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Exploring Factors Influencing E-Health Adoption and Use among Healthcare Professionals in the clinical area in Sub-Saharan Africa: Using Q-Methodology and Models of Technology Acceptance

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Abstract

Background: Despite the reported advantages of utilising healthcare technology within the clinical area in developed countries, there has been limited information on factors influencing e-health adoption and use in developing countries including sub-Saharan Africa. Thus, this study using Q-methodology provided insight into those salient factors that influences these group of participants' choices about e-health adoption and use in their clinical practices.

Methods: This research study utilised models of technology acceptance and use: Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) together with Q-methodology to explore e-health adoption and use among healthcare professionals (HCPs) in the clinical area sub-Saharan Africa.

Results: Findings from this study identified four divergent views (Factors) that these participants hold about adoption and use of e-health within their respective clinical practices. The first view represented a group of participants identified as "patient-focused e-health advocates" whose choices about using e-health in their clinical practice are informed by their patient/families' preferences. The second view represented a view identified as "task-focused e-health advocates". This group of HCPs are driven to adoption and use of e-health by the need to complete their allocated tasks. The third view that emerged represented the "traditionalistic-pragmatists" who recognised that e-health has its advantages within clinical practice, but do not integrate it within their work. This group sees technology as a separate entity to routine clinical practice. The final view represents the "tech-focused e-health advocates". This group recognise the value that e-health adds to their clinical practice and integrates it into their practice. In addition, this group also look for opportunities to utilise the e-health tools beyond their respective departments.

Discussion: The use of Q-methodology as a unique methodology to explore the HCPs subjectivity together with both TAM and UTAUT

provided in depth understanding of what influences HCPs e-health adoption and use. The findings from this study identified that personal viewpoints about technologies held by the participants' influences their choices about e-health. These viewpoints manifests as Factors within this research study. This research study also provided insight to the equivocal tripartite relationship that exist between these HCPs, e-health/clinical practice and the patients/families'.

Conclusion: This identifies how HCPs interpret the contribution that e-health makes and how this view influences their clinical practice. In addition, findings from this study will also inform stakeholders when implementing an e-health policy to consider the views of the HCPs who use these technologies.

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Table of Contents

Tables of Figures

TABLES

FIGURES

List of Acronyms

TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
SSA	Sub-Saharan Africa
ICT	Information and Communication Technologies
IT	Information Technology
HCP	Healthcare Professionals
CIS	Clinical Information Systems
PU	Perceived Usefulness
PEoU	Perceived Ease of Use
PE	Performance Expectancy
EE	Effort Expectancy
SN	Subjective Norm
SI	Social Influence
FC	Facilitating Conditions
ID	Individual Differences
BI	Behavioural Intention
EHR	Electronic Health Record
RCN	Royal College of Nursing

Chapter 1. Introduction

1.1 Overview

The use of information and communication technology (ICT) has been identified to have the potential for improving the health of individuals including the services and performance of their healthcare providers. This includes the provision of better quality healthcare, improved patient-healthcare professional relationship and better inter-professional collaborations among healthcare professionals (HCPs) (Akanbi et al., 2012, Buntin et al., 2011, Crow et al., 2012, Gagnon et al., 2012a, UnitedNationsFoundation, 2014b). ICTs have been described as tools that facilitate communication and the processing and transmission of information and the sharing of knowledge through electronic means (Bordé et al., 2010). Within healthcare, ICT is synonymous with the term health information technology (HIT) and e-health. E-health has been defined by the UnitedNationsFoundation (2014b) as 'the use of ICT in support and health related fields, including healthcare services; health surveillance; health literature; and health education, knowledge and research' (p.6). Though this definition may be broad a more encompassing definition that will be adopted by this research study will be the definition by the Royal College of Nursing (RCN). They defined e-health as "concerned with the promotion, empowering and facilitating health and wellbeing with individual, families and communities and the enhancement of professional practice using information management and information and communication technologies" (RCN, 2017). Due to the advantages that e-health offers, various healthcare institutions and governments have invested both finance and infrastructure to ensure quality healthcare is achieved. However, there are still challenges facing adoption and use of these technologies by those HCPs who are expected to use them, especially in developing countries such as in Sub-Saharan Africa (SSA) (Akanbi et al., 2012).

Previous studies have explored barriers and facilitators to the use of these technologies but these studies have often excluded developing countries (Gagnon et al., 2012a). Moreover, these examples nearly

always focus on a single disease such as HIV/AIDS and malaria (Akanbi et al., 2012, Crow et al., 2012). Such exclusion obscures the information about adoption and use of these technologies by HCPs in these regions. Despite notable interest and commitments towards better healthcare by institutions and governments within those areas, a broader view of barriers and facilitators are not captured (Crow et al., 2012).

Cresswell et al. (2013) reported that despite the substantial financial, human and organisational investment towards e-health to provide quality healthcare, these technologies may hinder professional practice by HCPs in the clinical area. They further note that due to poor fit of these technologies within HCPs clinical practice may delay or fail to achieve its intended objective. For this reason, researchers such as Greenhalgh et al. (2017) and Ami-Narh and Williams (2012) have advocated for interdisciplinary studies that are locally situated using combination of methods to explore the interaction that exist between HCPs and these e-health tools.

As a result, this study utilised Q-methodology (a unique methodology to explore subjectivity) together with models of technology to understand the factors that influence e-health adoption and use among HCPs in clinical practice in SSA. The purpose was to provide an in-depth understanding of HCPs in SSA holistic views about e-health adoption and use.

1.2 E-health policy versus E-health adoption by HCPs

1.2.1 E-health policy and adoption in SSA

Sub-Saharan Africa, a region with 33 of 48 of the worlds' poorest countries (Wamala and Augustine, 2013) is identified to have many health problems due to its high disease burden, expanding population, shortage of healthcare professionals and poor infrastructures (Akanbi et al., 2012, Mars, 2012). Wamala and Augustine (2013) classified the challenges facing SSA into two categories, the technological and the non-technological challenges. The technological challenge they

identified to cover issues of poor infrastructure for e-health implementation, while the non-technological involves both individual (HCP) and government policies affecting adopting ICT within healthcare practices.

Thus, the emergence of e-health presents as a solution to some of the health problems affecting SSA (Akanbi et al., 2012, Mars, 2012, Obasola et al., 2015, Zayyad and Toycan, 2018) by providing an opportunity to address these issues. Despite this, some researchers have identified lack of political will by certain governments within the region such as Nigeria, towards developing and implementing health policies that incorporate e-health within its mandates (Mars, 2012, Zayyad and Toycan, 2018). The common reason these governments give are generally due to the expensive burden of e-health resources. Other researchers have also identified that in certain countries where governments have implemented e-health policies such as South Africa and Ethiopia, HCPs lag behind in adopting it within their clinical practices (Wamala and Augustine, 2013) . The reason provided by these researchers for the HCP's behaviours were due to increased burden of already existing workload, and in some instances fear of using new technologies (Gagnon et al., 2012a, Zayyad and Toycan, 2018).

In addressing these challenges and in line with achieving provision of quality healthcare, certain governments in SSA have taken measures to include ICT within the healthcare practices within their countries. Together with the provision of internet access in various healthcare institutions, some governments have entered collaborations with certain organisations and foreign governments (usually European) for the affordable and sustainable e-health resources (Wamala and Augustine, 2013). An example of such is the Pan-African e-network project and *Reseau en Africue Francophone pour la Telemedicine* (RAFT) that aim to support the development of indigenous regional networks within healthcare centres in developing countries and their respective universities. In addition, these networks are linked to the participating

European countries (Wamala and Augustine, 2013). Other examples of such collaborations include the *Keneya Blown* in Mali sponsored by the Swiss government and *Ashrafcom* in Sudan that brings e-health to HCPs (Wamala and Augustine, 2013).

Furthermore, recent studies have shown that countries within SSA that have successfully adopted e-health for improving quality healthcare have recorded significant gains in this regard (Zayyad and Toycan, 2018). These researchers identified improved patient identification, structured documentation and reporting, better financial management and decreased patient waiting times. Others researchers such as Qureshi (2016) have identified that incorporating ICT within healthcare played a major role in the tracking of cases during the Ebola epidemic in African countries such as Nigeria.

In Nigeria, the Federal Ministry of Health (FMOH) has a division responsible for e-health which among its duties is to support the implementation of e-health policies and initiatives, support the development and compliance to legal framework on e-health adoption and implementation and also support the collaboration between the country and international organisations towards e-health adoption and implementation (FMOH, 2017). However, the FMOH has stated the e-health policy within the country is still at an emerging stage. This means healthcare institutions within the country are not yet bound by a well-defined e-health policy for e-health adoption and use within the clinical environment. As a result, each hospital can decide to identify, administer and oversee e-health tools within its boundaries. The UnitedNationsFoundation (2014b) reported that the drivers for e-health within Nigeria revolve around political, commitment and healthcare needs by the country. As such, the government recognises e-health as an important driver towards improved quality healthcare within the country. In addition, the report stated that the government has no clear guidance on how to engage with stakeholders in e-health use, to ensure that these technologies integrate appropriately with existing workflows within the clinical area. In addition, it was also recognised that

healthcare financing for such tools rests on the healthcare institutions who will use these e-health tools (UnitedNationsFoundation, 2014b).

Thus, healthcare administrators in healthcare institutions become "saddled" with the choices of which e-health resource should be adopted to support healthcare within the scope of the organisation. These choices are further influenced by the provision of the e-health tools by donor projects (Akanbi et al., 2012). This limits the ability of HCPs themselves to influence which e-health should be provided within their respective clinical practices. This is because decision makers tend to "supply" the clinical environment with any e-health tool(s) they deem fit even if it may not be clinically adopted by the HCPs. This also pertained in the study setting in the current study. The hospital management provides all e-health tools in the hospital without consultation with stakeholders or users within the clinical area. For example, HCPs reported that desktops were available within all the wards at one point but were retrieved and subsequently replaced with portable handheld devices that do not have in-built software. Huryk (2010) also identified a similar issue while reviewing nursing attitudes to healthcare technology. The author reported that the nurses indicated they were not consulted in the design, which resulted in modification of the computerised care plan post-implementation even though they had positive attitudes towards such technologies.

This approach to e-health utilisation in the clinical setting is adjudged different to developed countries where a policy guiding the adoption and use of e-health is already in place. HCPs and hospital management in clinical settings in these hospitals are bound by those policies (Holden, 2010, Lluch, 2011, Lluch and Abadie, 2013, Verhoeven et al., 2009, Vezyridis and Timmons, 2014, Villalba-Mora et al., 2015, Wills et al., 2008). Notwithstanding however, HCPs within the developed countries as seen in Holden (2010) are also not devoid of challenges in the adoption and use of these e-health tools, which will be revealed later in this thesis, are synonymous with the findings of this study.

1.2.2 E-health policies in the UK

In the UK, the NHS in 1998 laid out an information strategy which includes amongst its objective is '*lifelong electronic health record for every person in the country; round the clock on-line access to patient records and information about best clinical practice for all clinicians*' (Burns, 1998, p9). However, this came on the back of admitting that a lot of money has been wasted and important data has also not been collected. Most NHS clinicians at that time were reported to perceive IT as more of a hindrance than a path to success (Dobson, 1998 cited in Burns, 1998).

Moreover, the UK National Health Service (NHS) was reported to have achieved almost 100% digitisation of general practice (GP) sector by the mid-2000. This was achieved even though the National Programme for information technology (NPfIT) was subsequently shut down after nine years for failing to achieve its goals such as the digitisation of secondary care amongst others (Robert, 2016). Recently, the National Advisory Group on Health Information Technology in England among its ten 'overall findings and principles identified that health information technology must be designed with the input of the end users to avoid poor design and implementation (unlike what was observed in the current study) (Robert, 2016). It is seen that the journey on the use of e-health in the UK was a key government drive (Eason and Waterson, 2013, Gerrish et al., 2006) which sought to elevate the standard of healthcare using information technology. Thus, Gerrish et al. (2006) emphasised that successful implementation of such strategy is dependent on HCPs having the necessary skill (and understanding) of how health information technology works. This is also based on the need to have an evidenced-based healthcare practice which among its necessary requirement; HCPs must have ready access to an 'up-to-date' clinical information (p.93). Despite this noteworthy drive by both the UK government and the NHS, adoption and use of ICT in clinical practice is reported to have its challenges (Timmons, 2003, Vezyridis and Timmons, 2015). These challenges range from 'resistive compliance'

(Timmons, 2003, p267) to ‘supportive non-use’ (Geiger et al., 2017, p2366). As part of addressing some of these challenges, there should be an initial engagement process with all the stakeholders in the clinical area followed by experimentation and learning and not just a controlled rolling-out of an e-health tool based on certain time-bound objectives (Bossen, 2007, Li et al., 2013).

In this regard, one of the aims of this current research study is to help understand these challenges by uncovering the respective viewpoints that HCPs have about these technologies.

These views reported in Chapter 5 show that they play a part in determining the type of interaction between both the HCPs, the patient and the e-health used within clinical practice.

1.3 Research aim

The aim of this research study was to explore factors influencing e-health adoption and use among HCPs in clinical practice in SSA while also contributing to existing literature. This was to make clear the barriers and facilitators to e-health adoption among HCPs in SSA. This may help inform institutional and governmental policies that concern e-health adoption and use within clinical practice. In fact, a clear understanding of viewpoints of HCPs by policy/decision makers might influence the appropriate implementation and subsequent adoption and use of the e-health tools. Utilising these informed decisions and policies will evidently provide a clear guide to future e-health practices by HCPs within clinical practice in SSA.

Specific objectives that guide this aim are provided in section 2.7.

1.4 Clarifying terms

As described in section 1.1, various researchers have operationalised the term e-health to mean a myriad healthcare technologies (Ami-Narh and Williams, 2012, Barello et al., 2015, de Grood et al., 2016, Obasola et al., 2015, van Gemert-Pijnen et al., 2011) while others use the term to refer to just one healthcare technology (While and Dewsbury, 2011) and usually an electronic health record (EHR). As such the e-health in

this research study involves both EHR, desktop computers, handheld electronic devices used for clinical activities together with the internet available at the study area.

Also, the term “factor” has a specific meaning within Q-methodology research and is often written and presented as “Factor” referring to a viewpoint or participant perspective that emerge after Q-factor analysis. Within this study, while referring to emerged viewpoint(s) the term “Factor” is used. However, other use of the word “factor” to describe an issue or to refer to one or more things which affect a something is also used where applicable.

1.5 Thesis outline

The outline for this thesis is structured as follows:

Chapter 2 presents a critical review on the factors influencing ICT adoption and use in healthcare. It analyses literature on the barriers and facilitators to ICT adoption and use by HCPs identified in previous research. The chapter also provides a critical analysis of the models of technology acceptance and use that served as theoretical framework for development of literature and meeting the objectives of the study for the study; Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT). The chapter concludes by introducing Q-methodology, the methodology adopted for this research study.

Chapter 3 provides the reader with an in-depth look at method and the Q-methodology process which has been introduced in Chapter 2, ethical issues considered during this research study was addressed in this chapter.

Chapter 4 presents the findings of this research study. The Factors that emerged following the Q-analysis process described in Chapter 3 were presented in this chapter. Both Model Q-sorts, Crib sheets and Factor narratives of the Factors are presented including consensus and disagreement to provide an in-depth understanding of the HCPs view about adoption and use of ICT/e-health in their respective clinical

practices. The discussion of these findings was analysed and presented in Chapter 5. Also, in Chapter 5, discussion about the key themes from both TAM and UTAUT described in Chapter 2 that influence the HCPs choices about adopting e-health. An analysis of the tripartite interaction that exist between the HCPs in the four Factors, patients/families and e-health was also presented in Chapter 5.

Chapter 6 provides the conclusion of the thesis, which reviewed and evaluates how the research aim and objectives were met. Implications for the research study are discussed which was followed by detailed recommendations for adapting the findings of the study. A paragraph on recommendations for future research concludes the chapter.

Chapter 2. Literature

2.1. Introduction

Gagnon et al. (2009) defines information and communication technology (ICT) as 'digital and analogue technologies that facilitate the capturing, processing, storage and exchange of information via the electronic communication which have the potential to improve information management, access to health services, quality of care, and continuity of services and cost containment' (p.1). Further, Gagnon et al. (2012a) in their review identified these ICTs to encompass all digital technologies that facilitate the electronic capture, processing, storage and exchange of information. ICT use in health care could improve information management, access to health services, quality and safety of care, continuity of services and cost containment (Buntin et al., 2011, Gagnon et al., 2012a).

ICT has also been used in care to support the daily living activities, help interaction, educate patients, and enable the use of health care services (Korhonen et al., 2014, Rauhala and Topo, 2003). While describing the healthcare benefit of ICT in Sub-Saharan Africa, Idowu et al. (2008) identified some as

- Reducing the running cost of hospitals,
- Potential for sharing patient information without threat to privacy,
- Use of encryption and password protection to keep patient data confidential,
- Improves efficiency of medical personnel,
- Makes information available for use by health personnel in an easily readable form,
- Assist patient to locate health facility and personnel, and
- Provides 24-hour access to health information.

In addition, Ami-Narh and Williams (2012) study to investigate technology acceptance among health professionals in Africa also identified some benefits to include:

Access

- Reduce waiting time for diagnostic and laboratory results
- Improved availability of community-based health services
- Reduce patient time travel and access to services
- Increase patient participation in home care

Quality

- Better interpretation of diagnostic and laboratory results
- Decreased adverse drug event
- Decrease prescription errors
- Increase speed and accuracy detecting infections and disease outbreaks

Productivity

- Increased access to patient data
- Reduce duplication of test and prescriptions
- Reduce prescription call backs
- Reduce patient and provider travel cost

Users of ICT in healthcare/e-health have witnessed an evolution of health information technologies over the years from mere data compilations into desktop computers, emails, web access in limited definitions to broad range of applications/solutions such as Electronic Health Records (EHRs), Computerized Physician Order Entry (CPOE), eICU-technology, mobile health applications, e-portfolios, etc. These transformations have progressed both within specific specialities and within the broader healthcare settings. Specifically, the Royal College of Nursing (RCN) definition of e-health in section 1.1 has been used to refer to healthcare technologies used by healthcare professionals (HCPs) in their practice. A more descriptive definition of e-health was provided by the Openclinical.org cited in Gagnon et al. (2009), it identified the e-health to encompass five categories; electronic medical records, telemedicine and telecare services, health information networks, decision support tools for HCPs, and internet based technologies and services. Within this

research study while recognising the earlier definitions of e-health, the term will also refer to e-health tools comprising of both desktop computers and handheld devices used for entering, sharing and retrieving patient health records and the internet.

Ajuwon and Rhine (2008) reported that ICT offers developing countries unique opportunities for narrowing the developing gap with industrialised countries. The use of ICTs including the internet in healthcare is viewed as the principle tool for bridging health information gaps globally. Akanbi et al. (2012) also identified that despite the dramatically improved access to the internet across countries in sub-Saharan Africa, there is still limited information on e-health. The adoption of e-health is thus reported as uncertain and challenging task in the fifty-three countries in sub-Saharan Africa unlike in the developed countries who were able to harness e-health through the empowerment of those who access and use it (Ajuwon and Rhine, 2008, Mostert-Phipps et al., 2013).

With all the advantages stated, a lot of healthcare institutions globally have invested financially to attain an excellent degree of healthcare quality and efficiency especially in developed countries, but e-health have not been harnessed in developing countries (Ajuwon and Rhine, 2008, Edejer, 2000, Odutola, 2003). Studies have reported on the adoption and use of e-health in the healthcare setting amongst different genre of health professionals ranging from health information professionals, reproductive health workers, organisational, maternal and child health workers, nurses, primary healthcare workers, and physicians in identifying various factors affecting e-health adoption. Despite these, such studies have not been able to demonstrate the understanding of the factors from the subjectivities of the users (Ajuwon and Rhine, 2008, Bennani and Oumlil, 2013, Gagnon et al., 2009, Gagnon et al., 2014, Gururajan and Hafeez-Baig, 2014, Idowu et al., 2008, Jimoh et al., 2012, Lluch, 2011, Olatokun and Adeboyejo, 2009, Pędziński et al., 2013, Robinson, 2010, Verhoeven et al., 2009). These studies which will be discussed in more detail later in this chapter have used health professionals as participants

within their studies, mostly physicians and few nurses. This is also substantiated by Li et al. (2013) who reported that healthcare providers e.g. physicians (and nurses) are the key driving force in pushing e-health, without their acceptance and actual use, those e-health benefits would be unlikely to be reaped. This study will use this same population to explore the factors that influence e-health adoption and use in clinical practice in sub-Saharan Africa, a region that has been identified to have been left behind in terms of e-health adoption which is required to improve healthcare (Akanbi et al., 2012, Crow et al., 2012).

In understanding e-health adoption and use, certain researchers have suggested the use of models of technology acceptance as frameworks within studies (Chuttur, 2009, Holden and Karsh, 2010, Yarbrough and Smith, 2007). Thus, Chuttur (2009) emphasized that it is essential for one to understand the Technology Acceptance Model (TAM) (see section 2.4). This corroborates Yarbrough and Smith (2007) who identified that although other predictive models of e-health adoption exist, the TAM is the most widely recognised model of behavioural intention in the information systems literature. Also, another model that literature has shown to have the highest power in explaining intention to use a technology than any theory on technology acceptance literature is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Ami-Narh and Williams, 2012) (see section 2.2.2).

As reported by Kowitlawakul (2011) the framework of TAM has been used extensively in information technology, education and business, however there have been few studies in the healthcare setting specifically among physicians and even fewer with regard to nursing practice (Aggelidis and Chatzoglou, 2009, Ami-Narh and Williams, 2012, Bennani and Oumlil, 2013, Chau and Hu, 2002, Chismar and Wiley-Patton, 2003, Holden and Karsh, 2010, Hu et al., 1999, Ketikidis et al., 2012, Kowitlawakul, 2011, Melas et al., 2011, Yarbrough and Smith, 2007). Furthermore, Hu et al. (1999) pointed

out that the choice of TAM in their study to explore physician acceptance of telemedicine technology was because "*TAM is general, parsimonious, IT-specific, and designed to provide adequate explanation for and a prediction of a diverse user population's acceptance of a wide array of IT within various organizational contexts; has a well researched a validated inventory of psychometric measurements making its use operationally appealing; it is a dominant model for investigating user technology acceptance and has accumulated fairly satisfactory empirical support for it overall exploratory power, and has posited causal links across a considerable variety of technologies, users, and organizational context*" (p.95).

2.2. The Technology Acceptance Model (TAM) and the Unified Theory of Technology Acceptance and use (UTAUT)

In understanding the user adoption of technologies, a framework to guide observation and enquiry regarding the subject area is most acceptable for researchers. This tends to ensure that most aspects of the questions raised could be closely monitored. As stated earlier in section 2.1, different models have been used to explore e-health adoption in various fields of practice. The two most used models, the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) will be discussed in the context of this study because of their wide recognition and high power of explanation of behaviour intention and usage in information systems literature than other models (Ami-Narh and Williams, 2012, Chuttur, 2009, Yarbrough and Smith, 2007).

2.2.1. The Technology Acceptance Model (TAM)

TAM was proposed in 1986 by Davis (Davis et al., 1989) to explain the potential user's behavioural intention to use a technological innovation (Figure 1). The TAM was developed from the Theory of Reasoned Action (TRA) of Martin Fishbein and Icek Ajzen (1975), though less general because it applies specifically to explain computer usage behaviour. The TRA asserted that both the attitude and subjective norm have an impact on behavioural intention which in turn affects how people perform the action (Schepers and Wetzels, 2007). Davis et al. (1989) stated that the goal of TAM was to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behaviour across a broad range of end-user computing technologies and populations, while at the same time being both parsimonious and theoretically justified. The model was conceptualised on the premise that individuals' ICT use is determined by two major variables: Perceived Usefulness-defined as the prospective user's subjective probability that using a specific ICT will increase ones job performance within an organisational context and Perceived Ease of Use-defined as the degree to which the

prospective user expects the target system to be free of effort (DongPing and LianJin, 2011). The model suggests that actual technology usage is determined by intention to use, which is affected by the perceived usefulness and attitude (Chuttur, 2009, Davis et al., 1989, DongPing and LianJin, 2011, Ketikidis et al., 2012, Lee et al., 2003, Venkatesh and Davis, 2000). DongPing and LianJin (2011) reported that the TAM theorises that the effects of external variables such as system characteristics, development process and training onto use are mediated by perceived usefulness and perceived ease of use. The external variables typically included system characteristics, user training, user participation in design and the nature of the implementation process (Chuttur, 2009).

TAM has been applied to different technologies, under different situations, with different control factors, and different subjects leading to its proponents to believe in its robustness (Lee et al., 2003). The features of a technology that determines its adoption [and use],

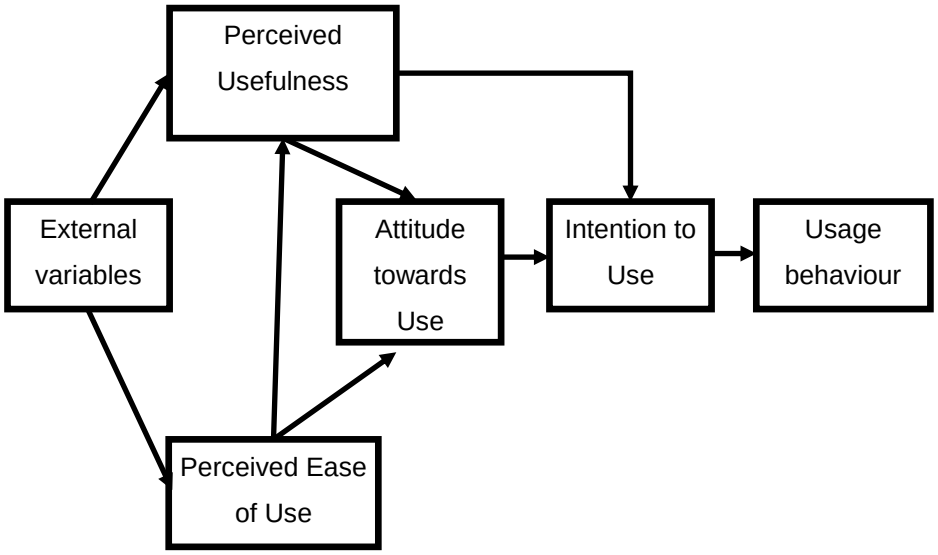


Figure 1: Technology Acceptance Model (Davies et al. 1989)

according to Rogers (1995) in England et al. (2000) are its relative advantage, compatibility, complexity, trial ability and observability. User exposure to these determinants generates reactions which Venkatesh and Davis (2000) referred to as self-reported use. These identified reactions tend to be attributed to the user intention to use and actual use of the said technology (Gagnon et al., 2014,

Gururajan and Hafeez-Baig, 2014, Haluza and Jungwirth, 2015, Idowu et al., 2003, Lluch, 2011, Saigi-Rubio et al., 2014).
Lee et al. (2003) reported that researchers conducted studies to investigate extensively whether TAM instruments were powerful, consistent, reliable and valid and they found the properties to hold. However, in 1996 Venkatesh and Davis modified the model to exclude the “attitude” construct and introducing the behavioural intention construct (Figure 2). Thus by removing the construct they were able to account for the direct influence of perceived usefulness on actual system use and also eliminated any unexplained direct influence observed from the system characteristics to the attitude construct (Chuttur, 2009).

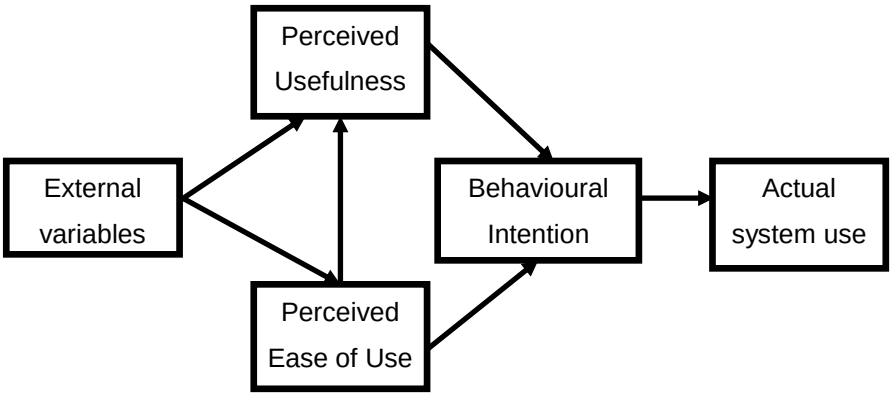


Figure 2: Final version of TAM (Venkatesh and Davis, 1996)

Venkatesh and Davis (2000) also extended the TAM four years later and referred to the new model as TAM2 (Figure 4). The extension was aimed at seeking for the critical influence factors outside the earlier identified constructs of the initial model. The external variables construct in the TAM was reported to involve both social influence processes (subjective norm, image, and voluntariness) and what they referred to as the cognitive instrument processes (job relevance, output quality, result demonstrability and perceived ease of use) (Chuttur, 2009, DongPing and LianJin, 2011, King and He, 2006, Venkatesh and Davis, 2000). Based on previous research, users' decision-making on acceptance and use of information technologies, Venkatesh and Bala (2008) sought to explore the organisational perspective on decision making relating to the use of information technologies in the work area. This led to the proposal of a new theoretical framework; the TAM3, which encompasses previous TAM, related research. They reported to combine the TAM2 model with the model of determinants of perceived ease of use (which was based on the anchoring and adjustment framing of human decision making) and develop the integrated model of technology acceptance-TAM3 (Figure 4). The new model tends to provide a complete nomological network of determinants of individuals' information technology adoption and use (Venkatesh and Bala, 2008). The anchors for the model of determinants of ease of use consist of computer self-efficacy, computer anxiety, computer playfulness and, perception of external conditions while the adjustments consist of perceived enjoyment and objective usability (DongPing and LianJin, 2011, Venkatesh and Bala, 2008). Ketikidis et al. (2012) also suggest that TAM variables can be effectively integrated with other variables or approaches to understand HCPs acceptance of new information technologies. Holden and Karsh (2010) elaborated the wide scope of research on use of the TAM outside of health care, and TAM has recently become an important tool for e-health research.

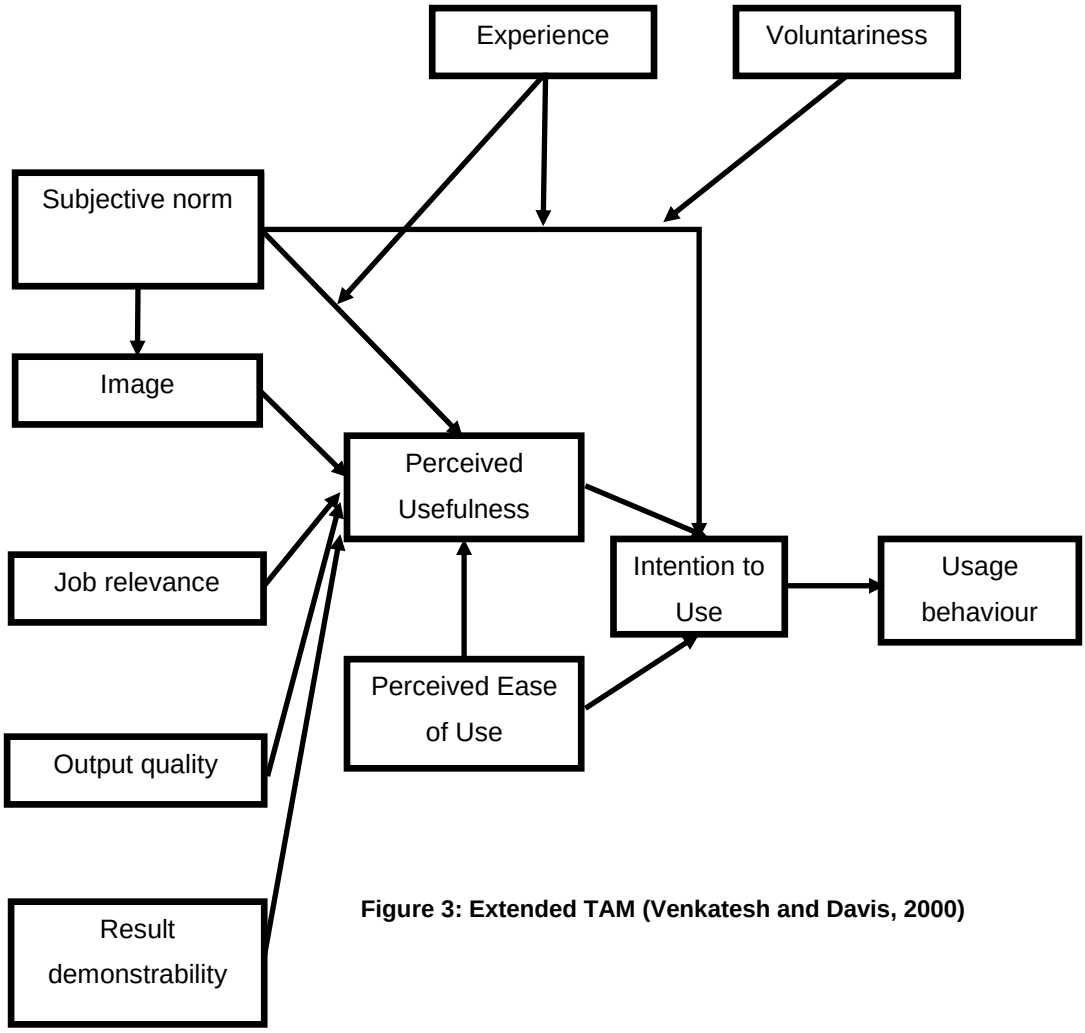


Figure 3: Extended TAM (Venkatesh and Davis, 2000)

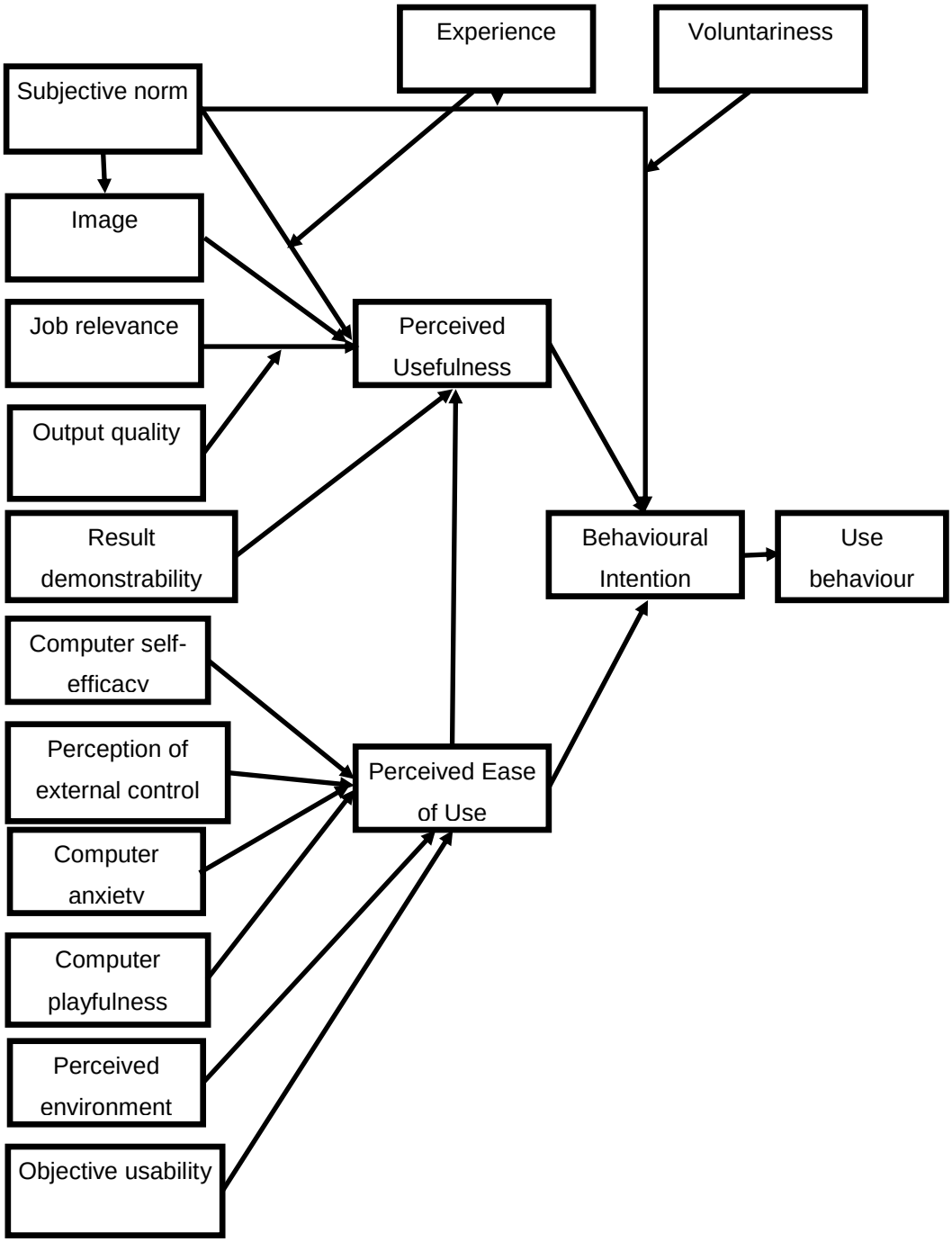


Figure 4: Technology Acceptance Model (TAM3) showing some of the relationships between the constructs (Venkatesh and Bala, 2008)

2.2.2. The Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT was developed by Venkatesh et al. (2003) and was aimed to unify eight prominent competing ICT acceptance and use models. The unified models include the Theory of Reasoned Action (TRA); the Technology Acceptance Model (TAM); the Motivational Model (MM), and the Theory of Planned Behaviour (TPB). Others include a model Combining the TAM and TPB (C-TAM-TPB), the Model of PC Utilisation (MPCU), the Innovation Diffusion Theory (IDT) and the Social Cognitive Theory (SCT) (see section 2.3) (DongPing and LianJin, 2011, Kijsanayotin et al., 2009, Phichitchaisopa and Naenna, 2013). The model was empirically tested and accounted for 70 percent of the variance in usage intention (DongPing and LianJin, 2011).

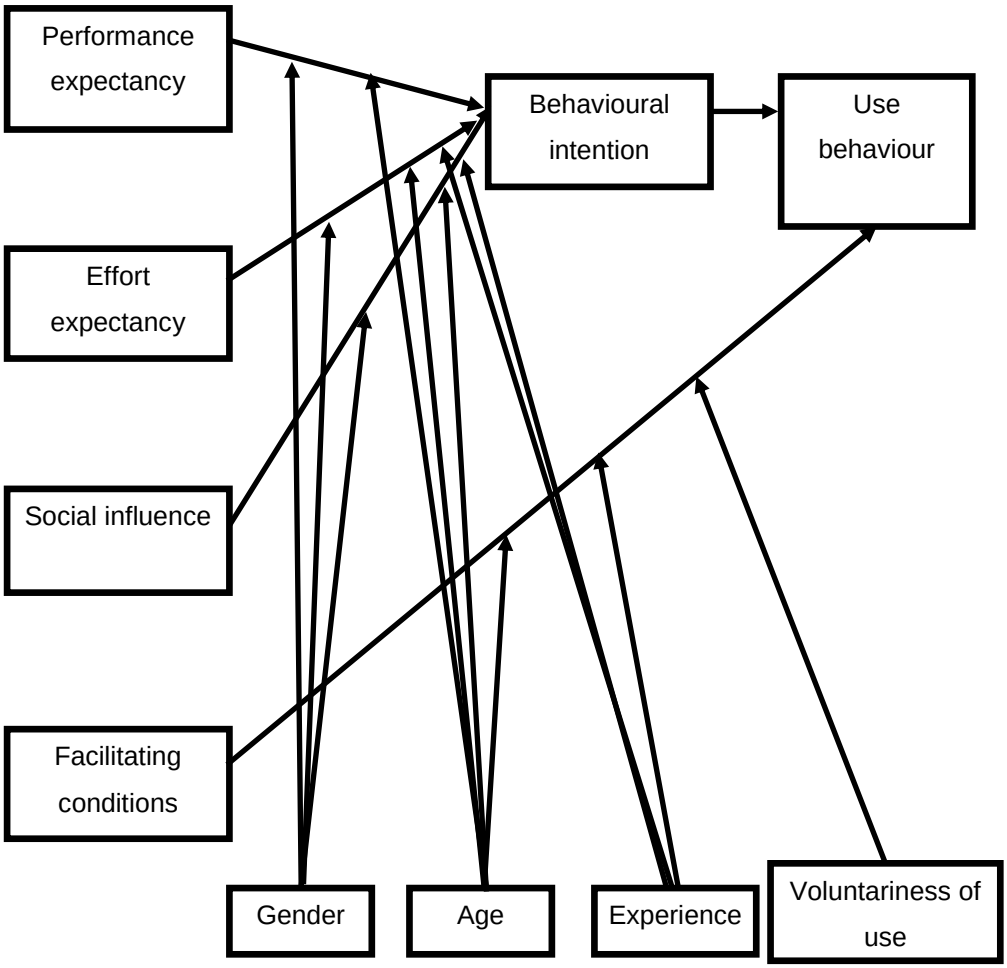


Figure 5: The Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)

It is suggested to be a behavioural model that aims to explain the behaviour of people or organisations in their use of ICT, the four core variables (Figure 5) identified by Venkatesh et al (2003) are performance expectancy, effort expectancy, social influence and facilitating conditions, of which the first three are viewed as the direct determinants of intention to use the ICT by individuals. It also has four moderating variables: age, gender, experience and voluntariness of use.

Venkatesh et al. (2003) defined the constructs of the UTAUT as; performance expectancy: the degree to which an individual believes that using a system will help him/her attain gains in job performance, effort expectancy: the degree of ease associated with the use of the system, social influence is defined as the degree to which an individual perceives that important others believe he/she should use the technology and, facilitating conditions is defined as the degree to which an individual believes that an organisational and technical infrastructure exist to support the use of the technology. They further report that various tests yielded strong empirical support for the model suggesting three direct determinants of intention to use technology (performance expectancy, effort expectancy and social influence) and two direct determinants of usage behaviour (facilitating conditions and behavioural intention).

2.3. Other models and theories on technology acceptance and use

While it is important to note that section 2.2 has extensively discussed the two most important models in technology literature (DongPing and LianJin, 2011, Samaradiwakara and Gunawardena, 2014), it necessary to recognize that there are other models considered it technology acceptance research. This section will identify other models and highlight their constructs.

2.3.1. Theory of Reasoned Action (TRA)

Ajzen and Fishbein developed this theory in 1975 within the realms of social psychology (Mishra et al., 2014, Venkatesh et al., 2003). It has been described as a fundamental and influential theory of human behaviour(Venkatesh et al., 2003). Core constructs include Attitude towards Behaviour and Subjective norm. The attitude construct implies that engaging in a particular behaviour leads to a distinct outcome while the subjective norm has to do with the normative belief that other people have an influence on an individual's action (Mishra et al., 2014)

2.3.2. Theory of Planned Behaviour (TPB)

This has been described as an extension of TRA by adding the construct of perceived behavioural control (Venkatesh et al., 2003). It was developed by Icek Ajzen in 1985 to build on the predictive power of TRA (Mohamadali, 2012). Venkatesh et al. (2003) mentions that it has been applied to "the understanding of individual acceptance and usage of many different technologies". Its core constructs include Attitude towards Behaviour, Subjective norm and Perceived Behavioural Control.

2.3.3. Motivational model (MM)

This was developed within the information systems domain (Venkatesh et al., 2003). They also mention that Davis et al (1992) applied motivational theory to "understand new technology adoption

and use". The core constructs for the model are Extrinsic motivation and Intrinsic motivation (Davis et al., 1992).

2.3.4. Combined TAM and TPB (C-TAM-TPB)

This model combines the predictors of TPB, subjective norm and perceived behavioural control with TAM (Samaradiwakara and Gunawardena, 2014). Key constructs are Attitude towards Behaviour, Subjective norm, Perceived Behavioural Control and Perceived Usefulness.

2.3.5. Model of PC Utilisation (MPCU)

This was developed by Thompson et al (1991) (Samaradiwakara and Gunawardena, 2014). It was built from Triand's 1997 theory of Human Behaviour. This model provides a new vantage point to that proposed by TRA and TPB. It is suited to predict individual acceptance of a range of information technologies (Samaradiwakara and Gunawardena, 2014, Venkatesh et al., 2003). Core constructs are job fit, complexity, long-term consequences, affect towards use, social factors and facilitating conditions.

2.3.6. Innovation Diffusion Theory (IDT)

This theory is grounded in sociology and adapted to technology context with the goal of looking at the application at the individual and organisational context and also how this technology evolves from 'invention' to adoption or otherwise Dillon and Morris 1996 in Samaradiwakara and Gunawardena (2014). Core constructs are Relative advantage, Ease of use, Image, Visibility, Compatibility, Result demonstrability, and Voluntariness of use (Venkatesh et al., 2003).

2.3.7. Social Cognitive Theory (SCT)

Identified by Bandura (1986) as one of the most powerful theories of human behaviour (Samaradiwakara and Gunawardena, 2014, Venkatesh et al., 2003). Core constructs include Outcome expectations (performance), Outcome expectations (personal), Self-efficacy, and Affect and anxiety (Venkatesh et al., 2003).

Though these models mentioned above have their unique applications to technology literature, evidently the TAM and the UTAUT have been more explored and applied widely within the technology discourse. This is also evident by statistical comparisons of TAM and UTAUT and other models. Empirical results have shown that both TAM and UTAUT have the highest explained variance in explaining technology acceptance and use (Samaradiwakara and Gunawardena, 2014). This might be why researchers have identified both the TAM and the UTAUT as the most widely used models in technology discourse that explores user intention to adopt and use ICT (DongPing and LianJin, 2011, Samaradiwakara and Gunawardena, 2014).

