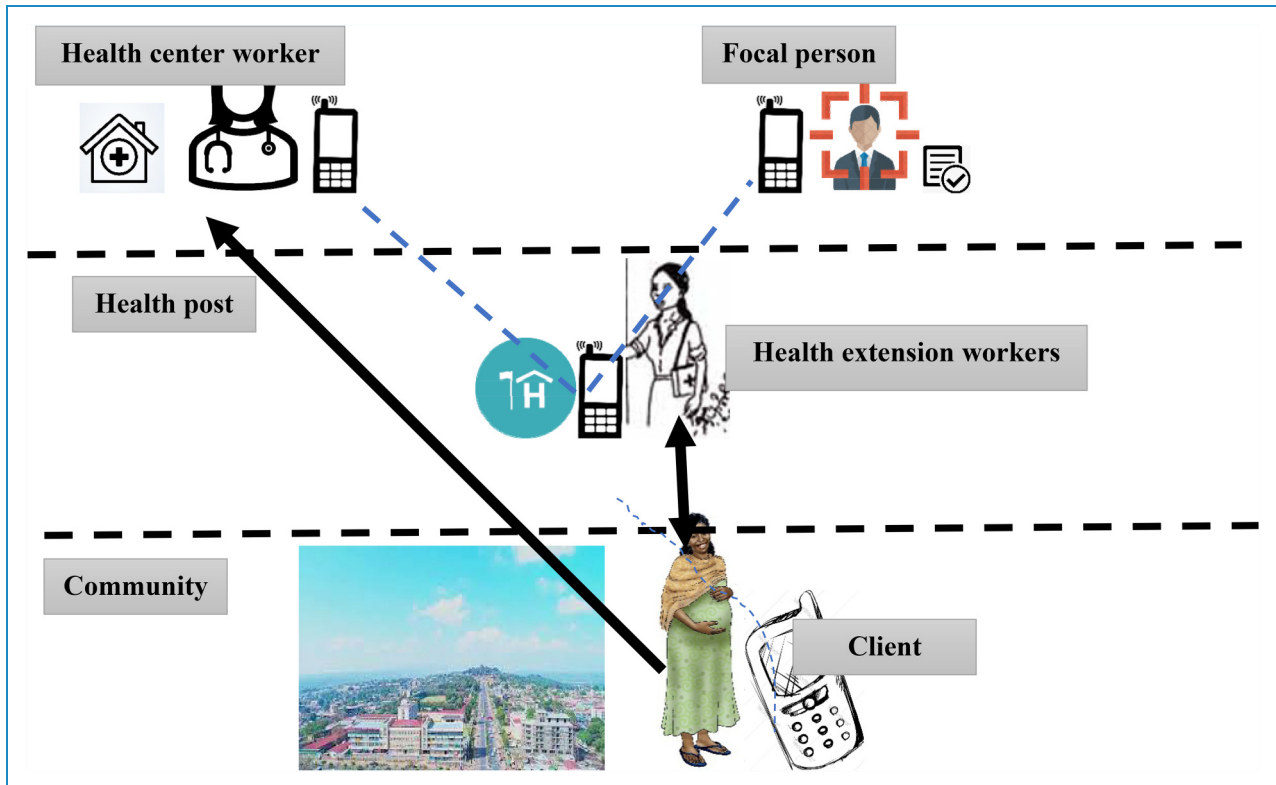


Figure 3. A graphical abstract sketched from the field demonstrating the social fabrics and influence on acceptance of eCHIS at PLHC settings of Wolaita Zone. (Sketched by the Prime author and credit to google image and icons).

is affected by others. That was the most difficult time while I work with others using technology as a tool.

The above data signifies, conscientious professionals could find it more difficult to trust in other health professionals in a group work for fear of others careless behavior reflecting on him/her. They prefer to work alone and are motivated to excel in what they do using technology. But most of the ICT-based health information services in PLHC settings such as eCHIS, Electronic Medical Record (EMR) system, and DHIS-2 implores for teamwork.

Sub-theme 5.2: Prior exposure to technology/openness to experience. Healthcare providers in the PLHC facilities have demonstrated a mixed behavior in accepting ICT-based health information services in regard to this sub-theme. More specifically, a few HCPs argued a prior exposure to technology (the event) and the outcome frustrated them to use it in the future. For instance, one of the key informants commented:

Basically, healthcare is human-centered endeavor. As to me, technology either can enable or distract. For example, I spend most of time on clerical tasks like feeding of data on DHIS-2 software and report generation. Thus, I am burnout. (Midwife 1).

