



Faculty of Sciences

Department of Computer of Science and Information Systems

EXAMINING NURSES' ACCEPTANCE AND USE OF ELECTRONIC HEALTH RECORDS IN RESOURCE- LIMITED HEALTHCARE SETTINGS

by

OABILE LESLEY OTHUSITSE

Student ID number: 18100039

BSc (HONS) in Electronic-Commerce (Staffordshire University)

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Supervisor(s): Dr, Malatsi Galani (Primary), Dr Tshiamo Sigwele (Core)

Department of Computer of Science and Information Systems,
Faculty of Science, BIUST

galanim@biust.ac.bw, (+267 4931106), sigwelet@biust.ac.bw (+267 4931109)

December, 2022

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Candidate (please write in caps or type) OABILE LESLEY OTHUSITSE

Student ID: 18100039

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Dr. Tshiamo Sigwele
(Supervisor)

Date: 30/05/2023

DEDICATION

This work is dedicated to my God, El-Shaddai El-Elyon na Adonai, YHWH for I commit to the Lord in whatever I do, and He establishes my plans. I completed this work through Him who strengthens me. This work is also dedicated to my best friend ***Leah Boitshoko***, my gift from God, for her unwavering support and guidance through this thing called life.

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ABSTRACT

Background: Electronic health records were introduced to revolutionize record keeping in healthcare. When used as intended, EHRs have been reported to improve patient care and care coordination, improve data integrity, and enable easy exchange of information between authorized users. However, achieving these benefits heavily relies on acceptance and use.

Purpose: The aim of this study is to identify, understand and examine factors that influence nurses' behavioural intention, and actual usage behaviour of EHRs in resource-limited settings. Also, there is a need to explore nurses' perceptions of the comfort levels, barriers, and facilitators to EHRs use to better understand acceptance and use in resource-limited settings.

Methodology: A cross-sectional study was conducted to explore the perception of nurses about EHRs using a convergent mixed-methods design to collect quantitative and qualitative data. A research questionnaire was administered to a total of 193 nurses in 54 healthcare facilities across eight DHMTs in Botswana's resource-limited settings. The collected data was analyzed using SPSSv26 and NVIVO software.

Findings: The findings identified individual, technological, and organizational characteristics as factors influencing nurses' behavioural intentions, comfort levels, and actual user behaviour. In addition, this study found the influence of moderators on the main study variables. Lastly, this study also identified barriers to EHRs use and reasons why nurses use EHRs in resource-limited settings within Botswana.

Conclusion: The findings of this study highlighted the need for the involvement of nurses in the development of EHRs and for nursing institutions to add EHRs education to nursing curricula to produce EHRs usage-ready graduates. Since technological issues arose, this study also emphasized the need for dedicated IT personnel to curb support and maintenance deterrents. There is also a need for health facilities to employ more nurses or EHRs dedicated personnel to ease the problem of workload and understaffing to the improvement EHRs utilization.

Keywords: electronic health records, behavioural intention, acceptance, usage behaviour, utilization, resource-limited settings.

LIST OF ABBREVIATIONS

EHRs:	Electronic Health Records
EMRs	Electronic Medical Records
MoH	Ministry of Health
DHMT	District Health Management Team
RLHF's	Resource-Limited Healthcare Facilities
IPMS	Integrated Patient Management System
PIMS	Patient Information Management System
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
TPB	Theory of Planned behaviour
UTAUT	Unified Theory of Acceptance and Use of Technology
MPCU	Model of Personal Computer Awareness
IDT	Innovation Diffusion Theory
DTPB	Decomposed Theory of Planned Behaviour
C-TAM-TPB	Combined TAM & TPB
TIB	Theory of Interpersonal Behaviour (TIB)
MM	Motivational Model
SCT	Social Cognitive Theory
IS	Information Systems
HM	Hedonic Motivation
PV	Price Value
HT	Habit
PU	Perceived usefulness
PEOU	Perceived Ease of Use
PE	Performance Expectancy
EE	Effort Expectancy
SI	Social Influence
ATT	Attitude
FC	Facilitating Conditions
CA	Computer Anxiety
CSE	Computer Self-Efficacy
RC	Resistance to Change
PI	Personal Innovativeness
BI	Behavioural Intention
BIU	Behavioural Intention to Use
AC	Actual Use
UB	Use Behaviour
DR	Demonstrability of Results
CVI	Content Validity Index

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1 CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 Introduction

The purpose of this chapter is to describe the concept of electronic health records in the healthcare system, provide background and insight into the structure of the healthcare system in Botswana and how electronic health records were adopted in Botswana. This chapter also presents an overview of the association between intention and actual user behaviour, a brief comparison of the most common theoretical frameworks, an insight into the problem this study seeks to address, and the organization this body of work.