2.4. Literature review

To understand the factors that influence e-health adoption and use, this chapter will review existing literature on the factors that influence e-health adoption and use among HCPs. The chapter will also review and the application of these models within healthcare research while drawing on relevant literature. This chapter will conclude by identifying the specific objectives guiding this research study.

2.4.1. Search strategy

The databases used for the exploration of literature were CINAHL, Medline, Ovid, PubMed and Web of Science. This was possible with the NUsearch facility made available by the University of Nottingham libraries. Thesis directory Ethos was also utilised as well as Google Scholar and grey literature. Search terms and strategy used for the literature search are presented in Table 1. While Figure 6 identified the flow diagram of the final selected papers.

The searches were conducted in four stages: A to D (see Table 1). This was to meet the aim of the literature review. This include: i) identifying literature on factors influencing adoption and use of e-health among HCPs, and ii) identify e-health literature on models of technology acceptance and use.

A: Main search terms used were information and communication technology, e-health, clinical information systems, health information systems, health information technologies, and health information science.

B: The terms used in stage A were then used in combination with the terms technology acceptance, technology adoption, technology use, ICT barriers, e-health barriers, ICT inhibitors, e-health inhibitors, ICT motivators, e-health motivators, ICT facilitators, and e-health facilitators.

C: Key terms such as nurse*, physician*, health professional, clinical practice and clinical setting were added to the searches in B.

The next stage of the searches was D. This involved the use of the terms models of technology acceptance, technology acceptance

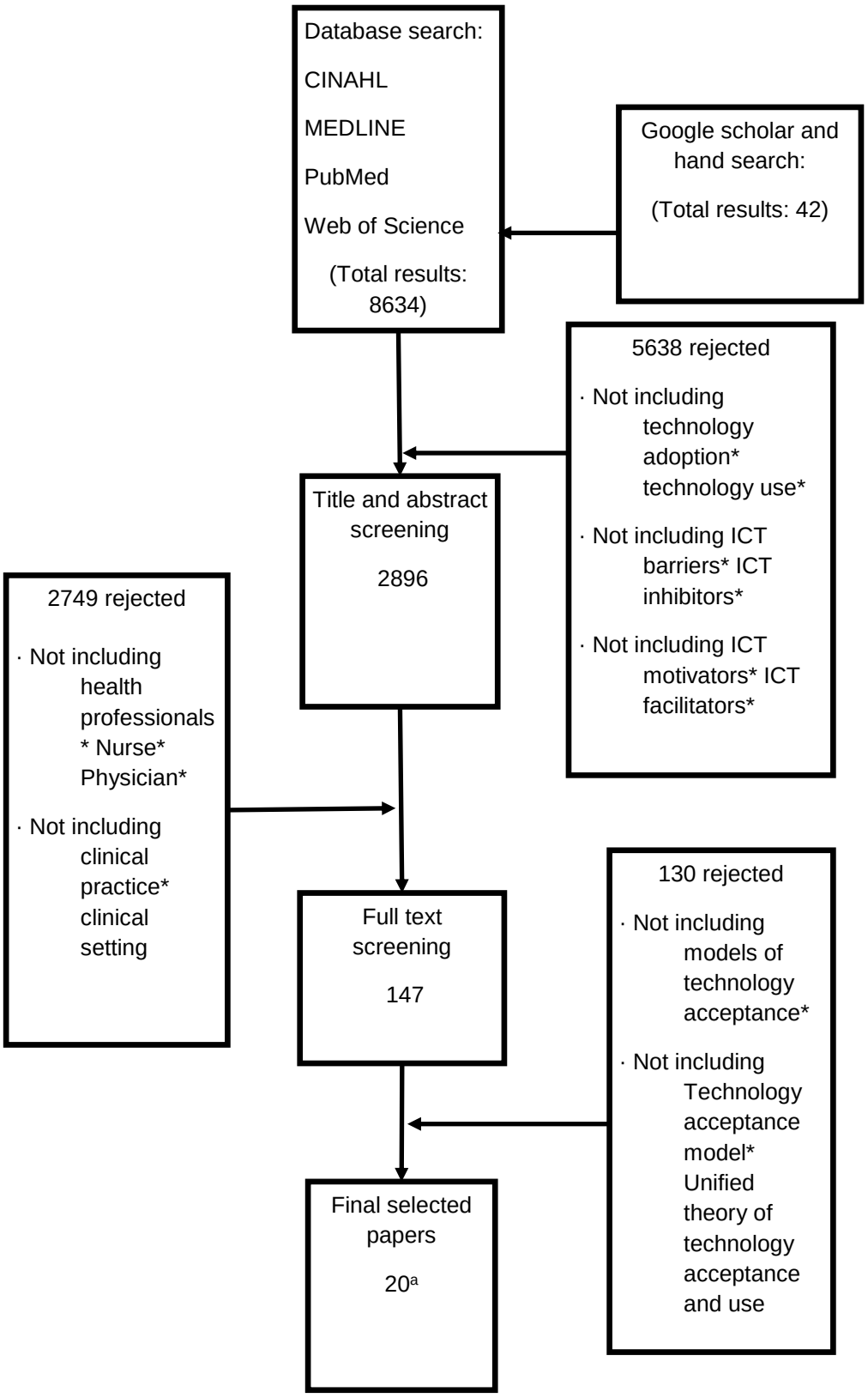
model and unified theory of acceptance and use of technology with the results in C.

In addition to the results of the systematic searches, articles found through broad searches using Google Scholar and from reference lists of the systematic searches were included.

However, conducting a literature review to cover such area as e-health adoption and use among HCPs while ensuring breadth and depth was challenging. In this regard, key terms used ensured boundaries of the aim of the review was strictly adhered to.

Table 1: Search terms and strategy

A	B	C	D
1-Information and Communications Technology/e-health OR 2-Clinical information systems OR 3-Health information systems OR 4-Health information technologies OR 5-Health information science	6- Technology acceptance OR 7-Technology adoption OR 8- Technology use AND 9- ICT/e-health Barriers OR 10-ICT/e-health inhibitors AND 11- ICT/e-health Motivators OR 12- ICT/e-health facilitators	13- Nurse* 14-Physician*s 15- (13 AND 14) 16- Health professionals OR 15 17- Clinical practice AND 16 OR 18- Clinical setting AND 16	19- Models of technology acceptance AND OR 20-Technology Acceptance Model AND OR 21- Unified Theory of Acceptance and use of Technology
8634*	2896*	147* (with A AND B)	20*



[a] No paper was identified to include Q-methodology with the search terms identified and within SSA

Figure 6: Flow diagram showing final paper selection

Table 2: Inclusion criteria for the articles used in literature review

1.	Papers published in English
2.	Q methodology papers, Qualitative studies, Quantitative studies, Mixed methods papers, Systematic reviews
3.	Papers involving nurses, physicians or both
4.	Papers which explored factors influencing e-health adoption and use in the clinical setting (including specific clinical ICT/e-health tools/applications)

2.5. Factors influencing e-health adoption and use in healthcare

The introduction of e-health was based on the need for HCPs within healthcare practice to be able to share information amongst themselves so that they effectively work as a team because e-health modifies both information and decision process. This technology modify how HCPs plan their clinical tasks, deliver improved quality healthcare, document their clinical decisions, and review such decisions (Rouleau et al., 2017). In addition, HCPs are able to communicate clinical interventions with their patients and their relatives.

This may however have its own unforeseen challenges (Bossen, 2007, Granja et al., 2018, Lluch, 2011).

ICTs have been identified to have the potential to address many of the challenges that many of the healthcare systems are currently confronting, such as improving information management, access to health services, quality and safety of care and cost containment and the request by patients that clinicians should use ICTs. Thus with increased computerisation in every sector of activity, ICTs are expected to become tools that are part of HCP practice (Gagnon et al., 2012a). Despite the importance of e-health, when healthcare services do not adopt new information technology for additional support, they will be ineffective and may lose credibility among

patients. This is because HCPs are in the best position to identify the barriers and facilitators they face in their work environment that could affect the success of these technologies and thus certain HCPs especially physicians have been identified to be noticeably lagging behind in the adoption of e-health (Gagnon et al., 2014, Phichitchaisopa and Naenna, 2013). Though one might also argue that other HCPs such as nurses have been shown to incorporate ICT and the internet at a rate significantly lower than physicians (Lupiáñez-Villanueva et al., 2011). There have been attempts by different researchers to identify different facilitators and barriers to e-health use in healthcare, which will be discussed in the following sections 2.3.1 and 2.3.2. Thus, as described by Gagnon et al. (2012a) that though factors facilitating adoption may be geared towards specific perceptions about the characteristics of the e-health tools by HCPs', barriers to adoption may also involve such characteristics but could also include individual, professional and organisational factors. Similarly, Verhoeven et al. (2009) identified four categories of factors that might influence e-health adoption and use among healthcare workers. This include; technological factors, individual factors, work related factors; and organisational factors. Despite this information, Crow et al. (2012) reported that the certain regions globally lack ICT for use in healthcare practice. In addition, they identify that in regions such as SSA the use of such technologies by HCPs is not well understood. In view of this, the subsections address barriers and facilitators to e-health adoption and use while referring to SSA in line with the aim of this study.

2.5.1. Barriers to e-health adoption and use in healthcare

As seen in section 2.1, information on e-health adoption and use in Sub-Africa are limited. Crow et al. (2012) synthesis of research on ICT adoption and use by medical professionals in SSA affirms that there is also poor understanding of ICT use in healthcare. Most of the reports of e-health use in sub-Saharan Africa are usually obtained

from HIV centres which includes Electronic Health Records (EHR)(Akanbi et al., 2012) as highlighted in section 1.1. These single disease centres are often built and equipped by donor agencies to monitor these diseases (Akanbi et al., 2012).

The consequent barriers to their uptake were notably identified as: poor existing infrastructure, frequent power outages, network failure, and lack of comfort with EHR among healthcare workers as a human factor (Akanbi et al., 2012). Other barriers highlighted by Gagnon et al. (2014) include human factors such as resistance to change due to fear of being replaced by a new technology or by someone with better ICT skills or if HCPs do not perceive a value addition to their routine activities. Infrastructural factors include poor electric power supply, and high cost of internet connectivity and despite the spread of mobile telephony there are no computer based appointments systems in any hospital in both Ghana and Nigeria which makes physicians unable to share (electronically) a patient file within the same hospital (Achampong, 2012, Crow et al., 2012).

Pędziński et al. (2013) explored barriers and facilitators to the use of Electronic Medical Records (EMR) among primary health care workers in Poland using online and telephone surveys. Similarly, the barriers to the use of the EMR among the participants have been found to include risk of malfunction in the system, resistance to change, lack of training and proper information and lack of funds to implement the technology application in some settings. Other issues include concern of privacy and security of the e-health resource including ‘negative impact on the interactions with patients’ (Pędziński et al., 2013, p.184). Likewise, limitations related to software and hardware, inadequate interfacing with other IT systems (interoperability), frequent alerts due to frequency and lack relevance, lack of flexible options and resistance to change from traditional routine have also been identified as barriers to adoption of e-health (Gagnon et al., 2014). Other similar barriers identified by Lammintakanen et al. (2010) include complexity in the use of the e-health resource, technical problems, concurrent use of different

versions of the system, and problem of information flow. Verhoeven et al. (2009) added that when looking at barriers to adoption of an e-health tool in the clinical setting four factors should be considered: technological factors which are concerned with the e-health tool itself, individual factors- which are concerned with the HCP, work-related factors such as stress and work pressure and organisational factors. In addition to the barriers identified above, other barriers or inhibitors to the adoption of e-health have been suggested. These are presented in Table 3.

Table 3: Category of barriers to e-health adoption in healthcare environments

Category	Barrier	Description
a- Structure of the healthcare organisation	Hierarchy (Lluch, 2011)	Healthcare settings follows the hierarchical model and new professionals conform to existing traditions rather than become agents of change
	Threat to autonomy(Lluch, 2011, Rouleau et al., 2017), Professional autonomy (Li et al., 2013)	HCPs would prefer to hold onto their autonomy rather than adopt new form of organisation
	Administrative constraint (Gururajan and Hafeez-Baig, 2014)	
	Device usage barrier (Gururajan and Hafeez-Baig, 2014)	
	Resource barrier (Gururajan and Hafeez-Baig, 2014)	Lack of infrastructure
b- Tasks	Change in work process and routines (Granja et al., 2018, Lluch, 2011)	
	Face to face interaction vs New way of thinking (Granja et al., 2018, Lluch, 2011)	
	Electronic Medical Record (EMR) and E-prescribing	
c- People and policies	Lack of training (Lluch, 2011)	
	Lack of support(Lluch, 2011)	
	Distrust of data produced (Lluch, 2011)/ Uncertainty about IT vendor (Li et al., 2013)	
	Liability and lack of legal framework (Gururajan and Hafeez-Baig, 2014, Lluch, 2011, Ross et al., 2016)	
	Patient privacy concerns (Li et al., 2013)	
	Accountability to employer and policy makers	
	Benefit evaluation barrier (Gururajan and Hafeez-Baig, 2014)	Expected usefulness of the ICT
d- Incentives	Reward system (Lluch, 2011)	Not providing rewards for ICT service conducted by health professional
e- Information and decision processes	Lack of information sharing (Lluch, 2011)	
	Communication barrier (Gururajan and Hafeez-Baig, 2014)	

Bossen (2007) added that stability of the e-health tool could also be a barrier to the HCPs especially when technical difficulties arise, and the users are at a loss of who to contact. In addition, issues such as the need for precision by most e-health tools such electronic medication plan (EMP) limits the freedom HCPs are used to when using papers-based medication plans. Another important barrier is the concept of power which was highlighted by Doolin (2004). He reports that this comes to effect when the decision makers impose an e-health tool that the HCPs perceive to give little benefit in the clinical area and at the same time duplicates their routine activities. In addition to the barriers, Farsi and West (2006) and Pagliari et al. (2003) identified the time used while using a particular e-health tool. They observed among their findings that HCPs identified the EMR as very time consuming. A review by Lu et al. (2005) identified other barriers such as negative patient perception, data entry, delicate devices (for fear of breaking), security, physical design such as screen size, touchscreen, and physical factors such as poor eye sight and large fingers as issues that HCPs consider when using the e-health tools. Similar findings were reported by Lyons et al. (2005), with tasks such as order entry, insufficient data retrieval as barriers observed by the HCPs when using e-health tools. Despite this, participants within the same study identified other tasks such as documentation; performance evaluation and decision support as both acting as barriers or facilitators within their clinical practices. In the same way, barriers such as design and technical concerns, privacy and security concerns, cost and liability issues, productivity, loss of patient-physician interaction, lack of time and workload, threatened clinical autonomy are among those highlighted in the review by de Grood et al. (2016) which explored adoption of e-health technologies by physicians. Though the review focused on papers published globally, no African paper was included. This does not indicate that their findings could not be broadened to the African context, but it rather evidently ceases to capture if those barriers apply to HCPs in that context. In another review by Rouleau et al. (2017) that

examined the impact of ICT on nursing care, they identified issues such as time spent for patient care, documentation time including time management as factors affecting nurses adoption and use of e-health in clinical practice. Similarly, Granja et al. (2018) review on the factors determining the success and failures of e-health interventions identified six important barriers. These are; increased workload on the HCPs compared to period before the introduction of e-health interventions; disruption of workflow, and difficulty in aligning with clinical processes. Others include the birth of undefined and changed roles due changes in responsibility due to the introduction of the e-health interventions where new roles may merge with no responsibility assigned. The last two barriers they identified were issues of undermined face-to-face communication and staff turnover where HCPs rotate to other departments and new ones are posted or recruited requiring both learning and training on the existing e-health tools. Ross et al. (2016) in their review of factors influencing the implementation of e-health report factors such as adaptability and complexity of e-health interventions as important barriers. They argue that adaptability issues arise when the HCPs find it difficult to adjust to the new e-health tool while the complexity manifest in the form of slow system performance and interoperability issues.

2.5.2. Facilitators to e-health adoption and Use in health care

E-health has been identified to have the ability to decrease medical errors, identify patients, manage physicians/nurse teams, and improve service quality and safety (Chismar and Wiley-Patton, 2003, Gururajan and Hafeez-Baig, 2014, Holden, 2010, Holden and Karsh, 2010, Phichitchaisopa and Naenna, 2013, Yarbrough and Smith, 2007). This section will identify relevant literature that explored facilitators to e-health adoption and use.

Vedel et al. (2012) studied HCPs' adoption and use of a clinical information system (CIS) in primary care from which they identified five factors having a direct influence on what they term as "exploitation of system functionalities". These include; User skills,

ease of use, comfort using the system in front of patients, support from colleagues and, perceived positive impact. They further observed that user skills and the system's expected ease of use and usefulness tend to favour adoption and use while perceived negative impact on the HCP-patient relationship hinders e-health adoption. Gururajan and Hafeez-Baig (2014) conducted a study in three countries; Pakistan, India and Australia to determine factors that motivate and limit the implementation of ICT in healthcare environments. They identified seventeen (17) motivators/facilitators to e-health adoption and use. Some of which include: delivery of high quality information, better quality of service easy access to data, efficiency in communication, improved clinical flow, improved clinical performance, improved delivery of information, improved public image, positive impact on patient safety, saving effort, savings in time, reduced inaccuracies, reduced medical errors, etc. These are similar to findings in Poland by Pędziński et al. (2013). Though limited to Electronic Medical Records (EMR) among general practitioners, they identified the need for more IT training and better networking of healthcare in order to share clinical information as one of the facilitators. The other facilitator identified was the need for e-health inclusion in medical education. In the work by Lluch (2011) and Pagliari et al. (2003), provision of training and offering support was also identified to enhance health ICT uptake in healthcare environments and in some cases the participants identified a one-to-one communication approach to training as a facilitator. Hains et al. (2009) have also identified facilitators such as hospital policies, endorsements, error reduction and evidence based as responsible for adoption and use of e-health by HCPs'.

Perceived usefulness and perceived ease of use as components of the model of human-computer interactions have also been identified as facilitators of the e-health use within clinical practice (Kowitlawakul, 2011). However, this finding was restricted to intensive care unit nurses (ICU) and using an e-health platform called the eICU and thus may not be generalised to other HCPs. Other facilitators to

e-health adoption and use by HCPs within the literature include some qualities of the e-health resource such as; time saving, making work easier, quality issues, alignment with work flow/ease of use/portability, availability of resources, technical support and training (Robinson, 2010, Vishwanath et al., 2009). Demographic factors such as age and gender have also been identified to influence e-health adoption among nurse practitioners (Dariel, 2011, Li et al., 2013). However Eley et al (2009) in Chow et al. (2012) argued that there is no significant association between age and ICT use.

Convenience and the ability of an e-health resource to save time has also been identified as a facilitator among HCPs (Angier et al., 1990, Øvretveit et al., 2007). Others have identified drivers such as the likely increase in patient safety, availability of more complete and better information, and provision HCPs with an opportunity for development (Øvretveit et al., 2007, Pagliari et al., 2003) as facilitators to such e-health use. In addition, issues such as healthcare technologies abilities to provide 'pre-analysis data', proof of utility such as avoidance of medication errors, availability of training and support and ownership were both identified as important facilitators by de Grood et al. (2016). It could be seen that most of the facilitators are mimicked from one study to the other even though the terminology may differ, the descriptions still hold. In addition, Granja et al. (2018) reported quality of healthcare and patient empowerment as important issues identified by HCPs that positively influence their adoption and use of e-health. They argue within their review that e-health interventions help in patient empowerment and self-management that will reduce HCPs workload within the clinical area. Consequently, it has also been observed that barriers identified in a healthcare environment or applied to a specific IT application may be viewed as a facilitator in another healthcare environment. This was noted in the review by Gagnon et al. (2012a) where they identified factors such as human and organisational factors to serve as either facilitators or barriers. They identified that that some of the factors identified by their review were reported to shift between facilitators

and barriers. These include: factors related to ICT [perception of benefits of the innovation, ease of use, compatibility with work process, interoperability, validity of the resources, etc.]; Individual and professional factors [lack of familiarity with ICT]. Others include Human environment [patient/health professional interaction, applicability to patients' characteristics and attitude of colleagues towards ICT and, patient attitude regarding ICT]; and Organisational environment [IT support, training, access to ICT, organisational support, etc.]. Furthermore, Granja et al. (2018) and Ross et al. (2016) in their review argue that issues of cost containment as difficult to identify as a barrier or a facilitator by HCPs. HCPs in their review equally identify cost containment as both a barrier and facilitator. They suggest that cost containment could be a facilitator at an early stage of an e-health adoption but at the long run may turn out to be a barrier due to sustainability issues.

This shift between barriers and facilitators might be due to participants' personal views on which factor is identified as a barrier or not, thus uncovering their respective subjectivities in defining each factor. In the same way, Terry et al. (2009) identified factors such as computer literacy, training, time in using the tool, the presence of "in-house" problem solvers and also an integrated message system with the e-health resource could serve as barriers or facilitators.

The HCPs being a heterogeneous group working within a common environment are exposed to these technologies and each group will have its own understanding of the applicable e-health as well as everyone within a group. These understandings/beliefs regarding an ICT platform/ solution or application have a direct impact on the individual or group behavioural intentions or actual use of such technologies. These understandings, beliefs, or views could be individual specific, group/speciality specific or inter-group/inter-speciality specific. Because of these views, attitudes as well as perceptions maybe modified by key indicators such as individual differences, system characteristics, social influence, and facilitating conditions (Venkatesh and Bala, 2008).

Views, opinions, beliefs, attitudes, as well as perceptions all generate from the subjective domain of the individual or group who has it. This subjectivity presents the individuals' unique stand on an issue. Akhtar-Danesh et al. (2008) defines subjectivity as judgment based on individual personal impressions, feelings and opinions rather than external facts. Stephenson (1986) reported that in the subjective domain, only the individual himself could observe and measure (order, position) his subjectivity. He further stated for this reason that Q methodology is so significant, as a closed system for making subjective measurements.

An understanding or view of end-users will favourably affect decisions by the both end-users and those responsible for decisions on e-health policies.

This section reviewed existing literature on the factors influencing e-health adoption and use among HCPs in clinical practice. The next section reviews existing literature on the models of technology acceptance used in the current research study; technology acceptance model (TAM) and unified theory of acceptance and use of technology (UTAUT). The section next sections also present reviewed literature on the application of these models within e-health research.

2.5.3. TAM in Healthcare

The TAM has enjoyed a lot of empirical and theoretical attention over the course of the years of its existence but despite being the popular model for e-health adoption and use, it is still not seen as a healthcare specific model (Holden and Karsh, 2010). Some have further argued that if used in its generic form, it may fail to capture or even contradict some unique contextual features of computerised healthcare i.e. indicating a significant gap in knowledge (Chismar and Wiley-Patton, 2003, Holden and Karsh, 2010, Melas et al., 2011). Many studies have attempted to utilise the TAM in explaining or predicting e-health adoption in healthcare by directing it to specific

healthcare applications (Aggelidis and Chatzoglou, 2009, Gagnon et al., 2012b, Ketikidis et al., 2012, Yarbrough and Smith, 2007). Others have modified the model to test new variables or hypothesis (Gagnon et al., 2012b, Hu et al., 1999, Jimoh et al., 2012, Kowitlawakul, 2011, Zayyad and Toycan, 2018).

It is worth mentioning that most studies in the literature of TAM and healthcare have been of quantitative antecedents with most studies centred on physicians' use of computerised healthcare applications. Yarbrough and Smith (2007) conducted a review on physicians' acceptance of technology and relating it to TAM. They identified that the TAM constructs generally hold in a physician-specific context, but the perceived ease of use component of the model does not prove to be consistent in relation to the attitude and perceived usefulness. However, they reported that to increase the explanatory power of the TAM, a variable(s) representing external barriers to technology acceptance needs to be added. They also noted that barriers to technology acceptance that are unique to physicians such as personal characteristics need to be added to the model. This they claim may provide better comprehension of the factors contributing to physician technology acceptance. Thus, promoting the appropriate implementation of ICT in healthcare organisations. In the review conducted by Holden and Karsh (2010), they included quantitative research articles that test relationships between the variables specified by TAM. They identified that the TAM has had a wide spread application in explaining healthcare providers' reaction to ICT. Among the strengths of the studies, they identified that perceived usefulness of a healthcare technology will have some impact on whether clinicians accept it and subsequently use it as the consistent significant construct. They however reported that no two studies within their review replicated a study testing an exact same model. This they attributed to variations within the TAM evolution itself. They suggested the type of healthcare provider as a moderator, and this needs to be further explored. They also emphasise the benefit of contextualising TAM constructs for healthcare.

To further test the predictive and explanatory power of TAM, Melas et al. (2011) selected a sample of 604 medical staff of which 534 are physicians in Greece. They introduced a new moderator to the TAM model; Physician's speciality, while ICT knowledge (ICT experience) and ICT feature demands are predictors of perceived ease of use and perceived usefulness. They established that; (i) the physician speciality can moderate the perceived usefulness-perceived ease of use and ICT feature demands-perceived usefulness relationships (ii) ICT knowledge and ICT feature demands explain an additional variance in perceived ease of use and perceived usefulness respectively and (iii) positive relationship exist within all TAM constructs (with emphasis on perceived ease of use-behavioural intention constructs).

The extended model (TAM2) was examined by Chismar and Wiley-Patton (2003) for fit in the physician (paediatricians) population. They suggest that the TAM2 was partially applicable in the professional context of the physicians. This means that the perceived usefulness construct has strong influence on the physicians' usage intentions while the perceived ease of use was not significant. This is similar to the findings of Hu et al. (1999) who examined the TAM using physicians' acceptance of telemedicine technology. Chismar and Wiley-Patton (2003) findings indicate that two of the determinants of perceived usefulness; job relevance and output quality were significant. They also note that the subjective norm and image constructs in the model to be insignificant as regards its relationship on physicians' behavioural intention on adoption and use of ICT in their clinical practices. Thus, suggesting the physicians' decisions to adopt and use ICT are not influenced by peers (or patients and their families) or how they will be perceived if they adopt e-health.

Ketikidis et al. (2012) explored a modified version of the TAM2 model (by adding the computer anxiety and descriptive norms constructs to the model i.e. to estimate how many of their colleagues would use ICT if it were implemented) among nurses and physicians. Unlike most TAM studies, their findings suggest that perceived ease of use

and not perceived usefulness as the most significant predictor of user intention to e-health adoption and use. They also reported that the descriptive norms added to the TAM2 do not predict the health professionals' intention to use ICT as they had earlier hypothesised. They also conclude by suggesting the TAM2 is more applicable to healthcare when compared to the original TAM model by Davis (1989). They also note that some constructs such as job relevance, social norms that are captured in the subsequent TAM3 may influence e-health adoption and use by the HCPs. However, they suggest that this exploration should be expanded to other cultures and ethnicities.

Chau and Hu (2002) compared the TAM and the Theory of Planned Behaviour (TPB) to predict and explain physicians' adoption and use of telemedicine technology (ICT). They reported their findings to suggest that the TAM is the appropriate model for explaining the physicians' acceptance decisions with a strong empirical support rather than the TPB, which they judged to be a weaker theory for such prediction and explanation. They also identified the perceived usefulness construct of the model to be the most important moderator for the physicians' behavioural intention. They explain this to be that individual physicians make decisions to accept versus reject a technology, they appear pragmatic, concentrating on the technology's usefulness rather than other determinants. Gagnon et al. (2012b) also modified the original TAM to include compatibility and habit in predicting nurses' and physicians' intention to use ICT in clinical practice. Despite a very low response rate (39.7%), findings suggest that the TAM is a good predictive model of HCPs' intention to use ICT. They identified the "facilitators" construct in their modified model as the most important factor in the prediction of HCPs' intention to use the technology.

Unlike most studies that used the TAM to predict and explain e-health adoption and use in healthcare which mostly centres on physicians (Li et al., 2013), Bennani and Oumlil (2013) explored ICT acceptance by nurses in Morocco using the TAM. Though using the original TAM

(however adding trust and image constructs to the model), they suggest that the principal constructs (perceived usefulness and perceived ease of use) of the model have a positive relationship with the intention of the nurses to use ICT in clinical practice. They also identified image as another construct that positively influence the intention suggesting that individual nurses believe that their image among other health care professionals, especially physicians would be improved. However, the trust construct introduced by the researchers showed no significant influence on the intention to use ICT in clinical practice. Another similar study that focused on nurses' was carried out by Kowitlawakul (2011). The study focused on predicting nurses' intention to use a specific telemedicine technology (eICU) using the original TAM developed by Davis in 1986. Despite renaming the model as Telemedicine Technology Acceptance Model (TTAM), all the key constructs of the original model were maintained. The results suggested that perceived usefulness remains the key determinant on the users' intention to use the telemedicine application. The researcher interprets the findings as nurses in the critical care units focus on the usefulness of the technology itself. They also suggest that perceived ease of use has a more significant effect on attitude than perceived usefulness. Also, years of working experience was suggested to have a negative statistical correlation with perceived usefulness. Further to this also, the findings suggest that the nurses' perceived usefulness of the technology is influenced positively by physicians' support whereas the perceived ease of use is influenced by support from administrators.

User "behavioural intention" and "Use behaviour" are key constructs in the TAM. These key constructs which are modified by the user attitudes and perceptions tend point to the subjectivity of the users. The subjectivity of HCPs may influence their behaviour towards adoption and use of e-health in clinical practice which could be explored on the key constructs of TAM. Though the TAM as an instrument for the measurement of acceptance or adoption and use does not assess subjectivity but seek to quantitatively identify the

strengths/ weaknesses of its constructs against user self-reported use (Chuttur, 2009, King and He, 2006, Lee et al., 2003, Melas et al., 2011, Venkatesh and Bala, 2008).

2.5.4. UTAUT in Healthcare

Like studies involving the TAM, UTAUT research in healthcare has involved a huge share of quantitative exploration. Most researchers (Kijsanayotin et al., 2009, Sharifian et al., 2014, Venkatesh et al., 2011) tested the empirical strengths of the model in their studies. Kijsanayotin et al. (2009) explored the UTAUT in community health centres in Thailand; they identified that performance expectancy, effort expectancy, social influence and voluntariness as having direct influence on intention to adopt and use the health technology. They suggest the performance expectancy construct as having more influence on behavioural intention than effort expectancy and social influence. They further report that their study tend to confirm the relationships within the UTAUT as proposed by Venkatesh et al. (2003), highlighting that the model could well be applicable in the healthcare setting.

Another similar study in Thailand (Phichitchaisopa and Naenna, 2013) set out to test the UTAUT to examine the factors influencing healthcare information technology services. They found the constructs with the significant impact on behavioural intention to adopt and use the health care technology are performance expectancy, effort expectancy and facilitating conditions, with performance expectancy as having the strongest direct effect on behavioural intention as with previous studies (Kijsanayotin et al., 2009). They however found the social influence construct as having no direct effect on behavioural intention.

However contrary to the findings of Phichitchaisopa and Naenna (2013), Wills et al. (2008) reported that by testing the UTAUT model among health professionals in Dakota to examine the acceptance of an ICT for health, the EMR using an online survey and partial least squares for analysis, social influence plays a greater role in EMR

adoption than performance and effort expectancy especially among the women. They noted as part of their limitation though that 94% of their respondents were female.

In Australia, Li et al. (2013) conducted a systematic review on health care provider adoption of e-health. Within the review they identified seven clusters of factors which they adapted to the UTAUT. Identified factors were: health care provider characteristics [e.g. IT experience and knowledge, gender, age, and years in practice], medical practice characteristics [e.g. practice size and teaching status], voluntariness of use, performance expectancy [perceived usefulness], effort expectancy [perceived ease of use], social influence [subjective norm] and, facilitating conditions [legal conditions]. They further identified that healthcare provider characteristic key items such as IT experience and knowledge, age, gender, years in practice have different effect on the adoption of ICT in health care. For example, they highlighted that age was reported to have an inversely proportional relationship with certain ICT use, and female HCPs were less likely to use ICT compared to their male counterparts.

Venkatesh et al. (2011) utilised a modified UTAUT as a theoretical foundation to adapt the theory to the context of EMR system adoption and use by doctors in clinical practise. They suggested that age, gender, voluntariness, and experience as moderators of varying magnitude to the participants intention to adopt and use the ICT. They found out that the modified UTAUT in their study predicted 44% of variance in intention to adopt and use EMR. They further suggest that future research should integrate UTAUT with other theoretical perspectives to explore e-health adoption and use. Ami-Narh and Williams (2012) also suggest the use of the UTAUT in a mixed method approach to understand the health professionals' acceptance of e-health specifically within Africa.

2.5.5. Combining TAM and UTAUT

The choice to use the two models together was informed by the rigorous research done on TAM within technology acceptance literature (Chuttur, 2009, Holden and Karsh, 2010, Schepers and Wetzels, 2007, Venkatesh and Bala, 2008, Yousafzai et al., 2007). Evidently, despite extensive empirical studies (see section 2.4.1) the TAM, previous research did not take into consideration salient characteristics of users of technology such as age and gender as seen in section 2.4.1. While the UTAUT takes into consideration these characteristics (Figure 6), Ami-Narh and Williams (2012) report that it will still need to be modified when adopting it into e-health research. Furthermore, DongPing and LianJin (2011) identified that TAM accounts for up to 74% of the variance on use behaviour of a technology (higher than UTAUT). On the other hand, they also report that the UTAUT accounts for 70% variance of intention to use a technology (higher than TAM). It is important to note that even though TAM is listed among the eight contributing models to UTAUT, its prediction of actual use behaviour is low in comparison to TAM. In addition, TAM has demonstrated strong evidence base in technology acceptance research (see section 2.2.1). Thus, the inclusion of TAM as a separate entity rather than a constituent of UTAUT strengthens the approach of this current research study.

As a result, both models are used as theoretical frameworks in this study to provide quality explication that serve as useful tool in exploring e-health adoption and use among HCPs in clinical practice in SSA. This is seen as in the development of sample statements in Chapter 3.

2.6. Summary

Exploring the adoption and use of e-health has been attempted though in most cases using purely quantitative approaches (Bennani and Oumlil, 2013, Legris et al., 2003, Schepers and Wetzels, 2007). Most of these studies were testing relationships within TAM constructs or its modified versions (Bennani and Oumlil, 2013, Chismar and Wiley-Patton, 2003, Gagnon et al., 2012b, Jimoh et al., 2012, Kowitlawakul, 2011). Holden and Karsh (2010) and DongPing and LianJin (2011) reported most e-health research has often focused on technology design and implementation. They suggest it is important to explore how HCPs as end users react to already implemented e-health. It is important to note that during review of literature in the current study only one article attempted to measure subjectivity of ICT consumers in the healthcare context (Valenta and Wigger, 1997). However, Valenta and Wigger (1997) evidently did not utilise any theoretical framework such as models of technology acceptance to structure to guide their research study.

Having discussed both TAM and the UTAUT in the sections 2.4.1 and 2.4.2 and their contributions to literature on adoption and use of technology in clinical practice, this study will combine the key constructs of both models and their determinants to answer the research question. These constructs are: perceived usefulness, perceived ease of use, subjective norms, facilitating conditions, performance expectancy, effort expectancy, social influence and individual differences and behavioural intention.

Evidently, literature search during this study did not uncover any research study report that used either or both models to explore the individual views or opinions of users of e-health through subjective assessment of factors that influence adoption and use. In this regard, some researchers have recommended that studies should incorporate other approaches in understanding user-e-health adoption and use (DongPing and LianJin, 2011, Holden, 2010).

2.7. Research objectives

This study set out with the research aim of exploring factors that influence e-health adoption and use among HCPs in clinical practice in SSA. Therefore, from this and in order to contribute to the knowledge in this field and to address the gaps identified by previous research (Ami-Narh and Williams, 2012, Gagnon et al., 2012a), specific objectives were identified. This will provide an in-depth understanding of HCPs adoption and use of e-health in clinical practice in SSA using both the models above and Q-methodology. The specific objectives of this research study are:

1. To use the TAM and UTAUT as the theoretical framework to develop and organise literature into concourse for Q-methodology
2. To carry out a Q-sort on nurses and physicians in SSA to identify their shared views on the factors influencing e-health adoption and use in clinical practice
3. To identify the themes in the theoretical framework has more influence on healthcare professionals' e-health adoption and use
4. To make recommendations based on findings from the study to inform e-health adoption and use in clinical practice in SSA

Chapter 3. Methodology

3.1 Introduction

Ami-Narh and Williams (2012) and Wu (2012) have recommended mixed method approaches to understanding e-health adoption and use together with the models of technology acceptance. They argue that this is will avoid over reliance to quantitative techniques which does not clearly uncover the users' views on such technology interactions. Furthermore, the review by Li et al. (2013) on HCP adoption of e-health demonstrated that various methodologies have been done to explore e-health adoption. However, they still insist that there is need to synthesise insights from such studies so that a holistic view could be generated on e-health adoption (and use) by HCPs. In this regard, this study will adopt Q-methodology which is a mixed methodological approach (Onwuegbuzie and Frels, 2015, Ramlo and Newman, 2011a). As such, it will explore the subjectivity of HCPs and to understand the factors that influence e-health adoption and use from the perspective of HCPs in clinical practice. The clinical setting with its characteristic heterogeneity and collective goals in provision of quality and safety in healthcare has not benefited from such exploration using both Q-methodology and the models of technology acceptance. This methodology provides a holistic/gestalt (Watts and Stenner, 2005a) approach to understanding those factors that influence e-health adoption by HCPs in SSA.

This methodology was developed by William Stephenson, an English Physicist and Psychologist in 1935 (Cross, 2005). The methodology is based on the need to explore subjective viewpoints of individuals in a systematic manner that is objective and scientific (Brown, 1980, Ho, 2017, vanExel and Graaf, 2005). The methodology is concerned with uncovering subjectivity which the 'perspectives/opinions of individuals could be made visible' (Barker, 2008, p.918). Though the real reason for naming the methodology 'Q' has been the subject of many debates (Watts and Stenner, 2012), current literature suggests that the letter 'Q' was derived as opposed to 'R' factor analysis associated with

correlation statistical techniques (Petit dit Dariel, 2011, Watts and Stenner, 2012).

Although some researchers still position Q-methodology within the realms of its own uniqueness of methodological approach (Dziopa and Ahern, 2011, Stenner and Stainton Rogers, 2004), others such as Watts and Stenner (2005b), and Gautier et al. (2016) suggest that it is typically qualitative and very critical. However, researchers such as Ramlo and Newman (2011b) and Onwuegbuzie and Frels (2015) believe that due to its qualitative and quantitative techniques it fits between the extremes of both qualitative and quantitative methods and much closer to a mixed method approach. It could be argued that the methodology is not within the principles of positivism and shares more characteristics with the constructivist paradigm (Stenner, 2009). The philosophical foundations of the methodology is centred around how people construct their own understanding of the world which portrays its epistemological orientations to fall under interpretivist-constructivism (Watts and Stenner, 2005a). This paradigm grew out of the philosophy of Edmund Husserl's phenomenology and Wilhelm Dilthey's study of interpretive understanding called hermeneutics (Mackenzie and Knipe (2006). Bartlett and DeWeese (2015) identify that the methodology is in 'opposition to the positivist assumptions underpinning traditional correlational research that often were passed over by quantitative procedures' (p.73). This is because the methodology explores how and why people think the way they do.

Q-methodology involves two distinct fundamental aspects; a) a participants sorting exercise b) and a Q-analysis or by-person factor analysis (Watts and Stenner, 2005a). The sorting exercise involves participants to rank-order statements within a topic of discourse in relation to the other statements. This is then followed by a Q-factor analysis also known as a by-person factor analysis that involves a correlation of the completed Q-sort by a participant with other participants' Q-sort (Barker, 2008, Brown, 1980, vanExel and Graaf, 2005, Watts and Stenner, 2005a, Watts and Stenner, 2012). This

presents the shared viewpoints in a gestalt approach- which implies the holistic way in which views/perspectives are interconnected by a group of participants and thus reducing the various individual sorts into a meaningful set of “Factors”. This contrasts the R-factor analysis, which correlates variables against other variables (Brown, 1980, Dariel, 2011, Paige and Morin, 2014, Watts and Stenner, 2012).

The inimitable nature of the methodology by its Q-sample generated from a wealth of concourse largely around TAM and UTAUT constructs and augmented by related literature will provide the participants (P-set) the opportunity to sort their views in a way that is purely a representation of their opinions. Factors (similar viewpoints) generated from the Q sorting will provide deeper comprehension of e-health adoption by nurses’ and physicians. Within the course of extensive literature search, studies that looked at ICT and healthcare in Sub-Saharan Africa (Akanbi et al., 2012) have been specific to one type of ICT (EHR) identifying only organisational factors as barriers to ICT use and the other study (Jimoh et al., 2012) identified loss of data that affected a general conclusion of the findings. However, no study utilised Q-methodology and the models of technology acceptance within the general African context and sub-Saharan Africa to identify the factors affecting adoption and use of e-health among health professionals in the clinical area.
Q-methodology according to Barker (2008) provides an opportunity to examine the participants point of view which is then conceptualised by the researcher who also offers an interpretation which follows the participants activity rather than imposing a framework where there is an implicit right or wrong. The benefit of Q-methodology has been reported to lie in the fact that it helps to identify the similarities and differences in subjective perception across a sample group and describe a variety of viewpoint (Bartlett and DeWeese, 2015). They further note that the Q factor analysis in the methodology provides information about similarities, preferences and viewpoints of individuals on a subject matter. This is an inversion of traditional

quantitative tactics, which allow the investigator to correlate participants instead of test items. Also Bartlett and DeWeese (2015) identify that the process does not require a large number of participants but rather a small number and large number of test items. As highlighted earlier in this chapter, Q-methodology has been applied in various fields to explore a wide range of discourses such as medicine (Stenner et al., 2015, Stenner et al., 2000), clinical simulation (Paige and Morin, 2015), nursing education (Petit dit Dariel et al., 2013), banking (vanExel and Graaf, 2005), environmental research (Webler et al., 2009), audience research (Davis and Michelle, 2011), beauty (Jordan et al., 2005), love (Watts and Stenner, 2014), death (Lee et al., 2008), and shopping (Gautier et al., 2016). Valenta and Wigger (1997) used the methodology to understand the reasons for acceptance or resistance of physicians and medical students towards information technology. Though as observed by Petit dit Dariel et al. (2010), this methodology has not been frequently used within the technology discourse. This could be because of quantitative research being more popular within the technology discourse.

3.2 Benefits of using Q-methodology

As identified by Webler et al. (2009) one of the benefits of Q-methodology is its ability to clarify peoples' views within a particular area of discourse. Q-methodology gives the participants this strength with its holistic, robust and in-depth technique by allowing the participants to actively engage in establishing meaning to statements derived from the context which affects them (Watts and Stenner, 2012). Unlike in traditional qualitative techniques which usually rely on the narrative abilities of the participants regarding a prior considered context, findings in Q-methodology manifests in an abductive nature of interpretation of Factor arrays. In this regard, Watts and Stenner (2012) reports that it starts with the identification of a 'surprising empirical fact' that leads to theoretical explanation and possible hypothesis generation (p.40). Moreover, the combination of both qualitative and quantitative techniques (the Q-sorting and factor analysis) renders strength to the

methodology. This allows the researchers to reduce the influence of their subjectivity while exploring the views of the participants. Also McKeown (1990) cited in Barker (2008) suggests that by adopting the traditional methods of exploring participant subjectivity such as focus groups, interviews, or quantitative approaches there is the manifestation of both participant and researcher's subjectivities which might not reflect the true viewpoint of the participants. In addition, these traditional methods provides challenges when reducing data to meaningful accounts (qualitative methods), or difficulty in uncovering individual subjectivities in the case of surveys (Barker, 2008). However, Q-methodology use of both qualitative and quantitative techniques as mentioned earlier reflects the true subjectivity of the participant at interpretation (Brown, 2017, Davis and Michelle, 2011). This makes this methodology important to this study. HCPs within this study that interact with technology may have divergent or convergent views/opinions about how such technologies influence their clinical practice.

3.2.1. Limitations of Q-methodology

Despite the benefits highlighted about the methodology, it is not without its limitations. As with most studies that employed qualitative techniques, Q-methodology uses a small sample and issues surrounding the generalisation of findings have often been highlighted (Valenta and Wigger, 1997, vanExel and Graaf, 2005). Though some researchers have dismissed the issue of generalisation as they claim it is of little concern in Q-methodology (vanExel and Graaf, 2005). This they argue that since the participants reflect their personal views on a subject and the findings shows the subjectivities of that specific group of people and not a percentage of a sample. Others like Watts and Stenner (2012) argue that it still has a wider application because generalisation in Q-methodology studies focuses on a 'conceptual form of generalisation driven by semantics rather than statistics' (Watts and Stenner, 2012, p.73). Thomas and Baas (1992) applied the term 'substantive inference' as described by Watts and Stenner (2012) to suggest that the generalisation focuses on 'concepts or categories,

theoretical propositions and models of practice' (p.73). This latter view shows the benefit of this approach. This suggests that though the nature of the methodology as it applies to the specific participants, the concept generated may have wider implication. Moreover, Valenta and Wigger (1997) argue that since Q-methodology studies are exploratory and qualitative in nature, and uses purposive samples rather than random, its values lies on the identification of opinion clusters which may be subsequently tested in large surveys.

Another issue that is often mentioned as a limitation of Q-methodology has to do with reliability and validity. Brown (1980) indicates that since the focus of Q-methodology has been to understand the viewpoint of an individual, concepts such as validity is of little use within the methodology. He emphasises that there is no external criterion for assessing a participant own perspective. This means that each participant has his/her own view on a subject and there should be no external scale to identify that the view is right or otherwise. However, Valenta and Wigger (1997) despite affirming that the validity in Q-methodology is differently assessed when compared to R-methodologies, still identify two types of validity within Q-studies, the face and content validity. In determining the face validity of Q-samples, this is addressed by adjusting the wording of the Q-sample statements that have been generated for grammar and readability (Akhtar-Danesh et al., 2008, Valenta and Wigger, 1997). Also Valenta and Wigger (1997) note that content validity in Q-methodology is determined by the depth in Q-sample items development and the eliciting of expert advice during the Q-sample development and in also the pilot of the Q-sample.