Paradoxically, the other informant said:

... Previously I used to work in the nearby mission hospital. In the hospital there is a system called SmartCare. It is fully integrated electronic health record system that facilitates routine works and enhances efficiency. I wish, it could have been similar in this health center too. (Medical doctor 1)

Therefore, there is a mixed feeling and experience on future use of ICT based health information services.

Another HCP commented as follows:

... I am experienced, I know what to do and how to do. Do not push me and level me as a resistant to change. I personally prefer to stick to things that I know. Because there several health technologies I experienced, and they are not sustainable. I have heard of SmartCare Ethiopia, Electronic medical record, and other health technologies. But there is nothing more than token importance. (MPH 2)

Thus, it was observed that a few healthcare providers are fatigue from such a false promise and no consistencies of

co-occurring actions regarding ICT-based health information services in the PLHC settings.

Sub-theme 5.3: Work experience. In this study, the time spent in the healthcare environment while working and the age of the healthcare providers are proportional. However, when it comes to ICT-based health information services acceptance the time spent at work and the question of age enters the fray.

Although there are instances of negative stereotyping of senior workers, it was observed that while older workers struggle to embrace it.

... don't confuse being old aged. If you can convenience me. Who hate up-to-date information? Although I am old aged, I do have the desire to respond to the changes and convenience of ICT-based health information services. (Health Officer 5)

In contrary, a group of young and newly employed workers were observed while discussing as follows:

Medical doctor 2: I am sorry to label like this. ... for me older [senior/aged] professionals are like a dinosaur who are incapable of gaining new ICT skills.

Midwife 1: Yes! I agree with the idea. We have had a DHIS-2 training together with a senior nurse. He is just refusing the technology and fixing to the business as usual.

Medical doctor 3: I think what we are discussing is not necessarily true all the time. As to me, the lack of ability and confidence needed to effectively engage with technologies is not age dependent. (Field note 18: 15 October 2020)

The other informant reflected as follows:

... As you can see me, I am one of the most experienced and old aged nurses in this health center. Despite the stereotype, I am naturally more inclined to new technologies. I am willing to accept ICTs if it is easy to use for me. (Clinical Nurse 4)

In nutshell, it was noted that older workers tend to heavily rely and need for technical support on how to use DHIS-2 and other ICT-based health information services.

Theme 6: Organizational culture

Even though PHCUs have their own identified and structured ways of doing things, they are adaptable and team-oriented with a horizontal structure and working for

the common goal of treating patients. For instance, the following observation discerned that:

PHCUs are the first contact sites for the community who seek healthcare services. Primarily staffed by medical doctors, Health officers, Nurses, Laboratory technologists, pharmacists, Midwives, and other healthcare providers and administrative staffs. It was noted that, there is deep-rooted culture of departmentalization among professionals with clear order of doing things and accountability. Medical doctors and Health officers are working in the outpatient department diagnosing and treating patient condition. Nurses are specialized in giving care to the patient in a need at different department. Laboratory, pharmacy, and midwives are working they defined tasks and report to the next level. (Field note 2: 15 January 2019)

From the above field note, we can draw the following four subcategories connected with the organizational culture of PHCUs. Such as leadership commitment/power, tasks, and personal interest of the staff.

Sub-theme 6.1: Leadership commitment. The way the PHCU leaders encourage the creativity and open-mindedness of their employees in experimenting with new technologies and procedures in the healthcare facilities inspired healthcare providers. For example:

The head of health center, always comes to the office before all healthcare providers. He walks around all the compound and talk with the cleaners and guards of the health center. Most of the time he is not sitting and working from his office. Rather he goes to each and every healthcare provider office and discuss with them. He motivates the professionals to use DHIS-2 and the Electronic medical record system. He gives freedom for the healthcare providers to use technology as appropriate. He is always saying ... Risk it to get the biscuit. (Field note 12: 25 April 2019)

On the contrary, the DHIS-2, the focal person of the district strictly follows and threatens the healthcare providers as if they are accountable if they make any mistake while trying to feed data and generate reports for local use. For instance, one of the health officers said:

I have been working in this health center for more than 5 years. However, in the last 2 years, after the implementation of DHIS-2, I am not comfortable with what I am doing. There is confusion. The head tell us to work confidently. Whereas the DHIS-2 peoples from district frighten us not to try all the functionalities.... This is demotivating. (Health Officer 1)

The above analysis indicates the need for bold leadership commitment to maximize the acceptance of ICT-based

health information services. Reassuring new ways of thinking and giving freedom to analyze problems from many different viewpoints were found to yield a better individual technology acceptance level in the PLHC settings.