1.2 Electronic Health Records in the Health System

Electronic health records (EHRs) are digital patient data storage systems that allow data exchange and access through authorized system use [1], [2]. Since EHRs are paperless, nurses are required to enter patient medical data into an information system for storage and dissemination [3]. EHRs are mainly used to organize patient care by documenting patients' needs per visit, the care provided and the relative results of the care provided to a patient by a nurse. [1], [4], [5]. As a result, stored patient data can be retrieved, viewed, and shared by authorized personnel. In addition, EHRs are used to generate legible and structured patient data records for easy access in a digital format [6]. This is in direct contrast to manual paper-based methods, which consume huge space and significantly delay access to patient and clinical data [7]. EHRs allow instant retrieval of records for logical and consistent access across a health care facility while improving healthcare practices and reducing errors [8]. Therefore, the acceptance and use of EHRs in healthcare settings have revolutionized data storage and communication by optimizing healthcare documentation processes [7].

Although electronic health records decrease errors, they improve efficiency and quality of service [5], [9], but some nurses have been found to revert to using paper-based medical recording systems [10]. The move from paper-based records to EHRs in healthcare has raised difficulties to accept the use of technology and behaviour concerns in healthcare [11]. Consequently, research has indicated low EHRs adoption rates [12] owing to individual, technological and organizational factors [13], [14]. Despite deterrents such as technology and

efficacy, nurses' willingness to adopt electronic health records has been stated to have a sizeable effect [15]. In addition, studies have also revealed that upon implementation, nurses may find it challenging to gain the necessary proficiency in EHR functionalities and this may lead to underutilization [16]. Furthermore, some studies show that nurses' resistance to the use of EHRs in healthcare may be motivated by their perceptions of EHR systems being a threat, and it may also be due to some technological incompatibility with their work [17], [18].

Nurses' acceptance and use of EHRs plays an important role in achieving the benefits associated with EHRs implementation [19]. Because nurses' perceptions on EHRs usage may differ amongst individual nurses or between groups [20], [21], it is important to examine factors influencing EHR acceptance and use. It is also important to study the complex individual, technical and social or organizational interactions between users of EHR systems and technology [22]. This study applies the modified Unified Theory of Acceptance and Use of Technology (UTAUT) [23] to explore the phenomenon of nurses' acceptance and use of electronic health records. This model incorporates eight different technology acceptance theories to present a holistic view of the nurses' acceptance and use of EHRs [24] in Botswana's public health facilities in resource-limited settings.

1.3 Background

Healthcare in Botswana

Botswana's healthcare is managed through public, private-for-profit, private-for-non-profit and traditional medical practice [25]. In addition to the available public health facilities, private hospitals, mine hospitals and non-governmental organizations, the Botswana Defence Force (BDF), Police and Prison Services also provide health care to distinctive groups [25]–[27]. Botswana's public healthcare system consists of 894 mobile health posts, 357 health posts, 290 clinics, 17 primary hospitals, 15 district hospitals and 3 referral hospitals [27], [28] spread over 29 districts [25],[27]. These facilities serve a population of more than 2.2 million people spread over 582000 km² and it is estimated that more than 40% of the population reside in rural areas [27].

Within the public sector, the Ministry of Health (MoH) is accountable for designing health policies, norms, standards, regulations and for providing health services to the general population [26]. Before 2010, the MoH was only responsible for hospital services, while the

Ministry of Local Government was mandated with overseeing health services provided by clinics, mobile stops, and health posts. However, the Botswana public health system was restructured in 2010, giving the MoH sole responsibility of healthcare in Botswana at all levels of healthcare [28]. The MoH provides health care through District Health Management Teams (DHMTs) that manage a sizable network of healthcare facilities such as clinics, referral hospitals, primary hospitals, health posts, and mobile stop clinics [23],[25].