In relation to reliability, Watts and Stenner (2012) and Brown (1980) note that there is also less emphasis about reliability in Q-methodology unlike in quantitative studies. Both argue that a repeated administration of Q-sort to a participant tells you about the reliability of the participant's viewpoint rather than the reliability of the method. This shows a varied application of the concept of reliability in quantitative studies. Valenta and Wigger (1997) adds that the administration of the same Q-sample

to the same individuals at two separate moments results in a correlation coefficient of 0.8 or even higher for test-retest reliability.

3.3 The Q-methodology process

As mentioned earlier, Q-methodology is useful in the study of subjectivity and various researchers have outlined the steps involved in conducting a Q-study (Akhtar-Danesh et al., 2008, Barker, 2008, Corr, 2001, Cross, 2005, Petit dit Dariel et al., 2010, Valenta and Wigger, 1997, vanExel and Graaf, 2005, Watts and Stenner, 2005a, Watts and Stenner, 2012). The process evolves from the formulation of a research question to the generation of a pool of relevant sample items called the concourse. The concourse is subsequently "filtered" to develop the final sample items which in Q studies are identified as the Q-set or the Q-sample (Akhtar-Danesh et al., 2008, Paige and Morin, 2014, vanExel and Graaf, 2005) which are provided to the participants to rank order. This ranking of the statements which is also called the Q-sorting is usually followed up by a post-sort interview (Watts and Stenner, 2005a, Watts and Stenner, 2012) to discuss the sorting exercise. This is followed up by a Q-factor analysis and finally an interpretation based on how the Q-set items are ranked on the final Factors or Q-sorts after analysis. The interpretation is usually done in relation to consensus (agreement statements) and the distinguishing statements(Brown, 1980, vanExel and Graaf, 2005, Webler et al., 2009) and more recently using a crib sheet (Watts and Stenner, 2012). The process of conducting a Q study as shown in Figure 7 will be discussed in more detail based on the sections that follow.

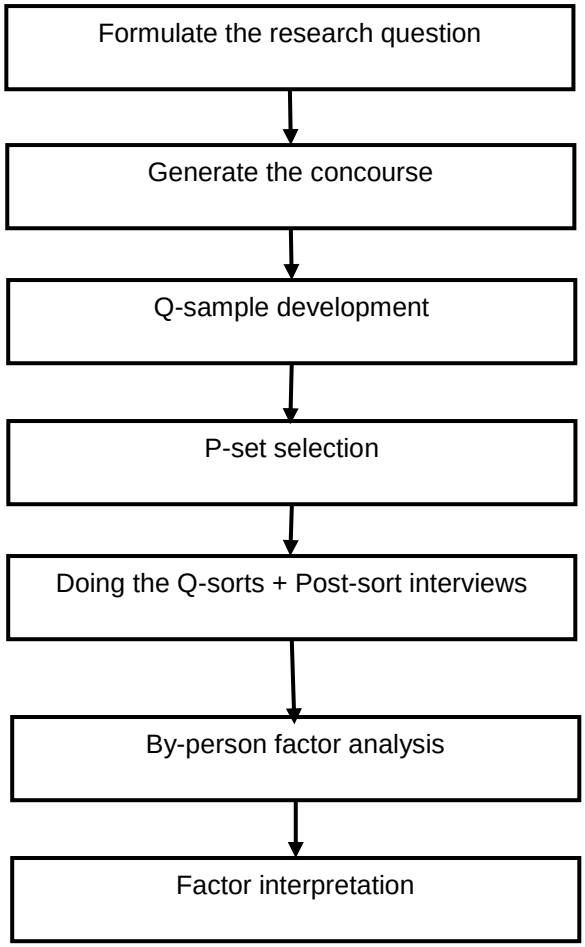


Figure 7: Process of conducting a Q-study adapted from Dariel et al. (2010)

3.3.1. The Concourse

The concourse in Q-methodology is literally all that has been said or written about the subject or topic of discourse. The concourse may include published literature, interviews, web sources, and discussions on a topic of interest. Valenta and Wigger (1997) added that it may include other items such as paintings, photographs or even musical items. Though in concourse development Petit dit Dariel (2011) identifies two paths: the naturalistic approach (Stenner et al., 2000) in which concourse samples are derived from essays or interviews from people specifically designed for a Q-study, and the quasi-naturalistic method which involves the use of secondary source items such as literatures around the topic of discourse, interviews with people who may not be participating in the final Q-study.

The concourse for this study was drawn using both the naturalistic and quasi-naturalistic approach as described by Senn (1996) cited in Petit dit Dariel (2011). This means the concourse was derived from both literature on the models of technology acceptance and use, factors influencing e-health adoption within clinical practice, and interviews with e-health experts. Some of the e-health experts participated in the pilot study of the Q-sort.

3.3.2. Q-set/Q-sample development

Though there may not be a single correct way to the generation of Q-set items, the aim is to create a set of items that provides 'good coverage in relation to the research question' which should be broadly representative and balanced (Watts and Stenner, 2012). They further identify that the items should be developed to effectively and smoothly cover all ground and without overlap, redundancy or repetition. In the development however, researchers could either use the structured approach (Paige and Morin, 2015, Petit dit Dariel et al., 2013) or the unstructured approach (Watts and Stenner, 2014). Though both suggests the generation of themes at the outset to capture the items being developed from the concourse, the structured approach is viewed as an effective way of ensuring a balanced and representative Q-set (Watts and Stenner, 2012).

Q-set for this study was developed using the structured approach. The models of technology acceptance and use specifically the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) from the literature were used as framework to identify the themes for the Q-set for this study. The choice for these two models follows an extensive literature review on models used in technology adoption and use as described in Chapter 2. Six themes were identified from one hundred and seventy items of the concourse. All the themes were drawn to capture the main constructs of the two models of technology acceptance and use in line with this study. The themes were: Perceived usefulness/Performance expectancy, Perceived ease of use/effort expectancy, Social influence/

subjective norms, Facilitating conditions, Individual differences and Behavioural intentions. Forty six statements drawn from the concourse following review by domain experts and piloting (see section 3.3.3.4) (Valenta and Wigger, 1997) were distributed across the six themes (Table 4). Each of the forty-six statements was printed on 5cm x 8cm laminated cards numbered from 1-46.

Table 4: Themes showing final number of statements

	Themes	**Number of Statements**
1.	Perceived usefulness/Performance expectancy	12
2.	Perceived ease of use/effort expectancy	9
3.	Social influence/ subjective norm	8
4.	Facilitating conditions	9
5.	Individual differences	4
6.	Behavioural intention	4

3.3.3. Ethical consideration

The ethical considerations taken regarding this study will be discussed based on the following headings.

3.3.3.1. Ethical approval

Ethical approval for this study was obtained from both the Faculty of Medicine and Health Sciences (FMHS) ethics committee and the study site (Appendix A). The FMHS ethics committee gave favourable opinion in March 2016 with no changes to the initial submission and an approval was received from the study site (see section 3.3.5) in June 2016 without correction as well.

3.3.3.2. Participant information and Informed consent

Volunteers for the study were provided with participant information sheets, which had the necessary information about the study in simple language. Those who opted to participate were provided with a typed informed consent sheet, which they signed in duplicate prior to commencement of the Q-sorting process. Participants were informed that their participation is voluntary, and they could withdraw at any time

they wish to. The participant kept a copy of the signed consent form and the researcher for records purposes retains the other copy.

As a requirement for commencing ethics application, the study area was contacted to inform them of the study as seek permission and co-operation in conducting the study at their site. A favourable response was obtained (Appendix A.1) which formed part of the documents submitted for ethics application. Within the response provided by the study site, it assured that volunteers would be available to assist with this study.

3.3.3.3. Anonymity, confidentiality, and data protection

All data collected has been anonymised. Eight alpha-numeric characters were attached to each participant to ensure anonymity. All participants were informed that both their sorting exercise and audio interviews would only be available to the research team. As regards data protection, this will be in line with the data protection guidelines of the University of Nottingham. All study records are kept under the responsibility of the chief investigator in a securely archived facility.

3.3.3.4. Validity and Pilot study

As described in section 3.2.1 on the types of validity assessment done in Q studies, face validation of the Q-set for this study was assessed by seven HCPs that have experience with using e-health within clinical practice. Five of the experts were from the Faculty of Medicine and Health Sciences, University of Nottingham, and two were from Nigeria. These volunteers read through the one hundred and seventy statements and reduced them to fifty-four statements based on readability, repetitiveness, and clarity.

Content validity was assessed by a total of four experts. Two experts in e-health were from the Nottingham University Hospitals, NHS Trust and two experts in e-learning and health informatics at the School of Health Sciences, University of Nottingham. They reviewed the statements and further reduced the Q-set to forty-five. A statement which read "*Using clinical information systems increases my chance of getting a raise*"

was modified to "*Using clinical information systems increases my chance of getting a praise or reward*" because the former statement was developed from an American literature and reflects only financial benefits while the second statement was agreed to be more general. Forty-five statements were generated prior to piloting of the statements.

To further assess content validity, the statements were subjected to piloting through sorting (Q-sort) and post-sort interviews with five volunteers at the School of Health Sciences, University of Nottingham. This resulted in the addition of one statement (#30: *My routine tasks prevent me from having time to use the clinical information systems*). This resulted in a total of forty-six statements within the final Q-set items. The result for the pilot study has been described in detail in Ladan et al. (2018).

3.3.4. Participants/P-set

The P-set which are the participants in a Q-study, are selected based on the need to get enough respondents to establish a Factor that can be compared with another Factor (vanExel and Graaf, 2005). Only a limited number of participants are required to participate. This is because the representation of perspectives is the objective in Q studies and not the number of people with a particular viewpoint as participants are the variables in the study and the Q-set is the sample (Akhtar-Danesh et al., 2008, Brown, 1980, Dennis, 1986, Watts and Stenner, 2012). Brown (1980) suggests that 40-60 participants are recommended for Q methodology studies and a lesser number may be required for specific studies. Though some researchers have suggested the use of ratio between participants and statements such as two statements to one participant (Watts and Stenner, 2012) or three statements to one participant as a maximum estimate for the number of participants (Webler et al., 2009). Others suggest the use of ratios between participants and perspectives (themes) as a minimum rule (Petit dit Dariel, 2011, Webler et al., 2009). This means for every theme identified during the concourse, three participants are expected to load on it. However, they note that this does not apply to most Q-studies as

some do not have themes outlined at the onset of concourse generation.

Furthermore, the P-set for this study was determined using a P-matrix (Paige and Morin). As described by Brown (2010) cited in Petit dit Dariel (2011) the P-matrix is a guide to participant selection which is aimed at getting the diversity of participants similar to the diverse nature of the Q-sample. He argued that previously mentioned approaches to participant selection is more related to quantitative research where rules are suggested prior to identification of characteristics of the participants. He however emphasises that the P-matrix should be a guide so that the diversity of the participant will uncover salient perspectives within Q-samples.

In line with the above suggestion, four characteristics of the participants were identified as guide to the P-set selection. This include; age, gender, years of experience and profession. These four characteristics were selected based on their already identified significance within information technology literature as identified by Lai and Li (2005) and Phichitchaisopa and Naenna (2013). Both age and gender have been used repeatedly because of their relationship with the main constructs of the models and especially the UTAUT (Gefen and Straub, 1997, Lai and Li, 2005, Venkatesh et al., 2011). In addition, the years of experience characteristic was also identified to influence the final intention to use an e-health tool in both TAM and the UTAUT (Phichitchaisopa and Naenna, 2013, Venkatesh and Bala, 2008, Venkatesh et al., 2003, Venkatesh et al., 2011). Moreover, the three characteristics (age, gender & experience) were seen to be very critical moderators of all the main constructs of both models used within this study. Thus, this influenced the choice of their use as determinant characteristic for the participant selection. In addition, the fourth characteristic (profession) was identified from the objective of the study, which reflects the two categories of the health professionals in this study (nurses and physicians). This also captured both the top, middle and lower level staff to encourage diversity of the participants. The

matrix yielded thirty-six possible combination of the characteristics as shown in Table 5.

Table 5: P-matrix showing Characteristics of participants

a. Gender	Male	Female	
b. Age	<35years	35-45years	>45years
c. Years of experience	<3years	3-7years	>7years
d. Profession	Nurse	Physician	

The gender and profession characteristics have two categories each, while the age and years of experience characteristic has three categories each. This yielded a possible combination of (2 [Gender] x 3 [Age] x 3 [Years of Experience] x 2 [Profession]) a total of thirty-six P-set. It is important to note the participants in Q-methodology are not selected at random but rather purposively based on the characteristics they possess that make them relevant to the context of the study (Bartlett and DeWeese, 2015, vanExel and Graaf, 2005).

3.3.4.1. The P-set characteristic

The final sociodemographic characteristics of the P-set are seen in Table 6. It shows more male participants (52.8%) as compared to females (47.2%) took part in the study. Most participants were within the age range of 35-45 years (47.2%). Both professions (nurses and physicians) had 50% representation each of the total thirty-six P-set within the study.

Table 6: Sociodemographic characteristics of P-set (N=36)

	Frequency	Percent (%)
Gender		
Male	19	52.8
Female	17	47.2
Age (years)		
<35	7	19.4
35-45	17	47.2
>45	12	33.3
Profession		
Nurse	18	50
Physician	18	50

3.3.5. The setting

Nigeria is the most populous country in Africa and the seventh most populated country in the world. It has an estimated population of 186 million (Zayyad and Toycan, 2018). The country is located in West Africa with a total land mass of 923,768sq.m. Nigeria shares a border with Niger republic and the Republic of Chad to the north, and the Republic of Cameroon and Benin to the east and West respectively. Nigeria's southern boundary is with the Atlantic Ocean with 853km of coastline. As a former colony of the United Kingdom until 1960, English is the official language in Nigeria with Christianity and Islam as the main religions. The country has 36 states and the Federal Capital Territory (FCT) with 768 local government administrative areas (LGAs).

According to the Federal Ministry of Health (FMOH, 2017), Nigeria operates an executive system of government comprising of three arms: the executive arm that is headed by the president and the legislative arm, which is headed by the president of the senate. The Chief Justice of the Federation (CJN) heads the judiciary, the third arm.

The National Bureau of Statistics (NBS, 2016) reported Nigeria's economy has been driven by oil while other sectors such as agriculture and private trading contributes on a smaller scale. The country was reported to enter a period of recession in 2016 due to the fall in global oil prices and exited recession the following year (NBS, 2017).

The life expectancy shows that 53 and 56 years for males and females respectively. Disease account for 58.6% of deaths in females and 41.4% in males. The infant and under-five deaths is on the decline according to the National Bureau for Statistics (NBS, 2017). Zayyad and Toycan (2018) report that majority of the population live in rural areas where access to basic amenities are not readily accessible. Their study reports the ratio of one physician to 4000 patients against the WHO recommendation of one physician to about 600 patients.

Nigeria is a beneficiary to international donations especially from the United States of America and the UK. The UK through the Department for International Development (DfiD) in 2009/2010 provided an aid relief of £120 million to cover areas of governance, health and education (FMOH, 2017).

3.3.5.1 Nigerian Healthcare System

The Nigerian healthcare system is divided into three, the primary healthcare service which is overseen by the local governments, the states are responsible for the secondary health care and the tertiary healthcare units are under the purview of the federal government through the FMOH (UnitedNationsFoundation, 2014a).

The Nigeria health system has been described to be categorised into orthodox, alternative and traditional medicine, though most data collated and used are from the orthodox healthcare services (Labiran et al., 2008). The primary healthcare covers areas of health education, adequate nutrition, safe water and sanitation, reproductive health and family planning, and immunization against major infectious diseases. The chairperson of the Local government is responsible for primary healthcare with assistance from the state level and also strategic

support from the FMOH through the National Primary Healthcare Development Agency (NPHCDA) (Labiran et al., 2008). The secondary health care services in the states are overseen by the Ministry of health in the respective state and led by the Commissioner of health in the state who is appointed by the state governor. Healthcare service at the secondary healthcare level includes the provision and technical support for the local government healthcare services.

The FMOH is headed by the minister of health and has 10 departments and six agencies through which its functions are carried out (UnitedNationsFoundation, 2014a). There are also 20 teaching hospitals, 22 federal medical centres and 13 speciality hospitals across the country (FMOH, 2017). The Federal Medical Centres are located in states that do not have a teaching hospital. These tertiary healthcare centres represent the highest level of health with emphasis on care for specific diseases, referrals from both secondary and primary healthcare levels and care for specific group of patients.

The FMOH also has as one of its service departments, the department of ICT which is responsible for all ICT matters including the deployment and development of ICT within the ministry and the health sector at large (FMOH, 2017). The department has three divisions which includes the service delivery and support division, data centre management and e-health strategy and solution division (FMOH, 2017). However, despite these, the FMOH has described the e-health as in an early stage and expected to come up with the National health policy and the development of a National Regulatory Framework with guidelines to standardise e-health care delivery. Political will and commitment together with health system needs and opportunities have been identified to be the main drivers of the e-health in Nigeria (UnitedNationsFoundation, 2014a). This is recognised by the country as an important enabler for achieving a healthy nation in tandem with its vision 2020. This vision, which includes the improvement of ICT infrastructure and building capacity for its use in order to make Nigeria among the top 20 economies by 2020. The ICT sector generally has

continuously undergone expansion and technology has become more affordable as evidenced by the increase in mobile phone use within the country (UnitedNationsFoundation, 2014a). Also most e-health services in Nigeria are SMS-based, data applications, pre-loaded applications or accessible through web-based portals (UnitedNationsFoundation, 2014a).

The setting is one of the oldest and largest teaching hospitals in Nigeria. At creation, the institution had the objective of providing facilities for training of doctors, nurses and other health personal. Presently the control of the hospital like other health institutions of its tier is by the Federal government of Nigeria supervised by the Ministry of Health. The hospital at the time of this study had 750 beds with 622 physicians and 800 nurses. The hospital has 21 clinical departments including pharmacy and physiotherapy. In November 2005, the hospital moved to its permanent site, which was a much larger and more equipped health facility with desktops in each clinical ward for documentation of clinical activities. As at 2016, all desktops within the clinical wards were withdrawn and replaced with 100 Z-pads (a mobile hand-held device) though no software has been incorporated within the hand-held devices.

The administrative structure of the hospital is headed by the Chief Executive (Chief Medical Director), the Chairman Medical Advisory Committee, the Director of Finance, the Chief Internal Auditor, Director of Administration, Assistant Director of Nursing (ADN), and the Assistant Director of Pharmacy. The nurses in the wards are headed by ward in-charge who is responsible for all activities within the ward and reports to the designated unit head who report to the deputy director nursing (DDN) or directly to the ADN. A designated unit, the in-service training unit is responsible for organising routine training activities in areas of patient care and academics to nurses and is headed by a DDN. The medical units within the hospital are coordinated by their respective departments shared by both the teaching hospital and the faculty of medicine within the university. These departments are headed

by a consultant physician and oversee training of resident doctors within the departments.

3.3.5.2 Positionality

Positionality describes how researchers' social views and the position they have adopted within a specific research (D'Silva et al., 2016, Sultana, 2007). Researchers such as Ozano and Khatri (2018) suggest that it has a wider impact in both the 'historical, political, economic, religious and intellectual contexts' of individuals (p.191). They further argue that positionality explains how the researcher view them self and how others view them. This may influence the outcome of research due to the way the researcher views it and draws interpretations from it (D'Silva et al., 2016). Despite this, D'Silva et al. (2016) emphasise that positionality still has its strengths and weakness. They suggest that a researcher new to a research setting might easily see what someone within the setting might miss. Likewise, researchers who are new to a setting and who fail to acknowledge their positionality might unwittingly disrupt their research process and the theoretical lens used in analysis (D'Silva et al., 2016, p.104). They further argue that this will result in the researcher missing 'intricacies' that were not part of their experiences.

Due to this, it is important to acknowledge my positionality within this particular research. For instance, I arrived at the research setting with a prior experience of having used e-learning resources within the academic environment with successful outcomes. I believed the successes that were achieved in my place of work could easily be replicated using e-health resources at the clinical area. Though the HCPs might see me as an insider due to my familiarity with the study setting having conducted student examinations and clinical teaching, I felt an outsider having not had any practical working experience in the setting. In addition, I was self-aware of the fact that I was the first PhD Nursing student to enter this setting and the first to conduct this study using this research approach. However, adhering to the ethical guideline of both the host institution and the study setting while also

constantly been in contact with my supervisors and experts in Q methodology assisted me to stay grounded with the aim of the study.

3.3.6. Recruitment process

The participant recruitment process (Figure 8) commenced in June 2016 with the advertisement of study posters across the study area. Data collection from the willing participants commenced in July 2016. However, the nurses within the hospital notified the researcher that they would be available from August 2016 due to a locally organised continuing development program that was taking place in July 2016. Therefore, the first round of participants in July were physicians. All volunteers who have had experience with the use of e-health technologies within their clinical practice and expressed interest to participate within the study were provided with a participant information sheet. Volunteers who agreed to participate were recruited and both researcher and they agreed an appropriate time for the data collection process. A consent form was given at the beginning of the Q-sorting exercise in duplicates for signing. However, during the recruitment process it became challenging to identify those who had experience in the use of the e-health and identifying the different categories of staff (top level, middle level and lower) among the volunteers. Thus, in addition a snowballing technique was also adopted so that a participant could suggest another person that may likely share the same

characteristics (e-health use experience). Thirty-six participants were eventually recruited for the study resulting in 100% response rate.

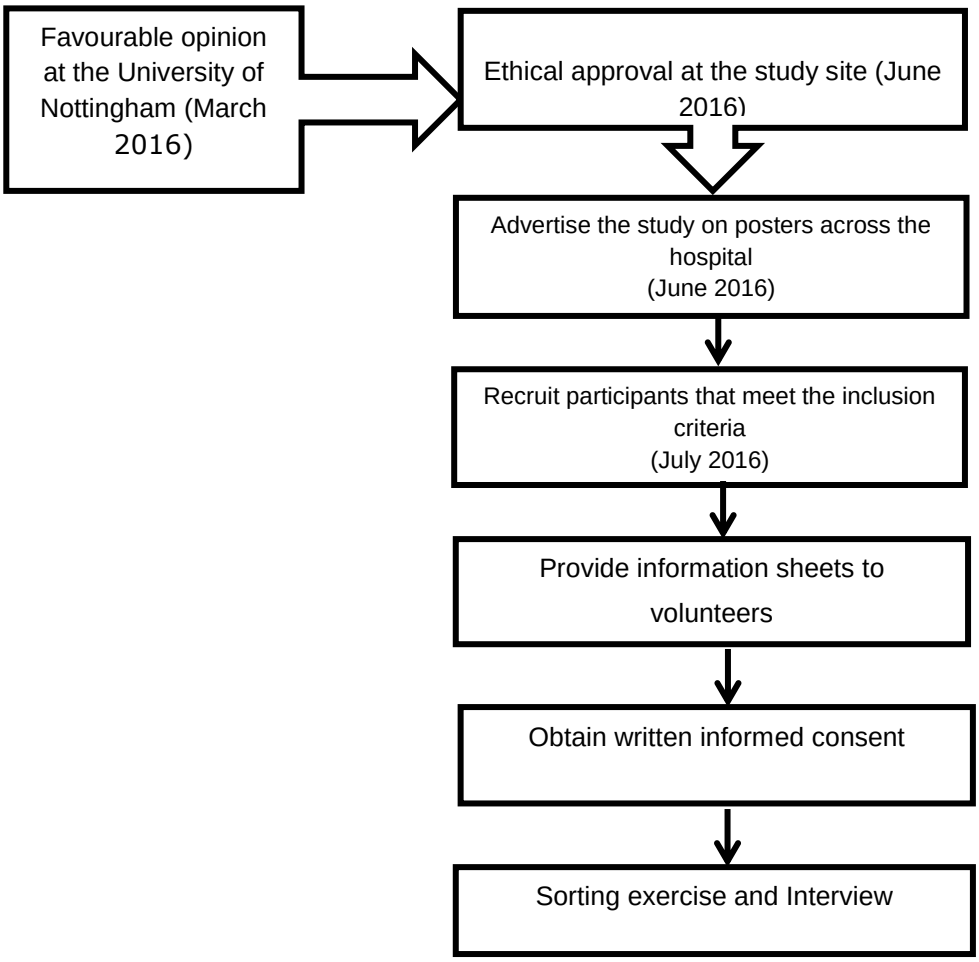


Figure 8: Participant Recruitment process for the study

3.3.7. Q-sorting

The data collection process in Q-methodology is through the Q-sorting process where the participants rank-order the Q-sample across a grid of agreement to disagreement using a 'condition of instruction' in a quasi-normal distribution. The condition of instruction is a pre-sorting information that guides the participant on how to sort the Q-sample statements (Valenta and Wigger, 1997, p.502).

The Q-sorting process for this study was conducted within the teaching hospital between July 2017 and October 2017. All physicians that participated had their Q-sorts within their offices or a traffic-free location within their clinical departments. However, a dedicated office was provided by the department of nursing services of the hospital for the

conduct of the sorting exercise and post-sorting interviews for nursing staff that were willing to participate within the study. After signing the consent form, each participant was provided with a deck of *forty-six* numbered laminated cards containing the typed Q-statements, the condition of instruction and the sorting grid (printed on an A0 cardboard) for the placement of the cards at the beginning of each meeting. At the commencement of each meeting and after an informed consent was obtained, the participants were asked to read the condition of instruction which read “consider factors that influence clinical information systems adoption and use in your clinical practice as a Nurse/Physician, which statements do you ‘Most agree’ with or ‘Most disagree’ influences your adoption and use. Ranks the statements from +6 (Most agree) to -6 (Most disagree)” (Figure 9).

Participants were then also encouraged to read all the cards and sort them initially into three piles of “agree”, “disagree” and “I will decide later”. They thus begin sorting the ‘agree’ and ‘disagree’ cards along the sorting grid. During the Q-sorting, participants were encouraged to ask the researcher questions relating to the process should they have the need to do so. At the end of the Q-sorting, participants were asked if they still need to change the position of any cards. If they indicate, they do not need to, the number of the card and the position it is placed on the Q-sorting grid is recorded on a mini-sorting grid (replica of the A0 sorting grid) on an A4 size paper, which was transferred to the computer software for subsequent analysis. A total of thirty-six completed sorts were retrieved and attached with its respective consent form. The Q-sort sessions ranged between twenty-five minutes to forty-five minutes in duration.

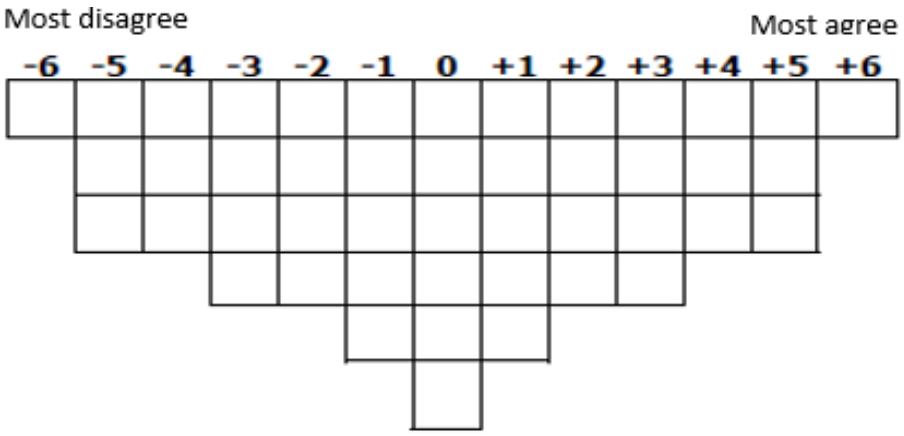


Figure 9: Sorting grid for this study showing the ranking order

3.3.8. Post-sort interviews

After the Q-sorting exercise, the participant post-sort interviews were conducted. The post-sort interviews have been described as supportive information which are useful during the data interpretation process (Watts and Stenner, 2005a, Watts and Stenner, 2012). These are usually brief and open-ended and may cover how the participant interpreted the items at the most extreme ends of the grid, if they have any item that they think should have been included or if they have any general comment about the whole Q-sorting process (Watts and Stenner, 2005b). However, it should be noted that the interview data collected only complements the final Q-sorts data (vanExel and Graaf, 2005, Watts and Stenner, 2012, Webler et al., 2009) and recently some researchers that conduct online Q-studies or by mail often overlook the post-sort interview stage (Paige and Morin, 2015). Though this is countered by traditional Q researchers as they argue that an insight as to the reason why some statements are placed in certain places might be lost if no post-sort interview is done.

An audio recorder was used to capture the responses of the participants for this study. There were three open ended questions: a) How do you interpret the items on the extreme ends of the sorting grid in relation to its implication on your practice? b) Is there any item you might wish to add to the statements? c) and; Is there any general

comment that you may want to add relating to the entire Q-sorting process?

All recordings were transcribed and used in the interpretation of the Factors.

3.3.9. Analysis and interpretation

This is also called the Q-analysis. It involves three main stages as shown in Figure 10: the correlation stage, by-person factor analysis, and computation of Factor scores (Valenta and Wigger, 1997). All Q-sorts are entered into the chosen Q-analysis software and subjected to Q factor analysis after correlation. vanExel and Graaf (2005) state that this stage is a technical and objective step in a Q study. The stages will be discussed in detail below.

The analysis software used for this study was the PQMethod 2.35 (November 2014 version) by Peter Schmolck and another software Ken-Q analysis (February 2017 version) a beta version developed by Shawn Banasick was used to validate the results. Both software were available free online during the duration of the study.

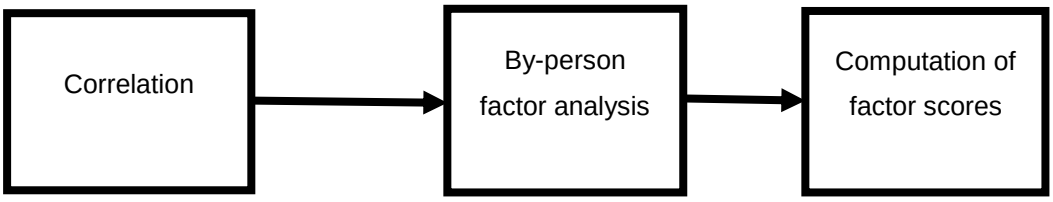


Figure 10: The three main stages in Q analysis

3.3.9.1. Correlation

This involved the creation of a correlation matrix which identifies patterns of relationships between Q-sorts based on similarities and differences from where which Factors will eventually emerge.

Each individual Q-sort within a Q-study was inter-correlated with other Q-sorts within the study to produce a correlation matrix (Barker, 2008, Valenta and Wigger, 1997, Watts and Stenner, 2012). All the thirty-six Q-sorts were entered into the PQMethod software and then correlated.

3.3.9.2. By-person factor analysis

This involved the extraction of Factors and subsequent rotation. As described by Watts and Stenner (2012), the two methods of extraction commonly used by Q-studies are the centroid extraction and the principal component analysis (PCA), though they the argued that the PCA is not factor analysis and components that are generated are not Factors. Thus centroid factor extraction was employed as described by Brown (1980). Watts and Stenner (2012) identified the centroid method of extraction as the traditional method of extraction in Q-methodology, and as suggested by them a Factor could be extracted for every six Q-sorts. This means for this study with thirty-six Q-sorts, six Factors was extracted.

The results for the Factor extraction process for this study is presented in Chapter 4 which show the eigenvalues and the explained variance for the extracted Factors.

3.3.9.3. Factor rotation and Factor loadings

Watts and Stenner (2012) described that the rotation allows for the Q-sort loadings take on a geometric function, which will become reference points or means of mapping the viewpoints in the study. Q-methodology employs two methods of Factor rotation. Though, Zabala and Pascual (2016) mentions that these techniques for rotation depend on the aim and prior knowledge that researchers have on the participants. These rotations are judgemental/manual/by hand rotation and the Varimax rotation (vanExel and Graaf, 2005, Watts and Stenner, 2005a, Watts and Stenner, 2012, Webler et al., 2009) rather than orthogonal rotations in R methodology that assumes Factors are not correlated.

Literature has shown that there is no right or wrong method of Factor rotation and that both methods of rotation are adjudged to produce similar findings (Watts and Stenner, 2012). In addition, both methods are reported to fit data well while also both resulting in higher interpretability (Zabala and Pascual, 2016). vanExel and Graaf (2005) have described the Varimax method as an objective procedure and that

during the Factor rotation, perspective from which the Q-sorts are observed shifts without altering the relation between Q-sorts.

Varimax rotation was used for this study to ascertain the dominant viewpoint within the participants by showing the best possible Factor solution using the PQMethod 2.35. The results from the Varimax rotation is shown in Chapter 4.

3.3.9.4. Factor scores and Factor arrays

A Factor score of a statement is the normalised weighted average statement score or Z-score of respondents that define such a Factor (Akhtar-Danesh et al., 2008, Brown, 1980, vanExel and Graaf, 2005, Webler et al., 2009). The Z-score according to Petit dit Dariel (2011) allows for an in-depth look at the subject of study. The author argues that these scores focus on the nature of the relationship the Q-sorts have with one another and they are also the important element for consideration when interpreting the Factors. Prior to the interpretation of these Factors the Z-scores are converted to Factor arrays. The Factors arrays are defined as a single Q-sort (model Q-sort or *synthetic Q-sort*) which is configured to bring forth the perspective/viewpoint of a Factor (Akhtar-Danesh et al., 2008, Watts and Stenner, 2012). The Factor arrays represent how participants within that Factor rank a statement within a particular Factor (+6, -6, +5, -5, etc.). Though it may be impossible to identify a participant's Q-sort that is exactly like the model Q-sort, however the resultant arrays are created from participants Q-sorts whose viewpoints share an approximate viewpoint with the relevant Factor (vanExel and Graaf, 2005, Watts and Stenner, 2012).

The PQMethod software used for this study shows the computed results of both the Z-scores as well as the Factor arrays showing the scores for each statement and the position of each statement with the final model Q-sort. It will be important to recognise the presence of consensus and distinguishing/dissenting statements. These statements highlight the similarities and differences between one Factor and the other (s). The extreme scores that occupy both the ends of the sorting

grid define them. As such they represent the most agreed and most disagreed upon statements in cross Factor comparison (Akhtar-Danesh et al., 2008, Valenta and Wigger, 1997). Watts and Stenner (2012) have suggested that though these distinguishing and consensus statements have been the traditional approach in the interpretation of Factors, a more holistic technique should be adopted rather than putting emphasis on a few statement items. Thus, they proposed the use of a Crib sheet. The crib sheet they argue provides the strength to the gestalt nature of Q. It helps describes each Factor as a whole. This is based on how statements within it are ranked in the following order: a) most agreed statement in a Factor, b) statements ranked higher in a Factor than other Factors, c) statements ranked lower in a Factor than in other Factors and, d) most disagreed statement in a Factor.

As will be discussed in Chapter 4, the PQMethod software identified these consensus and distinguishing statements which was adopted for cross-Factor comparisons and the crib sheet was used for Factor interpretation.

3.4. Summary

This chapter outlines the process of Q-methodology as it is applied to this study. It serves as a map to a traveller showing the important landmarks along the journey towards the perspectives of the participants of the study. From the start of the journey we have recognised how Q-methodology lends its subjective strength which has been described as typically qualitative and very credible. In the next chapter we will see how the next stage of the journey unveils the findings of the study.

Chapter 4. Findings

4.1. Introduction

This chapter describes the result of the Q-analysis conducted within this study. The process involved during the by-person factor analysis is seen in Figure 11. Thirty-Six Q-sorts were collected from the study area. The PQMethod 2.35 (November 2014 version) was used for analysis while another software the Ken Q analysis software (February 2017 version) was used to validate the results as earlier mentioned in the methodology chapter. Following correlation of the Q-sorts, the centroid method of extraction was employed to extract six Factors which was subsequently followed by Varimax rotation as already mentioned in the previous chapter to obtain a defining/model Q-sort for interpretation.

The subsequent sections explain Figure 11 in more detail within the context of this study.

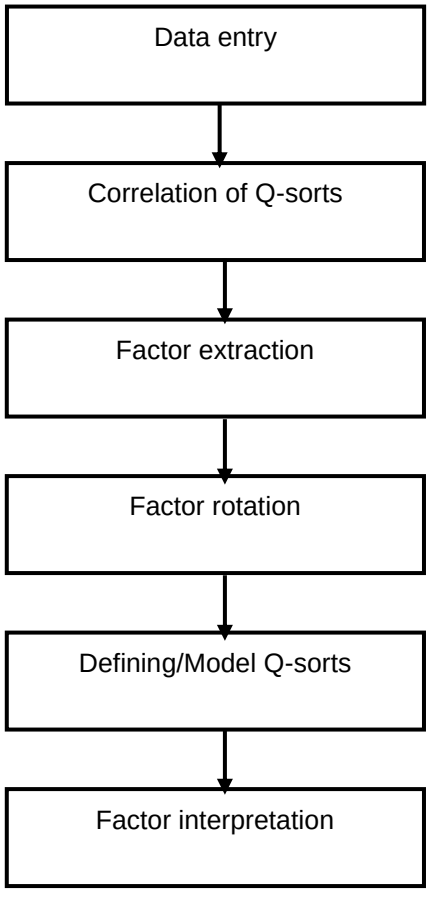


Figure 11: Q-analysis process

4.2. Correlation of Q-sorts

This was the first stage of the by-person factor analysis following data entry in to the analysis software. The PQMethod was used to inter-correlate all the thirty-six Q-sorts together and generated a correlation matrix (Appendix D) which was used for Factor extraction.

4.3. Factor extraction

The Factor extraction stage, which follows the correlation of Q-sorts for the study is presented in Table 7. This is the first step that identifies the similarity in the viewpoints as expressed by the participants of the study. In identifying the Factors to be carried forward following extraction, Watts and Stenner (2012) and Brown (1980) have identified certain criteria for retention of Factors as thus: the use of Kaiser Guttman's criteria which uses eigenvalues of greater than 1; the use of magic number seven (this they noted is arbitrary and ill-considered when trying to be objective); the use of two more significant loadings (where a Factor should have two or more significant loading Q-sorts to be retained) ;and lastly the use of Humphrey's rule (which suggests that for a Factor to be retained the cross product of its two highest loadings should at least exceed its standard error which is computed by the formula: Standard error (SE) = 1/√number of statements, for this study is was computed to 0.147≈0.15). The objective of using these criteria is for the final Factors to account for as much of the variability from the original correlation matrix as much as possible (Watts and Stenner, 2012).

Table 7: Eigenvalues and explained variance for extracted Factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Eigenvalues	13.6089	1.7290	1.7206	1.3670	0.2311	1.1481
% explained Variance	38	5	5	4	1	3
Factors that met the Kaiser-Guttman's criteria	1	2	3	4	-	6
Factors that met the Humphrey's rule	1	2	-	4	-	6

The use of magic number seven was abandoned as Q researchers have recently identified it not to be an objective way for Factor retention because of its arbitrariness as earlier mentioned in this section. On the one hand, adopting the use of significant loadings suggested that only three Factors (1, 2 & 4) will be carried forward for the next stage of the analysis process. This does not however capture most of the study variance which is the objective of the Factor retention after extraction.

This resulted in using both the Kaiser-Guttman's criteria (as recommended by Watts and Stenner (2012) and Webler et al. (2009)) because it is reported to be widely accepted during factor analysis in both quantitative and Q studies and the Humphrey's rule (Brown, 1980). This was used to retain Factors as illustrated in Table 7. Thus, the final Factors retained are Factors 1, 2, 4 and 6 which had 0.67, 0.26, 0.16 and 0.16 respectively.

4.4. Factor rotation

The four Factors were rotated using Varimax rotation as mentioned in Chapter 3. To reduce the number of confounding Q-sorts (Q-sorts that load significantly on more than one Factor) and non-significant loadings (Q-sort that does not load significantly on any Factor) as suggested by

Petit dit Dariel (2011), Plummer (2012), Watts and Stenner (2012), the significance level was raised from 0.380 to a cut-off of 0.460. The significance level in Q-methodology is calculated by using the formula 2.58 (1/√number of statements) (Brown, 1980, Watts and Stenner, 2012). Raising the cut-off to 0.460 allowed for the retention of as many participants (twenty-eight) to define the final Factors. This also reduced the number of confounded Q-sorts to three and the non-significant loadings Q-sorts to five. A detailed table for significance level determination is also provided by Jeffares (2013). Both confounding and non-significant loading Q-sorts are excluded from the final interpretation in this study as suggested by Akhtar-Danesh et al. (2008). Manual flagging of defining Q-sorts was done to identify the Q-sorts that load significantly (0.46) on a Factor.

4.5. Four Factor solution

A four-Factor solution as illustrated in Table 8 was established to represent the viewpoints of the participants of this study. Thirty-six participants took part in the study. Factor 1 has seven participants that loaded onto the Factor (7/36; 19%), seven participants also loaded on Factor 2 (7/36; 19%), Factor 3 was defined by six participants (6/36; 17%) and the final Factor 4 had eight participants that significantly loaded (8/36; 22%). Five participants did not load on any Factor and three participants were confounded.

Table 8: Four Factor solution of the thirty-six Q-sorts

	Participants/Q-sorts	Percentage (%)
Factor 1	7	19.4
Factor 2	7	19.4
Factor 3	6	16.7
Factor 4	8	22.2
Confounding	3	8.3
Non-significant	5	14.0

4.6. Factor correlations

As presented in the Table 9, the correlation between all four Factors is large based on the Cohen's 1988 guidelines for correlation. The guidelines identify that a correlation coefficient values of less than 0.3

indicate a small correlation, 0.3-0.5 indicate a medium correlation and greater than 0.5 indicate a large correlation (Cohen, 1977).

Table 9: Correlation between Factors

Factor	1	2	3	4
1	1.0000	0.6206	0.5337	0.6994
2	0.6206	1.0000	0.4836	0.5805
3	0.5337	0.4836	1.0000	0.5508
4	0.6994	0.5805	0.5508	1.0000

Though this shows statistical relationship between all the four Factors, in Q-methodology the similarities between Factors are presented as consensus statements and the difference in cross-Factor association is defined by the distinguishing statements as will be discussed subsequently in this chapter. Petit dit Dariel (2011) however cites that the use of Cohen's guidelines is arbitrary and thus the interpretation of such statistical relationships should be based on the purpose and context of the study. Notwithstanding, the guidelines identify that the reliability of the four Factors is shown to be strong with a composite reliability score range of 0.96 to 0.97 (Table 10).

Table 10: Factor characteristics

	1	2	3	4
Number of defining Q-sorts	7	7	6	8
Composite reliability	0.966	0.966	0.960	0.970
Standard error for Factor Z-scores	0.186	0.186	0.200	0.174

The composite reliability is calculated as:

$$r_f = \frac{0.8p}{1 + (p-1)0.8}$$

Where *f* is the Factor, *p* is the number of Q-sorts within the Factor and 0.8 is the value used in Q-methodology for average reliability coefficient (Brown, 1980, Zabala and Pascual, 2016).

The standard error for *Z-scores* is calculated as:

$$SE_f = S_f\sqrt{1 - r_f}$$

Where S_f is assigned the value 2.2 as a constant for forced distribution (Brown, 1980).

4.7. Factor loadings and defining Q-sort

Table 11 shows the Factor loadings for each individual Q-sort. The Q-sorts defining each Factor are shown in italic bold marked with an "***X***" and using the cut-off of 0.46. Twenty-eight of the Q-sorts loaded significantly across the four Factors, five of the Q-sorts however did not load on any of the four Factors and three Q-sorts loaded on more than one Factor (confounding). The last row in Table 11 also shows the percentage of explained variance for each Factor. Table 12 also shows the Factor array for all four Factors. The Factor arrays represent the Q-sorts which are configured to present viewpoints of the respective Factors (Watts and Stenner, 2005a, Watts and Stenner, 2012).