Sub-theme 6.2: Associated tasks. The healthcare tasks are complex and require a nuanced understanding of the health system, presenting patient conditions, and availability of essential medicines. It was clearly noted that most of the tasks in the PLHC are intertwined and require multiple small touches at different service delivery points. For instance:

The first contact for an ambulatory patient in PLHC is medical record room. In which the patient demographic information is registered both in hard and soft copies. The person working in medical record room send the hard copies of patient medical card to the out-patient departments. The healthcare providers working in the out-patient departments take history and do physical examination to diagnose the patient condition. Based on the information gathered, they send the patient to laboratory investigation room with lab request form. Then after, the patient lab result goes back to the out-patient department. Based on the lab finding, history and physical examination the healthcare provider decide the diagnosis and send the patient to the pharmacy department. The pharmacist dispenses the drug and provides counselling on how frequent to take the medicine and necessary precaution to take. (Field note 5: 25 January 2019)

The tasks mentioned above discern the potential for possible integration of the routine workflow in PLHC using ICT-based health information services. Further, it was backed by the key informant interviews as follows:

We waste our precious time while asking the same patient similar personal and medical information again and again. Because usually the patients lose the master patient index card given to them and there is no chance to use past medical history recorded. As to me, automation of patient registry and workflow in PLHC using the SmartCare software could probably enhance efficiency and effectiveness of our tasks. (BSc. Nurse 3)

The above analysis indicates the potential for introducing a new, automated, and acceptable all-in-one healthcare platform that eases the routine tasks of healthcare providers in PLHC settings.

Sub-theme 6.3: Interest of the staffs/people dimension. The demand and interest towards ICT-based health information are varied among the healthcare providers. There are different instances where healthcare providers reflected both their interest and boredom towards ICT application in health. For example:

I was born and raised up in pre-internet period. We travel long distance with referral [No Telemedicine], we read medical textbooks, guidelines, and manuals [No internet and mobile-based medical applications] for medical information. However, after sometimes back, everything is changed. Thus, I am open, passionate, and waiting for some very, very interesting technology in health. (Clinical Nurse 2)

I would be happy to have ICT-based services to facilitate my patient care and treatment. (Medical doctor 1)

Paradoxically, there are a few healthcare providers who reflected their disinterest towards ICT-based health information services such as electronic medical record and DHIS-2. For example:

There are no effective and consistent trainings on different versions of the ICT tools. I am too much boredom and feeling stressed while I am using the DHIS-2 software. ... I don't know it could be due to my hardware [personality] that I feel stressed. (Midwife 3)

In nutshell, it was observed that there are healthcare providers in PLHC who are far-sighted and see the marvels that ICT can potentially bring and vice versa.

Discussion

The findings from this study suggest that there are variations in healthcare provider's willingness to accept ICT-based health information services in the PLHC facilities. The willingness to accept and use was dependent on different factors in addition to the factors identified in the UTAUT model. The possible reason could be the unique nature of PLHC facilities and the application of ethnographic design that discerned the culture of ICT-based health information use and acceptance of new technologies in the context. Furthermore, it is supported by Ref. 42 conceptualization of the importance of context as a theoretical lens in the information science field. Therefore, unlike the Venkatesh and colleagues' (2003) models of technology acceptance that revolve around performance expectancy, effort expectancy, social influence, and facilitating conditions; this study extended the importance of the underlying ways of doing things, beliefs, values, and assumptions peculiar to the PLHC context; that is, organizational culture.

In this study, we validated the performance expectancy construct/dimension of UTAUT. More practically, prompt access to up-to-date and trustworthy health information, timely task accomplishment, and knowledge sharing have emerged as sub-themes of performance expectancy. Thus, the healthcare providers are willing to accept ICT-based health information services due to the gains in job performance.

This is supported by various studies reflecting the intention to use,⁴³ such as studies on decision support⁴⁴; a study on enhancing work performance and quality⁴⁵; study on reducing user's task through computerization processes⁴⁶; and study on evidence-based practice and knowledge sharing. Although there are individual healthcare provider's variations, the possible explanation for the observed similarities could be the introduction of DHIS-2 and improvement in job gains such as complete reporting of data and tracking of implementation.

However, there are observed tensions and paradoxes associated with the willingness to accept. For instance, a few healthcare providers complain that ICT-based health information service such as DHIS-2 and electronic health records hampered their gains in job performance and added additional clerical duties other than direct patient care. This could be due to the politics of data as echoed in the sub-section entitled information revolution of the health sector transformation plan of Ethiopia.⁴⁷ It was used as a measurement of performance in the PLHC settings of the studied area.