Table 11: Factor loading and defining Q-sort

Q-sort	Participant	Factor 1	Factor 2	Factor 3	Factor 4
1.	Participant 1	***0.6672X***	0.2203	0.2129	0.3309
2.	Participant 2	0.1332	0.5266	-0.0352	0.5679
3.	Participant 3	***0.5490X***	0.1363	0.4446	-0.1495
4.	Participant 4	***0.5063X***	0.4490	0.2769	0.3102
5.	Participant 5	0.3141	0.1710	0.0149	***0.5649X***
6.	Participant 6	0.1094	0.3611	***0.4819X***	0.3070
7.	Participant 7	0.1275	***0.4861X***	0.1284	0.4462
8.	Participant 8	0.0683	0.2893	0.0760	***0.5003X***
9.	Participant 9	***0.4783X***	0.1512	-0.0530	0.3665
10.	Participant 10	0.1067	0.2742	0.0701	***0.6931X***
11.	Participant 11	0.2968	-0.0028	0.2192	0.3534
12.	Participant 12	0.5164	0.4915	0.1349	0.3031
13.	Participant 13	0.4416	***0.4907X***	0.2674	0.4225
14.	Participant 14	0.5581	0.2105	0.2666	0.5275
15.	Participant 15	0.4444	0.1733	0.2232	***0.5622X***
16.	Participant 16	***0.4654X***	0.4237	0.4507	0.3414
17.	Participant 17	0.2041	***0.6309X***	0.1177	0.0560
18.	Participant 18	0.1456	0.3508	0.3101	-0.0545
19.	Participant 19	***0.5237X***	0.0652	0.1190	0.2137
20.	Participant 20	0.2357	***0.6950X***	-0.1229	0.1153
21.	Participant 21	0.4414	0.4099	0.2311	0.4160
22.	Participant 22	0.1572	0.0291	0.3012	0.0845
23.	Participant 23	0.1378	0.3177	***0.4706X***	0.1849
24.	Participant 24	0.2553	0.0041	0.1397	***0.5245X***
25.	Participant 25	0.0123	0.3674	0.0791	0.0296
26.	Participant 26	0.2463	0.4198	***0.5634X***	0.3211
27.	Participant 27	0.4034	0.2782	0.4014	***0.4813X***
28.	Participant 28	-0.1146	***0.5198X***	0.2068	0.2869
29.	Participant 29	0.1899	0.1354	0.2890	***0.5551X***
30.	Participant 30	***0.6780X***	0.2515	0.0936	0.3566
31.	Participant 31	0.3872	***0.6778X***	0.1075	0.2249
32.	Participant 32	0.1316	0.0550	***0.6338X***	-0.0373
33.	Participant 33	-0.1345	-0.0592	***0.7505X***	0.3345
34.	Participant 34	0.2003	***0.5609X***	0.3201	0.3889
35.	Participant 35	0.3023	0.4235	***0.5058X***	0.3383
36.	Participant 36	0.3475	0.0691	0.2153	***0.7114X***
% Explained Variance		**13%**	**13%**	**10%**	**15%**

Confounding Q-sort
Non-significant loading

Table 12: Factor Array showing the ranking of Q-statements across all Factors

No.	Statement	Factors			
		F1	F2	F3	F4
1.	It is easy to remember how to perform tasks with the clinical information systems	2	0	0	2
2.	Using clinical information systems improves patient care	4	5	1	3
3.	Using clinical information systems reduces likelihood of medication error	0	2	-2	2
4.	Superiors at work think I should use the clinical information systems	-1	-2	-2	-2
5.	If the clinical system is extended I would use it	6	1	2	1
6.	Using clinical information systems increases my productivity	2	4	4	1
7.	Using clinical information systems improves my performance	4	5	2	4
8.	I am certain about the reliability of the information I get from the system	1	-3	3	1
9.	Using clinical information systems facilitates better patient care decision making	3	6	1	0
10.	Using clinical information systems makes caring for patients easier	4	3	1	3
11.	Management support staff innovations on clinical information systems use in the workplace	-5	-4	-1	-4
12.	People in my organization who use the clinical information systems have more prestige than those who do not	-2	-4	-5	0
13.	The use of clinical information systems makes me apprehensive	-4	-5	-1	-3
14.	Using the clinical information systems is a status symbol in my organization	-3	-6	0	-1
15.	Patients/families believe clinical information systems use reduces chances of medication errors	2	0	-5	-1
16.	It is easy to get the system to do what I want it to do	-2	0	1	3
17.	Interaction with the clinical information systems does not require a lot of mental effort	-2	-4	-1	0
18.	Not having the clinical information system in some departments hinders my work in these areas	1	-1	-4	4
19.	The senior management of this organization has been helpful in the use of the clinical information systems	-4	2	-3	-6
20.	Using clinical information systems increases my chance of getting a praise or reward	-2	-2	-4	-1
21.	The use of clinical information systems is pertinent to my various related tasks	0	1	0	2
22.	The clinical information systems are clear and understandable	-3	3	0	2
23.	My use of clinical information systems is entirely voluntary	3	0	6	3
24.	My age has nothing to do with my ability to use the clinical information systems effectively	5	2	4	0
25.	My use of clinical information systems is entirely under my control	-3	-2	2	0
26.	It is easy for me to become skilful at using clinical information systems	1	3	3	4
27.	I always look for opportunities to use the system whenever I can	3	1	3	5
28.	Management organise regular training on the use of clinical information systems at the work place	-6	-3	-3	-5
29.	Clinical Information systems are useful in the hospital	5	5	5	6
30.	My routine tasks prevent me from having time to use the clinical information system	-1	-3	5	-3
31.	I could complete the job using the clinical information systems if there was no one around to tell me what to do as I go	0	0	3	1
32.	There is availability of technical assistance for clinical information systems in my hospital	-5	-1	-1	-5
33.	Clinical information systems improves work efficiency	5	4	4	5
34.	Using clinical information systems is easier than other computer systems I use	-1	-1	2	-2
35.	Patients/families like it when i use the clinical information system	1	-1	-5	-3
36.	My ICT experience affects my use of the clinical information system	-1	3	0	0
37.	People who influence my clinical behaviour think I should the system	2	0	0	-2
38.	There are available resources to use the clinical information system	-4	1	-2	-4
39.	Using clinical information systems enables me to accomplish tasks more quickly	3	4	5	5
40.	My gender affects my use of the clinical information systems	-5	-5	-6	-5
41.	People who are important to me think I should use the clinical information systems	0	-1	1	-2
42.	Patients/families believe clinical information systems use is good for quality patient care	0	1	-3	-1
43.	I hesitate to use the clinical information systems for fear of making mistakes I cannot correct	0	-5	-1	-3
44.	The information in the system is always updated	-3	-2	-4	1
45.	My use of the clinical information system is specific to the task i want to carry out	1	2	-2	-1
46.	The clinical information systems is not compatible with other platforms I use	-1	-3	-3	-4

4.8. Factor Interpretation

Factor narratives are presented with the aid of a crib sheet as described by Watts and Stenner (2005b), Watts and Stenner (2012). The crib sheet identifies the statement(s) that are higher in a specific Factor than in all other Factors, and those statement(s) that are lower in the Factor than in all other Factors. Cross-Factor comparisons are described within each Factor and represented with tables identifying the distinguishing statements that define a Factor against other Factors. The distinguishing statements are those that the participants within a Factor have ranked in a statistically significant position that is different from participants in other Factors (vanExel and Graaf, 2005). The use of both was aimed at remaining objective and reducing the researcher's bias while doing the interpretation. The crib sheet provided a systematic, holistic and consistent approach to Factor interpretation by emphasising on the detail within the generated Factor array. Statements during the interpretation are cited within brackets separated from the rank they occupy within a Factor array by a comma for example statement thirty-three ranked at +5 in Factor 1 will be cited as "(33, +5)". The distinguishing statements which were generated based on their statistical significance are also considered to illustrate the contrasting characteristics between one Factor and another. Statements that load significantly on all Factors will also be presented as consensus statements. Key constructs within the models of technology acceptance were also used to interpret the Factors that emerged in addition to both the crib sheets and the distinguishing statements so that a more holistic description of the Factors was achieved. The constructs within the models are represented with colour codes as shown in Table 13:

Table 13: Colour codes for key constructs for the models of technology acceptance

Perceived usefulness/Performance expectancy	
Perceived ease of use/effort expectancy	
Social influence/ subjective norm	
Facilitating conditions	
Individual differences	
Behavioural intention	

However, Factor interpretation are not without challenges because the aim of Q methodology is to provide a holistically capture shared viewpoints of Q-sorts and present it as a 'whole viewpoint' (Watts and Stenner, 2012, p.149). These authors suggest that it is important for researchers to consider statements items that occupy only the highest and least rankings but rather look at the inter-relationship between items within the Factors. Thus, researchers should allow these interrelationships within the Factor arrays to guide their interpretations rather than their concerns or prior biases.

4.9. Consensus statements

The consensus statements are statements that do not distinguish between the Factors that emerge and shows areas of agreement across the viewpoints (Barker, 2008, Brown, 1980, Coogan and Herrington, 2011). They are shared similarity between the Factors that emerge at the end of the by-person factor analysis that could be either positive, negative or neutral in agreement about the issue of discourse.

In this study, these statements are shared as similar viewpoints across the four Factors. The participants identified six statements that they agree with. These are seen in Table 14:

Table 14: Consensus statements

Statement number	Statements	Rank			
		Factor 1	Factor 2	Factor 3	Factor 4
#1	It is easy to remember how to perform tasks with the clinical information systems	+2	0	0	+2
#4	Superiors at work think I should use the clinical information systems	-1	-2	-2	-2
#26*	It is easy to become skilful at using the clinical information systems	+1	+3	+3	+4
#29*	Clinical information systems are useful in the hospital	+5	+5	+5	+6
#33*	Clinical information systems improves work efficiency	+5	+4	+4	+5
#40	My gender affects my use of the clinical information systems	-5	-5	-6	-5

(*All Listed Statements are Non-Significant at P>.01, and Those Flagged With an * are also Non-Significant at P>.05*)

All the study Factors agree that their gender does not influence their choice to adopt and use the clinical e-health resource for their clinical practices (#40) as seen in Table 14. All participants evidently agree that being either male or female does not influence their adoption and use of e-health tools in their respective clinical practice. These comments reflect how the participants within the Factors view the statement #40:

"*On -6 side I have, my gender affects my use of clinical information systems. I really don't think so it does anyway*". (Participant 6)

"I do not think there is anything about gender when it comes to ICT-something of knowledge and interest and does not have any effect on any gender". (Participant 25)

"In my opinion it should not be gender based. It should cut across. For the fact that I am a female does not mean I cannot be good in clinical information systems". (Participant 22)

"Whichever gender I may be, I am at liberty to use the clinical information systems". (Participant 12)

"No. No. No. I disagree with this. My gender has no effect, has no relationship whatsoever with my use of the clinical information systems". (Participant 28)

"I disagree with that because I think gender really shouldn't come in, we all have capabilities". (Participant 29)

"Whether male or female, you can have knowledge as well". (Participant 32)

"Most male and female can use the information em-clinical information systems. So, there is no one that is superior to above the other, we are both equal. We use the CIS, we use it together". (Participant 33)

"Though I am male, I have seen female individuals who are proficient in the use of ICT-technology in the workplace. So that is why I most disagree with that". (Participant 34)

Moreover, participants across all the four Factors also agree that clinical information systems are useful in the hospital (#29), and likewise they agree on the positive contributions of the e-health tools towards their clinical efficiency (#33). The high ranking of the statement evidences this across all the Factors within the study. This affirms their support for

the adoption and use of clinical/e-health tools within their clinical practice. The comments they provide in support of this view are:

> *"...making life simple for both the clinician as well as the patient and relatives. It also assists in the delivery of care and thereby limit the error rate and increases efficiency and effectiveness".* (Participant 28)

> *"…they are reproducible…save time which is priceless given a system that saves a number of patient per time"* (Participant 16)

> *"It is very very [sic] useful because it makes the work easy and it facilitate patient care in the clinical areas". (*Participant 7)

This shows the value and recognition that these e-health tools play an important role in the clinical environment as viewed by these HCPs.

However, participants across the four Factors acknowledge that their superiors do not support them towards the adoption and use of these e-health resources at the workplace (#4). Though senior health professionals participated in the study, this statement was ranked along -1 to -2 by all the four Factors. This seems to warrant that participants do not find the support they get from their superiors as encouraging when it comes to the adoption and use of e-health tools. The comment below by a participant illustrates the view held by most regarding the support from the superiors:

> *"…there were moments when the IT was introduced but some certain individuals [superiors] actually resist it. Feeling that because it is not understandable, it's not clear to them as in [sic] [it] complicates their work that is the task that is been given to them. So, they prefer to adopt as in [sic] the manual way rather than going the ICT way. But for most of them it's because it's not clear to them actually".* (Participant 3)

In addition, participants across the four Factors seem to recognise that though it might be easy to become skilful in using the e-health tools (#26), remembering how to use it may not be as easy (#1) with the

highest ranking identified as +2 and the least ranking identified as 0. This does not indicate that it is difficult to remember how to use e-health tools, but it may suggest that they experience certain challenges in recalling how to engage with them.

Model Q-Sort 1: Factor 1

-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6
#28.Mngt organise regular training on the use of CIS at the work place	#40.My gender affects my use of the CIS	#38.There are available resources to use the CIS	#22.The CIS are clear and understandable	#16.It is easy to get the system to do what I want it to do	#34.Using CIS is easier than other computer systems I use	#31.I could complete the job using the CIS if there was no one around to show me what to do as I go	#26. It is easy for me to become skilful at using CIS	#1.It is easy to remember how to perform tasks with the CIS	#9.Using CIS facilitates better patient care decision making	#2.Using CIS improves patient care	#24.My age has nothing to do with my ability to use the CIS effectively	#5. If the clinical system is extended I would use it
	#32.There is availability of technical assistance for CIS in my hospital	#19.The senior Mngt of this organization has been helpful in the use of the CIS	#25.My use of CIS is entirely under my control	#17.Interaction with the CIS does not require a lot of mental effort	#46.The CIS is not compatible with other platforms I use	#42.Patients/families believe CIS use is good for quality patient care	#18.Not having the CIS in some departments hinders my work in these areas	#15.Patients/families believe CIS use reduces chances of medication errors	#23.My use of CIS is entirely voluntary	#10.Using CIS makes caring for patients easier	#29.CIS are useful in the hospital	
	#11.Mngt support staff innovations on CIS use in the workplace	#13.The use of CIS makes me apprehensive	#14.Using the CIS is a status symbol in my organization	#20.Using CIS increases my chance of getting a praise or reward	#4.Superiors at work think I should use the CIS	#3.Using CIS reduces likelihood of medication error	#45.My use of the CIS is specific to the task i want to carry out	#6.Using CIS increases my productivity	#27.I always look for opportunities to use the system whenever I can	#7.Using CIS improves my performance	#33.CIS improves work efficiency	
			#44.The information in the system is always updated	#12.People in my organization who use the CIS have more prestige	#30.My routine tasks prevent me from having time to use the CIS	#21.The use of CIS is pertinent to my various related tasks	#8. I am certain about the reliability of the information I get from the system	#37.People who influence my clinical behaviour think I should the system	#39.Using CIS enables me to accomplish tasks more quickly			
					#36.My ICT experience affects my use of the CIS	#41.People who are important to me think I should use the CIS	#35.Patients/families like it when i use the CIS					
						#43.I hesitate to use the CIS for fear of making						

	Perceived usefulness/Performance expectancy
	Perceived ease of use/effort expectancy
	Social influence/ subjective norm
	Facilitating conditions
	Individual differences
	Behavioural intention

4.10. Factor 1: Patient-focused e-health advocates

Factor 1 (Model Q-sort 1) has seven significantly loading participants and explains 13% of the study variance. It has an eigenvalue of 4.68. Five of the loading participants are physicians and two are nurses. There are two females and five males with an average age of 37.7 years**.**

4.10.1. Factor 1 crib sheet

Item ranked at +6

#5: If the CIS is extended I would use it

Items ranked higher in Factor 1 array than other arrays

No.	Statement	Rank
33	Clinical information systems improves work efficiency	**+5**
40	My gender affects my use of the clinical information systems	**-5**
4	Superiors at work think I should use the clinical information systems	**-1**
1	It is easy to remember how to perform tasks with the clinical information systems	**+2**
10	Using clinical information systems makes caring for patients easier	**+4**
46	The clinical information systems is not compatible with other platforms I use	**-1**
37	People who influence my clinical behaviour think I should the system	**+2**
24	My age has nothing to do with my ability to use the clinical information systems effectively	**+5**
43	I hesitate to use the clinical information systems for fear of making mistakes I cannot correct	**0**
35	Patients/families like it when I use the clinical information system	**+1**
15	Patients/families believe clinical information systems use reduces chances of medication errors	**+2**

Items ranked lower in Factor array 1 than any other

No.	Statement	Rank
26	It is easy for me to become skilful at using clinical information systems	**+1**
21	The use of clinical information systems is pertinent to my various related tasks	**0**
39	Using clinical information systems enables me to accomplish tasks more quickly	**+3**
31	I could complete the job using the clinical information systems if there was no one around to tell me what to do as I go	**0**
16	It is easy to get the system to do what I want it to do	**-2**
11	Management support staff innovations on clinical information systems use in the workplace	**-5**
25	My use of clinical information systems is entirely under my control	**-3**
36	My ICT experience affects my use of the clinical information system	**-1**
32	There is availability of technical assistance for clinical information systems in my hospital	**-5**
22	The clinical information systems are clear and understandable	**-3**
38	There are available resources to use the clinical information system	**-4**

Item ranked at -6

#28: Management organise regular training on the use of clinical information systems at the work place

4.10.1. Interpretation Factor 1

HCPs within this Factor recognise that e-health improves their work efficiency (33, +5) without the influence of their personal characteristics such as age and gender (24, +5; 40, -5) or their previous ICT experience (36, -1). They consider the views of their patients/families when using these technologies (35, +1; 15, +2) and will continue using it if it is made available beyond their departments (5, +6). Even though they identify that it is not easy to become used to these technologies as well as remembering how to perform tasks using it (26, +1; 16, -2; 1, +2), it still helps them in accomplishing tasks more quickly (39, +3). Diminished support from both management and superiors (28, -6; 11, -5; 4, -1; 37, +2) led to the provision of e-health tools which are rather challenging to adopt and use (22, -3; 38, -4). HCPs have concerns when it comes to access to such technologies (25, -3) and this affects their confidence when applying these technologies within their clinical practice (43, 0; 31, 0). For them issues such as compatibility with other technology platforms (46, -1) play a major role in adopting such technologies to simplify their daily routines in the clinical setting.

In comparing Factor 1 with the other Factors as seen in Table 15, thirteen statements differentiate it from the other three Factors (at $p<0.05$) with eight of the statements significant at $p<0.01$. Participants within this Factor have identified statement five (#5) "*If the clinical system is extended I would use it"* as having the highest rank when compared to the other three Factors (+6). This view is affirmed by their ranking of statement #18 (*Not having the clinical information system in some departments hinders my work in these areas*) on +1. These participants capture a statement affirming this:

"If the clinical information system is extended definitely I will use it. I want to adopt it…" (Participant 3)

"…is a major challenge because most times you, there are things you actually have to like so really look for on your own…"(Participant 4)

"*Whereas concerning if the clinical information system is extended, I would use it. I am 100% sure that if at all it was brought today or it was introduced today I will surely use it and continue to use it".* (Participant 9)

"…right now we are at a phase almost all you want they will say no resources, no money, no resources for everything. Is just management and management but when things improve, things will go back to its normal…" (Participant 30)

They show that they will use the e-health tools when it is made available beyond their clinical departments. They also ranked item #28 (*Management organise regular training on the use of clinical information systems at the work place) the least* when compared to the other three Factors. The reason for this placement can be seen in these comments:

> *"…because in our setting we don't have regular training on the use of clinical information systems, that is in our workplace it's not done so that is why I rate it as -6".* (Participant 3)
>
> *"Even though I had experience, I wasn't really trained, I was just shown by my colleagues that's how it works. The management did not really train me and I have not really had or attended any training on [sic] the past or in the present".* (Participant 9)
>
> *"I attended only one session [training]…and that was about five years ago".* (Participant 16)
>
> *"For now there is nothing of such [training]. So that is why I disagree with this card and that's why I placed it there".* (Participant 19)

HCPs within this Factor, hold the view that patients/families' choices are being considered by them when using these e-health tools. This is evidenced by their consistent ranking of the statements referencing patients and or their families (#9: *Using clinical information systems facilitates better patient care decision making, +3*; #15: *Patients/families believe clinical information systems use reduces chances of medication*

errors, +2; #35: *Patients/families like it when I use the clinical information system, +1 ; and #42: Patients/families believe clinical information systems use is good for quality patient care, 0)* between 0 to +3 on Factor 1 in Model Q-sort 1. These ranking are higher than in other Factors (except for statement #9 which was ranked higher in Factor 1 and statement #42 which was ranked +1 in Factor 2 (see Factor 1 crib sheet and Table 15 which shows the distinguishing statements for Factor 1). In addition, the following comments justify some of their views:

> *"Yes, if I have this system at hand…I will be able to cover more patients than in a short time and effectively than maybe using the manual stuff"*. (Participant 19)
>
> "…*they also save time which is priceless given a system that saves a number of patients per time"*. (Participant 16)
>
> "*Whether patients are happy with it, whether it's going to improve patient care, because obviously if you are both happy, it's going to improve patient care*". (Participant 1)

Similarly, Factor 1 Model Q-sort also shows how the participants ranked the constructs on the models of technology acceptance. It illustrates that out of the twelve statements representing perceived usefulness/performance expectancy (PU/PE) which explores participants views on the usefulness of the e-health within their clinical practice, ten statements were ranked between 0 to +5 and all the statements on behavioural intention (BI) were ranked between +1 to +6. However, eight of nine statements representing facilitating conditions (FC) which explores both technical, managerial support including resource availability were ranked between -1 to -6. Statements representing both perceived ease of use/effort expectancy (PEOU/EE) which explores the ease in interaction with the e-health tools by the HCPs and social influence/subjective norm (SI/SN) which explores influence of patients/families, superiors and others in the HCPs' views on adoption and use of the e-health were ranked between -4 to +4 and -

3 to +2 respectively. However, all three statements referring to patient/families in SI/SN were ranked between 0 to +2 which is higher than all the other Factors. The four items on individual differences (ID) which explores the influence of HCPs' personal characteristics were spread between -5 to +5.

Table 15: Distinguishing Statements for Factor 1

Statements	**Factor 1**	Factor 2	Factor 3	Factor 4
#5: If the clinical system is extended I would use it	**+6; 2.11***	+1; 0.45	+2; 0.50	+1, 0.53
#9: Using clinical information systems facilitates better patient care decision making	**+3; 0.96**	+6; 1.65	+1; 0.36	0; 0.45
#39: Using clinical information systems enables me to accomplish tasks more quickly	**+3; 0.72**	+4; 1.37	+5; 1.52	+5; 1.50
#15: Patients/families believe clinical information systems use reduces chances of medication errors	**+2; 0.53***	0; -0.32	-5; -1.93	-1; -0.24
#18: Not having the clinical information system in some departments hinders my work in these areas	**+1; 0.41***	-1; -0.34	-4; -1.24	+4; 1.08
#35: Patients/families like it when i use the clinical information system	**+1; 0.26***	-1; -0.52	-5; -1.83	-3; -1.04
#3: Using clinical information systems reduces likelihood of medication error	**0; 0.03**	+2; 0.73	-2; -0.63	+2; 0.63
#46: The clinical information systems is not compatible with other platforms I use	**-1; -0.29**	-3; -1.05	-3; -0.88	-4; -1.28
#30: My routine tasks prevent me from having time to use the clinical information system	**-1; -0.30***	-3; -0.98	+5; 1.45	-3; -1.21
#12: People in my organization who use the clinical information systems have more prestige than those who do not	**-2; -0.56***	-4; -1.47	-5; -1.39	0; 0.36
#22: The clinical information systems are clear and understandable	**-3; -0.70***	+3; 1.09	0; 0.33	+2; 0.66
#14: Using the clinical information systems is a status symbol in my organization	**-3; -1.10***	-6; -2.03	0; -0.23	-1; -0.18
#28: Management organise regular training on the use of clinical information systems at the work place	**-6; -2.16**	-3; -0.84	-3; -1.09	-5; -1.55

(* indicates significance at p<0.01; Z-scores are shown next to ranked scores)

Model Q-Sort 2: Factor 2

-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6
#14.Using the CIS is a status symbol in my organizatio n	#40.My gender affects my use of the CIS	#11.Mngt support staff innovations on CIS use in the workplace	#8. I am certain about the reliability of the information I get	#25.My use of CIS is entirely under my control	#18.Not having the CIS in some departments hinders my work in these areas	#1.It is easy to remember how to perform tasks with the CIS	#21.The use of CIS is pertinent to my various related tasks	#3.Using CIS reduces likelihood of medication error	#36.My ICT experience affects my use of the CIS	#6.Using CIS increases my productivity	#7.Using CIS improves my performanc e	#9.Using CIS facilitate s better patient care decision
	#13.The use of CIS makes me apprehen sive	#17.Interact ion with the CIS does not require a lot of mental effort	#28.Mngt organise regular training on the use of CIS at the work place	#4.Superior s at work think I should use the CIS	#32.There is availability of technical assistance for CIS in my hospital	#37.People who influence my clinical behaviour think I should the system	#5. If the clinical system is extended I would use it	#19.The senior Mngt of this organization has been helpful in the use of the CIS	#22.The CIS are clear and understanda ble	#39.Using CIS enables me to accomplish tasks more quickly	#29.CIS are useful in the hospital	
	#43.I hesitate to use the CIS for fear of making	#12.People in my organizatio n who use the CIS have more prestige	#30.My routine tasks prevent me from having time to use the CIS	#20.Using CIS increases my chance of getting a praise or reward	#41.People who are important to me think I should use the CIS	#16.It is easy to get the system to do what I want it to do	#38.There are available resources to use the CIS	#24.My age has nothing to do with my ability to use the CIS effectively	#10.Using CIS makes caring for patients easier	#33.CIS improves work efficiency	#2.Using CIS improves patient care	
			#46.The CIS is not compatible with other platforms I use	#44.The information in the system is always updated	#35.Patients/fami lies like it when i use the CIS	#23.My use of CIS is entirely voluntary	#42.Patient s/families believe CIS use is good for quality patient care	#45.My use of the CIS is specific to the task i want to carry out	#26. It is easy for me to become skilful at using CIS			
					#34.Using CIS is easier than other computer systems I use	#31. I could complete the job using the CIS if there was no one around to show me what to do as I go	#27.I always look for opportunitie s to use the system whenever I can					
						#15.Patients/fami lies believe CIS use reduces chances of medication errors						

	Perceived usefulness/Performance expectancy
	Perceived ease of use/effort expectancy
	Social influence/ subjective norm
	Facilitating conditions
	Individual differences
	Behavioural intention

4.11. Factor 2: Task-focused e-health advocates

Factor 2 (Model Q-sort 2) has seven significantly loading participants and explains 13% of the study variance. It has an eigenvalue of 4.68. Five of the loading participants are physicians and two are nurses. There are two females and five males within this Factor and have an average age of 42.6 years.

4.11.1. Factor 2 crib sheet

Item ranked at +6

#9: Using clinical information systems facilitates better patient care decision making

Items ranked higher in Factor 2 array than other arrays

No.	Statement	Rank
40	My gender affects my use of the clinical information systems	**-5**
7	Using clinical information systems improves my performance	**+5**
6	Using clinical information systems increases my productivity	**+4**
2	Using clinical information systems improves patient care	**+5**
45	My use of the clinical information system is specific to the task i want to carry out	**+2**
28	Management organise regular training on the use of clinical information systems at the work place	**-3**
42	Patients/families believe clinical information systems use is good for quality patient care	**+1**
3	Using clinical information systems reduces likelihood of medication error	**+2**
36	My ICT experience affects my use of the clinical information system	**+3**
32	There is availability of technical assistance for clinical information systems in my hospital	**-1**
22	The clinical information systems are clear and understandable	**+3**
38	There are available resources to use the clinical information system	**+1**
19	The senior management of this organization has been helpful in the use of the clinical information systems	**+2**

Items ranked lower in Factor 2 array than other arrays

No.	Statement	Rank
33	Clinical information systems improves work efficiency	**+4**
4	Superiors at work think I should use the clinical information systems	**-2**
1	It is easy to remember how to perform tasks with the clinical information systems	**0**
31	I could complete the job using the clinical information systems if there was no one around to tell me what to do as I go	**0**
13	The use of clinical information systems makes me apprehensive	**-5**
17	Interaction with the clinical information systems does not require a lot of mental effort	**-4**
43	I hesitate to use the clinical information systems for fear of making mistakes I cannot correct	**-5**
8	I am certain about the reliability of the information I get from the system	**-3**
5	If the clinical system is extended I would use it	**+1**
23	My use of clinical information systems is entirely voluntary	**0**
30	My routine tasks prevent me from having time to use the clinical information system	**-3**

Item ranked at -6

#14: Using the clinical information systems is a status symbol in my organization

4.11.2. Interpretation Factor 2

Though HCPs within this Factor show high value of e-health tools within their clinical practice (9, +6; 33, +4; 5, +1), as well as confidence in using it (13, -5; 43, -5; 31, 0), they still put a lot of mental effort to get used to it despite having ICT experience (17, -4; 36, +3). Accordingly, they use these technologies specifically for the tasks they want to perform (45, +2) and without interruption to their routine activities (30, -3). However, HCPs within this Factor still have concerns with the reliability of these technologies (8, -3). Despite considering the patients/families views as contributors to their own choice to use the e-health tools (42, +1), e-health tools contribution to their tasks/activities are the main motivators to their use (7, +5; 6, +4; 2, +5; 3, +2). In spite of the management not organising regular training for the use of e-health resource within the hospital (28, -3), they have been helpful unlike clinical superiors (4, -2) in the provision of voluntary, clear and understandable e-health (23, 0; 19, +2; 38, +1; 22, +3; 32, -1). Use of the e-health tools by the participants in this Factor are not influenced by their gender (40, -5) or desire to be different from other HCPs (14, -6).

Factor 2 distinguishes from other Factors as seen in Table 16 by recognising that the use of the clinical e-health tools helps them to facilitate better clinical decision making, which is evidenced by their ranking of statement #9 higher than all the other three Factors. This suggested their strong view on the importance these technologies in relation to their clinical practice and this comment supports this view:

> *"…if I am not sure of a drug to drug interaction… this kind of things are on the system for one to check."* (Participant 13)

> *"Because I use it a lot…there are so many things you cannot get from the clinics but you when you go online you you you you you [sic] you hear a lot of patients giving their own experiences on the use of a particular medication or an experience of a particular treatment, and therefore this is what I most agree with."* (Participant 17)

"So, my access to information [technologies] has actually improved our patient care, and we actually have information that tells us of the best options on how to manage patients…and it actually differentiates us from been a secondary or tertiary health care setting…and we believe with such information we are actually giving the best to our patients within the restrictions that we have in sub-Saharan Africa. So, I think it actually helped in making such decisions". (Participant 20)

"It assists in the delivery of care and thereby limit the error rate and increase efficiency and effectiveness". (Participant 28)

Participants here also emphasise the salient role of their experiences on ICT, and how it affects their current adoption and use of the e-health resource within their clinical practice. This was also ranked higher when compared to the other Factors (#36, +3). This view is accentuated by the comment:

"Those that are less experienced in ICT, they don't look at clinical information systems as important because they don't even know how to access the system or how to use it and I was like that before…" (Participant 17)

"*The-as [sic] the card on +6 says, that is, 36 'My ICT experience affects my use of the CIS'…I personally was trained so to say-I trained myself to come across. What I mean the first time I came across ICT and ah I was so fascinated with the system, so I deemed it necessary that in the future it will help me in my workplace*…" (Participant 34)

Moreover, the HCPs within this Factor and in contrast to all the other Factors have recognised that the senior management within the hospital have been helpful in the use of the e-health tools within their clinical practice (#19, +2) (Table 16). This seems to warrant that this group of participants get support from the senior management within their respective clinical work areas. This view is also highlighted by their placement of statement #38 (*There are available resources to use the*

clinical information system) higher than in all the other Factors (#38, +1).

In addition, they also commented on the support they get from the senior management such as training.

> *"Yes, on several occasions we receive update training on how to use information systems. I remember in the last three months I received close to three training on ICT".* (Participant 28)

Participants have also shown a strong disagreement to the statement #14 (*Using the clinical information systems is a status symbol in my organisation*). They have ranked it lower than all the other Factors certainly suggesting they do not consider it in their clinical practice. This is emphasised by the comments below and by their ranking of similar statement #12 (*People in my organization who use the clinical information systems have more prestige than those who do not*) at -4.

> *"For the fact, you have access to information technology does not make you superior to anybody and it does not make you um at a higher pedestal compared to your colleagues*". (Participant 20)

> *"I feel that most people that work in the hospital are professionals…because of that professionalism I believe that um no one, no hospital staff or people who work in the hospital are least likely individuals to consider clinical information systems as a symbol".* (Participant 31)

In addition, Model Q-sort 2 illustrates that seven out of twelve statement items on PU/PE and specifically items #6, #7, #9, #33 and #39 all which refer to clinician personal task roles (productivity, performance, decision making, work efficiency and finishing tasks quickly) were all ranked between +4 to +6. This placement clearly contrasts placement of such items in all other Factors as no other Factor ranked the same items together as depicted in Factor 2. While two other statements on the same construct addressing e-health tools relevance to their various

related tasks and e-health resource use on reducing medication error, which also refer to clinician task roles, were also ranked between +1 and +2. Thus, indicating nine items in the construct were ranked between +1 to +6 which in combination is higher than all the other Factors. Moreover, statement items on PEOU/EE were spread between -5 to +3. Of the nine items within the construct, three were all ranked on +3 (#22, #10 and #26). All these three items refer to how clear, understandable and easy it is to use the available e-health tools by the HCPs within this Factor. Items on the SI/SN construct were all ranked between -6 to +1, with statements about the influence by superiors, important others and patient/families on the use of e-health tools within the clinical practice by the HCPs ranked between -2 to +1. BI items have also been ranked between -1 to +2 with three items placed within ranks +1 and +2 as seen in figure 3. The three items refer to the intention of these HCPs to use it beyond their departments (#5, +1), their continuous search for opportunities to use the e-health tools (#27, +1) and their identification of the e-health as only specific to the task they want to perform (#45, +2). Both statement items on FC (nine items) and ID (four items) are spread across ranks -4 to +2 and -5 to +3 respectively.

Table 16: Distinguishing Statements for Factor 2

Statements	Factor 1	**Factor 2**	Factor 3	Factor 4
#9: Using clinical information systems facilitates better patient care decision making	+3; 0.96	**+6; 1.65***	+1; 0.36	0; 0.45
#36: My ICT experience affects my use of the clinical information system	-1; -0.31	**+3; 1.26***	0; 0.10	0; 0.10
#19: The senior management of this organization has been helpful in the use of the clinical information systems	-4; -1.40	**+2; 0.70***	-3; -0.77	-6; -1.74
#38: There are available resources to use the clinical information system	-4; -1.32	**+1; 0.40***	-2; -0.52	-4; -1.35
#27: I always look for opportunities to use the system whenever I can	+3; 0.76	**+1; 0.24**	+3; 1.03	+5; 1.69
#23: My use of clinical information systems is entirely voluntary	+3; 0.80	**0; -0.06***	+6; 1.93	+3; 0.80
#18: Not having the clinical information system in some departments hinders my work in these areas	+1; 0.41	**-1; -0.34***	-4; -1.24	+4; 1.08
#35: Patients/families like it when i use the clinical information system	+1; 0.26	**-1; -0.52**	-5; -1.83	-3; -1.04
#8: I am certain about the reliability of the information I get from the system	+1; 0.33	**-3; -0.75***	+3; 0.92	+1; 0.60
#17: Interaction with the clinical information systems does not require a lot of mental effort	-2; -0.50	**-4; -1.32***	-1; -0.26	0; 0.17
#14: Using the clinical information systems is a status symbol in my organization	-3; -1.10	**-6; -2.03***	0; -0.23	-1; -0.18

(* indicates significance at $p<0.01$; Z-scores are shown next to ranked scores)

Model Q-Sort 3: Factor 3

-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6
#40.My gender affects my use of the CIS	#12.People in my organization who use the CIS have more prestige	#44.The information in the system is always updated	#19.The senior Mngt of this organization has been helpful in the use of the CIS	#38.There are available resources to use the CIS	#17.Interaction with the CIS does not require a lot of mental effort	#22.The CIS are clear and understandable	#16.It is easy to get the system to do what I want it to do	#25.My use of CIS is entirely under my control	#27.I always look for opportunities to use the system whenever I can	#24.My age has nothing to do with my ability to use the CIS effectively	#29.CIS are useful in the hospital	#23.My use of CIS is entirely voluntary
	#35.Patients/ families like it when i use the CIS	#20.Using CIS increases my chance of getting a praise or reward	#46.The CIS is not compatible with other platforms I use	#45.My use of the CIS is specific to the task i want to carry out	#43.I hesitate to use the CIS for fear of making	#21.The use of CIS is pertinent to my various related tasks	#2.Using CIS improves patient care	#34.Using CIS is easier than other computer systems I use	#8. I am certain about the reliability of the information I get	#33.CIS improves work efficiency	#39.Using CIS enables me to accomplish tasks more quickly	
	#15.Patients/ families believe CIS use reduces chances of medication errors	#18.Not having the CIS in some departments hinders my work in these areas	#28.Mngt organise regular training on the use of CIS at the work place	#3.Using CIS reduces likelihood of medication error	#32.There is availability of technical assistance for CIS in my hospital	#36.My ICT experience affects my use of the CIS	#10.Using CIS makes caring for patients easier	#7.Using CIS improves my performance	#31. I could complete the job using the CIS if there was no one around to show me what to do as I go	#6.Using CIS increases my productivity	#30.My routine tasks prevent me from having time to use the CIS	
			#42.Patients/families believe CIS use is good for quality patient care	#4.Superiors at work think I should use the CIS	#11.Mngt support staff innovations on CIS use in the workplace	#1.It is easy to remember how to perform tasks with the CIS	#41.People who are important to me think I should use the CIS	#5. If the clinical system is extended I would use it	#26. It is easy for me to become skilful at using CIS			
					#13.The use of CIS makes me apprehensive	#37.People who influence my clinical behaviour think I should the system	#9.Using CIS facilitates better patient care decision					
						#14.Using the CIS is a status symbol in my organization						

	Perceived usefulness/Performance expectancy
	Perceived ease of use/effort expectancy
	Social influence/ subjective norm
	Facilitating conditions
	Individual differences
	Behavioural intention

4.12. Factor 3: Traditionalistic-pragmatists

Factor 3 (Model Q-sort 3) has six significantly loading participants and explains 10% of the study variance. It has an eigenvalue of 3.6. Three of the participants are nurses and three are physicians. There are three females and three males within this Factor and they have an average age of 42.8 years.

4.12.1. Factor 3 crib sheet

Item ranked at +6

#23: My use of clinical information systems is entirely voluntary

Items ranked higher in Factor 3 array than other arrays

No.	Statement	Rank
39	Using clinical information systems enables me to accomplish tasks more quickly	**+5**
31	I could complete the job using the clinical information systems if there was no one around to tell me what to do as I go	**+3**
6	Using clinical information systems increases my productivity	**+4**
13	The use of clinical information systems makes me apprehensive	**-1**
34	Using clinical information systems is easier than other computer systems I use	**+2**
41	People who are important to me think I should use the clinical information systems	**+1**
11	Management support staff innovations on clinical information systems use in the workplace	**-1**
28	Management organise regular training on the use of clinical information systems at the work place	**-3**
25	My use of clinical information systems is entirely under my control	**+2**
32	There is availability of technical assistance for clinical information systems in my hospital	**-1**
8	I am certain about the reliability of the information I get from the system	**+3**
14	Using the clinical information systems is a status symbol in my organization	**0**
30	My routine tasks prevent me from having time to use the clinical information system	**+5**

Items ranked lower in Factor 3 array than other arrays

No.	Statement	Rank
33	Clinical information systems improves work efficiency	**+4**
4	Superiors at work think I should use the clinical information systems	**-2**
21	The use of clinical information systems is pertinent to my various related tasks	**0**
1	It is easy to remember how to perform tasks with the clinical information systems	**0**
10	Using clinical information systems makes caring for patients easier	**+1**
20	Using clinical information systems increases my chance of getting a praise or reward	**-4**
7	Using clinical information systems improves my performance	**+2**
2	Using clinical information systems improves patient care	**+1**
45	My use of the clinical information system is specific to the task i want to carry out	**-2**
42	Patients/families believe clinical information systems use is good for quality patient care	**-3**
3	Using clinical information systems reduces likelihood of medication error	**-2**
44	The information in the system is always updated	**-4**
12	People in my organization who use the clinical information systems have more prestige than those who do not	**-5**
35	Patients/families like it when i use the clinical information system	**-5**
18	Not having the clinical information system in some departments hinders my work in these areas	**-4**
15	Patients/families believe clinical information systems use reduces chances of medication errors	**-5**

Item ranked at -6

#40: My gender affects my use of the clinical information systems

4.12.2. Interpretation Factor 3

Having identified that their use of clinical ICT resources as voluntary and within their control (23, +6; 25, +2), HCPs within this Factor indicate that the available e-health tools enable them to accomplish their clinical tasks quickly, make caring for patients easier and improves their work output (39, +5, 6, +4; 10, +1; 34, +2; 7, +2; 2, +1) even though its use interferes with other routine clinical activities (30, +5). Although the HCPs have some confidence in the use of the e-health technologies (31, +3; 34, +2; 8, +3) they are still hesitant in the use of it (13, -1; 44, -4; 3, -2). Moreover, participants within this Factor can continue carrying out their clinical responsibilities without the e-health tools (18, -4) because it is not specific to their routine tasks (45, -2; 21, 0) and remembering how to use it is challenging (1, 0). Patients/families views are not considered to be determinants for the uptake of such technologies by these HCPs (42, -3; 35, -5; 15, -5). This is despite other people that are not even related to their clinical practice motivating them to use the technologies within their work (41, +1). HCPs also do not see the use of the e-health tools as making them unique from their colleagues or even gives them the opportunity to be recognised for their efforts (14, 0; 20, -4; 12, -5). This is aggravated by the poor support from the management and clinical superiors (11, -1; 28, -3; 32, -1; 4, -2).

Table 17 shows that participants in Factor 3 have identified that their e-health tools adoption and use is entirely voluntary and under their control. This is reflected in their placement of the items #23 and #25 higher in rank (+6 and +2 respectively) than all the other Factors. This suggests their volition to use these e-health resources within their own clinical practice or not.

> *"Then the most agree, that's my use of the e-health resources is entirely voluntary".* (Participant 33)

Participants have also shown that their routine tasks prevent them from using the e-health tools. The Factor that has the highest ranking for the

statement that explores their view on the issue (#30; +5). This suggests that participants separate the e-health tools from their routine activities unlike the other Factors, which seem to incorporate these resources within their routine clinical activities. Further to this, Factor 3 also ranked statement #18 (*Not having the clinical information system in some departments hinders my work in these areas*) lower than all the other Factors (#18; -4). This emphasises the view held by the HCPs within this Factor they can carry out their clinical activities without the e-health tools in their workplace.

This Factor has also consistently shown that patients/families views do not influence the HCPs' views on the adoption and use of the available e-health tools. This they have shown by ranking all items that elicit their opinion about the influence of patients/families on their adoption and use of e-health tools lower than all the other Factors (#42; -3, #35; -5, #15; -5). A comment that supports the view of this Factor is shown:

> *"I can't really agree with that much because ah often times you know patients themselves are not too keen on this thing [e-health]"* (Participant 26)
>
> *"Some of the patients are [we] are dealing with are not learned, so and ah since they are not learned we will be the one to educate them on the use of the clinical information systems [e-health tools]".* (Participant 23)

Factor 3 (Model Q-sort 3) shows that the HCPs within this Factor ranked nine out of twelve statement items in the PU/PE construct between 0 to +5 and the other three items ranked between -4 to -2. The nine items ranked on the positive side of the sorting grid all shows that the participants agree with the contribution the e-health tools make in their clinical tasks such as improving efficiency, productivity, performance, improves patient care, facilitate better decision making and recognising its usefulness in the hospital and how it helps them accomplish tasks quickly. They however ranked statement #21 (*The use of clinical information systems is pertinent to my various related*

tasks) at 0 suggesting that despite agreeing with the eight items, they still don't see this e-health as important in their clinical roles. PEOU/EE statement which identify items which shows the ease in using the e-health tools were ranked between -1 to +3 with seven out of the nine statements were ranked between -1 and +1 (Model Q-sort 3). Items on SC/SN were ranked between -5 to +1, with five out of eight statements ranked between -5 to -2 positions. All items relating to patients/families influence on these HCPs use of e-health tools (#15, #35 and #42) were ranked between -5 to -3, which is lower than all the other Factors and shows their disagreement with these items in terms of how it influences their adoption and use of e-health within their clinical practice. FC items were ranked between -3 to +6 with six out of nine items ranked between -3 to -1 positions. All these six items are addressing the availability of management and technical support towards e-health in their clinical practice. While the three other statement items referring to participants' voluntariness and control in using the e-health tools were ranked +2 to +6. Statement items on ID were ranked across the grid from -6 to +4, with statement #40 which refers to gender influence on e-health use by the participant within the Factor ranked at -6. The four statements on BI were also spread across Factor 3 (see Model Q-sort 3) with the items occupying positions -4 to +3. It shows that the participants ranked the statement #18 (*Not having the clinical information system in some departments hinders my work in these areas*) on -4 which is lower than all the other Factors. This shows that they could still carry out their clinical tasks outside their departments even in the absence of e-health tools.

Table 17: Distinguishing Statements for Factor 3

Statements	Factor 1	Factor 2	**Factor 3**	Factor 4
#23: My use of clinical information systems is entirely voluntary	+3; 0.80	0; -0.06	**+6; 1.93***	+3; 0.80
#30: My routine tasks prevent me from having time to use the clinical information system	-1; -0.30	-3; -0.98	**+5; 1.45***	-3; -1.21
#25: My use of clinical information systems is entirely under my control	-3; -0.74	-2; -0.58	**+2; 0.59**	0; -0.01
#34: Using clinical information systems is easier than other computer systems I use	-1; -0.22	-1; -0.52	**+2; 0.55***	-2; -0.55
#7: Using clinical information systems improves my performance	+4; 1.27	+5; 1.61	**+2; 0.55***	+4; 1.41
#11: Management support staff innovations on clinical information systems use in the workplace	-5; -1.65	-4; -1.06	**-1; -0.39**	-4; -1.45
#13: The use of clinical information systems makes me apprehensive	-4; -1.41	-5; -1.57	**-1; -0.48***	-3; -1.24
#38: There are available resources to use the clinical information system	-4; -1.32	+1; 0.40	**-2; -0.52***	-4; -1.35
#3: Using clinical information systems reduces likelihood of medication error	0; 0.03	+2; 0.73	**-2; -0.63**	+2; 0.63
#19: The senior management of this organization has been helpful in the use of the clinical information systems	-4; -1.40	+2; 0.70	**-3; -0.77**	-6; -1.74
#42: Patients/families believe clinical information systems use is good for quality patient care	0; 0.10	+1; 0.28	**-3; -1.13***	-1; -0.25
#20: Using clinical information systems increases my chance of getting a praise or reward	-2; -0.52	-2; -0.67	**-4; -1.23**	-1; -0.29
#18: Not having the clinical information system in some departments hinders my work in these areas	+1; 0.41	-1; -0.34	**-4; -1.24***	+4; 1.08
#35: Patients/families like it when i use the clinical information system	+1; 0.26	-1; -0.52	**-5; -1.83***	-3; -1.04
#15: Patients/families believe clinical information systems use reduces chances of medication errors	+2; 0.53	0; -0.32	**-5; -1.93***	-1; -0.24

(* indicates significance at p<0.01; Z-scores are shown next to ranked scores)

Model Q-Sort 4: Factor 4

-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6
#19.The senior Mngt of this organization has been helpful in the use of the CIS	#28.Mngt organise regular training on the use of CIS at the work place	#46.The CIS is not compatible with other platforms I use	#35.Patients /families like it when i use the CIS	#34.Using CIS is easier than other computer systems I use	#14.Using the CIS is a status symbol in my organization	#9.Using CIS facilitates better patient care decision	#8. I am certain about the reliability of the information I get	#21.The use of CIS is pertinent to my various related tasks	#10.Using CIS makes caring for patients easier	#7.Using CIS improves my performanc e	#27.I always look for opportunities to use the system whenever I can	#29.CIS are useful in the hospital
	#32.There is availability of technical assistance for CIS in my hospital	#38.There are available resources to use the CIS	#43.I hesitate to use the CIS for fear of making	#37.People who influence my clinical behaviour think I should the system	#15.Patients /families believe CIS use reduces chances of medication errors	#12.People in my organization who use the CIS have more prestige	#44.The information in the system is always updated	#1.It is easy to remember how to perform tasks with the CIS	#16.It is easy to get the system to do what I want it to do	#18.Not having the CIS in some department s hinders my work in these areas	#33.CIS improves work efficiency	
	#40.My gender affects my use of the CIS	#11.Mngt support staff innovations on CIS use in the workplace	#30.My routine tasks prevent me from having time to use the CIS	#41.People who are important to me think I should use the CIS	#42.Patients /families believe CIS use is good for quality patient care	#24.My age has nothing to do with my ability to use the CIS effectively	#5. If the clinical system is extended I would use it	#22.The CIS are clear and understan dable	#23.My use of CIS is entirely voluntary	#26. It is easy for me to become skilful at using CIS	#39.Using CIS enables me to accomplish tasks more quickly	
			#13.The use of CIS makes me apprehensiv e	#4.Superiors at work think I should use the CIS	#20.Using CIS increases my chance of getting a praise or reward	#17.Interacti on with the CIS does not require a lot of mental effort	#6.Using CIS increases my productivity	#3.Using CIS reduces likelihood of medication error	#2.Using CIS improves patient care			
					#45.My use of the CIS is specific to the task i want to carry out	#36.My ICT experience affects my use of the CIS	#31. I could complete the job using the CIS if there was no one around to show me what to do as I go					
						#25.My use of CIS is entirely under my control						

	Perceived usefulness/Performance expectancy
	Perceived ease of use/effort expectancy
	Social influence/ subjective norm
	Facilitating conditions
	Individual differences
	Behavioural intention

4.13. Factor 4: Tech-focused e-health advocates

Factor 4 (Factor 4 model Q-sort) has eight significantly loading participants and explains 15% of the study variance. It has an eigenvalue of 5.4. Five of the participants are nurses and three are physicians. There are four females and four males within this Factor and they have an average age of 44.9 years.

4.13.1. Factor 4 crib sheet

Item ranked at +6

#29: Clinical Information systems are useful in the hospital

Item ranked higher at Factor 4 array than other arrays

No.	Statements	Rank
33	Clinical information systems improves work efficiency	**+5**
26	It is easy for me to become skilful at using clinical information systems	**+4**
40	My gender affects my use of the clinical information systems	**-5**
21	The use of clinical information systems is pertinent to my various related tasks	**+2**
1	It is easy to remember how to perform tasks with the clinical information systems	**+2**
39	Using clinical information systems enables me to accomplish tasks more quickly	**+5**
20	Using clinical information systems increases my chance of getting a praise or reward	**-1**
16	It is easy to get the system to do what I want it to do	**+3**
27	I always look for opportunities to use the system whenever I can	**+5**
17	Interaction with the clinical information systems does not require a lot of mental effort	**0**
3	Using clinical information systems reduces likelihood of medication error	**+2**
44	The information in the system is always updated	**+1**
12	People in my organization who use the clinical information systems have more prestige than those who do not	**0**
18	Not having the clinical information system in some departments hinders my work in these areas	**+4**

Items ranked lower at Factor 4 array than others

No.	Statements	Rank
4	Superiors at work think I should use the clinical information systems	**-2**
46	The clinical information systems is not compatible with other platforms I use	**-4**
6	Using clinical information systems increases my productivity	**+1**
34	Using clinical information systems is easier than other computer systems I use	**-2**
37	People who influence my clinical behaviour think I should the system	**-2**
41	People who are important to me think I should use the clinical information systems	**-2**
9	Using clinical information systems facilitates better patient care decision making	**0**
32	There is availability of technical assistance for clinical information systems in my hospital	**-5**
38	There are available resources to use the clinical information system	**-4**
30	My routine tasks prevent me from having time to use the clinical information system	**-3**

Item ranked at -6

#19: The senior management of this organization has been helpful in the use of the clinical information systems

4.13.2. Interpretation Factor 4

Participants within this Factor acknowledge the importance of the e-health within their clinical practice (29, +6). They recognise that the use of the e-health is crucial to their individual clinical practices (33, +5; 21, +2; 39, +5; 6, +1; 3, +2; 30, -3) and even look for opportunities to use it (27, +5) irrespective of their gender (40, -5). This is because they find these technologies not difficult to become used to (26, +4; 1, +2; 17, 0; 16, +3) though they must overcome compatibility issues (46, -4; 34, -2). Despite this however, they do not strongly rely on it for their clinical decisions (9, 0) because there is less routine update of the e-health (44, +1) and this hinders their adoption and use of it in areas of the hospital where it is lacking (18, +4; 38, -4). This is also made more challenging by the non-availability of management and technical support including support from both colleagues within and outside the clinical environment (19, -6; 4, -2; 37, -2; 41, -2). Moreover, HCPs recognise that using e-health in clinical practice does not accrue to them any professional developmental advantage among their peers (12, 0; 20, -1).

In comparing Factor 4 with the other Factors as shown in Table 18, participants have indicated strong interest in the use of the e-health tools within their clinical practice. This is evident by their ranking of statement #27 (*I always look for opportunities to use the system whenever I can*) higher than all the other Factors (#27; +5). This is also suggested by the comments below:

> *"…though in my organisation most of it can be practicable but I personally, I know I like using clinical information [systems], [it] improves ones' performance and skills in doing your ideal job".* (Participant 10)
>
> *"By using the technologies, it helps a lot and it is very important in taking care of the patient"* (Participant 24)
>
> *"I will look for opportunities to use it; it will help me to improve my care to the patient…"* (Participant 27)

> *"And now that we are talking of technology, it is the easiest way of maintaining and keeping records safe and accessible at all times".* (Participant 29)

> *"Clinical information system improves efficiency, so when you agree that it is useful…and that is why I chose this one. It improves efficiency significantly. And as for someone who know the usefulness will always look for an opportunity to actually use it whenever it is available".* (Participant 36)

They also suggest that non-availability of these e-health tools in certain areas affects their ability to work in those areas highlighting their incorporation of e-health tools with their clinical activities. This interaction is shown by the comment:

> *"We basically use the system to report our own activities in the department. Had it been connected with other department[s], we would have gotten much more information that is clinical relevant to the management of the patient".* (Participant 15)

In addition, participants within this Factor indicate that the information on the e-health tools is always updated. This is seen by their ranking of statement item #44 higher (+1) than all the other Factors. Likewise, contrary to all the other Factors, HCPs within this Factor indicate that people who use e-health technology within clinical practice may have some prestige compared to those who do not. This is evidenced by their ranking of statement item #12 higher (0) than all the other Factors. As seen in Table 18, participants within this Factor do not see that people who influence their clinical behaviour have any impact in their use of e-health in clinical practice. They express this view by ranking statement #37 lower (-2) than all the other Factors. In addition, HCPs within this Factor have identified that people who influence their clinical behaviour do not suggest they use the e-health tools. This seems to suggest that they make their own choice when it comes to adopting and using e-health for their respective clinical practices. For example, the comment

below show that HCPs make personal efforts to bring these e-health resources to their clinical environments.

"Most of the software system that we use, they are either individual driven or departmental driven software" (Participant 15)

The Model Q-sort 4 shows that the statement items for PU/PE were all ranked between -1 to +6. Eleven out of twelve items of this construct have all been ranked between 0 to +6 with only the item about using e-health increasing chance of getting a reward or praise ranked at -1. This construct views the usefulness of the e-health to the HCPs within their clinical practice. Furthermore, statement items on PEOU/EE were ranked by the participants between -3 to +4. However, six statement items out the nine statements were ranked from 0 to +4. Consequently, these six items are associated with the PU/PE items ranked with them as they underscore the HCPs' views as to how useful the e-health is to them in their clinical practice. The six items reveal how the participants find the e-health tools easy to use, remember, understand and how it makes them care for patients easier. All the statement items on SI/SN were ranked between -3 to 0. This is the only Factor that has ranked all the items together in such order, which suggests the participants do not seem to be influenced by the SI/SN when it comes to e-health adoption and use within their clinical practice. In addition, seven out of the nine statement items in the FC construct were ranked between -6 to -3. The six items are related to support from both management staff, technical staff and availability of the e-health tools including training in the use of these resources. These items were ranked between -6 to -4, like Factor 1 in Model Q-sort 1. ID statement items were ranked across the Model Q-sort between positions -5 to +1. Three of the four items in the ID construct were ranked between 0 to +1 with only statement #40 ranked at -5. The BI items within this Factor were all ranked between -1 to +5. Three items in this construct ranked between +1 and +5, emphasising the view participants in this Factor hold regarding the importance and usefulness of e-health in their clinical practice.

Table 18: Distinguishing Statements for Factor 4

Statements	Factor 1	Factor 2	Factor 3	**Factor 4**
#27: I always look for opportunities to use the system whenever I can	+3; 0.76	+1; 0.24	+3; 1.03	**+5; 1.69**
#18: Not having the clinical information system in some departments hinders my work in these areas	+1; 0.41	-1; -0.34	-4; -1.24	**+4; 1.08***
#44: The information in the system is always updated	-3; -1.28	-2; -0.68	-4; -1.15	**+1; 0.53***
#12: People in my organization who use the clinical information systems have more prestige than those who do not	-2; -0.56	-4; -1.47	-5; -1.39	**0; 0.36***
#25: My use of clinical information systems is entirely under my control	-3; -0.74	-2; -0.58	+2; 0.59	**0; -0.01**
#37: People who influence my clinical behaviour think I should the system	+2; 0.50	0; 0.08	0; -0.02	**-2; -0.80***
#35: Patients/families like it when I use the clinical information system	+1; 0.26	-1; -0.52	-5; -1.83	**-3; -1.04**

(* indicates significance at p<0.01; Z-scores are shown next to ranked scores)

4.14. Summary

This chapter presented the results of the Q-methodology study that explores factors that influence information and communication technology among HCPs in the clinical area in Sub-Saharan Africa. The aim was to use models of technology acceptance (TAM and UTAUT) and Q-methodology to understand what factors facilitate or serve as barriers to nurses and physicians' adoption and use of technologies within their clinical practice. Four Factors emerged after the Q-analysis. Eight statements distinguished Factor 1 from the other Factors, nine statements distinguished Factor 2 from the other Factors, ten statements distinguish Factor 3 from the other Factors and four statements distinguished Factor 4 from the other Factors within this study at significance $p<0.01$. Consequently, six statements do not distinguish between any of the Factors i.e. are consensus within the study.

Factor 1 believe in the use of technologies within their clinical practices and their use of these technologies is influenced by their patients'/families' views on using it. Factor 2 however is of the view that their task or activities determine their use of these e-health tools. Also, participants in Factor 3 view the e-health tools as a separate entity within their clinical schedules and indicating their use of it is entirely voluntary and prefer the traditional routine of clinical activities. Finally, those participants in Factor 4 recognise the contributions of these technologies, will use them beyond their clinical environments, and will rely on them for clinical decisions if the e-health tools are regularly updated.

Chapter 5. Discussion

5.1. Introduction

The aim of this study was to examine the views about information and communication technology (ICT) adoption and use among HCPs in the clinical area in Sub-Saharan Africa (SSA). This chapter provides a critical discussion on how the findings have addressed this aim. Using a mixed-method approach as recommended by Ami-Narh and Williams (2012) and Wu (2012), Q methodology together with the models of technology acceptance and use provided a novel approach to understanding the equivocal interaction that exists between HCPs and technology. This original piece of work provides a unique perspective unlike that described in qualitative or quantitative studies as shown in the current literature in Chapter 2.

As described in section 2.5.5, both TAM and UTAUT are used together to complement each other to explore factors that influence HCPs' adoption and use of e-health. However, this is the first time that both models are used together to understand the factors that influence adoption and use of these technologies. These models together with Q methodology examine the perspective of the HCPs working in SSA adoption and use of e-health rather than from the perspective of the specific ICT applications they use.

The specific objectives of the study were:

1. To use the TAM and UTAUT as the theoretical framework to develop and organise literature into concourse for Q-methodology
2. To carry out a Q-sort on nurses and physicians in SSA to identify their shared views on the factors influencing e-health adoption and use in clinical practice
3. To identify the themes in the theoretical framework that have more influence on HCPs' e-health adoption and use

4. To make recommendations based on findings from the study to inform e-health adoption and use in clinical practice in SSA

This chapter will focus discussion on objective three (3) by arguing how the four Factors that emerged represent the views of these HCP's understanding of the influence of e-health within their respective clinical practice. The remaining objectives will be discussed in the next chapter. The perspectives (Factors) that emerged from this study confirm the various facilitators and barriers (Gagnon et al., 2012a, Lluch, 2011) that HCPs perceive as influencing their e-health adoption within their clinical practice. However, this research study presents HCPs views about the interconnected determinants to their choice about e-health adoption and use in a holistic approach rather than as individual facilitators/barriers as in previous research. As a recap, it is important to note that within this research study ICT is defined as e-health tools comprising of both the desktop computers and handheld devices used for entering, sharing and retrieving patient health records and the internet. This definition is more encompassing as compared to Gough et al. (2014) who used two broad categories (Information technology and Clinical technology) to describe ICT use in clinical practice. They described clinical technologies as those which are used to monitor patients' conditions while information technology covers patient databases. Thus, the term e-health will be used in this chapter to address these variations.

As seen in the literature chapter, previous studies have often identified the type of technology as a predictor to its adoption and use without providing insight on the holistic nature of the roles that both e-health and HCPs play in the provision of quality health care to the patient (van Gemert-Pijnen et al., 2011). In addition, most literature (Bossen, 2007, Doolin, 2004, Gagnon et al., 2012a) emphasised the inability of the proper integration of e-health into routine clinical activity by HCPs. This is because previous research studies usually look at factors influencing e-health adoption and use of the specific technologies/e-health available to the HCPs rather than from the perspectives of the users of

such technologies (Gagnon et al., 2014, Holden, 2010, Kowitlawakul, 2011, Yarbrough and Smith, 2007).

This study addressed this by identifying how HCPs hold various views in relation to the contribution of technologies within their clinical practice. Thus, the four Factors discussed in this chapter show how HCPs differ in their understanding of what predicts their adoption and use of e-health within their clinical practice. It should also be noted that the findings identified within this study agree in part with the factors that influence technology adoption within clinical practice from previous published studies (Crow et al., 2012, Gagnon et al., 2012a, Li et al., 2013, Lluch, 2011) such as organisational issues, technology/infrastructural issues, and human factors. However, it further adds contrasting preferences (such as influence by patients and their families) that exist among HCPs in SSA on what influences their choice of adoption and use of e-health while also showing areas of interconnection. These are discussed in more detail in the subsequent sections within this Chapter.

As mentioned above, this chapter will focus on the third objective while drawing from previous chapters, the four Factors will be discussed in terms of their views on e-health in clinical practice. The chapter will then conclude with a summary.

5.2. HCPs different perspectives on e-health

E-health improves productivity within healthcare through better healthcare collaborations, patient safety and care amongst other benefits (Gagnon et al., 2012a). In SSA, e-health tools such as the electronic health record (EHR) could provide benefits such as improved data accuracy and timeliness, reduction in duplicated data and prompt availability to routine reports (Akanbi et al., 2012). However, adoption and use of e-health cannot be said to be devoid of challenges (Gagnon et al., 2014, Gagnon et al., 2012a). As such the findings in this study show the different perspectives with which HCPs in SSA approach adoption and use of e-health within their clinical practice.

Table 19 briefly outlines the four Factors for ease of reference during the discussion. The Factors are explained in detail in Chapter 4.

Table 19: Factors and their description

Factor 1	Patient-focused e-health advocates	HCPs use the e-health tools because the patients and their families motivate them.
Factor 2	Task-focused e-health advocates	HCPs use the e-health because it helps them accomplish their clinical tasks
Factor 3	Traditionalistic-pragmatists	HCPs recognise the contributions e-health makes in clinical practice, but they see it separate from their routine clinical activities
Factor 4	Tech-focused e-health advocates	HCPs use the e-health tools because they are motivated by the technology itself

5.2.1. Patient preference on e-health adoption and use

Factor 1 shows a positive relationship between the HCPs choice to adopt and use e-health and patient/families' attitudes and preferences towards its use during care. Ruland and Bakken (2001) examined patient preference-related concepts for inclusion in EHR and identified that the HCPs integration of patient preferences in clinical decisions are important 'pieces of evidence' for appropriate decision-making (p415). Similarly, Taner and Antony cited in Phichitchaisopa and Naenna (2013) reported that patients in private hospitals expressed greater satisfaction with the services of both nurses and physicians when they use medical technology when compared to government hospitals that lack such technologies. In addition, Granja et al. (2018) identified that e-health adoption and use by HCPs also contributes to patient empowerment and self-management. They identified that patients/families want to be involved in e-health interventions by HCPs.

However, unlike the Factor 1, Al-Jafar (2013) who explored patients' satisfaction with EHR in selected primary healthcare centres, identified participants perceived negative impact of computerisation with more than 36% suggesting that the EHR use by the doctor has taken attention away from them. Similarly, Koivunen et al. (2008) explored nurses use of an interactive internet portal for patient education and suggested that patients are not keen to see the HCPs (nurses) using e-health during care and this resulted in the nurses not using e-health systems. However, the nurses and not the patients themselves reported this observation. The nurses reported that due to their patients' 'poor mental status' and poor computer experience, the patients had negative attitudes towards the available interactive portal (e-health) (p416). However, like the studies of Al-Jafar (2013) and Koivunen et al. (2008), Factor 3 showed that patients (and families) preferences are not considered by all HCPs to inform choices to use e-health in clinical practice. Participants in Factor 3 stated:

> *"… some of the patients that are dealing with they are not learned so and ah if since they are not learned we will be the one to educate them on the use of the Clinical Information Systems"* (Participant 23)

> *"I can't really agree with that much because ah-often times you know patient themselves are not too ah-keen on this thing (e-health). So, I do not believe that they think ah when I use it ah I mean ah like it when I use it per se"* (Participant 26)

Factor 3 also echo a category of nurses described by Lupiáñez-Villanueva et al. (2011) as 'non-integrated' users (nurses) of ICT and the internet (p133). This category, like Factor 3 believe that their patients interaction with ICT and internet will have less effect on their clinical outcome (Lupiáñez-Villanueva et al., 2011). This evidently matches the views of Factor 3 described by the statement of participant 26 above. This shows the varying perspectives of both Factor 1 and Factor 3 on the HCPs using patient preference to inform their clinical

practice. Thus, the integration of patient preferences in patient care (Ruland and Bakken, 2001) drives Factor 1 choices to adoption and use of e-health in clinical practice. Also, Factors 2 and 4 are both ‘‘neutral’’ on patient preferences informing their choices to e-health use while showing emphasis on other determinants to their views on e-health in clinical practice. This reflects the equivocal views on patient preference and e-health adoption and use by HCPs.

Considering the themes within the models, Factor 1 shows that the perceived usefulness/performance expectancy (PU/PE) was ranked higher than the social influence/subjective norm (SI/SN) construct which consists of the patients'/families' preferences that defined the Factor. This seems to warrant that though these HCPs do consider their patients/families' preferences about use of technologies in their clinical care, they still make their choice alongside their views of the e-health tools usefulness to their clinical practice. Looking closely at these rankings (Model Q-sort 1 in Chapter 4), it could be argued that the main factor that influences the adoption and use of e-health tools by HCPs in Factor 1 are both the PU/PE and the SI/SN. It could be seen also from the previous chapter on results that even the PU/PE statements that were ranked higher such as *#2: using clinical information systems improves patient care* and *#9: Using clinical information systems facilitates better patient care decision making* both were those linked with “patients care” in mind. This affirms that this group of HCPs make their choices about e-health adoption and use by consideration of both constructs as facilitators to adopting these technologies. In addition, these participants closely consider also their behavioural intentions (BI) towards adopting and using the e-health as drivers to both the PU/PE and the SI/SN constructs. These participants' consideration of PU/PE resonates with the nurse participants in the study by Bennani and Oumlil (2013) who examined IT acceptance by nurses in Morocco. However, these authors only used three constructs of the original TAM model (PU, PEOU and attitude) without considering the other constructs of the model. Thus, they did not report on the influence of the other

constructs considered in this study. The strength of SI/SN was nonetheless captured by Holden et al. (2012) as an important driver to the adoption and use of e-health by physicians in their study. They reported SI construct among three predictors of BI. Moreover, participants in Factor 1 identified facilitating conditions (FC) as the major barrier to their adoption and use of e-health. As argued by Aggelidis and Chatzoglou (2009), this construct/theme is a very crucial determinant for users when making a decision about adoption and use of technologies. Issues concerning management, availability of technical assistance, training were main concerns among these participants in this Factor.

5.2.2. Clinical tasks completion and e-health adoption

Factor 2 expressed another viewpoint, which envisioned HCPs that are driven by the contribution of the e-health in to complete their clinical tasks. Unlike Factors 1, 3 and 4 the driving influence on the adoption and use of these e-health tools is the ability of the technology to aid in completing tasks effectively and efficiently. HCPs here are more concerned with getting through their routines and the e-health available provides them with the opportunity to do so. This resonates with some of the findings of Hains et al. (2009) who focused on a clinical decision support system. Hains et al. (2009) explored nurse and physicians use of a computerised clinical decision support system (Cancer Institute Standard Cancer Treatment Program: CI-SCaT). They identified among other findings, that some senior nurses and senior physicians utilise the e-health resource because of convenience and its ability to consolidate the information that they may need. Participants within their study indicated that the availability of the resource and its ease of use motivates them to use it to accomplish their respective clinical task. Thus, driven by the need to carryout various clinical duties within a specific timeframe, HCPs in Factor 2 adopt these tools because using such technologies provides convenience and ease to their clinical task. This also echoes the findings of Gough et al. (2014) that showed how nurses interact with new technologies. However, they only focused on

nurses but like this current research study, they also used non-specific digital clinical technology and information technologies. They recruited 125 participants across two Australian states in a piece of qualitative research. They conducted interviews from five hospitals in two states. Their findings indicated that nurses use these technologies because it makes their completion of tasks faster, easier and offers them more work. This showed that the HCPs in their study are more oriented towards their operational tasks only to support their practice. Lupiáñez-Villanueva et al. (2011) while examining the integration of ICT into nursing identified a category of nurses that are similar to Factor 2. They referred to this category as 'non-integrated': who were reported to 'use ICT and the internet in a restricted fashion and only to directly support their nursing practice' (p138). Thus, the choice to use e-health is influenced by how it can be consolidated towards their task completion.

In addition, Factor 2 like the previous Factor, PU/PE was the main construct/theme considered as facilitator to the adoption and use of an e-health tool by these participants. However, this Factor differs from Factor 1 by not associating choice to adopt and use with the SI/SN. As mentioned in previous paragraphs, these participants are more focused on task completion as drivers for e-health adoption and as a result they recognise the PU/PE as the main determinant for their choices. Thus reaffirming findings from Chow et al. (2012) and Phichitchaisopa and Naenna (2013) which identified PU and PE as the strongest influence when considering HCPs adoption and use of healthcare information technology but with emphasis on the task completion as the main driver for their choice. Consequently, SI/SN and FC were the themes/constructs identified as barriers for this group of HCPs. These constructs tend to "co-habit", though like in Factor 1, issues of management support, training, technical support were both identified as barriers too. Doolin (2004) described the issue of managerial support along the lines of power and resistance. Thus, arguing that in situations where the management sees the HCPs as passive subjects rather than

actors towards the implementation of e-health, there often arise resistance that may manifest as poor adoption of such resources.

5.2.3. Routine clinical activities and e-health adoption

On the other hand, as briefly described in Table 19 above, Factor 3 shows a HCP that is more grounded in their day-to-day routine of clinical duties without the utilisation of e-health. Participants in Factor 3 shows that they do not see the e-health as part of their routine activities but rather as a conflicting task that could not be combined with their ‘‘normal’’ schedules. Like in the study by Hains et al. (2009) mentioned above, they identified that even though most HCPs highlighted the benefits of using the CI-SCaT, senior physicians emphasised that they cannot be compelled to use the e-health resource. Their findings identified that the senior physicians cited issues of clinical autonomy as reason for non-adoption of these technologies. The issue of clinical autonomy will be discussed later in section 5.2.3 (unintended outcomes of e-health interaction). However, professional roles (senior staff/junior staff; nurse/physician) have been identified to have influence on clinical autonomy in relation to patient care (Verhoeven et al., 2009).

Further, Factor 3 suggest that though they recognised the role of PU/PE of the e-health tools available, the theme is not a dominant facilitator for their uptake of such technologies. However, PEOU/EE statement items dominated the middle of the model Q-sort grid between extremes of agreement and disagreement. Though it could be argued that they wittingly posit somewhat neutrality on this construct by suggesting that they are not concerned with it much while considering adoption and use of e-health tools. This reverberates the findings of Chow et al. (2012) who identified in their quantitative study which examined the perceptions and attitudes of nurses’ towards computerisation in a private hospital. There findings showed that there was a weak positive relationship between the PU/PE, PEOU/EE and e-health adoption and use by HCPs (nurses). However, this Factor shows that SI/SN items are the recognised barriers by participants here. HCPs identify that the

items concerning social influence/interactions do not encourage their adoption and use of technologies within their clinical practices

5.2.4. Integrating e-health in clinical practice

Factor 4 suggested technologically “savvy” HCPs that always engage in the e-health adoption and use. Like the e-advocates nurse lecturers in Petit dit Dariel et al. (2013) Q-study on e-learning, this group of HCPs see e-health as a tool that could improve both the quality of patient care and the potential to use it beyond their clinical departments. Also Hains et al. (2009) showed that nurses and junior doctors within their study exhibited similar views about the e-health (CI-SCaT) akin to HCPs in Factor 4 in this study. Though both the two studies mentioned used different (e-learning and CI-SCaT) technologies both HCPs including those in Factor 4 demonstrated that these technologies play important roles in their clinical practices. Hains et al. (2009) reports that participants in their study praised both the quality and structure of the e-health tool identifying it as part of their routine clinical tasks unlike Factor 3. Hier et al. (2004) findings on acceptance of EHR, reported that both groups of participants (senior and junior physicians) within their study showed more than 88% positive attitudes towards using EHR in their clinical practice even though the acceptance was reported higher for the junior physicians. Also, Joos et al. (2006) explored electronic medical record use in primary care. Their findings indicated that physicians identified efficiency gains on using electronic medical records (EMR) tools. They also reported that the physicians need to use the EMR beyond their respective clinical environment. These participants like in Factor 4 generally agreed that the use of the e-health tools improved their clinical practice.

Factor 4 also resonates with the first profile categorisation of HCPs (nurses) by Lupiáñez-Villanueva et al. (2011). The authors described the HCPs as ‘integrated nurses’, who by their characterisation place high emphasis on e-health so much so that it forms an important aspect of their clinical practice (Lupiáñez-Villanueva et al., 2011, p137). In the present study, participants in Factor 4 stated:

"Umm, well, it is eh though in my organisation most of it might be practicable [sic] but I personally, I know like using Clinical information systems really improves ones' performance and skills in doing your ideal job…Um I think most organisations should have E-Systems of electronic system of information [sic]" (Participant 10)

"*It improves efficiency significantly, I strongly agree with that. Also, for someone who knows the usefulness, will always look for an opportunity to actually use it whenever it is available*" (Participant 36).

This shows how those who contribute to Factor 4 champion the use of these e-health resource and advocate its use beyond their departments and drawing on the similarity to Lupiáñez-Villanueva et al. (2011), these HCPs are predicted to be involved in research activities. Factor 4 represents HCPs who see e-health from an unrestricted broader application within clinical practice unlike Factor 2.

However, Factor 4 like studies that use either the TAM/UTAUT (Bennani and Oumlil, 2013, Hu et al., 1999, Kowitlawakul, 2011, Pai and Huang, 2011) indicate the theme with the most influence on e-health adoption and use by HCPs within clinical practice was PU/PE. Similarly, like Factor 1, Factor 4 showed that the FC within the hospital is a barrier to the HCPs adoption and use of e-health tools. This emphasises what Aggelidis and Chatzoglou (2009) identified earlier indicating that if the FC is effective it could serve as an excellent facilitator or as the case of this study a barrier when not effective.

5.3. E-health, HCP and Patient: A tripartite relationship?

In the adoption of e-health technologies, van Gemert-Pijnen et al. (2011) identified that HCPs are sceptical in adoption and use of these technologies. The researchers claim that these HCPs argue that the technologies do not work for them or show benefit for their patients. Though this may seem applicable to one of the views (Factor 3) discussed in section 5.2.3., it does not sum all the views of HCPs in the clinical setting as seen in this study.

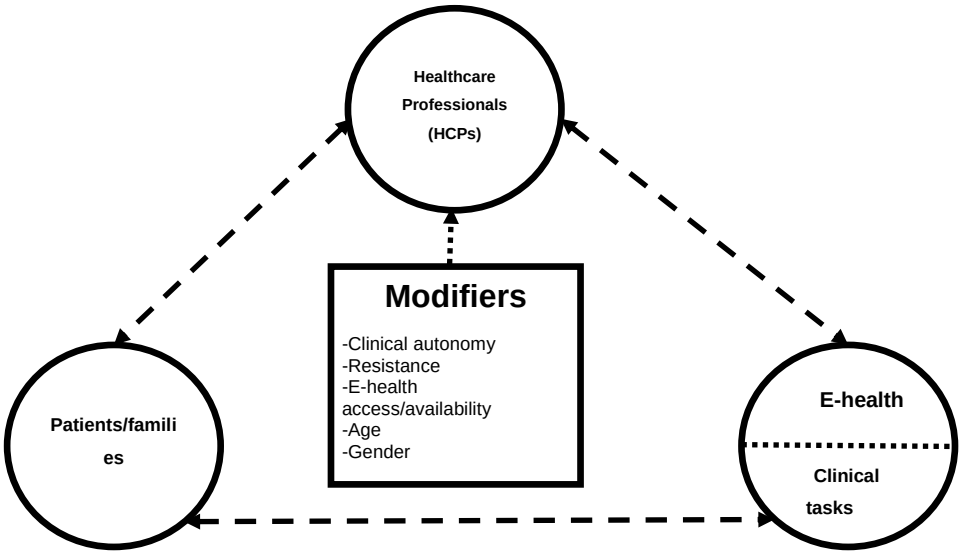


Figure 12: Tripartite relationship showing interaction between the key actors in the clinical area

Nonetheless, van Gemert-Pijnen et al. (2011) while reviewing frameworks to develop a holistic framework for e-health uptake and impact noted that some user-centred e-health frameworks advocate three important areas involved in e-health adoption in clinical practice. These are the HCPs, the e-health tools and the patient. Thus, in the current research study these three areas could be perceived to relate to each other in a “triangular” or tripartite interaction (see Figure 12) and in addition to the three areas this study adds “clinical tasks” co-existing with e-health. Though the distance between the points on the triangle maybe assumed to vary depending on the description of the relationship as exists within this study. For example, a positive relationship between either of HCP, patient or e-health will reduce the distance between those areas. On the contrary, should the distance

between any two points on the triangle be wide, it could be perceived that those points may not have a favourable interaction. Modifiers such as clinical autonomy, resistance, availability/access to e-health, age and gender that influenced the choices of these HCPs to adopt and use the e-health tools, influence this change in length. For example, in Figure 13 representing the tripartite relationship for Factor 1, the distance between HCPs and Patient/families is short when compared to both their distance to an e-health/clinical task complex. This re-emphasise the description of Factor 1in section 4.9.2 in which HCPs choices to use e-health in their practice are influenced by the close relationship they have with their patients. On the other hand, Figure 14 show how the tripartite relationship in Factor 2 is driven more by the “closeness” of the distance between the HCPs an unequal e-health/clinical task complex (see section 5.2.2). However, Figure 15 identifies a relationship that draws the HCPs close to their clinical practice while excluding the e-health. This also shows that patients and their families preferences are kept at a distance as discussed in 5.2.1. Finally, Figure16 identifies Factor 4 with an equidistant length between patient and their families and an equal e-health/clinical task complex.

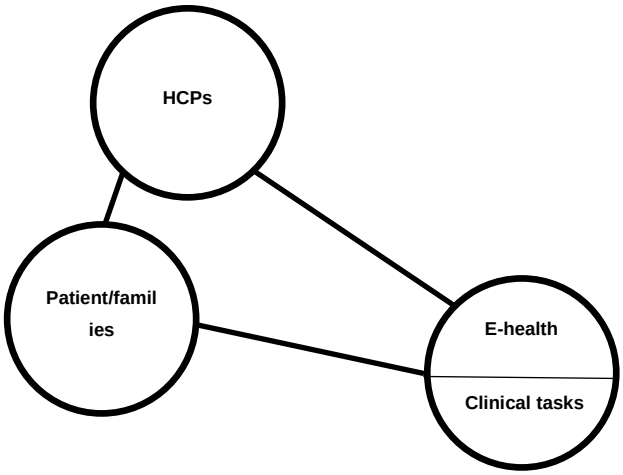


Figure 13: Factor 1 Tripartite relationship

As seen in Figure 13 showing the tripartite relationship for Factor 1, the distance between the HCPs and patients/families is less. This is due to the influence of the patients/families on HCPs choices on e-health adoption and use within their clinical practices. This suggests that the HCPs have moved closer to the patients/families when compared to Figure 12 that portrays a *default* position that each one of them holds within the tripartite interaction. This also emphasises that SI/SN of both TAM and UTAUT influences this Factor in addition to the PU/PE as described in section 4.9.2. Furthermore, Figure 13 also shows that HCPs within Factor 1, the HCPs maintain that e-health and clinical tasks as a combined entity. This is also influenced by the recognition of both PU/PE together with PEOU/EE of the e-health resources and the roles the e-health contributes to the provision of quality healthcare. Arguably, maintaining the same distance between both the e-health/clinical task construct and patient/families and the HCPs constructs as shown in Figure 12 indicates that the prior interactions still hold in Figure 13 also.

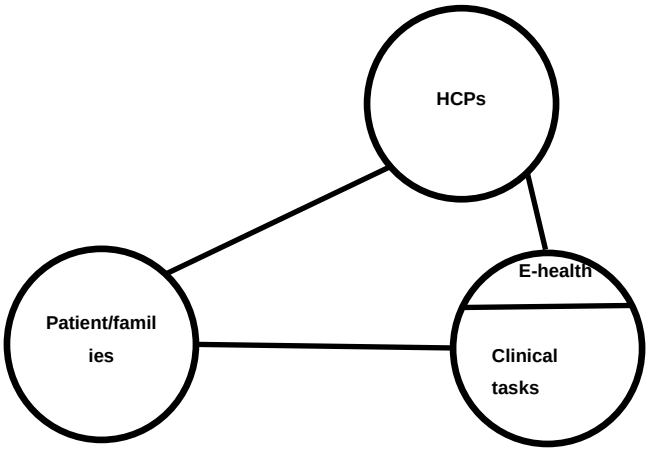


Figure 14: Factor 2 Tripartite relationship

Unlike Factor 1, Figure 14 shows a tripartite relation within Factor 2 with HCPs emphasising the important role clinical task completion influences their choice to adopt and use the e-health resources. In Figure 14, the length between HCPs and the e-health/clinical tasks construct is shorter when compared to Figure 12. However, the distance between the HCPs and patient/families, and the one between patient/families and e-health/clinical tasks is still maintained as in Figure 12. Interestingly, due to the emphasis this viewpoint has on task completion, the clinical tasks have more space than the e-health within their combined construct. This shows that PU/PE of the e-health are driven towards clinical task completion as an important influence on HCPs choice to adopt and use the e-health resources as described in section 4.10.2. Unlike Factor 1, the SI/SN construct of TAM/UTAUT does not contribute to the viewpoint in this tripartite relationship as discussed in section 5.2.2.

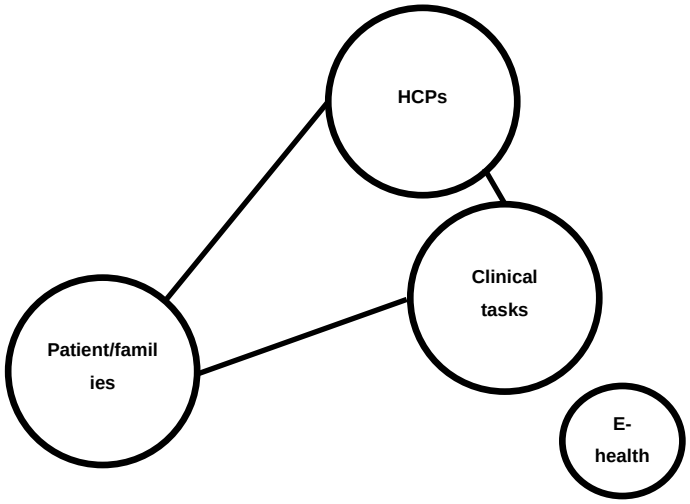


Figure 15: Factor 3 Tripartite relationship

The tripartite relationship in Figure 15 show the viewpoint of the HCPs in Factor 3. A shortened distance is seen between HCPs and Clinical task constructs. The HCPs have a strong relationship with their clinical tasks. However, this viewpoint shows that the e-health seen by the HCPs as something which is not part of their routine clinical activities. This is why the e-health is seen as an isolated component and has no *link* with either of the constructs in the default Figure 12. This viewpoint is not influenced by the SI/SN of TAM and UTAUT. In addition, it also identifies what has already been described in section 5.2.3 regarding HCPs and routine clinical activities. Having a *floating* and isolated e-health construct unconnected with the clinical tasks emphasises that these HCPs continuously view e-health separate from routine clinical duties (see section 5.2.3).

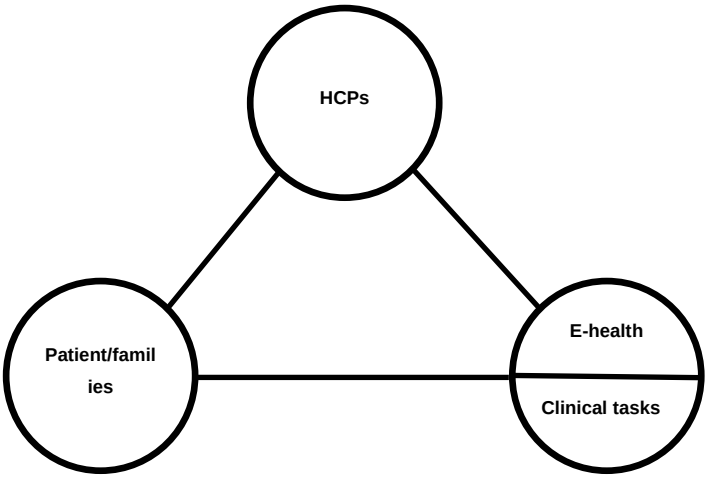


Figure 16: Factor 4 Tripartite relationship

In Figure 16, that shows the viewpoint of Factor 4, the interaction between the three constructs is similar to the *default* Figure 12. This viewpoint indicates that it is influenced by PU/PE, which drive HCPs towards providing quality healthcare. PEOU/EE also influence this viewpoint as described in section 4.12.2. It suggests that both e-health and clinical tasks are a single entity of equal complementing value. Furthermore, the length between both HCPs, patients/families and the e-health/clinical tasks constructs are equidistant like Figure 12. However, despite not been influenced by SI/SN does not suggest they do not consider patient views within their clinical duties but rather this construct of TAM/UTAUT solely influence their choice of e-health adoption and use.

5.3.1. Unintended outcomes of e-health interaction

Despite the common acceptance that e-health could positively impact healthcare practice (Gagnon et al., 2009, Gagnon et al., 2014, Gagnon et al., 2012a, Gagnon et al., 2012b, Huryk, 2010), van Gemert-Pijnen et al. (2011) , Doolin (2016) and Harrison et al. (2007) reported that unintended/undesired consequences usually arise that alter the type of tripartite relationship that exist. Among such consequences are issues of clinical autonomy or professional autonomy (Brewster et al., 2014, Rouleau et al., 2017, Verhoeven et al., 2009) and resistance to technology (Doolin, 2004, Granja et al., 2018, Greenhalgh et al., 2014, Rouleau et al., 2017, Timmons, 2003). These play an important part in

determining how HCPs interpret how e-health modify their interactions with the patients' vis-à-vis the triangular relationship.

Both issues of resistance and clinical autonomy resonates with the Factor 3 (Figure 15). A participant comment clearly describes such:

> *"Yes, there are-there were moments when the IT (information technology) was introduced but some certain individuals [senior physicians] actually resist it. Feeling that because it is not understandable, it's not clear to them as in complicates their work that is the task that is been given to them. So, they prefer to adopt in the manual way rather than going the ICT way. But for most of them it's because it's not clear to them actually"* (Participant 3)

> "…*there was a time when computers were posted to the wards but at the end they see especially nurses are not using it to gain information but to play along with by maybe by watching films or whatever…*" (Participant 10)

5.3.1.1. Clinical autonomy

However, Factor 3 in this study has not explicitly stated the issue of clinical autonomy but has rather implied such by identifying to be comfortable without these technologies. Verhoeven et al. (2009) explored factors affecting healthcare workers adoption of an online resource for infection control. They identified that senior physicians reported that they have the necessary skills and training and will therefore not engage with the resource provided. Similarly senior physicians were identified to have the same views in the study by Hains et al. (2009) and Rouleau et al. (2017) as mentioned above. Thus, the consequence of the availability of both e-health tools in the aforementioned studies and also by the participant 3 statement above, evidently shows that senior physicians drive the issue of clinical autonomy to avoid adoption of e-health tools. The views of senior physicians in Verhoeven et al. (2009) is contrary to the views of senior nurses reported by Gosling, 2004 cited in Gerrish et al. (2006). He

reported that senior nurses were shown to utilise information technologies more than their junior colleagues did. However, in the current research study despite acknowledging that e-health could make a positive contribution to clinical practice HCPs in Factor 3 seem to agree with the findings of Verhoeven et al. (2009). These HCPs are comfortable by doing what they have routinely been doing without integrating the e-health in their daily clinical activities. The already busy setting of the clinical area hinders the adoption of e-health as suggested by Bossen (2007) because of the recursive nature of these technologies, e-health use is seen by them as an extra task and thus avoided. In addition, Brewster et al. (2014) and Granja et al. (2018) review of factors affecting frontline staff acceptance and factors determining the success and failure of health technologies reported that nurses often view e-health as extra responsibility and not a part of routine healthcare practice. This becomes as an extra workload, which affects *normal* workflow within the clinical environment. Verhoeven et al. (2009) adds to this by arguing that the already existing stress at the work place and poor understanding of how e-health tools work, these HCPs get “put off” from adopting and using them.

However a contrary argument by Doolin (2004) suggests that some HCPs fail to adopt healthcare technologies as a defensive technique to avoid having an audit trail of the errors they might make. As stated earlier, even though clinical autonomy is implied within this study, it does not suggest or exclude either of these reasons but rather emphasise that these HCPs are comfortable without using these technologies. Threatened clinical autonomy was identified among the most important barriers to physicians adoption of e-health technology in the review by de Grood et al. (2016). They reported that some physicians will not change their practice patterns due to introduction of certain technologies such as telemedicine. The authors implied that these categories of HCPs may fear that the e-health could threaten their independent decisions. Thus de Grood et al. (2016) infer that this may expose flaws in senior physicians decision making or it could be that

they fear change due to poor understanding of how the technology works as in Factor 3 in this study and the statement by participant 3 above.

5.3.1.2. Resistance

Resistance to healthcare technologies has been identified to also influence adoption and use of information technologies in clinical practice (Bacon and Stocking, 2004, Doolin, 2004, Doolin, 2016, Granja et al., 2018, Greenhalgh et al., 2014, Timmons, 2003). Also citing the statement by participant 3 and participant 10 above and reflecting on Factor 3 unlike the other Factors, HCPs avoid using the e-health because they do not understand how the technologies work or use it for non-clinical activity. Timmons (2003) argues that what may constitute as "resistance" may vary when describing nurses' resistance to information technology. This could range from refusal to use the information system to criticism of the available technology (Timmons, 2003) or if using the e-health is seen as extra work (Eley et al., 2009). In addition, Granja et al. (2018) suggests that HCPs develop negative feelings towards the success of an e-health intervention. These negative feelings hinder the adoption and use of such e-health resources. In the same way, resistance to e-health could be viewed as a message to those in power (Doolin, 2004, Stephen and Theresa, 2000). Doolin (2004) further identifies that it could be a reaction by HCPs to the hospital management to express dissatisfaction with imposition of e-health on the HCPs due to non-end-user consultation prior to implementation. Evidently, there were many concerns by HCPs across all the four Factors about management attitude in the provision of the e-health tools in the study area. Except for the statement by Participant 25 who did not load on any Factor, all Factors disagree that both the management and superiors support them in the use of e-health in their clinical practice.