Drawing attention from the work of Ref. 30 in this study, the effort expectancy dimension of UTAUT model is validated. Accordingly, the degree of simplicity associated with the use of ICT-based health information services is found to be associated with the willingness to accept. More specifically, healthcare providers in PLHC demonstrated their willingness to accept technologies that ease effort put forth at work, clear and understandable, and saving time, and money. Consistently, studies conducted by^{30,48-50} demonstrated simplicity to navigate and ease of access, clarity, and efficiency as a factor associated with technology acceptance and use. The possible explanation for the observed similarity would be, in the PLHC facilities there is no consistent and organized technical support on how to use, thus technologies that are simple to use and easier to navigate with little or no training are preferred.

This study has validated the Refs. 30 and 33 constructs focusing on the importance of facilitating conditions for acceptance of technologies. Accordingly, healthcare providers working in the PLHC facilities have demonstrated their willingness to accept ICT-based health information services when all the necessary facilities, tools, equipment, and assistance are provided to support their use. This could be explained due to the perception that infrastructure exists to support using system and perception of availability of opportunities, skills, and resources necessary for using. Another the study conducted by Ref. 44 reinforces the availability of computers at the workplace and continuous training and support as a booster of healthcare provider's attitude towards acceptance of ICT-based health information services. However, in the studied healthcare facilities it was found that there is a shortage of infrastructures (hardware's and software's) that enable the acceptance and use of ICT-based health information services. Therefore, designing

a conducive enabling environment/infrastructure is imperative to enhance acceptance and use in PLHC settings.

Even though social influence is a complex and delicate concept, several studies have discerned the impact of social influence on the willingness to accept health information technologies.^{30,32,51-53} However, the significant finding of this study is the PLHC providers cognition of important others expectation to use eCHIS cause the health extension workers to use system. More importantly, this created a sense of belongingness to the technology (eCHIS) and the health system. We argue it could be explained by the thesis of the Theory of Reasoned Action's (TRA) claiming a specific behavioral intention is a function of healthcare provider's expectation that relevant referents expect them to perform the behavior.

The noteworthy finding of this study is the individual healthcare provider's difference on the willingness to accept and the paradoxes with prior research. For instance, the study conducted by Ref. 54 implicated that HCPs with longer tenure and older age are likely to resist and not willing to accept new technology. However, in this study it was discerned that *the lack of ability and confidence needed to effectively engage with technologies is not age dependent*. Rather, it was observed that, HCPs who display tendencies to be organized, careful, and thorough are more willing to accept ICT-based health information services despite of their age and work experience. For instance, a few conscientious HCPs in the PLHC settings demonstrated motive to excel in what they do using technology such as DHIS-2 and electronic health record. However, consistent to earlier study by⁵⁵ prior exposure/openness to experience to similar technologies is linked to acceptance. It could be explained because prior experience cannot only enable a user to assess how easy it may be to use a system, but to also evaluate the helpfulness of the system.

Conclusions

On this basis, we conclude that the willingness to accept ICT-based health information services in the PLHC settings are not limited to those factors discussed in the UTAUT model of technology acceptance. Therefore, this study may be considered a further validation of the UTAUT model in the context of PLHC in low-income settings. More specifically, the constructs such as effort expectancy, performance expectancy, and facilitating conditions are consistently validated as factors associated with the willingness to accept ICT-based health information services. However, there are tensions and paradoxes peculiar to the PLHC context in relation to constructs such as individual variations and organizational culture in determining the willingness to accept. Thus, it was recommended to consider the culture of PLHC facilities and individual HCPs willingness while designing and developing ICT-based

health information services for successful and sustainable implementation to move beyond business as usual.

Limitations of the research

Though this study contributes to the field of ICT-based health information services acceptance in PLHC contexts using ethnographic design, it suffers from certain limitations inherent to the design that is not able to be generalized. Further, due to the high information security and data sharing rule, we were not able to supplement the thick descriptions of direct observation and in-depth interviews via document analysis. Despite the limitations, it has widened our conception of technology acceptance via validating the UTAUT to the context PLHC facilities in low-income countries.

Guarantor: Senait Samuel Bramo

Acknowledgments: We would like to express our gratitude and appreciation to all those participants who gave us the possibility to complete this study.

Author's contribution: All the authors approved the final version of the manuscript.

Declaration of conflicting interests: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding: The author(s) received no financial support for the research, authorship, and/or publication of this article.

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