> *"…Honestly I don't think the senior management of my organisation has been helpful in a providing the resources…" (Participant 5)*

"The senior management of this organisation has not been helpful to the use of CIS. They have not really been helpful because um first of all the availability of the systems to work on, then the internet facility is not really encouraging for everybody to have access to and use in terms of clinical practice" (Participant 12)

"…In fact, in this organisation I don't think they are doing anything about information. Though especially in nursing, I have not seen any serious IT [information technology). We don't really use more of it. Just that they say the in paying office and pharmacy, I have not been there to see, they have started using it but (exclamation) the information system is still poor". (Participant 14)

"As I have said, the senior management since there is no compulsion on the staff to use, then they have not been used, they have not been helpful in the use of CIS in the hospital" (Participant 27)

"*So, why I chose management support staff innovation on clinical information systems in my workplace is that there was a time when we came to the Hospital permanent site newly, the management was even able to train many nurses, they employed a computer person to teach us on how to use computers in this place and the management was so kind to pay. From time to time they will make a roster and send nurses to come up here and learn about computer. And then there were some instalment they made about the computers to be used on the wards and recently um Z-pads [mobile handheld devices] were given to all the wards and a studio of about 50 desktops was fixed in the hospital and I believe we will start to make our work easy*". (Participant 25)

Thus the manifestation of non-use of e-health by Factor 3 and the consensus by all the Factors about not getting their superiors' support

to adopting and using these technologies would be an ‘unintended consequence’ (Harrison et al., 2007, p542) of these e-health tools (Lupiáñez-Villanueva et al., 2011). These unintended/unanticipated changes to routine HCPs in terms of e-health adoption and use is what Massaro (1993) cited in Timmons (2003) summed up to be within the locus of resistance. This type of resistance by HCPs was reported by Massaro to be because of complex and emotional views that could be interpreted as contradictory positions on information technology in clinical practice.

5.3.2. E-health, gender, age and access

However, certain factors have been identified to also modify the tripartite relationship. Things such as access to the e-health resource and the internet (Eley et al., 2009, Gerrish et al., 2006, Gough et al., 2014, Trivedi et al., 2009), age of the HCPs (Eley et al., 2009, Huryk, 2010, Li et al., 2013, Phichitchaisopa and Naenna, 2013) and gender (Bacon and Stocking, 2004, Li et al., 2013, Phichitchaisopa and Naenna, 2013) have been addressed by participants within this study. Indeed, both the issue of gender and age has been identified by all four Factors as not affecting their interaction with the e-health in their clinical practice in this current study. Gender was identified as an important consensus statement that all the Factors ranked against (-5 to -6) and supported by statements already mentioned in section 4.13 and the one here:

> “*The most disagreed is, my own most disagreed is my gender how my gender affects my use of clinical information systems- I don’t think there is anything about gender when it comes to ICT- something of knowledge and interest and it does not have any effect on any gender*”. (Participant 25)

Though this study does not compare gender or HCPs roles, it does recognise that each HCPs has his/her own characteristics. This variation of characteristics manifests in overlap of duties and roles between HCPs, unlike previous studies that emphasises single role

studies (Bacon and Stocking, 2004, Li et al., 2013, Venkatesh et al., 2011) or role comparisons in terms of e-health adoption and use in clinical practice (Hains et al., 2009). This also adds to the strength of Q within this study by putting emphasis on the holistic nature of healthcare practice. Thus, contrary to Bacon and Stocking (2004) that viewed nursing as a feminine profession which gender roles influences e-health adoption, gender does not influence any of the Factors in this study. This shows HCPs in this study have moved away from gender stereotyping in professional roles in clinical practice at least in relation to e-health adoption and use.

In addition, age as a factor has also been regarded as having no influence on all the Factors in terms of e-health adoption and use. This also contrasts previous studies that noted younger and junior HCPs are more oriented to use technologies in their practice than senior colleagues (Hains et al., 2009), or that age is correlated with effort expectancy in technology adoption by HCPs (Phichitchaisopa and Naenna, 2013). Huryk (2010) also found out that age consistently influenced nurses' attitudes toward computerised care plan and EHR, emphasising that younger nurses were more inclined to use such technology than older colleagues. While Menachami and Brooks cited in Li et al. (2013) showed that use of electronic medical records was also inversely associated to physicians age.

In terms of access to the e-health within their clinical practice, the Factors differ on availability of the e-health tools.

> *"That [e-health tool] was mounted about 2 months ago and uh it was part of a project brought in by an outside organisation and uh up till few weeks ago about 2 weeks ago when I spoke with the staff in charge of the um information comm-ICT in the hospital, he made me understand that there were some logistic problems in completing the installation but that the installation might be completed soon enough, and they will provide passwords for us".* (Participant 5)

> *"No, at the level of the department… to a certain extent the department has some collaborations with NGOs and other developmental partners and they do organise ah-training especially if they are having a project they want the department to carry out".* (Participant 28)

> *"Most of the software system that we use, they are either individual driven or departmental driven software, so they are not connected within the department. I mean among-between the departments. So, each department has its own different software different from the other departments*. (Participant 15)

In addition, below is a comment by a member of the hospital management:

> *"…definitely there are challenges here and there um for example not all parts of the hospital might have been covered. So, the resources the the [sic] infrastructure for this kind of information system may not be completely 100%".* (Participant 2)

The varied response in some cases is attributed to the relationship some of the departments in the study location have with external bodies or organisations that offer support. This is affirmed by the statements of both participant 5, participant 28. These departments are usually involved in collaborative research activities with these organisations who in turn provide support ranging from the provision of both hardware and software facilities to training in the use of such resources for clinical practice. Akanbi et al. (2012) made a similar observation while exploring the challenges and progress made in EHR use in SSA. They noted that the presence of the epidemics such as malaria, HIV/AIDS and Tuberculosis results in deployment of ICT to improve healthcare in such areas. In the same regard, some departments work separately from other departments as seen in the statement by participant 15. Whereas, other departments solely rely on the hospital management for the provision of such e-health facilities and as seen in participant 2

statement, they have challenges which makes access not uniform across the whole study location.

Access to e-health tools as reported by Eley et al. (2009) was more of conflict between two groups of HCPs (nurses and physicians) due limited availability of desktops within the wards for data entry. This was identified as a barrier to e-health by nurses in Australia by the authors. This was unlike the HCPs (nurses) in UK who were reported to use computers throughout twenty-four hour period in the clinical area with no restricted access (Gerrish et al., 2006).

In summary, each of the four Factors has an interpretation on what the e-health can do to their clinical practice (see Figure 13-16). The description of this contribution is influenced by but not limited to either power (Doolin, 2004), resistance (Doolin, 2004, Timmons, 2003), clinical autonomy (de Grood et al., 2016, Hains et al., 2009, Verhoeven et al., 2009), and access. These factors will invariably modify the tripartite relationship as depicted above. Thus, the distance between the three categories (HCPs, patients, and e-health) will either lengthen or shorten depending on how each of the Factors interpret the contribution of the factors discussed above (see Figure 13-16).

5.4. Factors versus Models constructs/themes: Confluence and Congruence

Evidently, each Factor from the study has interacted with both the TAM and UTAUT in its specific way. However, Factors 1, 2 and 4 have clearly identified that PU/PE either alone or in combination with other constructs as important facilitators to the adoption and use of e-health tools in the clinical setting. This suggests that despite their respective difference on e-health, they still recognise its usefulness within clinical practice. Both Factor 1 and Factor 4 also identified the FC as a recurrent barrier.

Furthermore, despite the differences on what influences the choices of these HCPs on adoption and use of e-health in clinical practice, they have also identified a *common ground*, which is recognised by all the

Factors. As shown in previous chapter on findings, all the HCPs across the four Factors identified six statements they either agree or disagree with. Two statements on PU/PE: #*29; Clinical Information systems are useful in the hospital,* and # *33; Clinical information systems improves work efficiency* were both ranked from +4 to +6 suggesting their strong agreements for these statements. It emphasises PU/PE as an important determinant to adoption and use in clinical practice as identified in the literature (Holden et al., 2012, Venkatesh et al., 2011). All participants also recognise that their gender as described earlier (e-health, gender and age) does not influence their adoption and use of e-health (#40; *My gender affects my use of the clinical information systems*) by ranking the statement -6 to -5. This is one of the statement items of the individual differences (ID) theme from both TAM and UTAUT. Magrabi et al. (2007) on the contrary identified that HCPs within their study are positively influenced by their gender to use clinical retrieval technologies. Abdolrasulnia et al. (2004) specifically reported that female HCPs were more likely to seek clinical information online resource described in their study than the male HCPs. Their findings echoes what Huryk (2010) identified while reviewing factors influencing nurse's attitude on healthcare technology. The review reported that female nurses were more likely to use healthcare technologies than their male colleagues or other specialities. While describing nursing profession along the lines of femininity, Bacon and Stocking (2004) identified that male nurses are more likely to adopt a technology for their practice than their female colleagues. Their conclusion was however based on a 13% male representation within their study.

Despite all the above, the four Factors in this current study do not attribute gender as a factor that influences HCPs choice to adopt and use technology. This suggests a move from initial perception that gender markedly affects HCPs clinical roles (Bacon and Stocking, 2004).

In addition, all four Factors are not comfortable with the support they receive from their superiors about using these e-health tools in the

clinical area. The issue of leadership support together with managerial factors responsible as one of the factors for the variations in the adoption of healthcare technology by HCPs in the clinical area (Gagnon et al., 2012a). On the other hand, all the four Factor participants have identified a positive consensus on two statement items on the PEOU/EE theme (*#1: It is easy to remember how to perform tasks with the clinical information systems; #26: It is easy to become skilful at using the clinical information systems*) which shows their agreement that the e-health tools are easy to remember and easy to become skilful at. Evidently, this shows that the participants within the four Factors can easily adapt to the available e-health tools within their clinical practices.

5.5. Summary

It could be seen from the responses on e-health adoption and use by these HCPs, one may argue that the issue about the factors influencing e-health in clinical practice may not just be placed into the categories as described by Gagnon et al. (2012a). Rather, there exist many factors which are considered by these HCPs in the clinical area when making choices about e-health adoption and these may differ from one HCP to another. As reported by Lyons et al. (2005), different stakeholder groups within the clinical environment perceive factors differently either as drivers or barriers to e-health adoption and use. Thus, using TAM/UTAUT and Q-methodology to guide the understanding of such factors, have shown that training, availability of e-health tools, support from both management and superiors are equally be considered alongside patient preferences. In addition, ability of the HCPs to contribute decisions about the e-health to be adopted in the clinical area, clear integration of e-health in routine clinical activities, and the need to extend e-health beyond local departments are also considered by these HCPs.

Using Q methodology and the models of technology acceptance, HCPs within this study have identified how they make their choices about these technologies within their practice from their own perspectives. Four Factors identified, suggests a multiplex relationship these HCPs

have with the e-health during their practice with each Factor showing emphasis on what influences the choice of the participation HCPs in a gestalt manner. Despite this complexity of perspectives, participants have identified a consensus that e-health tools are useful in the clinical setting and that it improves efficiency in practice. Issues involving social influences/subjective norms have also been collectively identified by all the Factors as an important barrier to adoption and use of these technologies in their clinical area.

This study has contributed to the available literature and the general understanding about those issues that HCPs in the SSA consider as having influence on their choices about adoption and use of e-health that may perhaps be hidden in other context or not visible using other approaches.

Chapter 6. Conclusion

6.1. Introduction

This section will review the objectives of the study and discuss the recommendations of the study

The specific objectives of the study were:

1. To use the TAM and UTAUT as the theoretical framework to develop and organise literature into concourse for Q-methodology
2. To carry out a Q-sort on nurses and physicians in SSA to identify their shared views on the factors influencing e-health adoption and use in clinical practice
3. To identify the themes in the theoretical framework that have more influence on HCPs' e-health adoption and use
4. To make recommendations based on findings from the study to inform e-health adoption and use in clinical practice in SSA

To use TAM and UTAUT as theoretical framework to develop and organise literature into concourse for Q methodology.

In line with the first objective, an extensive literature search was done on both the models of technology acceptance in Chapter 2 to identify key constructs and moderators based on previous studies. To the knowledge of the researcher and based on available literature at time of this study, this is the first time both models TAM and UTAUT were used in combination and together with Q-methodology. As seen in the literature, both models were explored from their origin, the modification that was done to the TAM, and their applications in healthcare research. These were complemented by literature around e-health adoption and use within the clinical setting and interviews with stakeholders and experts in e-health and health informatics within the host university. This led to various stages of refinement of

the concourse as seen in Chapter 3 from an initial number of one hundred and seventy-four to a final Q-sample of forty-six. This Q-sample was categorised into six themes which reflect all the key constructs and moderators of both the TAM and UTAUT: Perceived Usefulness/Performance Expectancy (12 statements), Perceived Ease of Use/Effort Expectancy (9 statements), Social Influence/Subjective Norm (8 statements), Facilitating Conditions (9 statements), Individual differences (4 statements), and Behavioural intention (4 statements). Using both models have provided an expanded depth for understanding the influence of e-health within HCPs in their clinical practices which might not have been captured using just one of the models alone (see section 2.5.5). In addition, combining the two models strengthened the sample statements used in the current study by including the participant characteristics (age and gender). These characteristics have been consistently omitted in previous TAM research in healthcare even though their importance has previously been highlighted Gagnon et al. (2012a) as discussed in Chapter 2. Also, despite the reported high explained variance on intention to use a technology of UTAUT (DongPing and LianJin, 2011), few research studies have extended it healthcare when compared to TAM. Thus, as discussed in section 2.5.5, combining both models provided more depth in exploring adoption and use of e-health among HCPs that was not previously uncovered by the literature.

To carry out a Q-sort on nurses and physicians in SSA to identify their shared views on the factors influencing e-health adoption and use in clinical practice.

The HCPs prioritised the statements during the Q-sort and this led to four distinct Factors emerging (Patient-focused e-health advocates, Task-focused e-health advocates, Traditionalistic-pragmatists and Tech-focused e-health advocates) showing the different views that these HCPs have about e-health in clinical practice. The combination

of both TAM, UTAUT and Q-methodology allowed the HCPs to actively uncover their shared perceptions about the role that e-health plays in the clinical practice. This is the first study to the researcher's knowledge to have utilised both these models and Q-methodology to understand ICT adoption and specifically e-health. This equivocal interpretation of the role that e-health shows the uniqueness of Q-methodology in exploring the subjectivities of the HCPs. Also, areas of consensus show that participants agree e-health can positively contribute to clinical practice and that more support from both senior and management staff is lacking within their area of practice.
Also, using the ranking pattern in Q-methodology afforded the participants highlight important aspects for consideration for their clinical practice within TAM and UTAUT constructs. This might not have been captured using other methodological techniques to understand subjectivity. This is due the fact that these techniques have been identified to have their methodological difficulties in reducing individual subjectivities to meaningful accounts (see section 3.2). Though the Q-sort afforded these HCPs means to express their viewpoints in a gestalt manner, the resultant Factors are not to be assumed as static or generalisable beyond these participants. However, the logical inference from the findings could lead to an explanatory hypothesis in future studies.

To identify which theme in the theoretical framework that have more influence on HCPs' ICT adoption and use

As discussed in Chapter 5, despite the distinct peculiarities among the four Factors, PU/PE have been identified by all the Factors as important contributors to e-health adoption and use in their clinical practice. Only Factor 1 has in addition to the PU/PE theme the SI/SN theme as co-contributor to their view on e-health adoption and use. However, Factors have differed in those themes that impedes their e-health adoption (see section 5.4). These variations in the perception of barriers adds strength to the diversity of opinion that HCPs hold

about how e-health could integrate into their clinical practices. Themes such as FC and SI/SN either together or in combination have been highlighted by these participants as important barriers to their e-health adoption and use.

To make recommendations based on findings from the study to inform e-health adoption and use in clinical practice in SSA

The recommendations based on the findings are presented in section 6.5 in this chapter.

The first two objectives provided the platform for which this research study was able to achieve the third objective which was discussed in chapter 5. This affirms that the objectives set in line with the aim of this research study have been achieved.

6.2. Reflexivity

At this stage of the study, using both Q-methodology and the models of technology acceptance are considered to have appropriately met the aim and objectives of this research. Using a disciplined self-aware analysis as reported by Finlay and Gough cited in Marshall et al. (2010), reflexivity is seen as a trail to understand the researcher's interpretations in this study. Reflexivity is important as it provides the researcher the ability to continuously review the research process and question his/her own perception and influence on the study (Marshall et al., 2010). Moreover, within the interpretive paradigm within which Q-methodology is built (Ramlo and Newman, 2011b) reflexivity has a lot of significance. Moreover, Heidegger cited in Marshall et al. (2010) identified that it is not possible to bracket personal beliefs, in this regard it is important for the researcher to acknowledge his/her own beliefs and bias and how they might influence the study. Thus, my own perception at the beginning of this study was that technology could provide solutions to problems within clinical practice. This view has originated within my experience as a lecturer in my institution. I have used technology within the academic environment and have perceived its influence in both the efficiency and effectiveness of my job. As a

nurse/midwife I have seen how complex it was in carrying out clinical activities with little or no e-health tools. As a result, this PhD research study set out to explore what influences HCPs in SSA adoption and use of healthcare technologies.

The research journey has been interrupted on occasions by delay due to industrial actions by unions of both HCPs within the study area. As a result, nurses' recruitment commenced a month after the first physician recruitment. Also, during the data collection my position as lecturer and a Fellow of the West African College of Nursing who is conducting a PhD abroad might have positively influenced my access to the study area through the gatekeepers. This was evident as both heads of management of the respective HCPs participated in the study. Therefore, recognising these human factors re-emphasised adhering to the ethical guidelines and the recruitment process (Appendix A and B) to ensure that those who met the inclusion criteria were recruited. In addition, utilising Q-methodology reduces reliance on the researcher's interpretive ability and personal biases as common with other quantitative or qualitative approaches. This because the participants in Q-methodology studies have a 'high level of control in deciding what is and is not significant to them in relation to a specific phenomenon' (Barker, 2008, p922).

To understand this methodology, in addition to reading various literature, I joined the global Q-methodology community listserv, the T&Q community in the UK, and workshops and conferences both within the UK. This afforded me access to a network of Q-methodology researchers and debates which shaped my thought and provided me deeper understanding of this methodology.

6.3. Strengths and limitations

As stated in section 6.2, using both the models of technology acceptance and Q-methodology was appropriate to understand the factors that influence HCPs adoption and use of e-health in clinical practice in SSA. The use of both Technology Acceptance Model (TAM)

and Unified Theory of Acceptance and Use of Technology (UTAUT) together as a theoretical framework facilitated the development of the concourse for this study and was also influential in the analysis and interpretation of the findings. Though this is the first time that both models are used together, both models have been identified to be the most widely used in technology research (DongPing and LianJin, 2011). The literature review in Chapter 2 provided the reader with basis for choice of these two models. Despite both models not being developed for a qualitative study (Ami-Narh and Williams, 2012, Wu, 2012) nor for healthcare, this should not be seen as a limitation as Q-methodology provided participants in this study opportunity to identify how both models influence their choices about e-health in clinical practice. Also, the rigorous Q-statement development process and pilot study (Ladan et al., 2018) provided the participants with a refined set of statements derived from both models and interviews with experts as described in the methodology chapter. This complemented the models constructs while also 'tailoring' the statement to healthcare.

The use of Q-methodology within this study enabled the participants to uncover their respective views about e-health adoption and use in clinical practice which might not have been explicitly identified using other methods such as surveys or interviews (Barker, 2008). Though some of these methods could be used to explore subjectivity or attitudes, researchers have argued that the methods still pose challenges during data reduction (Barker, 2008, Ho, 2017). The methodological limitation of Q-methodology has been elucidated in the methodology chapter of this study, this approach has been able to uncover previously silent yet salient views that these HCPs hold about adoption and use of e-health in the clinical area in SSA in an in-depth and gestalt manner. In addition, using Q-methodology made visible the areas each of the four Factors placed emphasis when making choices about e-health while also showing the similarities that all the four Factors share when making those choices. Though these findings cannot be generalised beyond the participants as the methodology

relies on a small number of participants, the strength is rather in getting variant perspectives (Barker, 2008, Ho, 2017, Valenta and Wigger, 1997) as seen in the four Factors that have emerged. Also, logistically the conduct of Q-methodology study is quite challenging and especially with HCPs in this research study due to the time they can allocate within their clinical working hours to complete a Q-sort.

Also, another important point to note in using Q-methodology among HCPs in the clinical area is the issue of time. It was observed during this study that some HCPs made comments about the time needed to complete a Q-sort. This could be challenging because for all HCPs that participated in this study have not heard of the methodology prior to this study. It was important to briefly explain the methodology before they do the Q-sorting. Though this was an important discovery has not been mentioned in previous research, perhaps because this is the first time these participants were exposed to this type of methodology.

Another important limitation is the lack of available information on how to conduct the analysis especially for new researchers. However, the “T & Q” community in the UK together with the Q-methodology listserv have been very helpful for guidance and the practical session during the data analysis process. It might be important for future researchers to explore developing an online learning resource (OER) that guide novice researchers on the important steps in conducting a Q-study including the analysis process.

Despite this, the strength of this approach to address the aim of this research study outweighs its limitations. Moreover, my initial standpoint that technology could and should make work easier including clinical practice at the beginning of this research study was modified. This modification now acknowledges that despite the recognition of the roles that technology plays in clinical practice, its adoption and use is subject to how the user(s) interpret these roles within his/her own practice.

6.4. Implications

This section demonstrates how the four Factors that emerged within this study can have wider implications within clinical practice, e-health policy in SSA, e-health research. It will also show the implication of the findings from this study on future research.

6.4.1. Impact on clinical practice in SSA

6.4.1.1. HCPs in the clinical area

The four Factors in this study have shown that the HCPs within the study have equivocal perspectives on how e-health influence their clinical practice. Though one may argue that the study findings may not be generalizable beyond the participants (Valenta and Wigger, 1997), it could still have wider application beyond the study area (Thomas and Baas, 1992). These views of HCPs in SSA have shown that there is need to move away from the assumption that technology has the same interpretation among all HCPs (Petit dit Dariel et al., 2013). As a result, HCPs need to recognise and understand that their respective characteristics together with other factors discussed in Chapter 5 influence their interaction with e-health. Accordingly, HCPs need to understand that patient's and/or their families' preference contribute to their own care as seen in Factor 1. Hence, HCPs should involve them while making choices about which type of e-health they are more satisfied with while weighing such preferences against best clinical practice in relation to patient empowerment (Vezyridis and Timmons, 2015). In addition, issues about clinical autonomy and e-health resistive practice (s) should be explored to understand what might have driven the HCPs to such positions. As discussed earlier, some of these are evidently from poor understanding of what the e-health does (Doolin, 2004, Greenhalgh et al., 2014). This has also been identified to result from non-involvement of the HCPs in designing and implementation processes by the decision makers. Another important point is the HCPs in Factor 3 identification of e-health as separate entity within routine clinical practice. Though the results of this study have clearly identified that different perspectives exist to roles e-health plays in clinical

practice. e-Health adoption and use is required to realise sustainable innovative healthcare (van Gemert-Pijnen et al., 2011). In this regard, HCPs in SSA need to identify what type of e-health tool(s) best suit their assigned roles to sustain quality clinical practice. They also need to identify the training/continuous professional development that meets the requirement for the implemented e-health resources.

6.4.1.2. Decision makers within the clinical area

The findings of this research study and the subsequent discussions have raised key areas that need to be recognised in relation to decision makers within the clinical area. Key issues such as support from superiors and management, clinical autonomy, availability of training and technical support that are identified by the Factors should be considered when managers are introducing a new e-health. Also highlighted within this study by some of the participants is the imposition and withdrawal of a clinical technology by decision makers without consulting the consumers/end users of these technologies. These actions result in HCPs either going into resistive compliance (using the e-health while complaining and seeing them as imposition from hospital management) or supportive non-use (acknowledging that e-health has benefits but will not use adopt it in practice) of such technologies (Geiger et al., 2017, Timmons, 2003). Going forward, with the global transition toward evidence-based health practice together with e-health, the four Factors recognise that technology could improve quality of healthcare. Decision makers among participants have clearly reported that this study has certainly shaped their thinking and have a better understanding of issues regarding e-health. Issues of shared governance (Anthony, 2004) as applied within the NHS in the UK could be adopted by decision makers when making choices about e-health in the clinical area. This involves a facilitative leadership approach “where staff have collective ownership to develop and improve practice…” (Nottingham University Hospitals, 2017). This encourages key stake holders to be actively involved from the design to implementation and

evaluation to meet with evolving healthcare demands to reduce unintended/undesired outcomes.

6.4.2. E-health policy in SSA

Evidently, this study has shown that though e-health is recognised as a component of healthcare practice by the Ministry of Health in Nigeria, a substantive policy guiding development, implementation and evaluation is not well defined. Hence this study identified that HCPs are not bound to e-health adoption policies within their clinical work environment. This has resulted in healthcare institutions having local policies that are usually not sustainable as most key stake holders are not involved. Findings from this study has also shown that even within various departments within the same institution e-health policies exist without collaboration with other departments but rather with organisations outside these institutions. In the UK, there is a routine e-health policy update (Burns, 1998) which sets strategies for implementation and evaluates previous policies to match with healthcare evolving needs. Though some argue that not all these strategies have meet their expected goals (Greenhalgh et al., 2014, Greenhalgh et al., 2017). Notwithstanding, Robert (2016) identifies that there is a continuous drive to modernise and transform e-health within the UK health context. This study may empower policy makers in SSA to recognise the different perspectives that HCPs have about e-health adoption and use in clinical practice. In addition, areas of concern such as involving HCPs in decision making through feedback about the appropriate e-health to be implemented should be encouraged. Monitoring of adoption could also be done by keeping an audit trail of use to address compliance and areas of concern. Patient preference should also be taking into consideration while developing such policies since this study has shown these preferences influence HCPs e-health adoption and use choices.

6.4.3. Theoretical and Empirical contributions

This study uncovered a tripartite relationship that exists between e-health, HCPs and the patients/families. It identified how the viewpoints influence HCPs choices in adopting and using e-health within their

respective clinical practices. The viewpoints projected four diverse relationships (see section 5.3) that emphasise the importance of either patient/families preferences or the role that e-health plays within the clinical practice in HCPs decisions. This is the first time that this kind of tripartite relationship is used to understand the how both the HCPs, patients/families and the e-health relate with each other within clinical practice. However, these relationships will need to be examined further using correlation analysis in future studies to explain the strengths of these relationships.

In addition, in combining TAM and UTAUT, this study pioneers the use of the constructs of both models together. This provided balance in both the explained variances in intention to use and usage behaviour of both models. Combining the constructs of both models also provided a new dimension to previous studies that has always shown that SI/SN is often a weak influence in choice to adopt a technology in clinical practice (see section 2.5). However, this study has shown that SI/SN is an important influence in HCPs choices especially in Factor 1 (section 4.10.1).

6.5. Recommendations

This section provides recommendations about the findings from this study to inform both practice and policy. Though recommendations may be specifically geared towards the study area, they are pertinent to other similar settings across SSA. Recommendations will adopt Cresswell et al. (2013) outline for key considerations for successful implementing and adoption of healthcare technology/e-health.

6.5.1. Clarifying the problem the e-health tool is going to address and building consensus

Policy strategy by the Federal Ministry of Health should clearly identify what the e-health is going to address prior to design and implementation. As discussed in Chapter 5, the four Factors from the findings showed a consensus recognising the important role that e-health plays in clinical practice. In this regard, there should be an initial

assessment of the needs of both the HCPs and their respective clinical practices to ascertain the problem that exist. This should be a shared collaboration with key stake-holders including decision makers and HCPs who are the e-health consumers within clinical areas in SSA should identify specific objective that the e-health tool will achieve. In identifying the problem, short, medium and long-term goals could be set which should be both specific, measurable, reliable and achievable.

At the healthcare centres, each department through the HCPs should identify the area of need that the e-health could address. This should also consider collaboration with other departments in terms of information flow and sharing. It should be a facilitative leadership where both the HCPs and the decision makers within the clinical area have a sense of ownership in identifying the problem/area of e-health need.

6.5.2. Considering options and making choice about the appropriate e-health tool

Though this study was not done at the national level but since all healthcare institutions are guided by national health policies, policy design adjustment should be done when the area of need is established, adequate budget and requisite e-health infrastructure could then be procured. This should follow careful appraisal of similar e-health to capture the cost of sustainability, software updating, maintenance, training and re-training.

Decision makers and HCPs should consider the type and position of hardware that are going to be available. In the post-sort interviews, some HCPs have identified preference for mobile e-health devices while working. This may have informed the study area to purchase portable e-health device though decision makers have identified that the devices were not equipped with software at the time of this study. Therefore, when considering the software or the appropriate e-health they should identify a sustainable application that will be easy to use that address the problems identified. When making choices about the appropriate e-health tool, there should be consideration of either it will

be linked to an intranet or internet. Issues about the type of secured access and the level of access need to be clearly identified when selecting the appropriate e-health tool. Both the decision makers and the HCPs should identify the appropriate technical support and how this can be accessed when the need arise.

6.5.3. Planning and developing the right infrastructure

As highlighted that there should be necessary input from both the HCPs and the decision makers (section 6.4.1.2), suppliers and/or developers should also be involved when planning for e-health implementation. Active engagement with other organisations using similar e-health tools should be done to identify areas of strengths and weaknesses in their own implementation. Cresswell et al. (2013) recognised that during the planning, two implementation processes should be considered. The first one is the 'phased' approach involving a gradual transition from paper to computer-based applications or upgrading one healthcare technology to another. The second one is what they described as the 'big-bang' approach involved a sudden introduction of e-health across the clinical area (p11). Thus, findings from this study suggest the former approach is more appropriate for the study area especially in Factor 3 who despite recognising the e-health contributions still adhere to clinical practices which excludes it. HCPs will need to slowly adjust to the new technology to understand the value it will add to their clinical practices. It is imperative also to adhere to the plan as some decision makers tend to expand the scope of the implementation process against initial considerations (Cresswell et al., 2013).Timelines should also be inserted during the planning process. This should include training, workshops/roadshows with both the HCPs, decision makers and suppliers/or developers, implementation dates, dates for scope expansion within the clinical area.

The right infrastructure needs to be incorporated within the planning to identify relevant resource that ensures adequate execution of the e-health platform. This includes the number and location of computers (both desktops and handheld devices) to be provided, internet host,

cyber security providers, backup electricity should all be considered in the planning process.

6.5.4. Training and re-training including support of HCPs

Though the issue of training has been mentioned in the previous sections, its importance needs to be emphasised. During the post-sort interviews, some HCPs identified that they have never been trained since their employment while others have had one in the last five years necessitating them to learn on the job. This should be avoided and clear points of training and re-training should be identified from the planning phase. Those who should give the training need to be identified and should be familiar with the implemented e-health. HCPs more familiar with the e-health tools such as Factor 4 (also called super users including senior staff) within the clinical area could be the identified. They could be the first point of call should a need to clarify minor accessibility issues before escalating to technical support. The time of training should be communicated early, and reminders sent across to attendees.

Ina addition, participants in this research study have identified that they do not get support from their superiors in using the available e-health tools. In this regard, senior HCPs should be involved from identifying problems which the e-health tool will address to planning and developing the appropriate e-health infrastructure (see section 6.5.1 to 6.5.3). This will afford them confidence in the e-health tool provided and thus encourage junior colleagues to adopt and use it.

6.5.5. E-health evaluation and maintenance

This should also be clearly identified from the planning process. Evaluation through both feedback from HCPs and technical assessment of hardware and software should be done at routine intervals. HCPs could drop their feedback(s) in suggestion boxes at designated areas within the clinical area. On the other hand, hospital management could conduct routine surveys either quarterly or twice a year to ascertain both level of implementation and HCPs suggestions. This will provide

for identification of area of either human capacity development or e-health tool(s) update/upgrade. An audit trail of e-health use will also provide information about acceptability of such tools. Real time access visibility could also be captured by the technical support team which may promptly provide quick response to flagged errors.

Issues of maintenance of the e-health tools and associated devices need to be done routinely as well. This should include updates/upgrades or changes of the e-health, addressing resultant system or network expansion across the clinical area.

6.6. Summary

It is also important to note that all these recommendations require collaborations from both HCPs and decision makers. Another key point is to ensure that there is no conflicting or parallel technology systems within the institution. This usually tend to increase HCP workload and may negatively affect provision of quality healthcare. It is also important to restrict gradually the use of paper-based system during the e-health implementation process. Making the e-health adoption and use mandatory unlike what presently exist in the study area will help address some issues raised by the participants. Having a single interconnected e-health rather than discrete technologies localised within departments will also improve collaboration among HCPs and improve the quality of health and patient care.

6.7. Recommendations for future research

This section provides recommendations resulting from the findings of this research study to inform future research. Though the logical inference from the findings might inform hypothesis beyond the study area and population, this recommendation is directed at the HCPs and the study area.

During the data collection process, it was reported that the decision makers in the study area has shown commitment towards implementing e-health tools for adoption by HCPs (see Chapter 5). The Factors that

emerged identified that despite this commitment by the hospital management, HCPs were not involved in the decision process. It is important to note that the participants in this study are a fraction of the entire HCP population in the hospital, thus the same Q-sample could be provided to another set of HCPs to assess the reliability of the viewpoints that emerged. This means other categories HCPs such as pharmacists could also be included in future to identify areas of agreement or disagreement with the current Q-sample.

Furthermore, decision makers in this study identified that new mobile devices have been made available to the HCPs though no software was included. The decision makers together with HCPs could identify appropriate software to in-cooperate in these new devices taking into consideration the Factors from this study and evaluated using a longitudinal research design.

In the same regard, the surprising fact that defines Factor 3, who though acknowledge that e-health are useful and could improve work efficiency in the clinical area yet prefer not to adopt it could be explored further.

The four Factors that emerged from this study could be quantitatively tested using surveys across larger participant population within the study area. Moreover, findings from the study about the most relevant theme that influence HCPs adoption and use of e-health could be integrated as questions in the survey. This will identify the spread of what the HCPs see as the most contributing theme from the two models used in this study in a wider population of HCPs. A model of technology acceptance could be contextualised and empirically tested for e-health to include the viewpoints of the HCPs in this study.

In addition, hypotheses could be developed to test the tripartite relationship identified in the HCPs, e-health and patient/families' preference in healthcare.

6.8. Looking back

In retrospect, having completed this study, it is considered that the aim and objectives of this study have been adequately met using both TAM and UTAUT and Q-methodology. Using these two models of technology acceptance as theoretical framework to guide the development of the Q-sample for this study was appropriate in exploring the HCPs viewpoints on e-health adoption and use. Though these models have been used more in empirical studies, adapting them to a Q-methodology provided an opportunity to explore their constructs further in e-health research. It might be argued that these models have their weakness (Holden and Karsh, 2010, Yousafzai et al., 2007) however, combining both models (see section 2.5.5) ensured their constructs were strengthened. This afforded an in-depth evaluation of their application to e-health adoption and use and HCPs rather than summing inferences as obtained in previous empirical studies. This was seen in the emerged Factors showing emphasis within a construct. For example, Factor 1 while recognising the importance of patient preferences in HCPs choice to adopt and use e-health yet identify support from superiors as inadequate. Both would have been summed as SN/SC influence but using both models and Q-methodology provided depth of clarity on what aspect(s) within a construct has more influence on their choices to adopt and use e-health tools. Evidently, using both models to explore adoption and use of e-health was well suited for the aim of this research study.

Furthermore, in section 3.2 the benefits and limitations for using Q-methodology in this study were addressed. Using this methodology has allowed HCPs to move away from past typologies of *barriers* and *facilitators*, which often does not reflect their subjective viewpoints, and often fail to capture minority viewpoints. The abductive nature of the methodology which relies on exploration of observed phenomena by detecting ‘surprising empirical fact(s)’ (Watts and Stenner, 2012, p40) strengthened this approach. This means Q-methodology provided means to explore the e-health adoption and use by HCPs as cues to

understand their viewpoints rather than confirming or falsifying it (Brown, 2017, Brown et al., 2017). In addition, using HCPs from across various ranks including decision makers allowed for a holistic understanding of viewpoints held by these participants. This diversity showed that despite the difference in cadre and profession, the HCPs share these viewpoints as no Factor within this study had only nurses or physicians loading separately. Also, combining Q-methodology with TAM and UTAUT indeed uncovered unanticipated viewpoints (Factors 1 and 3) within this population of HCPs (see section 4.9 and 4.11). Indeed, as discussed in section 6.3, findings of this study are not generalisable beyond the participants. However, the concepts that emerged can be expanded to other HCPs including other similar settings (Thomas and Baas, 1992). Despite this limitation, the strengths of Q-methodology within this research far outweigh its weaknesses.

By way of closing, using this approach among HCPs in clinical practice in SSA has shown that it is challenging to have specific categorisation of factors influencing e-health adoption and use. Findings from the study have shown that HCPs do recognise the value e-health add to clinical practice. However, involving HCPs in design, implementation and evaluation as discussed in 6.5 will address some of the HCPs concerns and complexities. In this regard, it is important to recognise these four Factors in issues related to e-health adoption and use.

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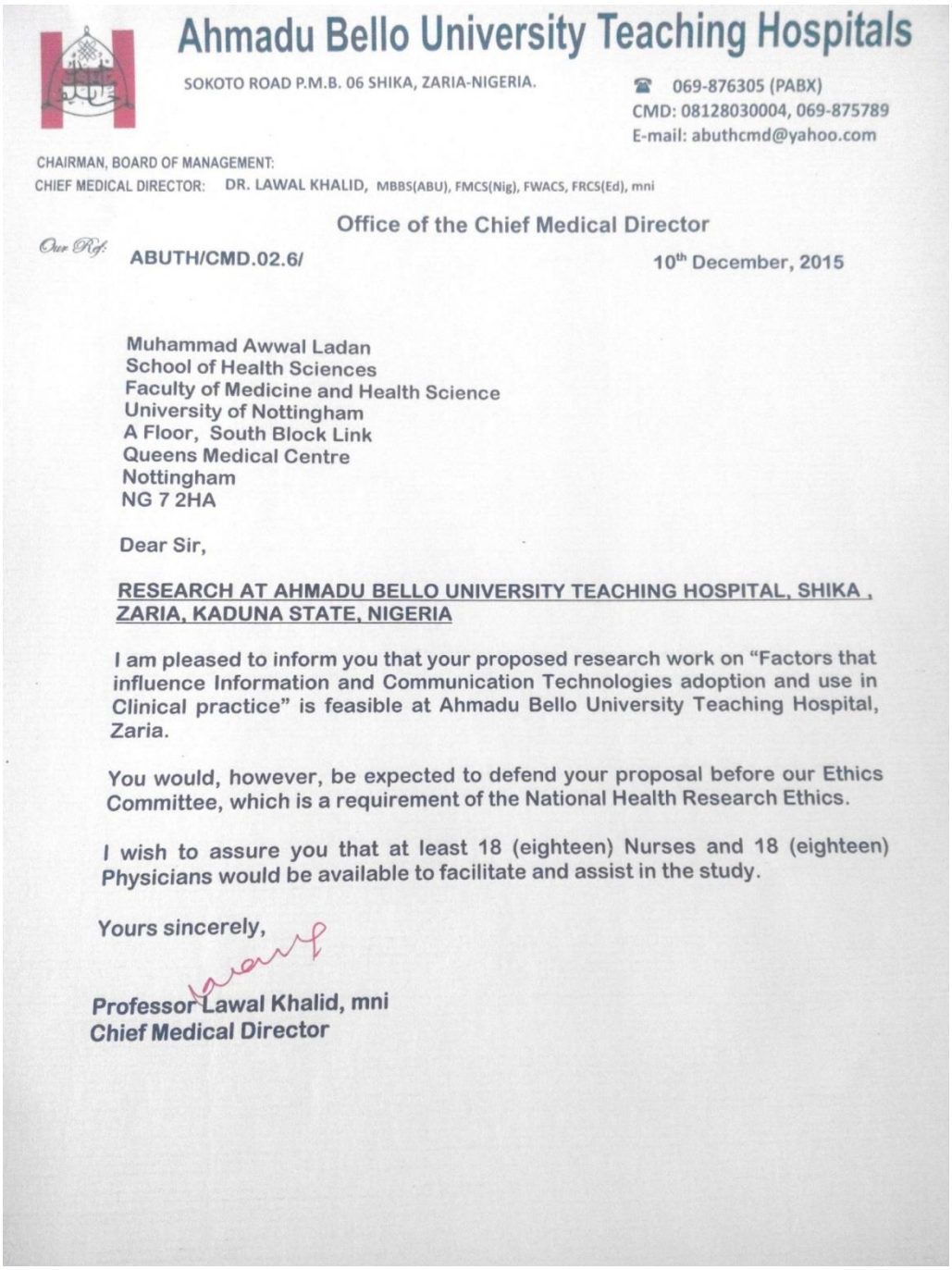
Appendix A: Ethical clearance documents

A.1: Letter of Permission to conduct study



Ahmadu Bello University Teaching Hospitals

SOKOTO ROAD P.M.B. 06 SHIKA, ZARIA-NIGERIA.

☎ 069-876305 (PABX)
CMD: 08128030004, 069-875789
E-mail: abuthcmd@yahoo.com

CHAIRMAN, BOARD OF MANAGEMENT:
CHIEF MEDICAL DIRECTOR: DR. LAWAL KHALID, MBBS(ABU), FMCS(Nig), FWACS, FRCS(Ed), mni

Office of the Chief Medical Director

Our Ref: ABUTH/CMD.02.6/

10th December, 2015

Muhammad Awwal Ladan
School of Health Sciences
Faculty of Medicine and Health Science
University of Nottingham
A Floor, South Block Link
Queens Medical Centre
Nottingham
NG 7 2HA

Dear Sir,

RESEARCH AT AHMADU BELLO UNIVERSITY TEACHING HOSPITAL, SHIKA , ZARIA, KADUNA STATE, NIGERIA

I am pleased to inform you that your proposed research work on "Factors that influence Information and Communication Technologies adoption and use in Clinical practice" is feasible at Ahmadu Bello University Teaching Hospital, Zaria.

You would, however, be expected to defend your proposal before our Ethics Committee, which is a requirement of the National Health Research Ethics.

I wish to assure you that at least 18 (eighteen) Nurses and 18 (eighteen) Physicians would be available to facilitate and assist in the study.

Yours sincerely,

Professor Lawal Khalid, mni
Chief Medical Director

A.2: Ethical clearance from University of Nottingham

The University of Nottingham

Faculty of Medicine and Health Sciences

Research Ethics Committee
School of Medicine Education Centre
B Floor, Medical School
Queen's Medical Centre Campus
Nottingham University Hospitals
Nottingham
NG7 2UH

Direct line/e-mail
+44 (0) 115 8232561
Louise.Sabir@nottingham.ac.uk

24th March 2016

Muhammad Awwal Ladan
PhD Student, Nursing Studies
c/o Professor Heather Wharrad
Professor of e-learning and Health Informatics
Room B53
School of Health Sciences
QMC Campus
Nottingham University Hospitals
NG7 2UH

Dear Muhammad

Ethics Reference No: H16022016 SoHS – **please always quote**
Study Title: Exploring Information and Communications Technology Adoption and use among health professionals in the clinical area in sub-Saharan Africa: Using Q-metholdology and models of technology acceptance.
Chief Researcher/Academic Supervisor: Professor Heather Wharrad, Professor of e-Learning and Health Informatics, Dr Richard Windle Associate Professor, School of Health Sciences.
Other Key researchers/Student: Muhammad Awwal Ladan, PhD Nursing Studies, School of Health Sciences.
Duration of Study: 02/2016-31/08/2018 24 mths **No of Subjects** 36 (18+ yrs)

Thank you for submitting the above application which was considered by the Committee at its meeting on 16th February 2016 and the following documents were received:

Short Title: ICT adoption and Use among health professionals in Sub-Saharan Africa: A Q-study:

- FMHS Research Ethics Committee Application Form v1.0, 22/01/2016
- Letter of permission from Professor Lawal Khalid, Chief Medical Director, Ahmadu Bello University Teaching Hospitals, Zaria-Nigeria dated 10th December 2015.
- Study Protocol Final version 1.0 February 2016
- Recruitment Advert v 1.0, date: 22/01/2016
- Participant Information Sheet Final version 1.0: 22.01.2016
- Consent Form Final version 1.0 date: 22/01/2016
- Draft Statements version 1.0 date: 22/01/2016
- Interview (Open Ended) Questions v 1.0 date: 22/01/2016
- Abuth Health Research Ethics Committee Application form

These have been reviewed and are satisfactory and the study has been given a favourable opinion.

Approval is given on the understanding that the conditions set out over the page are followed:

The University of Nottingham

1. Please submit a copy of the ethical clearance letter from: The Ahmadu Bello University Teaching Hospital Research Ethics Committee when this is available for our records.

2. A Favourable opinion is given on the understanding that all appropriate ethical and regulatory permissions are respected and followed in accordance with all local laws of the country in which the study is being conducted and those required by the host organisation/s involved.

3. You must follow the protocol agreed and inform the Committee of any changes using a notification of amendment form (please request a form).

4. You must notify the Chair of any serious or unexpected event.

5. This study is approved for the period of active recruitment requested. The Committee also provides a further 5 year approval for any necessary work to be performed on the study which may arise in the process of publication and peer review.

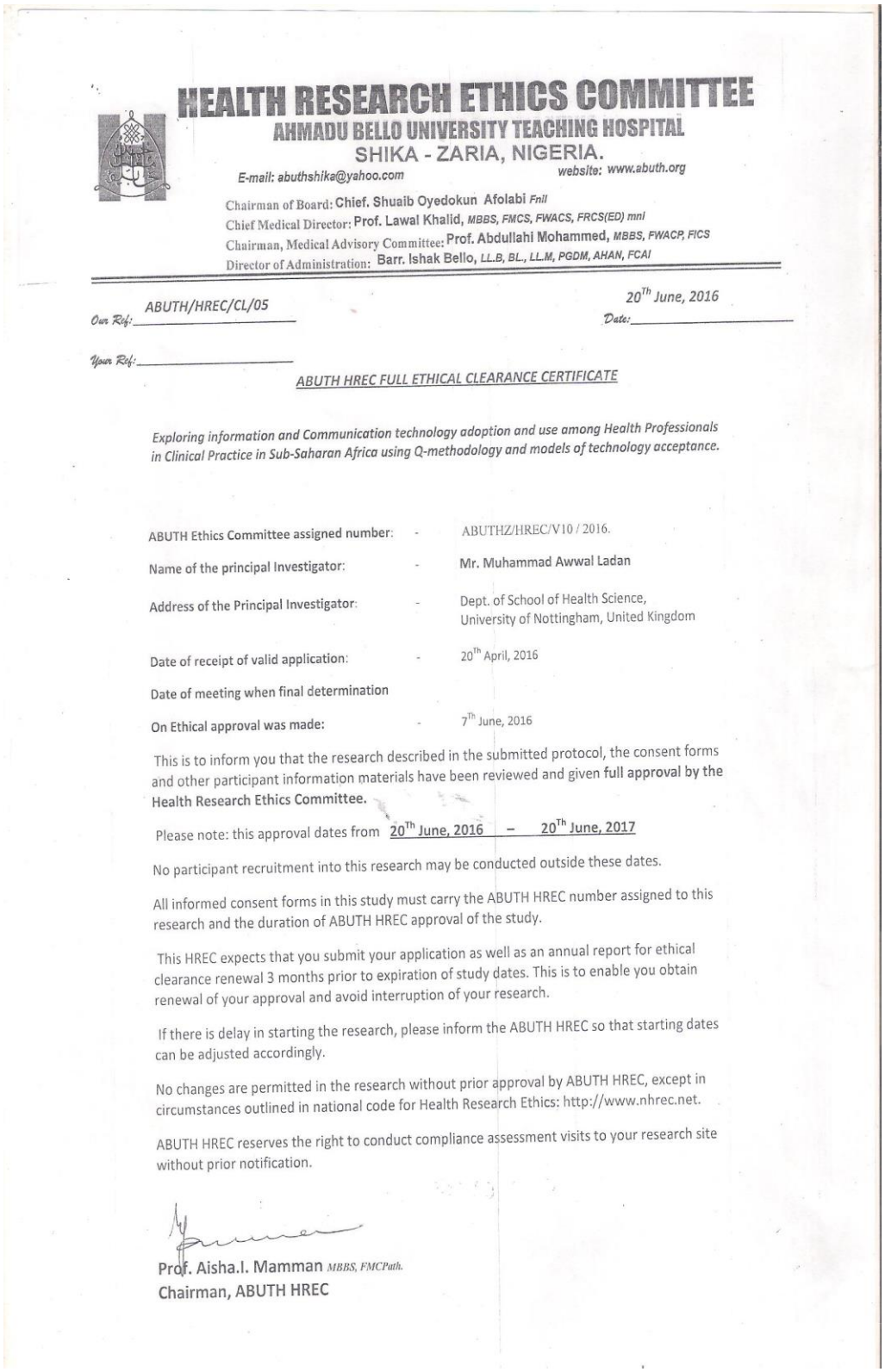
6. An End of Project Progress Report is completed and returned when the study has finished (Please request a form).

Yours sincerely

pp Lawrence

Professor Ravi Mahajan
Chair, Faculty of Medicine & Health Sciences Research Ethics Committee

A.3: Ethical clearance from study site



HEALTH RESEARCH ETHICS COMMITTEE

AHMADU BELLO UNIVERSITY TEACHING HOSPITAL

SHIKA - ZARIA, NIGERIA.

E-mail: abuthshika@yahoo.com website: www.abuth.org

Chairman of Board: Chief. Shuaib Oyedokun Afolabi *Fnil*
Chief Medical Director: Prof. Lawal Khalid, *MBBS, FMCS, FWACS, FRCS(ED) mnl*
Chairman, Medical Advisory Committee: Prof. Abdullahi Mohammed, *MBBS, FWACP, FICS*
Director of Administration: Barr. Ishak Bello, *LL.B, BL., LL.M, PGDM, AHAN, FCAI*

Our Ref: ABUTH/HREC/CL/05 Date: 20Th June, 2016

Your Ref:

ABUTH HREC FULL ETHICAL CLEARANCE CERTIFICATE

Exploring information and Communication technology adoption and use among Health Professionals in Clinical Practice in Sub-Saharan Africa using Q-methodology and models of technology acceptance.

ABUTH Ethics Committee assigned number:	-	ABUTHZ/HREC/V10 / 2016.
Name of the principal Investigator:	-	Mr. Muhammad Awwal Ladan
Address of the Principal Investigator:	-	Dept. of School of Health Science, University of Nottingham, United Kingdom
Date of receipt of valid application:	-	20Th April, 2016
Date of meeting when final determination On Ethical approval was made:	-	7Th June, 2016

This is to inform you that the research described in the submitted protocol, the consent forms and other participant information materials have been reviewed and given **full approval by the Health Research Ethics Committee.**

Please note: this approval dates from 20Th June, 2016 – 20Th June, 2017

No participant recruitment into this research may be conducted outside these dates.

All informed consent forms in this study must carry the ABUTH HREC number assigned to this research and the duration of ABUTH HREC approval of the study.

This HREC expects that you submit your application as well as an annual report for ethical clearance renewal 3 months prior to expiration of study dates. This is to enable you obtain renewal of your approval and avoid interruption of your research.

If there is delay in starting the research, please inform the ABUTH HREC so that starting dates can be adjusted accordingly.

No changes are permitted in the research without prior approval by ABUTH HREC, except in circumstances outlined in national code for Health Research Ethics: http://www.nhrec.net.

ABUTH HREC reserves the right to conduct compliance assessment visits to your research site without prior notification.

Prof. Aisha.I. Mamman *MBBS, FMCPath.*
Chairman, ABUTH HREC

Appendix B: Recruitment documents

B.1: Participant Information Sheet

Title of Study: Exploring Information and Communication Technology Adoption and Use among health professionals in the clinical area in sub-Saharan Africa: Using Q-methodology and models of technology acceptance.

Name of Researcher(s): Muhammad Awwal Ladan, postgraduate research student.

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve for you. One of our team will go through the information sheet with you and answer any questions you have. Talk to others about the study if you wish. Ask us if there is anything that is not clear.

What is the purpose of the study?

Despite the massive increase in the availability of ICT within the healthcare arena and the obvious benefits that it can bring to patient care, the nature of use of these systems by clinical staff still appears to be an issue slowing the rate of adoption. By having a better understanding of the factors that influence adoption of technology we will be able to make the introduction of new technologies more streamlined and acceptable for clinicians. The aim of this study is to identify barriers and drivers to the use of ICT within healthcare by clinical staff to inform ICT implementation programmes within clinical practice. This study will provide information on reasons for acceptability and use or not of ICT in the healthcare setting. It is also expected to give insight to areas that might modify attitudes or behaviours towards technology at an individual or managerial level.

Why have I been invited?

You have been chosen to participate in this study because you are a clinician at Ahmadu Bello University Teaching Hospital, Shika-Zaria. We are recruiting a range of different clinical staff to get a wide perspective on the opinions about using ICT in practice. We are hoping to recruit 36 participants (both nurses and physicians) of different ages, years of experience and gender.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part, you are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?

This study takes the form of a research process called Q-methodology. If you agree to take part in this study, I will be contacting you to schedule a time to carry out a simple card sorting exercise where you place statements onto a grid. This process will take about 30 – 45 minutes to complete. This will be followed by a short interview which will take about 25-35 minutes to complete. All your responses from the card sorting or the interview will be confidential, and all data will be anonymised and stored securely.

Both sorting and interview will occur at the workplace of the participant. Q-sort exercise done by you will be captured on a mini sorting grid similar to the one used for subsequent entry into the computer for analysis. The interview sessions will be audio recorded which will then be transcribed and analysed for use to complement interpretation of the final study findings.

Expenses and inconvenience allowance

We will not be able to pay you for taking part as this is research I am undertaking as part of my doctoral studies, but will arrange the meeting so that you do not have to travel and will incur no expense.

What are the possible disadvantages and risks of taking part?

Loss of time of between 1 hour to 1 hour 30 minutes during the sorting and subsequent interview may be the only disadvantage for participating in the study.

List of inclusion and exclusion criteria include the following:

To participate in the study, you must:

- Be a nurse or physician working in the clinical area of Ahmadu Bello University Teaching Hospital, Shika-Zaria either in the Out-Patient department, Lay-in wards, Accident and Emergency unit or involved in clinical management
- Have used or have access to clinical information system (internet enabled desktop and or laptop, internet enabled portable hand-held device, eg. Smartphone or tablet or other computerized devices used in patient care) within the hospital.

The exclusion criteria:

- Nurses or physicians working in the teaching hospital involved only as academics will also be excluded.

What are the possible benefits of taking part?

This will also be the first study of its kind to look at the issues specifically within the context of Africa. Therefore, many of the issues that we uncover are likely to be able to support the better use of health-related ICT within developing countries more generally. The information we get from your participation in this study may help in understanding the factors that individually influence ICT adoption and use by health professionals in the clinical area.

Will my taking part in the study be kept confidential?

All participant data will be kept confidential. Information will be coded using date and number of participant which will be securely held, and password protected for a period of 7 years. We will follow ethical and legal practice as outlined in the University of Nottingham Code of Research Conduct.

If you join the study, data will only be available in a non-anonymised form to authorised persons from the University of Nottingham who are organising the research. It may also be reviewed by authorised people to check that the study is carried out correctly. Anyone else seeing the data will only see it in a form in which all identifying information has been removed.

What will happen if I don't want to carry on with the study?

Your participation is voluntary, and you are free to withdraw at any time, without giving any reason.

What will happen to the results of the research study

Findings from the study will be disseminated at various stages of the study (from pilot to the conclusion of the main study). It is expected also that the result will inform understanding of clinical information system adoption and use by health professionals in the study setting as well as provide substantive inference (transferability) for similar settings. This may help to positively modify the factors that affect technology adoption and use and improve its acceptance among healthcare professionals.

The study being a requirement for the award of a PhD, it is anticipated that the study will be published as series of research articles in appropriate scientific journal in open access journals for wider coverage and accessibility within 18 months after data

analysis. However, participants will not be identified in any of the publications. Symposia and local workshops will also be held within the Teaching hospital and the Ahmadu Bello University to communicate the findings of the study.

Who is organising and funding the research?

This research is being organised by the University of Nottingham and my doctoral studies are being funded by TETFUND/Ahmadu Bello University, Zaria-Nigeria.

Who has reviewed the study?

All research in the University of Nottingham is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by the Faculty of Medicine & Health Sciences (FMHS) Research Ethics Committee.

What if there is a problem?

If you have a concern about any aspect of this study, you should contact the Chief investigator e-mail: **heather.wharrad@nottingham.ac.uk**. The full contact details of the research team are given at the end of this information sheet. If you remain unhappy and wish to complain formally, you should then contact the FMHS Research Ethics Committee Administrator, c/o The University of Nottingham, School of Medicine Education Centre, B Floor, Medical School, Queen's Medical Centre Campus, Nottingham University Hospitals, Nottingham, NG7 2UH. E-mail: louise.sabir@nottingham.ac.uk.

Further information and contact details

Chief Academic/Supervisor:	**Other key researchers/collaborators**
Professor Heather Wharrad Professor of e-Learning and Health Inform Room B53 Queen's Medical Centre Nottingham NG7 2UH, UK **heather.wharrad@nottingham.ac.uk**	Dr Richard Windle Associate Professor in e-learning Room B53 Queen's Medical Centre Nottingham NG7 2UH, UK **richard.windle@nottingham.ac.uk**

B.2: CONSENT FORM

Title of Study: Exploring Information and Communication Technology Adoption and Use among health professionals in the clinical area in sub-Saharan Africa: Using Q-methodology and models of technology acceptance

REC ref:H16022016 SoHS

Name of Researcher: Muhammad Awwal Ladan

Name of Participant: **Please initial box**

1. I confirm that I have read and understand the information sheet version number ……dated..... for the above study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. ☐
3. I understand that relevant sections of my data collected in the study may be looked at by the research group and by other responsible individuals for monitoring and audit purposes. I give permission for these individuals to have access to these records and to collect, store, analyse and publish information obtained from my participation in this study. I understand that my personal details will be kept confidential. ☐
4. I understand that the Q-sort will be captured on mini-sorting grids and the subsequent interview will be audio recorded using an audio recorder and that anonymous direct quote from the interview may be used in the study reports. ☐
5. I understand that all data will be anonymous and confidential with the exception of information being revealed during the interview which is of concern and may need reporting i.e. potential risks to another person or to myself ☐
6. I agree to maintain the confidentiality of interview discussions. ☐
7. I understand that information about me recorded during the study will be kept in a secure database. If the data is transferred is will be made anonymous. Data will be kept for 7 years after the study has ended and then securely destroyed. ☐
8. I agree to take part in the above study. ☐

_____ _____

Name of Participant Date Signature

_____ _____

Name of Person taking consent Date Signature

Appendix C

C.1: Q Statements

1. It is easy to remember how to perform tasks with the clinical information systems
2. Using clinical information systems improves patient care
3. Using clinical information systems reduces likelihood of medication error
4. Superiors at work think I should use the clinical information systems
5. If the clinical system is extended I would use it
6. Using clinical information systems increases my productivity
7. Using clinical information systems improves my performance
8. I am certain about the reliability of the information I get from the system
9. Using clinical information systems facilitates better patient care decision making
10. Using clinical information systems makes caring for patients easier
11. Management support staff innovations on clinical information systems use in the workplace
12. People in my organization who use the clinical information systems have more prestige than those who do not
13. The use of clinical information systems makes me apprehensive
14. Using the clinical information systems is a status symbol in my organization
15. Patients/families believe clinical information systems use reduces chances of medication errors
16. It is easy to get the system to do what I want it to do
17. Interaction with the clinical information systems does not require a lot of mental effort
18. Not having the clinical information system in some departments hinders my work in these areas
19. The senior management of this organization has been helpful in the use of the clinical information systems
20. Using clinical information systems increases my chance of getting a praise or reward
21. The use of clinical information systems is pertinent to my various related tasks
22. The clinical information systems are clear and understandable
23. My use of clinical information systems is entirely voluntary
24. My age has nothing to do with my ability to use the clinical information systems effectively
25. My use of clinical information systems is entirely under my control
26. It is easy for me to become skilful at using clinical information systems
27. I always look for opportunities to use the system whenever I can
28. Management organise regular training on the use of clinical information systems at the work place
29. Clinical Information systems are useful in the hospital
30. My routine tasks prevent me from having time to use the clinical information system
31. I could complete the job using the clinical information systems if there was no one around to tell me what to do as I go
32. There is availability of technical assistance for clinical information systems in my hospital
33. Clinical information systems improves work efficiency
34. Using clinical information systems is easier than other computer systems I use
35. Patients/families like it when i use the clinical information system
36. My ICT experience affects my use of the clinical information system
37. People who influence my clinical behaviour think I should the system
38. There are available resources to use the clinical information system
39. Using clinical information systems enables me to accomplish tasks more quickly
40. My gender affects my use of the clinical information systems
41. People who are important to me think I should use the clinical information systems
42. Patients/families believe clinical information systems use is good for quality patient care
43. I hesitate to use the clinical information systems for fear of making mistakes I cannot correct
44. The information in the system is always updated
45. My use of the clinical information system is specific to the task i want to carry out
46. The clinical information systems is not compatible with other platforms I use

C.2: Themes and corresponding Q-statements

Theme	Statement
Perceived usefulness/Performance expectancy	1. Clinical Information systems are useful in the hospital 2. Using clinical information systems enables me to accomplish tasks more quickly(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al.,

	2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003)(Gagnon et al., 2012a, Holden and Karsh, 2010, Venkatesh et al., 2003) 3. Using clinical information systems increases my productivity 4. The use of clinical information systems is pertinent to my various related tasks 5. Using clinical information systems improves my performance 6. Clinical information systems improves work efficiency 7. Using clinical information systems increases my chance of getting a praise or reward 8. Using clinical information systems enhances my effectiveness in my job 9. I am certain about the reliability of the information I get from the system 10. The information in the system is always updated 11. Using clinical information systems facilitates better patient care decision making 12. Using clinical information systems improves patient care 13. Using clinical information systems reduces likelihood of medication error
Perceived ease of use/Effort expectancy	1. It is easy for me to become skilful at using clinical information systems 2. Interaction with the clinical information systems does not require a lot of mental effort 3. It is easy to get the system to do what I want it to do 4. The clinical information systems are clear and understandable 5. It is easy to remember how to perform tasks with the clinical information systems

	6. I feel apprehensive about using the clinical information systems 7. I hesitate to use the clinical information systems for fear of making mistakes I cannot correct 8. Using clinical information systems is easier than other computer systems I use 9. Using clinical information systems makes caring for patients easier
Social influence/ Subjective norm	1. People who influence my clinical behaviour think I should the system 2. People who are important to me think I should use the clinical information systems 3. People in my organization who use the clinical information systems have more prestige than those who do not (Venkatesh and Bala, 2008) 4. Using the clinical information systems is a status symbol in my organization 5. Superiors at work think I should use the clinical information systems 6. Patients/families like it when clinical staff use the systems 7. Patients/families believe clinical information systems use by clinical staff reduces chances of medication errors 8. Patients/families believe clinical information systems use by clinical staff is good for quality patient care

Facilitating conditions	1. I have necessary resources to use the clinical information systems 2. There is availability of technical assistance for clinical information systems in my hospital 3. Using clinical information systems is entirely under my control 4. The senior management of this organization has been helpful in the use of the clinical information systems 5. The clinical information systems is not compatible with other platforms I use 6. My use of clinical information systems is entirely voluntary 7. Management organise regular training on the use of clinical information systems at the work place 8. Management support staff innovations on clinical information systems use in the workplace 9. My routine tasks prevent me from having time to use the clinical information systems
Individual differences	1. My age has nothing to do with my ability to use the clinical information systems effectively 2. My gender has nothing to do with my ability to use the clinical information systems effectively 3. I have a lot of experience in the use of clinical information systems in the workplace 4. I could complete the job using the clinical information systems if there was no one around to tell me what to do as I go
Behavioural intention	1. I always look for opportunities to use the system whenever I can 2. If the clinical system is extended I would use it 3. I only use the clinical information system for the things I am required to use it for 4. Not having the clinical information system in some departments hinders my work in these areas

Appendix D: PQMethod Analysis Export data

D.1: Correlation Matrix Between Sorts

SORTS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	DRM35115	100	41	57	62	38	31	39	39	52	50	34	62	51	67	56	58	36	26	59	20	49	28	33	34	16	47	50	12	36	56
2	DRM53221	41	100	7	39	37	32	50	58	43	48	34	51	49	60	37	48	44	15	19	48	46	3	29	40	40	43	33	43	37	46
3	DRM35325	57	7	100	48	8	18	8	22	6	-1	32	39	31	40	29	43	23	37	33	9	33	38	34	17	21	42	31	-6	13	38
4	DRM34428	62	39	48	100	38	41	45	28	37	53	27	65	61	59	71	66	51	39	44	35	62	11	45	28	18	56	56	34	39	53
5	DRM34503	38	37	8	38	100	33	41	36	35	59	35	40	50	52	62	42	16	6	25	39	57	14	16	35	13	41	47	9	23	48
6	DRF35603	31	32	18	41	33	100	34	22	14	36	23	31	55	37	29	51	33	19	40	41	54	9	43	30	5	59	53	42	37	31
7	NSF42704	39	50	8	45	41	34	100	38	37	52	17	32	53	38	48	44	61	14	21	50	33	14	19	36	11	39	51	47	53	37
8	NSF42805	39	58	22	28	36	22	38	100	21	52	37	36	44	32	25	35	22	19	19	14	36	12	29	37	18	37	36	25	28	28
9	DRM36908	52	43	6	37	35	14	37	21	100	34	21	52	33	46	41	45	19	7	21	37	37	27	14	22	10	13	37	15	40	56
10	NSF53101	50	48	-1	53	59	36	52	52	34	100	20	52	47	45	55	44	36	7	20	21	43	11	34	44	5	50	55	25	30	33
11	NSM30111	34	34	32	27	35	23	17	37	21	20	100	31	34	39	28	37	4	3	36	-2	41	17	9	30	12	31	24	9	35	38
12	DRF31121	62	51	39	65	40	31	32	36	52	52	31	100	65	59	48	60	40	17	33	40	55	33	42	32	25	42	57	42	30	67
13	DRM33131	51	49	31	61	50	55	53	44	33	47	34	65	100	61	52	71	50	30	40	48	73	24	44	44	15	68	76	37	44	66
14	NSF39142	67	60	40	59	52	37	38	32	46	45	39	59	61	100	68	62	29	21	46	36	61	17	52	43	30	55	64	20	53	72
15	DRM44152	56	37	29	71	62	29	48	25	41	55	28	48	52	68	100	62	26	20	40	20	58	17	27	36	6	51	65	22	53	55
16	DRM37162	58	48	43	66	42	51	44	35	45	44	37	60	71	62	62	100	44	44	43	37	57	31	47	37	15	68	66	40	45	58
17	DRM54172	36	44	23	51	16	33	61	22	19	36	4	40	50	29	26	44	100	19	28	61	30	10	24	13	4	47	38	34	13	24
18	NSF52183	26	15	37	39	6	19	14	19	7	7	3	17	30	21	20	44	19	100	14	25	37	1	20	11	25	40	24	29	22	10
19	NSF42190	59	19	33	44	25	40	21	19	21	20	36	33	40	46	40	43	28	14	100	20	56	-11	16	22	-7	34	38	1	30	35
20	DRF45200	20	48	9	35	39	41	50	14	37	21	-2	40	48	36	20	37	61	25	20	100	48	-3	10	11	13	34	33	37	20	45
21	NSF51210	49	46	33	62	57	54	33	36	37	43	41	55	73	61	58	57	30	37	56	48	100	-5	38	32	17	57	56	27	39	62
22	NSF56221	28	3	38	11	14	9	14	12	27	11	17	33	24	17	17	31	10	1	-11	-3	-5	100	18	18	16	20	23	9	13	33
23	NSM41231	33	29	34	45	16	43	19	29	14	34	9	42	44	52	27	47	24	20	16	10	38	18	100	23	41	47	51	22	24	30
24	NSM35241	34	40	17	28	35	30	36	37	22	44	30	32	44	43	36	37	13	11	22	11	32	18	23	100	0	41	48	13	43	45
25	NSF52251	16	40	21	18	13	5	11	18	10	5	12	25	15	30	6	15	4	25	-7	13	17	16	41	0	100	13	-2	29	6	5
26	DRM34261	47	43	42	56	41	59	39	37	13	50	31	42	68	55	51	68	47	40	34	34	57	20	47	41	13	100	68	26	35	38
27	NSF54272	50	33	31	56	47	53	51	36	37	55	24	57	76	64	65	66	38	24	38	33	56	23	51	48	-2	68	100	31	63	57
28	DRM34280	12	43	-6	34	9	42	47	25	15	25	9	42	37	20	22	40	34	29	1	37	27	9	22	13	29	26	31	100	49	24
29	NSF54290	36	37	13	39	23	37	53	28	40	30	35	30	44	53	53	45	13	22	30	20	39	13	24	43	6	35	63	49	100	41
30	NSF45300	56	46	38	53	48	31	37	28	56	33	38	67	66	72	55	58	24	10	35	45	62	33	30	45	5	38	57	24	41	100
31	DRM41310	44	52	31	61	38	51	58	26	40	36	22	55	63	56	38	50	58	31	35	68	61	9	32	26	33	53	47	42	40	55
32	NSF52321	27	0	28	16	0	49	10	-11	22	-3	27	13	19	16	14	35	10	17	17	10	29	25	34	6	10	26	20	28	29	19
33	NSF52331	24	12	35	29	11	37	25	26	-1	22	34	8	16	25	42	37	7	19	6	-9	21	23	43	22	7	47	28	26	34	15
34	NSM49341	44	53	34	59	38	50	36	47	31	49	25	68	66	47	54	63	40	28	28	41	59	17	42	14	30	62	61	47	43	40
35	DRM43352	52	43	40	61	46	50	53	34	30	50	34	51	60	59	56	62	55	29	26	39	47	30	47	26	9	74	63	30	36	50
36	DRM43362	58	48	11	52	52	50	36	25	52	58	31	49	46	66	72	56	7	12	42	26	59	8	25	47	8	47	57	33	58	53

Correlation Matrix Between Sorts (contd)

SORTS		31	32	33	34	35	36
1	DRM35115	44	27	24	44	52	58
2	DRM53221	52	0	12	53	43	48
3	DRM35325	31	28	35	34	40	11
4	DRM34428	61	16	29	59	61	52
5	DRM34503	38	0	11	38	46	52
6	DRF35603	51	49	37	50	50	50
7	NSF42704	58	10	25	36	53	36
8	NSF42805	26	-11	26	47	34	25
9	DRM36908	40	22	-1	31	30	52
10	NSF53101	36	-3	22	49	50	58
11	NSM30111	22	27	34	25	34	31
12	DRF31121	55	13	8	68	51	49
13	DRM33131	63	19	16	66	60	46
14	NSF39142	56	16	25	47	59	66
15	DRM44152	38	14	42	54	56	72
16	DRM37162	50	35	37	63	62	56
17	DRM54172	58	10	7	40	55	7
18	NSF52183	31	17	19	28	29	12
19	NSF42190	35	17	6	28	26	42
20	DRF45200	68	10	-9	41	39	26
21	NSF51210	61	29	21	59	47	59
22	NSF56221	9	25	23	17	30	8
23	NSM41231	32	34	43	42	47	25
24	NSM35241	26	6	22	14	26	47
25	NSF52251	33	10	7	30	9	8
26	DRM34261	53	26	47	62	74	47
27	NSF54272	47	20	28	61	63	57
28	DRM34280	42	28	26	47	30	33
29	NSF54290	40	29	34	43	36	58
30	NSF45300	55	19	15	40	50	53
31	DRM41310	100	21	7	46	52	38
32	NSF52321	21	100	48	26	37	31
33	NSF52331	7	48	100	30	47	34
34	NSM49341	46	26	30	100	58	47
35	DRM43352	52	37	47	58	100	47
36	DRM43362	38	31	34	47	47	100

D.2: Unrotated Factor Matrix

	Factors					
	1	2	3	4	5	6
SORTS						
1 DRM35115	0.7208	0.1299	0.1530	-0.2979	0.0916	0.0905
2 DRM53221	0.6412	-0.3817	0.1718	0.1798	0.0873	0.2305
3 DRM35325	0.4450	0.3150	-0.2745	-0.4091	0.1874	0.1567
4 DRM34428	0.7728	-0.0351	-0.0412	-0.1754	0.0252	-0.1097
5 DRM34503	0.5678	-0.0460	0.3446	0.0628	0.0701	-0.2197
6 DRF35603	0.6116	0.0654	-0.2312	0.1923	0.0183	-0.2289
7 NSF42704	0.6169	-0.2482	0.0155	0.1601	0.0258	-0.1324
8 NSF42805	0.4947	-0.1518	0.1516	0.2317	0.0344	0.1513
9 DRM36908	0.5007	-0.0340	0.3153	-0.1938	0.0946	0.1853
10 NSF53101	0.6116	-0.1370	0.2903	0.3077	0.0824	-0.1790
11 NSM30111	0.4356	0.2093	0.1647	0.0181	0.0421	0.1994
12 DRF31121	0.7371	-0.1543	0.0233	-0.2252	0.0498	0.2354
13 DRM33131	0.8208	-0.0882	-0.0020	-0.0660	0.0089	-0.1293
14 NSF39142	0.7933	0.1436	0.2173	-0.0882	0.0539	0.0529
15 DRM44152	0.7188	0.1160	0.2513	0.0113	0.0485	-0.1164
16 DRM37162	0.8285	0.0841	-0.1258	-0.0804	0.0137	0.0016
17 DRM54172	0.5069	-0.3397	-0.2616	-0.1261	0.0841	-0.2478
18 NSF52183	0.3510	-0.0247	-0.3362	-0.0807	0.0432	-0.0012
19 NSF42190	0.4646	0.1507	0.1683	-0.2672	0.0872	-0.1891
20 DRF45200	0.4896	-0.5329	-0.1011	-0.1821	0.1586	-0.2239
21 NSF51210	0.7605	-0.0520	0.0514	-0.0753	0.0122	-0.1588
22 NSF56221	0.2655	0.2071	-0.1002	-0.0016	0.0216	0.3491
23 NSM41231	0.5306	0.0979	-0.2727	0.1009	0.0229	0.1304
24 NSM35241	0.4814	0.1422	0.3034	0.1255	0.0672	-0.0375
25 NSF52251	0.2445	-0.2164	-0.1885	0.0118	0.0243	0.4516
26 DRM34261	0.7520	0.1067	-0.2614	0.1103	0.0219	-0.2889
27 NSF54272	0.7806	0.1435	0.0378	0.0399	0.0115	-0.2018
28 DRM34280	0.4562	-0.2792	-0.2076	0.2813	0.0573	0.1182
29 NSF54290	0.5951	0.1252	0.1576	0.2268	0.0350	0.0125
30 NSF45300	0.7073	0.0334	0.2294	-0.3238	0.1109	0.1040
31 DRM41310	0.7131	-0.3385	-0.1245	-0.1813	0.0779	-0.1102
32 NSF52321	0.3352	0.3949	-0.3923	0.0347	0.1294	0.0872
33 NSF52331	0.3995	0.4865	-0.2532	0.4861	0.2206	0.0905
34 NSM49341	0.7390	-0.1632	-0.1485	0.1166	0.0103	0.0931
35 DRM43352	0.7678	0.0806	-0.2033	0.0608	0.0097	-0.1002
36 DRM43362	0.6970	0.1631	0.3684	0.1731	0.0984	-0.0435
Eigenvalues	13.6089	1.7290	1.7206	1.3670	0.2311	1.1481
% expl.Var.	38	5	5	4	1	3

D.3: Cumulative Communalities Matrix

	Factors 1 Thru					
	1	2	3	4	5	6
SORTS						
1 DRM35115	0.5195	0.5364	0.5598	0.6485	0.6569	0.6651
2 DRM53221	0.4112	0.5569	0.5864	0.6188	0.6264	0.6795
3 DRM35325	0.1981	0.2973	0.3726	0.5400	0.5751	0.5997
4 DRM34428	0.5972	0.5984	0.6001	0.6309	0.6315	0.6435
5 DRM34503	0.3224	0.3245	0.4433	0.4472	0.4521	0.5004
6 DRF35603	0.3741	0.3784	0.4318	0.4688	0.4691	0.5215
7 NSF42704	0.3806	0.4422	0.4424	0.4681	0.4687	0.4863
8 NSF42805	0.2447	0.2677	0.2907	0.3444	0.3456	0.3685
9 DRM36908	0.2507	0.2519	0.3513	0.3888	0.3978	0.4321
10 NSF53101	0.3741	0.3929	0.4771	0.5718	0.5786	0.6107
11 NSM30111	0.1898	0.2336	0.2607	0.2610	0.2628	0.3026
12 DRF31121	0.5433	0.5671	0.5676	0.6183	0.6208	0.6762
13 DRM33131	0.6737	0.6815	0.6815	0.6858	0.6859	0.7026
14 NSF39142	0.6294	0.6500	0.6973	0.7050	0.7080	0.7108
15 DRM44152	0.5167	0.5301	0.5933	0.5934	0.5957	0.6093
16 DRM37162	0.6865	0.6935	0.7094	0.7158	0.7160	0.7160
17 DRM54172	0.2569	0.3723	0.4407	0.4566	0.4637	0.5251
18 NSF52183	0.1232	0.1238	0.2369	0.2434	0.2453	0.2453
19 NSF42190	0.2159	0.2386	0.2669	0.3383	0.3459	0.3817
20 DRF45200	0.2397	0.5236	0.5338	0.5670	0.5921	0.6423
21 NSF51210	0.5783	0.5810	0.5837	0.5894	0.5895	0.6147
22 NSF56221	0.0705	0.1134	0.1234	0.1234	0.1239	0.2458
23 NSM41231	0.2815	0.2911	0.3655	0.3756	0.3762	0.3932
24 NSM35241	0.2317	0.2520	0.3440	0.3598	0.3643	0.3657
25 NSF52251	0.0598	0.1066	0.1422	0.1423	0.1429	0.3469
26 DRM34261	0.5655	0.5769	0.6452	0.6574	0.6578	0.7413
27 NSF54272	0.6093	0.6299	0.6313	0.6329	0.6331	0.6738
28 DRM34280	0.2082	0.2861	0.3292	0.4083	0.4116	0.4256
29 NSF54290	0.3541	0.3698	0.3946	0.4461	0.4473	0.4475
30 NSF45300	0.5003	0.5014	0.5540	0.6588	0.6711	0.6819
31 DRM41310	0.5085	0.6231	0.6386	0.6715	0.6776	0.6897
32 NSF52321	0.1124	0.2683	0.4222	0.4234	0.4402	0.4478
33 NSF52331	0.1596	0.3963	0.4604	0.6967	0.7453	0.7535
34 NSM49341	0.5462	0.5728	0.5948	0.6084	0.6085	0.6172
35 DRM43352	0.5896	0.5961	0.6374	0.6411	0.6412	0.6512
36 DRM43362	0.4858	0.5124	0.6481	0.6780	0.6877	0.6896
cum% expl.Var.	38	43	47	51	52	55

D.4: Factor Matrix with an X Indicating a Defining Sort

		Loadings			
QSORT		1	2	3	4
1	DRM35115	0.6672X	0.2203	0.2129	0.3309
2	DRM53221	0.1332	0.5266	-0.0352	0.5679
3	DRM35325	0.5490X	0.1363	0.4446	-0.1495
4	DRM34428	0.5063X	0.4490	0.2769	0.3102
5	DRM34503	0.3141	0.1710	0.0149	0.5649X
6	DRF35603	0.1094	0.3611	0.4819X	0.3070
7	NSF42704	0.1275	0.4861X	0.1284	0.4462
8	NSF42805	0.0683	0.2893	0.0760	0.5003X
9	DRM36908	0.4783X	0.1512	-0.0530	0.3665
10	NSF53101	0.1067	0.2742	0.0701	0.6931X
11	NSM30111	0.2968	-0.0028	0.2192	0.3534
12	DRF31121	0.5164	0.4915	0.1349	0.3031
13	DRM33131	0.4416	0.4907X	0.2674	0.4225
14	NSF39142	0.5581	0.2105	0.2666	0.5275
15	DRM44152	0.4444	0.1733	0.2232	0.5622X
16	DRM37162	0.4654X	0.4237	0.4507	0.3414
17	DRM54172	0.2041	0.6309X	0.1177	0.0560
18	NSF52183	0.1456	0.3508	0.3101	-0.0545
19	NSF42190	0.5237X	0.0652	0.1190	0.2137
20	DRF45200	0.2357	0.6950X	-0.1229	0.1153
21	NSF51210	0.4414	0.4099	0.2311	0.4160
22	NSF56221	0.1572	0.0291	0.3012	0.0845
23	NSM41231	0.1378	0.3177	0.4706X	0.1849
24	NSM35241	0.2553	0.0041	0.1397	0.5245X
25	NSF52251	0.0123	0.3674	0.0791	0.0296
26	DRM34261	0.2463	0.4198	0.5634X	0.3211
27	NSF54272	0.4034	0.2782	0.4014	0.4813X
28	DRM34280	-0.1146	0.5198X	0.2068	0.2869
29	NSF54290	0.1899	0.1354	0.2890	0.5551X
30	NSF45300	0.6780X	0.2515	0.0936	0.3566
31	DRM41310	0.3872	0.6778X	0.1075	0.2249
32	NSF52321	0.1316	0.0550	0.6338X	-0.0373
33	NSF52331	-0.1345	-0.0592	0.7505X	0.3345
34	NSM49341	0.2003	0.5609X	0.3201	0.3889
35	DRM43352	0.3023	0.4235	0.5058X	0.3383
36	DRM43362	0.3475	0.0691	0.2153	0.7114X
% expl.Var.		13	13	10	15

D.5: Free Distribution Data Results

QSORT		MEAN	ST.DEV.
1	DRM35115	0.000	3.098
2	DRM53221	0.000	3.098
3	DRM35325	0.000	3.098
4	DRM34428	0.000	3.098
5	DRM34503	0.000	3.098
6	DRF35603	0.000	3.098
7	NSF42704	0.000	3.098
8	NSF42805	0.000	3.098
9	DRM36908	0.000	3.098
10	NSF53101	0.000	3.098
11	NSM30111	0.000	3.098
12	DRF31121	0.000	3.098
13	DRM33131	0.000	3.098
14	NSF39142	0.000	3.098
15	DRM44152	0.000	3.098
16	DRM37162	0.000	3.098
17	DRM54172	0.000	3.098
18	NSF52183	0.000	3.098
19	NSF42190	0.000	3.098
20	DRF45200	0.000	3.098
21	NSF51210	0.000	3.098
22	NSF56221	0.000	3.098
23	NSM41231	0.000	3.098
24	NSM35241	0.000	3.098
25	NSF52251	0.000	3.098
26	DRM34261	0.000	3.098
27	NSF54272	0.000	3.098
28	DRM34280	0.000	3.098
29	NSF54290	0.000	3.098
30	NSF45300	0.000	3.098
31	DRM41310	0.000	3.098
32	NSF52321	0.000	3.098
33	NSF52331	0.000	3.098
34	NSM49341	0.000	3.098
35	DRM43352	0.000	3.098
36	DRM43362	0.000	3.098

D.6: Factor Scores with Corresponding Ranks

No.	Statement	No.	Factors 1		2		3		4	
1	It is easy to remember how to perform tasks with the c	1	0.56	12	0.17	21	0.07	24	0.66	13
2	Using clinical information systems improves patient ca	2	1.37	5	1.45	4	0.41	17	0.72	11
3	Using clinical information systems reduces likelihood	3	0.03	23	0.73	12	-0.63	34	0.63	15
4	Superiors at work think I should use the clinical info	4	-0.29	29	-0.58	33	-0.75	35	-0.90	35
5	If the clinical system is extended I would use it	5	2.11	1	0.45	17	0.50	15	0.53	18
6	Using clinical information systems increases my produc	6	0.51	14	1.42	5	1.25	7	0.52	19
7	Using clinical information systems improves my perform	7	1.27	7	1.61	2	0.55	14	1.41	5
8	I am certain about the reliability of the information	8	0.33	19	-0.75	36	0.92	9	0.60	16
9	Using clinical information systems facilitates better	9	0.96	8	1.65	1	0.36	20	0.45	21
10	Using clinical information systems makes caring for pa	10	1.32	6	1.04	10	0.41	18	0.86	8
11	Management support staff innovations on clinical infor	11	-1.65	45	-1.06	40	-0.39	30	-1.45	42
12	People in my organization who use the clinical informa	12	-0.56	35	-1.47	42	-1.39	43	0.36	22
13	The use of clinical information systems makes me appre	13	-1.41	42	-1.57	44	-0.48	31	-1.24	39
14	Using the clinical information systems is a status sym	14	-1.10	38	-2.03	46	-0.23	26	-0.18	27
15	Patients/families believe clinical information systems	15	0.53	13	-0.32	26	-1.93	45	-0.24	28
16	It is easy to get the system to do what I want it to d	16	-0.34	32	-0.06	23	0.46	16	0.80	9
17	Interaction with the clinical information systems does	17	-0.50	33	-1.32	41	-0.26	27	0.17	24
18	Not having the clinical information system in some dep	18	0.41	17	-0.34	27	-1.24	42	1.08	6
19	The senior management of this organization has been he	19	-1.40	41	0.70	13	-0.77	36	-1.74	46
20	Using clinical information systems increases my chance	20	-0.52	34	-0.67	34	-1.23	41	-0.29	30
21	The use of clinical information systems is pertinent t	21	0.01	24	0.46	16	0.26	22	0.68	12
22	The clinical information systems are clear and underst	22	-0.70	36	1.09	9	0.33	21	0.66	14
23	My use of clinical information systems is entirely vol	23	0.80	9	-0.06	24	1.93	1	0.80	10
24	My age has nothing to do with my ability to use the cl	24	1.74	2	0.61	14	1.30	5	0.35	23
25	My use of clinical information systems is entirely und	25	-0.74	37	-0.58	32	0.59	12	-0.01	26
26	It is easy for me to become skilful at using clinical	26	0.49	16	0.93	11	0.86	11	0.90	7
27	I always look for opportunities to use the system when	27	0.76	10	0.24	20	1.03	8	1.69	2
28	Management organise regular training on the use of cli	28	-2.16	46	-0.84	37	-1.09	38	-1.55	43
29	Clinical Information systems are useful in the hospita	29	1.63	3	1.58	3	1.66	2	1.74	1
30	My routine tasks prevent me from having time to use th	30	-0.30	30	-0.98	38	1.45	4	-1.21	38
31	I could complete the job using the clinical informatio	31	0.20	21	-0.18	25	0.91	10	0.47	20
32	There is availability of technical assistance for clin	32	-1.57	44	-0.39	28	-0.32	29	-1.55	44
33	Clinical information systems improves work efficiency	33	1.40	4	1.33	7	1.28	6	1.51	3
34	Using clinical information systems is easier than othe	34	-0.22	27	-0.52	31	0.55	13	-0.55	32
35	Patients/families like it when i use the clinical inf	35	0.26	20	-0.52	30	-1.83	44	-1.04	36
36	My ICT experience affects my use of the clinical infor	36	-0.31	31	1.26	8	0.10	23	0.10	25
37	People who influence my clinical behaviour think I sho	37	0.50	15	0.08	22	-0.02	25	-0.80	33
38	There are available resources to use the clinical infr	38	-1.32	40	0.40	18	-0.52	32	-1.35	41
39	Using clinical information systems enables me to accom	39	0.72	11	1.37	6	1.52	3	1.50	4
40	My gender affects my use of the clinical information s	40	-1.51	43	-1.47	43	-2.01	46	-1.65	45
41	People who are important to me think I should use the	41	-0.01	25	-0.40	29	0.41	19	-0.87	34
42	Patients/families believe clinical information systems	42	0.10	22	0.28	19	-1.13	39	-0.25	29
43	I hesitate to use the clinical information systems for	43	-0.19	26	-1.57	45	-0.29	28	-1.12	37
44	The information in the system is always updated	44	-1.28	39	-0.68	35	-1.15	40	0.53	17
45	My use of the clinical information system is specific	45	0.39	18	0.55	15	-0.57	33	-0.45	31
46	The clinical information systems is not compatible wit	46	-0.29	28	-1.05	39	-0.88	37	-1.28	40

D.7: Factor Scores -- For Factor 1

No.	Statement	No.	Z-SCORES
5	If the clinical system is extended I would use it	5	2.106
24	My age has nothing to do with my ability to use the clinical	24	1.743
29	Clinical Information systems are useful in the hospital	29	1.635
33	Clinical information systems improves work efficiency	33	1.395
2	Using clinical information systems improves patient care	2	1.367
10	Using clinical information systems makes caring for patients	10	1.324
7	Using clinical information systems improves my performance	7	1.266
9	Using clinical information systems facilitates better patien	9	0.955
23	My use of clinical information systems is entirely voluntary	23	0.803
27	I always look for opportunities to use the system whenever I	27	0.762
39	Using clinical information systems enables me to accomplish	39	0.723
1	It is easy to remember how to perform tasks with the clinica	1	0.559
15	Patients/families believe clinical information systems use r	15	0.530
6	Using clinical information systems increases my productivity	6	0.510
37	People who influence my clinical behaviour think I should th	37	0.505
26	It is easy for me to become skilful at using clinical inform	26	0.486
18	Not having the clinical information system in some departmen	18	0.407
45	My use of the clinical information system is specific to the	45	0.386
8	I am certain about the reliability of the information I get	8	0.334
35	Patients/families like it when i use the clinical informati	35	0.257
31	I could complete the job using the clinical information syst	31	0.200
42	Patients/families believe clinical information systems use i	42	0.102
3	Using clinical information systems reduces likelihood of med	3	0.032
21	The use of clinical information systems is pertinent to my v	21	0.010
41	People who are important to me think I should use the clinic	41	-0.012
43	I hesitate to use the clinical information systems for fear	43	-0.191
34	Using clinical information systems is easier than other comp	34	-0.222
46	The clinical information systems is not compatible with othe	46	-0.291
4	Superiors at work think I should use the clinical informatio	4	-0.294
30	My routine tasks prevent me from having time to use the clin	30	-0.303
36	My ICT experience affects my use of the clinical information	36	-0.314
16	It is easy to get the system to do what I want it to do	16	-0.337
17	Interaction with the clinical information systems does not r	17	-0.503
20	Using clinical information systems increases my chance of ge	20	-0.516
12	People in my organization who use the clinical information s	12	-0.561
22	The clinical information systems are clear and understandabl	22	-0.696
25	My use of clinical information systems is entirely under my	25	-0.743
14	Using the clinical information systems is a status symbol in	14	-1.102
44	The information in the system is always updated	44	-1.284
38	There are available resources to use the clinical infromatio	38	-1.319
19	The senior management of this organization has been helpful	19	-1.403
13	The use of clinical information systems makes me apprehensiv	13	-1.414
40	My gender affects my use of the clinical information systems	40	-1.511
32	There is availability of technical assistance for clinical i	32	-1.566
11	Management support staff innovations on clinical information	11	-1.650
28	Management organise regular training on the use of clinical	28	-2.164

D.8: Factor Scores -- For Factor 2

No.	Statement	No.	Z-SCORES
9	Using clinical information systems facilitates better patien	9	1.648
7	Using clinical information systems improves my performance	7	1.610
29	Clinical Information systems are useful in the hospital	29	1.579
2	Using clinical information systems improves patient care	2	1.452
6	Using clinical information systems increases my productivity	6	1.416
39	Using clinical information systems enables me to accomplish	39	1.374
33	Clinical information systems improves work efficiency	33	1.330
36	My ICT experience affects my use of the clinical information	36	1.257
22	The clinical information systems are clear and understandabl	22	1.093
10	Using clinical information systems makes caring for patients	10	1.043
26	It is easy for me to become skilful at using clinical inform	26	0.933
3	Using clinical information systems reduces likelihood of med	3	0.727
19	The senior management of this organization has been helpful	19	0.701
24	My age has nothing to do with my ability to use the clinical	24	0.606
45	My use of the clinical information system is specific to the	45	0.554
21	The use of clinical information systems is pertinent to my v	21	0.457
5	If the clinical system is extended I would use it	5	0.448
38	There are available resources to use the clinical infromatio	38	0.403
42	Patients/families believe clinical information systems use i	42	0.281
27	I always look for opportunities to use the system whenever I	27	0.245
1	It is easy to remember how to perform tasks with the clinica	1	0.167
37	People who influence my clinical behaviour think I should th	37	0.076
16	It is easy to get the system to do what I want it to do	16	-0.060
23	My use of clinical information systems is entirely voluntary	23	-0.061
31	I could complete the job using the clinical information syst	31	-0.182
15	Patients/families believe clinical information systems use r	15	-0.319
18	Not having the clinical information system in some departmen	18	-0.338
32	There is availability of technical assistance for clinical i	32	-0.387
41	People who are important to me think I should use the clinic	41	-0.396
35	Patients/families like it when i use the clinical informati	35	-0.517
34	Using clinical information systems is easier than other comp	34	-0.517
25	My use of clinical information systems is entirely under my	25	-0.576
4	Superiors at work think I should use the clinical informatio	4	-0.578
20	Using clinical information systems increases my chance of ge	20	-0.674
44	The information in the system is always updated	44	-0.679
8	I am certain about the reliability of the information I get	8	-0.752
28	Management organise regular training on the use of clinical	28	-0.841
30	My routine tasks prevent me from having time to use the clin	30	-0.985
46	The clinical information systems is not compatible with othe	46	-1.052
11	Management support staff innovations on clinical information	11	-1.059
17	Interaction with the clinical information systems does not r	17	-1.317
12	People in my organization who use the clinical information s	12	-1.465
40	My gender affects my use of the clinical information systems	40	-1.472
13	The use of clinical information systems makes me apprehensiv	13	-1.569
43	I hesitate to use the clinical information systems for fear	43	-1.570
14	Using the clinical information systems is a status symbol in	14	-2.032

D.9: Factor Scores -- For Factor 3

No.	Statement	No.	Z-SCORES
23	My use of clinical information systems is entirely voluntary	23	1.928
29	Clinical Information systems are useful in the hospital	29	1.659
39	Using clinical information systems enables me to accomplish	39	1.525
30	My routine tasks prevent me from having time to use the clin	30	1.450
24	My age has nothing to do with my ability to use the clinical	24	1.302
33	Clinical information systems improves work efficiency	33	1.283
6	Using clinical information systems increases my productivity	6	1.249
27	I always look for opportunities to use the system whenever I	27	1.031
8	I am certain about the reliability of the information I get	8	0.917
31	I could complete the job using the clinical information syst	31	0.910
26	It is easy for me to become skilful at using clinical inform	26	0.856
25	My use of clinical information systems is entirely under my	25	0.586
34	Using clinical information systems is easier than other comp	34	0.554
7	Using clinical information systems improves my performance	7	0.551
5	If the clinical system is extended I would use it	5	0.504
16	It is easy to get the system to do what I want it to do	16	0.462
2	Using clinical information systems improves patient care	2	0.412
10	Using clinical information systems makes caring for patients	10	0.409
41	People who are important to me think I should use the clinic	41	0.407
9	Using clinical information systems facilitates better patien	9	0.359
22	The clinical information systems are clear and understandabl	22	0.332
21	The use of clinical information systems is pertinent to my v	21	0.258
36	My ICT experience affects my use of the clinical information	36	0.104
1	It is easy to remember how to perform tasks with the clinica	1	0.072
37	People who influence my clinical behaviour think I should th	37	-0.019
14	Using the clinical information systems is a status symbol in	14	-0.225
17	Interaction with the clinical information systems does not r	17	-0.265
43	I hesitate to use the clinical information systems for fear	43	-0.292
32	There is availability of technical assistance for clinical i	32	-0.318
11	Management support staff innovations on clinical information	11	-0.394
13	The use of clinical information systems makes me apprehensiv	13	-0.483
38	There are available resources to use the clinical infromatio	38	-0.520
45	My use of the clinical information system is specific to the	45	-0.569
3	Using clinical information systems reduces likelihood of med	3	-0.630
4	Superiors at work think I should use the clinical informatio	4	-0.751
19	The senior management of this organization has been helpful	19	-0.774
46	The clinical information systems is not compatible with othe	46	-0.884
28	Management organise regular training on the use of clinical	28	-1.088
42	Patients/families believe clinical information systems use i	42	-1.126
44	The information in the system is always updated	44	-1.149
20	Using clinical information systems increases my chance of ge	20	-1.234
18	Not having the clinical information system in some departmen	18	-1.241
12	People in my organization who use the clinical information s	12	-1.393
35	Patients/families like it when i use the clinical informati	35	-1.826
15	Patients/families believe clinical information systems use r	15	-1.929
40	My gender affects my use of the clinical information systems	40	-2.008

D.10: Factor Scores -- For Factor 4

No.	Statement	No.	Z-SCORES
29	Clinical Information systems are useful in the hospital	29	1.740
27	I always look for opportunities to use the system whenever I	27	1.694
33	Clinical information systems improves work efficiency	33	1.512
39	Using clinical information systems enables me to accomplish	39	1.498
7	Using clinical information systems improves my performance	7	1.407
18	Not having the clinical information system in some departmen	18	1.079
26	It is easy for me to become skilful at using clinical inform	26	0.901
10	Using clinical information systems makes caring for patients	10	0.864
16	It is easy to get the system to do what I want it to do	16	0.803
23	My use of clinical information systems is entirely voluntary	23	0.802
2	Using clinical information systems improves patient care	2	0.718
21	The use of clinical information systems is pertinent to my v	21	0.683
1	It is easy to remember how to perform tasks with the clinica	1	0.662
22	The clinical information systems are clear and understandabl	22	0.658
3	Using clinical information systems reduces likelihood of med	3	0.631
8	I am certain about the reliability of the information I get	8	0.602
44	The information in the system is always updated	44	0.533
5	If the clinical system is extended I would use it	5	0.527
6	Using clinical information systems increases my productivity	6	0.517
31	I could complete the job using the clinical information syst	31	0.475
9	Using clinical information systems facilitates better patien	9	0.445
12	People in my organization who use the clinical information s	12	0.362
24	My age has nothing to do with my ability to use the clinical	24	0.351
17	Interaction with the clinical information systems does not r	17	0.171
36	My ICT experience affects my use of the clinical information	36	0.102
25	My use of clinical information systems is entirely under my	25	-0.013
14	Using the clinical information systems is a status symbol in	14	-0.179
15	Patients/families believe clinical information systems use r	15	-0.244
42	Patients/families believe clinical information systems use i	42	-0.250
20	Using clinical information systems increases my chance of ge	20	-0.291
45	My use of the clinical information system is specific to the	45	-0.450
34	Using clinical information systems is easier than other comp	34	-0.552
37	People who influence my clinical behaviour think I should th	37	-0.798
41	People who are important to me think I should use the clinic	41	-0.867
4	Superiors at work think I should use the clinical informatio	4	-0.904
35	Patients/families like it when i use the clinical informati	35	-1.043
43	I hesitate to use the clinical information systems for fear	43	-1.124
30	My routine tasks prevent me from having time to use the clin	30	-1.213
13	The use of clinical information systems makes me apprehensiv	13	-1.241
46	The clinical information systems is not compatible with othe	46	-1.283
38	There are available resources to use the clinical infromatio	38	-1.347
11	Management support staff innovations on clinical information	11	-1.454
28	Management organise regular training on the use of clinical	28	-1.550
32	There is availability of technical assistance for clinical i	32	-1.551
40	My gender affects my use of the clinical information systems	40	-1.645
19	The senior management of this organization has been helpful	19	-1.738

D.11: Descending Array of Differences Between Factors 1 and 2

No.	Statement	No.	Type 1	Type 2	Difference
5	If the clinical system is extended I would use it	5	2.106	0.448	1.658
43	I hesitate to use the clinical information systems for fear	43	-0.191	-1.570	1.379
24	My age has nothing to do with my ability to use the clinical	24	1.743	0.606	1.137
8	I am certain about the reliability of the information I get	8	0.334	-0.752	1.086
14	Using the clinical information systems is a status symbol in	14	-1.102	-2.032	0.930
12	People in my organization who use the clinical information s	12	-0.561	-1.465	0.904
23	My use of clinical information systems is entirely voluntary	23	0.803	-0.061	0.864
15	Patients/families believe clinical information systems use r	15	0.530	-0.319	0.849
17	Interaction with the clinical information systems does not r	17	-0.503	-1.317	0.814
35	Patients/families like it when i use the clinical informati	35	0.257	-0.517	0.774
46	The clinical information systems is not compatible with othe	46	-0.291	-1.052	0.761
18	Not having the clinical information system in some departmen	18	0.407	-0.338	0.745
30	My routine tasks prevent me from having time to use the clin	30	-0.303	-0.985	0.682
27	I always look for opportunities to use the system whenever I	27	0.762	0.245	0.517
37	People who influence my clinical behaviour think I should th	37	0.505	0.076	0.428
1	It is easy to remember how to perform tasks with the clinica	1	0.559	0.167	0.392
41	People who are important to me think I should use the clinic	41	-0.012	-0.396	0.384
31	I could complete the job using the clinical information syst	31	0.200	-0.182	0.383
34	Using clinical information systems is easier than other comp	34	-0.222	-0.517	0.295
4	Superiors at work think I should use the clinical informatio	4	-0.294	-0.578	0.284
10	Using clinical information systems makes caring for patients	10	1.324	1.043	0.281
20	Using clinical information systems increases my chance of ge	20	-0.516	-0.674	0.158
13	The use of clinical information systems makes me apprehensiv	13	-1.414	-1.569	0.155
33	Clinical information systems improves work efficiency	33	1.395	1.330	0.065
29	Clinical Information systems are useful in the hospital	29	1.635	1.579	0.055
40	My gender affects my use of the clinical information systems	40	-1.511	-1.472	-0.039
2	Using clinical information systems improves patient care	2	1.367	1.452	-0.085
25	My use of clinical information systems is entirely under my	25	-0.743	-0.576	-0.167
45	My use of the clinical information system is specific to the	45	0.386	0.554	-0.168
42	Patients/families believe clinical information systems use i	42	0.102	0.281	-0.179
16	It is easy to get the system to do what I want it to do	16	-0.337	-0.060	-0.277
7	Using clinical information systems improves my performance	7	1.266	1.610	-0.345
26	It is easy for me to become skilful at using clinical inform	26	0.486	0.933	-0.447
21	The use of clinical information systems is pertinent to my v	21	0.010	0.457	-0.447
11	Management support staff innovations on clinical information	11	-1.650	-1.059	-0.591
44	The information in the system is always updated	44	-1.284	-0.679	-0.605
39	Using clinical information systems enables me to accomplish	39	0.723	1.374	-0.652
9	Using clinical information systems facilitates better patien	9	0.955	1.648	-0.692
3	Using clinical information systems reduces likelihood of med	3	0.032	0.727	-0.695
6	Using clinical information systems increases my productivity	6	0.510	1.416	-0.907
32	There is availability of technical assistance for clinical i	32	-1.566	-0.387	-1.179
28	Management organise regular training on the use of clinical	28	-2.164	-0.841	-1.323
36	My ICT experience affects my use of the clinical information	36	-0.314	1.257	-1.571
38	There are available resources to use the clinical infromatio	38	-1.319	0.403	-1.721
22	The clinical information systems are clear and understandabl	22	-0.696	1.093	-1.789
19	The senior management of this organization has been helpful	19	-1.403	0.701	-2.104

D.12: Descending Array of Differences Between Factors 1 and 3

No.	Statement	No.	Type 1	Type 3	Difference
15	Patients/families believe clinical information systems use r	15	0.530	-1.929	2.458
35	Patients/families like it when i use the clinical informati	35	0.257	-1.826	2.083
18	Not having the clinical information system in some departmen	18	0.407	-1.241	1.648
5	If the clinical system is extended I would use it	5	2.106	0.504	1.602
42	Patients/families believe clinical information systems use i	42	0.102	-1.126	1.228
45	My use of the clinical information system is specific to the	45	0.386	-0.569	0.956
2	Using clinical information systems improves patient care	2	1.367	0.412	0.955
10	Using clinical information systems makes caring for patients	10	1.324	0.409	0.914
12	People in my organization who use the clinical information s	12	-0.561	-1.393	0.832
20	Using clinical information systems increases my chance of ge	20	-0.516	-1.234	0.718
7	Using clinical information systems improves my performance	7	1.266	0.551	0.714
3	Using clinical information systems reduces likelihood of med	3	0.032	-0.630	0.662
9	Using clinical information systems facilitates better patien	9	0.955	0.359	0.596
46	The clinical information systems is not compatible with othe	46	-0.291	-0.884	0.593
37	People who influence my clinical behaviour think I should th	37	0.505	-0.019	0.523
40	My gender affects my use of the clinical information systems	40	-1.511	-2.008	0.497
1	It is easy to remember how to perform tasks with the clinica	1	0.559	0.072	0.487
4	Superiors at work think I should use the clinical informatio	4	-0.294	-0.751	0.458
24	My age has nothing to do with my ability to use the clinical	24	1.743	1.302	0.441
33	Clinical information systems improves work efficiency	33	1.395	1.283	0.112
43	I hesitate to use the clinical information systems for fear	43	-0.191	-0.292	0.101
29	Clinical Information systems are useful in the hospital	29	1.635	1.659	-0.024
44	The information in the system is always updated	44	-1.284	-1.149	-0.135
17	Interaction with the clinical information systems does not r	17	-0.503	-0.265	-0.238
21	The use of clinical information systems is pertinent to my v	21	0.010	0.258	-0.248
27	I always look for opportunities to use the system whenever I	27	0.762	1.031	-0.269
26	It is easy for me to become skilful at using clinical inform	26	0.486	0.856	-0.370
36	My ICT experience affects my use of the clinical information	36	-0.314	0.104	-0.419
41	People who are important to me think I should use the clinic	41	-0.012	0.407	-0.419
8	I am certain about the reliability of the information I get	8	0.334	0.917	-0.583
19	The senior management of this organization has been helpful	19	-1.403	-0.774	-0.629
31	I could complete the job using the clinical information syst	31	0.200	0.910	-0.709
6	Using clinical information systems increases my productivity	6	0.510	1.249	-0.739
34	Using clinical information systems is easier than other comp	34	-0.222	0.554	-0.776
38	There are available resources to use the clinical infromatio	38	-1.319	-0.520	-0.798
16	It is easy to get the system to do what I want it to do	16	-0.337	0.462	-0.799
39	Using clinical information systems enables me to accomplish	39	0.723	1.525	-0.802
14	Using the clinical information systems is a status symbol in	14	-1.102	-0.225	-0.876
13	The use of clinical information systems makes me apprehensiv	13	-1.414	-0.483	-0.931
22	The clinical information systems are clear and understandabl	22	-0.696	0.332	-1.028
28	Management organise regular training on the use of clinical	28	-2.164	-1.088	-1.075
23	My use of clinical information systems is entirely voluntary	23	0.803	1.928	-1.125
32	There is availability of technical assistance for clinical i	32	-1.566	-0.318	-1.248
11	Management support staff innovations on clinical information	11	-1.650	-0.394	-1.255
25	My use of clinical information systems is entirely under my	25	-0.743	0.586	-1.329
30	My routine tasks prevent me from having time to use the clin	30	-0.303	1.450	-1.753

D.13: Descending Array of Differences Between Factors 1 and 4

No.	Statement	No.	Type 1	Type 4	Difference
5	If the clinical system is extended I would use it	5	2.106	0.527	1.578
24	My age has nothing to do with my ability to use the clinical	24	1.743	0.351	1.392
37	People who influence my clinical behaviour think I should th	37	0.505	-0.798	1.303
35	Patients/families like it when i use the clinical informati	35	0.257	-1.043	1.300
46	The clinical information systems is not compatible with othe	46	-0.291	-1.283	0.992
43	I hesitate to use the clinical information systems for fear	43	-0.191	-1.124	0.933
30	My routine tasks prevent me from having time to use the clin	30	-0.303	-1.213	0.910
41	People who are important to me think I should use the clinic	41	-0.012	-0.867	0.855
45	My use of the clinical information system is specific to the	45	0.386	-0.450	0.836
15	Patients/families believe clinical information systems use r	15	0.530	-0.244	0.774
2	Using clinical information systems improves patient care	2	1.367	0.718	0.649
4	Superiors at work think I should use the clinical informatio	4	-0.294	-0.904	0.610
9	Using clinical information systems facilitates better patien	9	0.955	0.445	0.510
10	Using clinical information systems makes caring for patients	10	1.324	0.864	0.459
42	Patients/families believe clinical information systems use i	42	0.102	-0.250	0.352
19	The senior management of this organization has been helpful	19	-1.403	-1.738	0.335
34	Using clinical information systems is easier than other comp	34	-0.222	-0.552	0.329
40	My gender affects my use of the clinical information systems	40	-1.511	-1.645	0.134
38	There are available resources to use the clinical infromatio	38	-1.319	-1.347	0.028
23	My use of clinical information systems is entirely voluntary	23	0.803	0.802	0.001
6	Using clinical information systems increases my productivity	6	0.510	0.517	-0.008
32	There is availability of technical assistance for clinical i	32	-1.566	-1.551	-0.015
1	It is easy to remember how to perform tasks with the clinica	1	0.559	0.662	-0.103
29	Clinical Information systems are useful in the hospital	29	1.635	1.740	-0.105
33	Clinical information systems improves work efficiency	33	1.395	1.512	-0.117
7	Using clinical information systems improves my performance	7	1.266	1.407	-0.141
13	The use of clinical information systems makes me apprehensiv	13	-1.414	-1.241	-0.173
11	Management support staff innovations on clinical information	11	-1.650	-1.454	-0.196
20	Using clinical information systems increases my chance of ge	20	-0.516	-0.291	-0.225
8	I am certain about the reliability of the information I get	8	0.334	0.602	-0.268
31	I could complete the job using the clinical information syst	31	0.200	0.475	-0.275
26	It is easy for me to become skilful at using clinical inform	26	0.486	0.901	-0.415
36	My ICT experience affects my use of the clinical information	36	-0.314	0.102	-0.416
3	Using clinical information systems reduces likelihood of med	3	0.032	0.631	-0.599
28	Management organise regular training on the use of clinical	28	-2.164	-1.550	-0.614
18	Not having the clinical information system in some departmen	18	0.407	1.079	-0.672
21	The use of clinical information systems is pertinent to my v	21	0.010	0.683	-0.672
17	Interaction with the clinical information systems does not r	17	-0.503	0.171	-0.674
25	My use of clinical information systems is entirely under my	25	-0.743	-0.013	-0.729
39	Using clinical information systems enables me to accomplish	39	0.723	1.498	-0.775
12	People in my organization who use the clinical information s	12	-0.561	0.362	-0.923
14	Using the clinical information systems is a status symbol in	14	-1.102	-0.179	-0.923
27	I always look for opportunities to use the system whenever I	27	0.762	1.694	-0.932
16	It is easy to get the system to do what I want it to do	16	-0.337	0.803	-1.140
22	The clinical information systems are clear and understandabl	22	-0.696	0.658	-1.354
44	The information in the system is always updated	44	-1.284	0.533	-1.817

D.14: Descending Array of Differences Between Factors 2 and 3

No.	Statement	No.	Type 2	Type 3	Difference
15	Patients/families believe clinical information systems use r	15	-0.319	-1.929	1.610
19	The senior management of this organization has been helpful	19	0.701	-0.774	1.475
42	Patients/families believe clinical information systems use i	42	0.281	-1.126	1.406
3	Using clinical information systems reduces likelihood of med	3	0.727	-0.630	1.357
35	Patients/families like it when i use the clinical informati	35	-0.517	-1.826	1.309
9	Using clinical information systems facilitates better patien	9	1.648	0.359	1.288
36	My ICT experience affects my use of the clinical information	36	1.257	0.104	1.153
45	My use of the clinical information system is specific to the	45	0.554	-0.569	1.123
7	Using clinical information systems improves my performance	7	1.610	0.551	1.059
2	Using clinical information systems improves patient care	2	1.452	0.412	1.040
38	There are available resources to use the clinical infromatio	38	0.403	-0.520	0.923
18	Not having the clinical information system in some departmen	18	-0.338	-1.241	0.903
22	The clinical information systems are clear and understandabl	22	1.093	0.332	0.761
10	Using clinical information systems makes caring for patients	10	1.043	0.409	0.633
20	Using clinical information systems increases my chance of ge	20	-0.674	-1.234	0.559
40	My gender affects my use of the clinical information systems	40	-1.472	-2.008	0.536
44	The information in the system is always updated	44	-0.679	-1.149	0.469
28	Management organise regular training on the use of clinical	28	-0.841	-1.088	0.247
21	The use of clinical information systems is pertinent to my v	21	0.457	0.258	0.200
4	Superiors at work think I should use the clinical informatio	4	-0.578	-0.751	0.174
6	Using clinical information systems increases my productivity	6	1.416	1.249	0.168
37	People who influence my clinical behaviour think I should th	37	0.076	-0.019	0.095
1	It is easy to remember how to perform tasks with the clinica	1	0.167	0.072	0.095
26	It is easy for me to become skilful at using clinical inform	26	0.933	0.856	0.077
33	Clinical information systems improves work efficiency	33	1.330	1.283	0.047
5	If the clinical system is extended I would use it	5	0.448	0.504	-0.056
32	There is availability of technical assistance for clinical i	32	-0.387	-0.318	-0.068
12	People in my organization who use the clinical information s	12	-1.465	-1.393	-0.073
29	Clinical Information systems are useful in the hospital	29	1.579	1.659	-0.079
39	Using clinical information systems enables me to accomplish	39	1.374	1.525	-0.150
46	The clinical information systems is not compatible with othe	46	-1.052	-0.884	-0.168
16	It is easy to get the system to do what I want it to do	16	-0.060	0.462	-0.523
11	Management support staff innovations on clinical information	11	-1.059	-0.394	-0.665
24	My age has nothing to do with my ability to use the clinical	24	0.606	1.302	-0.696
27	I always look for opportunities to use the system whenever I	27	0.245	1.031	-0.787
41	People who are important to me think I should use the clinic	41	-0.396	0.407	-0.803
17	Interaction with the clinical information systems does not r	17	-1.317	-0.265	-1.052
34	Using clinical information systems is easier than other comp	34	-0.517	0.554	-1.071
13	The use of clinical information systems makes me apprehensiv	13	-1.569	-0.483	-1.086
31	I could complete the job using the clinical information syst	31	-0.182	0.910	-1.092
25	My use of clinical information systems is entirely under my	25	-0.576	0.586	-1.162
43	I hesitate to use the clinical information systems for fear	43	-1.570	-0.292	-1.277
8	I am certain about the reliability of the information I get	8	-0.752	0.917	-1.669
14	Using the clinical information systems is a status symbol in	14	-2.032	-0.225	-1.806
23	My use of clinical information systems is entirely voluntary	23	-0.061	1.928	-1.989
30	My routine tasks prevent me from having time to use the clin	30	-0.985	1.450	-2.435

D.15: Descending Array of Differences Between Factors 2 and 4

No.	Statement	No.	Type 2	Type 4	Difference
19	The senior management of this organization has been helpful	19	0.701	-1.738	2.439
38	There are available resources to use the clinical infromatio	38	0.403	-1.347	1.749
9	Using clinical information systems facilitates better patien	9	1.648	0.445	1.202
32	There is availability of technical assistance for clinical i	32	-0.387	-1.551	1.164
36	My ICT experience affects my use of the clinical information	36	1.257	0.102	1.155
45	My use of the clinical information system is specific to the	45	0.554	-0.450	1.003
6	Using clinical information systems increases my productivity	6	1.416	0.517	0.899
37	People who influence my clinical behaviour think I should th	37	0.076	-0.798	0.874
2	Using clinical information systems improves patient care	2	1.452	0.718	0.734
28	Management organise regular training on the use of clinical	28	-0.841	-1.550	0.709
42	Patients/families believe clinical information systems use i	42	0.281	-0.250	0.531
35	Patients/families like it when i use the clinical informati	35	-0.517	-1.043	0.526
41	People who are important to me think I should use the clinic	41	-0.396	-0.867	0.471
22	The clinical information systems are clear and understandabl	22	1.093	0.658	0.435
11	Management support staff innovations on clinical information	11	-1.059	-1.454	0.395
4	Superiors at work think I should use the clinical informatio	4	-0.578	-0.904	0.326
24	My age has nothing to do with my ability to use the clinical	24	0.606	0.351	0.255
46	The clinical information systems is not compatible with othe	46	-1.052	-1.283	0.231
30	My routine tasks prevent me from having time to use the clin	30	-0.985	-1.213	0.228
7	Using clinical information systems improves my performance	7	1.610	1.407	0.204
10	Using clinical information systems makes caring for patients	10	1.043	0.864	0.178
40	My gender affects my use of the clinical information systems	40	-1.472	-1.645	0.173
3	Using clinical information systems reduces likelihood of med	3	0.727	0.631	0.096
34	Using clinical information systems is easier than other comp	34	-0.517	-0.552	0.034
26	It is easy for me to become skilful at using clinical inform	26	0.933	0.901	0.032
15	Patients/families believe clinical information systems use r	15	-0.319	-0.244	-0.075
5	If the clinical system is extended I would use it	5	0.448	0.527	-0.079
39	Using clinical information systems enables me to accomplish	39	1.374	1.498	-0.123
29	Clinical Information systems are useful in the hospital	29	1.579	1.740	-0.161
33	Clinical information systems improves work efficiency	33	1.330	1.512	-0.182
21	The use of clinical information systems is pertinent to my v	21	0.457	0.683	-0.225
13	The use of clinical information systems makes me apprehensiv	13	-1.569	-1.241	-0.328
20	Using clinical information systems increases my chance of ge	20	-0.674	-0.291	-0.383
43	I hesitate to use the clinical information systems for fear	43	-1.570	-1.124	-0.446
1	It is easy to remember how to perform tasks with the clinica	1	0.167	0.662	-0.496
25	My use of clinical information systems is entirely under my	25	-0.576	-0.013	-0.562
31	I could complete the job using the clinical information syst	31	-0.182	0.475	-0.657
16	It is easy to get the system to do what I want it to do	16	-0.060	0.803	-0.863
23	My use of clinical information systems is entirely voluntary	23	-0.061	0.802	-0.864
44	The information in the system is always updated	44	-0.679	0.533	-1.213
8	I am certain about the reliability of the information I get	8	-0.752	0.602	-1.354
18	Not having the clinical information system in some departmen	18	-0.338	1.079	-1.417
27	I always look for opportunities to use the system whenever I	27	0.245	1.694	-1.449
17	Interaction with the clinical information systems does not r	17	-1.317	0.171	-1.488
12	People in my organization who use the clinical information s	12	-1.465	0.362	-1.827
14	Using the clinical information systems is a status symbol in	14	-2.032	-0.179	-1.853

D.16: Descending Array of Differences Between Factors 3 and 4

No.	Statement	No.	Type 3	Type 4	Difference
30	My routine tasks prevent me from having time to use the clin	30	1.450	-1.213	2.663
41	People who are important to me think I should use the clinic	41	0.407	-0.867	1.274
32	There is availability of technical assistance for clinical i	32	-0.318	-1.551	1.232
23	My use of clinical information systems is entirely voluntary	23	1.928	0.802	1.125
34	Using clinical information systems is easier than other comp	34	0.554	-0.552	1.106
11	Management support staff innovations on clinical information	11	-0.394	-1.454	1.060
19	The senior management of this organization has been helpful	19	-0.774	-1.738	0.964
24	My age has nothing to do with my ability to use the clinical	24	1.302	0.351	0.952
43	I hesitate to use the clinical information systems for fear	43	-0.292	-1.124	0.831
38	There are available resources to use the clinical infromatio	38	-0.520	-1.347	0.826
37	People who influence my clinical behaviour think I should th	37	-0.019	-0.798	0.780
13	The use of clinical information systems makes me apprehensiv	13	-0.483	-1.241	0.758
6	Using clinical information systems increases my productivity	6	1.249	0.517	0.731
25	My use of clinical information systems is entirely under my	25	0.586	-0.013	0.599
28	Management organise regular training on the use of clinical	28	-1.088	-1.550	0.461
31	I could complete the job using the clinical information syst	31	0.910	0.475	0.435
46	The clinical information systems is not compatible with othe	46	-0.884	-1.283	0.398
8	I am certain about the reliability of the information I get	8	0.917	0.602	0.315
4	Superiors at work think I should use the clinical informatio	4	-0.751	-0.904	0.152
39	Using clinical information systems enables me to accomplish	39	1.525	1.498	0.027
36	My ICT experience affects my use of the clinical information	36	0.104	0.102	0.003
5	If the clinical system is extended I would use it	5	0.504	0.527	-0.023
26	It is easy for me to become skilful at using clinical inform	26	0.856	0.901	-0.045
14	Using the clinical information systems is a status symbol in	14	-0.225	-0.179	-0.046
29	Clinical Information systems are useful in the hospital	29	1.659	1.740	-0.081
9	Using clinical information systems facilitates better patien	9	0.359	0.445	-0.086
45	My use of the clinical information system is specific to the	45	-0.569	-0.450	-0.120
33	Clinical information systems improves work efficiency	33	1.283	1.512	-0.229
2	Using clinical information systems improves patient care	2	0.412	0.718	-0.306
22	The clinical information systems are clear and understandabl	22	0.332	0.658	-0.326
16	It is easy to get the system to do what I want it to do	16	0.462	0.803	-0.341
40	My gender affects my use of the clinical information systems	40	-2.008	-1.645	-0.362
21	The use of clinical information systems is pertinent to my v	21	0.258	0.683	-0.425
17	Interaction with the clinical information systems does not r	17	-0.265	0.171	-0.436
10	Using clinical information systems makes caring for patients	10	0.409	0.864	-0.455
1	It is easy to remember how to perform tasks with the clinica	1	0.072	0.662	-0.590
27	I always look for opportunities to use the system whenever I	27	1.031	1.694	-0.662
35	Patients/families like it when i use the clinical informati	35	-1.826	-1.043	-0.783
7	Using clinical information systems improves my performance	7	0.551	1.407	-0.855
42	Patients/families believe clinical information systems use i	42	-1.126	-0.250	-0.876
20	Using clinical information systems increases my chance of ge	20	-1.234	-0.291	-0.942
3	Using clinical information systems reduces likelihood of med	3	-0.630	0.631	-1.261
44	The information in the system is always updated	44	-1.149	0.533	-1.682
15	Patients/families believe clinical information systems use r	15	-1.929	-0.244	-1.685
12	People in my organization who use the clinical information s	12	-1.393	0.362	-1.754
18	Not having the clinical information system in some departmen	18	-1.241	1.079	-2.320

D.17: Factor Q-Sort Values for Each Statement

No.	Statement	No.	Factor Arrays 1	2	3	4
1	It is easy to remember how to perform tasks with the clinica	1	2	0	0	2
2	Using clinical information systems improves patient care	2	4	5	1	3
3	Using clinical information systems reduces likelihood of med	3	0	2	-2	2
4	Superiors at work think I should use the clinical informatio	4	-1	-2	-2	-2
5	If the clinical system is extended I would use it	5	6	1	2	1
6	Using clinical information systems increases my productivity	6	2	4	4	1
7	Using clinical information systems improves my performance	7	4	5	2	4
8	I am certain about the reliability of the information I get	8	1	-3	3	1
9	Using clinical information systems facilitates better patien	9	3	6	1	0
10	Using clinical information systems makes caring for patients	10	4	3	1	3
11	Management support staff innovations on clinical information	11	-5	-4	-1	-4
12	People in my organization who use the clinical information s	12	-2	-4	-5	0
13	The use of clinical information systems makes me apprehensiv	13	-4	-5	-1	-3
14	Using the clinical information systems is a status symbol in	14	-3	-6	0	-1
15	Patients/families believe clinical information systems use r	15	2	0	-5	-1
16	It is easy to get the system to do what I want it to do	16	-2	0	1	3
17	Interaction with the clinical information systems does not r	17	-2	-4	-1	0
18	Not having the clinical information system in some departmen	18	1	-1	-4	4
19	The senior management of this organization has been helpful	19	-4	2	-3	-6
20	Using clinical information systems increases my chance of ge	20	-2	-2	-4	-1
21	The use of clinical information systems is pertinent to my v	21	0	1	0	2
22	The clinical information systems are clear and understandabl	22	-3	3	0	2
23	My use of clinical information systems is entirely voluntary	23	3	0	6	3
24	My age has nothing to do with my ability to use the clinical	24	5	2	4	0
25	My use of clinical information systems is entirely under my	25	-3	-2	2	0
26	It is easy for me to become skilful at using clinical inform	26	1	3	3	4
27	I always look for opportunities to use the system whenever I	27	3	1	3	5
28	Management organise regular training on the use of clinical	28	-6	-3	-3	-5
29	Clinical Information systems are useful in the hospital	29	5	5	5	6
30	My routine tasks prevent me from having time to use the clin	30	-1	-3	5	-3
31	I could complete the job using the clinical information syst	31	0	0	3	1
32	There is availability of technical assistance for clinical i	32	-5	-1	-1	-5
33	Clinical information systems improves work efficiency	33	5	4	4	5
34	Using clinical information systems is easier than other comp	34	-1	-1	2	-2
35	Patients/families like it when i use the clinical informati	35	1	-1	-5	-3
36	My ICT experience affects my use of the clinical information	36	-1	3	0	0
37	People who influence my clinical behaviour think I should th	37	2	0	0	-2
38	There are available resources to use the clinical infromatio	38	-4	1	-2	-4
39	Using clinical information systems enables me to accomplish	39	3	4	5	5
40	My gender affects my use of the clinical information systems	40	-5	-5	-6	-5
41	People who are important to me think I should use the clinic	41	0	-1	1	-2
42	Patients/families believe clinical information systems use i	42	0	1	-3	-1
43	I hesitate to use the clinical information systems for fear	43	0	-5	-1	-3
44	The information in the system is always updated	44	-3	-2	-4	1
45	My use of the clinical information system is specific to the	45	1	2	-2	-1
46	The clinical information systems is not compatible with othe	46	-1	-3	-3	-4

Variance = 9.391 St. Dev. = 3.065

D.18: Factor Q-Sort Values for Statements sorted by Consensus vs. Disagreement (Variance across Factor Z-Scores)

No.	Statement	No.	Factor Arrays 1	2	3	4
29	Clinical Information systems are useful in the hospital	29	5	5	5	6
33	Clinical information systems improves work efficiency	33	5	4	4	5
26	It is easy for me to become skilful at using clinical inform	26	1	3	3	4
40	My gender affects my use of the clinical information systems	40	-5	-5	-6	-5
4	Superiors at work think I should use the clinical informatio	4	-1	-2	-2	-2
21	The use of clinical information systems is pertinent to my v	21	0	1	0	2
1	It is easy to remember how to perform tasks with the clinica	1	2	0	0	2
39	Using clinical information systems enables me to accomplish	39	3	4	5	5
10	Using clinical information systems makes caring for patients	10	4	3	1	3
20	Using clinical information systems increases my chance of ge	20	-2	-2	-4	-1
46	The clinical information systems is not compatible with othe	46	-1	-3	-3	-4
31	I could complete the job using the clinical information syst	31	0	0	3	1
7	Using clinical information systems improves my performance	7	4	5	2	4
6	Using clinical information systems increases my productivity	6	2	4	4	1
13	The use of clinical information systems makes me apprehensiv	13	-4	-5	-1	-3
2	Using clinical information systems improves patient care	2	4	5	1	3
16	It is easy to get the system to do what I want it to do	16	-2	0	1	3
34	Using clinical information systems is easier than other comp	34	-1	-1	2	-2
37	People who influence my clinical behaviour think I should th	37	2	0	0	-2
41	People who are important to me think I should use the clinic	41	0	-1	1	-2
11	Management support staff innovations on clinical information	11	-5	-4	-1	-4
45	My use of the clinical information system is specific to the	45	1	2	-2	-1
28	Management organise regular training on the use of clinical	28	-6	-3	-3	-5
9	Using clinical information systems facilitates better patien	9	3	6	1	0
25	My use of clinical information systems is entirely under my	25	-3	-2	2	0
27	I always look for opportunities to use the system whenever I	27	3	1	3	5
17	Interaction with the clinical information systems does not r	17	-2	-4	-1	0
42	Patients/families believe clinical information systems use i	42	0	1	-3	-1
3	Using clinical information systems reduces likelihood of med	3	0	2	-2	2
24	My age has nothing to do with my ability to use the clinical	24	5	2	4	0
43	I hesitate to use the clinical information systems for fear	43	0	-5	-1	-3
36	My ICT experience affects my use of the clinical information	36	-1	3	0	0
32	There is availability of technical assistance for clinical i	32	-5	-1	-1	-5
8	I am certain about the reliability of the information I get	8	1	-3	3	1
22	The clinical information systems are clear and understandabl	22	-3	3	0	2
5	If the clinical system is extended I would use it	5	6	1	2	1
23	My use of clinical information systems is entirely voluntary	23	3	0	6	3
38	There are available resources to use the clinical infromatio	38	-4	1	-2	-4
44	The information in the system is always updated	44	-3	-2	-4	1
12	People in my organization who use the clinical information s	12	-2	-4	-5	0
14	Using the clinical information systems is a status symbol in	14	-3	-6	0	-1
35	Patients/families like it when i use the clinical informati	35	1	-1	-5	-3

18	Not having the clinical information system in some departmen	18	1	-1	-4	4
15	Patients/families believe clinical information systems use r	15	2	0	-5	-1
19	The senior management of this organization has been helpful	19	-4	2	-3	-6
30	My routine tasks prevent me from having time to use the clin	30	-1	-3	5	-3

D.19: Standard Errors for Differences in Factor Z-Scores

(Diagonal Entries Are S.E. Within Factors)

Factors	1	2	3	4
1	0.263	0.263	0.273	0.255
2	0.263	0.263	0.273	0.255
3	0.273	0.273	0.283	0.265
4	0.255	0.255	0.265	0.246

D.20: Distinguishing Statements for Factor 1

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors					
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
5	If the clinical system is extended I would use it	5	6	2.11*	1	0.45	2	0.50	1	0.53
9	Using clinical information systems facilitates better patien	9	3	0.96	6	1.65	1	0.36	0	0.45
39	Using clinical information systems enables me to accomplish	39	3	0.72	4	1.37	5	1.52	5	1.50
15	Patients/families believe clinical information systems use r	15	2	0.53*	0	-0.32	-5	-1.93	-1	-0.24
18	Not having the clinical information system in some departmen	18	1	0.41*	-1	-0.34	-4	-1.24	4	1.08
35	Patients/families like it when i use the clinical informati	35	1	0.26*	-1	-0.52	-5	-1.83	-3	-1.04
3	Using clinical information systems reduces likelihood of med	3	0	0.03	2	0.73	-2	-0.63	2	0.63
46	The clinical information systems is not compatible with othe	46	-1	-0.29	-3	-1.05	-3	-0.88	-4	-1.28
30	My routine tasks prevent me from having time to use the clin	30	-1	-0.30*	-3	-0.98	5	1.45	-3	-1.21
12	People in my organization who use the clinical information s	12	-2	-0.56*	-4	-1.47	-5	-1.39	0	0.36
22	The clinical information systems are clear and understandabl	22	-3	-0.70*	3	1.09	0	0.33	2	0.66
14	Using the clinical information systems is a status symbol in	14	-3	-1.10*	-6	-2.03	0	-0.23	-1	-0.18
28	Management organise regular training on the use of clinical	28	-6	-2.16	-3	-0.84	-3	-1.09	-5	-1.55

D.21: Distinguishing Statements for Factor 2

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors					
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
9	Using clinical information systems facilitates better patien	9	3	0.96	6	1.65*	1	0.36	0	0.45
36	My ICT experience affects my use of the clinical information	36	-1	-0.31	3	1.26*	0	0.10	0	0.10
19	The senior management of this organization has been helpful	19	-4	-1.40	2	0.70*	-3	-0.77	-6	-1.74
38	There are available resources to use the clinical infromatio	38	-4	-1.32	1	0.40*	-2	-0.52	-4	-1.35
27	I always look for opportunities to use the system whenever I	27	3	0.76	1	0.24	3	1.03	5	1.69
23	My use of clinical information systems is entirely voluntary	23	3	0.80	0	-0.06*	6	1.93	3	0.80
18	Not having the clinical information system in some departmen	18	1	0.41	-1	-0.34*	-4	-1.24	4	1.08
35	Patients/families like it when i use the clinical informati	35	1	0.26	-1	-0.52	-5	-1.83	-3	-1.04
8	I am certain about the reliability of the information I get	8	1	0.33	-3	-0.75*	3	0.92	1	0.60
17	Interaction with the clinical information systems does not r	17	-2	-0.50	-4	-1.32*	-1	-0.26	0	0.17
14	Using the clinical information systems is a status symbol in	14	-3	-1.10	-6	-2.03*	0	-0.23	-1	-0.18

D.22: Distinguishing Statements for Factor 3

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors					
			1		2		3	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
23	My use of clinical information systems is entirely voluntary	23	3	0.80	0	-0.06	6	1.93*
30	My routine tasks prevent me from having time to use the clin	30	-1	-0.30	-3	-0.98	5	1.45*
25	My use of clinical information systems is entirely under my	25	-3	-0.74	-2	-0.58	2	0.59
34	Using clinical information systems is easier than other comp	34	-1	-0.22	-1	-0.52	2	0.55*
7	Using clinical information systems improves my performance	7	4	1.27	5	1.61	2	0.55*
11	Management support staff innovations on clinical information	11	-5	-1.65	-4	-1.06	-1	-0.39
13	The use of clinical information systems makes me apprehensiv	13	-4	-1.41	-5	-1.57	-1	-0.48*
38	There are available resources to use the clinical infromatio	38	-4	-1.32	1	0.40	-2	-0.52*
3	Using clinical information systems reduces likelihood of med	3	0	0.03	2	0.73	-2	-0.63
19	The senior management of this organization has been helpful	19	-4	-1.40	2	0.70	-3	-0.77
42	Patients/families believe clinical information systems use i	42	0	0.10	1	0.28	-3	-1.13*
20	Using clinical information systems increases my chance of ge	20	-2	-0.52	-2	-0.67	-4	-1.23
18	Not having the clinical information system in some departmen	18	1	0.41	-1	-0.34	-4	-1.24*
35	Patients/families like it when i use the clinical informati	35	1	0.26	-1	-0.52	-5	-1.83*
15	Patients/families believe clinical information systems use r	15	2	0.53	0	-0.32	-5	-1.93*

			4	
No.	Statement	No.	Q-SV	Z-SCR
23	My use of clinical information systems is entirely voluntary	23	3	0.80
30	My routine tasks prevent me from having time to use the clin	30	-3	-1.21
25	My use of clinical information systems is entirely under my	25	0	-0.01
34	Using clinical information systems is easier than other comp	34	-2	-0.55
7	Using clinical information systems improves my performance	7	4	1.41
11	Management support staff innovations on clinical information	11	-4	-1.45
13	The use of clinical information systems makes me apprehensiv	13	-3	-1.24
38	There are available resources to use the clinical infromatio	38	-4	-1.35
3	Using clinical information systems reduces likelihood of med	3	2	0.63
19	The senior management of this organization has been helpful	19	-6	-1.74
42	Patients/families believe clinical information systems use i	42	-1	-0.25
20	Using clinical information systems increases my chance of ge	20	-1	-0.29
18	Not having the clinical information system in some departmen	18	4	1.08
35	Patients/families like it when i use the clinical informati	35	-3	-1.04
15	Patients/families believe clinical information systems use r	15	-1	-0.24

D.23: Distinguishing Statements for Factor 4

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors							
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
27	I always look for opportunities to use the system whenever I	27	3	0.76	1	0.24	3	1.03	5	1.69
18	Not having the clinical information system in some departmen	18	1	0.41	-1	-0.34	-4	-1.24	4	1.08*
44	The information in the system is always updated	44	-3	-1.28	-2	-0.68	-4	-1.15	1	0.53*
12	People in my organization who use the clinical information s	12	-2	-0.56	-4	-1.47	-5	-1.39	0	0.36*
25	My use of clinical information systems is entirely under my	25	-3	-0.74	-2	-0.58	2	0.59	0	-0.01
37	People who influence my clinical behaviour think I should th	37	2	0.50	0	0.08	0	-0.02	-2	-0.80*
35	Patients/families like it when i use the clinical informati	35	1	0.26	-1	-0.52	-5	-1.83	-3	-1.04

D.24: Consensus Statements -- Those That Do Not Distinguish Between ANY Pair of Factors.

All Listed Statements are Non-Significant at P>.01, and Those Flagged With an * are also Non-Significant at P>.05.

			Factors							
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
1	It is easy to remember how to perform tasks with the clinica	1	2	0.56	0	0.17	0	0.07	2	0.66
4	Superiors at work think I should use the clinical informatio	4	-1	-0.29	-2	-0.58	-2	-0.75	-2	-0.90
26*	It is easy for me to become skilful at using clinical inform	26	1	0.49	3	0.93	3	0.86	4	0.90
29*	Clinical Information systems are useful in the hospital	29	5	1.63	5	1.58	5	1.66	6	1.74
33*	Clinical information systems improves work efficiency	33	5	1.40	4	1.33	4	1.28	5	1.51
40	My gender affects my use of the clinical information systems	40	-5	-1.51	-5	-1.47	-6	-2.01	-5	-1.65