Electronic Health Records in Botswana

Information technology (IT) is seen as the answer to information management, and over the years we have seen an increase in the implementation of electronic health record (EHR) systems worldwide due to their perceived benefits [30]. Botswana equipped its public health facilities with modern tools and systems [26] after committing to invest in e-Health to improve health care delivery [30], [31]. Botswana's recognition of the importance of EHRs led to the implementation of digital systems that are used for tracking patient care and patient reporting systems through initiatives for effective information communication technologies, such as Integrated Patient Management System (IPMS) and Patient Information Management System (PIMS II) [31]. The move from paper-based medical record systems to EHRs began when IPMS was first introduced in 2 referral hospitals, 2 primary hospitals, and 16 clinics by the Ministry of Health and Wellness in collaboration with Medical Technology Incorporated (MEDITECH) [30], [32]. By 2016, IPMS was implemented in 27 hospitals, and paper-medical cards were converted to an electronic format in a quest to improve health care delivery [33]. In addition to patient care and administrative use of healthcare facilities, EHRs have been implemented in Botswana for healthcare planning and epidemiology [30], cost reduction, improved and organized work practices, data integrity in public health clinics, and to minimize disparities in the quality of care given [34].

Although medical record officers were trained in health informatics to accelerate the adoption and acceptance of EHRs [25], [33], the implementation of IPMS quickly led to acceptance issues [33]. Various circumstances that are unique to developing countries contribute to the limited adaptation of EHRs [35]. Studies point to human capacity, limited skilled personnel, limited resources and poor infrastructure gaps as persistent deterrents to use of EHRs in Botswana [25], [28], [30], [36]. In addition, it has been found that some officers operating EHRs are unqualified due to lack of training [36]. As a result, IPMS has been found to be

underutilized in certain hospitals and clinics with poorly maintained records [30], [33]. Research also found that due to understaffing, nurses and doctors did not have time to consistently input patient information in IPMS, while other medical practitioners stated that they experienced discomforts with the general use of computers compared to the old paper-based medical recording systems [33]. In addition, other studies indicated incomplete, unreliable and poorly maintained information with poor integration, leading to data redundancy as nurses kept both paper and electronic records [37]. Furthermore, public health caregivers are not always trained or available to utilize EHRs [26]. The current status has revealed difficulties related to collection and combination of data, analysis, interpretation, and dissemination in public health clinics. Due to the underutilization of EHRs by nurses, patient health data is poorly captured, and at times it is not captured in the database. There is lack of use of recorded information which undermines information quality, which also limits the usefulness of the system [26]. Lastly, shortage of trained and qualified personnel affects the acceptance and meaningful use of EHRs in public health facilities [38], [39].

1.4 Intention-Behaviour Relationship

The correlation between the conveyed attitudes and enacted behaviours following the expression of attitudes has been a topic of interest in modern psychology [40]. Research has revealed that individuals with low self-control generally exhibit a strong connection between expressed attitudes and enacted behaviours than individuals with high self-control [41], [42]. Intention has previously been linked to determination in that the formation of intention led to the creation of determination, which then prompts an individual to exhibit a behaviour [40]. However, this was later criticized when the concept of intentions as needs came into play. This concept highlights that intentions, like needs, can influence an individual's subsequent behaviour [43].

Numerous intention-behaviour theories have been advanced to expound human behaviour and the factors that influence clinical practice [44]. Clinical practice is regarded as a set of human conduct that is closely associated with the delivery of interventions and is directly influenced by the motivational inclination of the user of a system [45], [46]. Furthermore, studies reiterate that, intentions are closely linked to an individual's actual engagement in a particular behaviour [40], [47]–[49]. Moreover, studies examining nurses' behavioural intention in relation to EHRs usage further pointed out that intentions determine actual behaviour on the use of EHRs with these predictions accounting for 28.2%-58% in actual behaviour variance [45], [50], [51].

1.5 Nurses' Behavioural Intention to use EHRs

Research highlights nurses' behavioural intention to use EHRs as an important factor in actual use behaviour [52]. Consequently, the low intention of nurses to use EHRs has been suggested as an influence that directly contributes to the EHRs underutilization [53]–[58]. The complex correlation between technological and social issues has been identified as some of the causes of a decrease in behavioural intentions to use EHRs [34], [58]. In addition, other studies found that variables that affect behavioural intentions may be grouped into individual, technological, and organizational factors [59], [60]. Empirical evidence from previous research suggests that examples of individual factors that influence behavioural intention include nurses' age, experience, computer efficacy, and attitude towards the use of EHRs in their work environment [53], [61], [62]. In addition, there are some technological factors influencing nurses behavioural intentions and according to research these are related to complexity of EHRs, EHRs design, interoperability and compatibility with other existing clinical information systems as factors that affect nurses' behavioural intention [53], [54], [63]. Furthermore, training, support and maintenance have been found to effect nurses' behavioural intentions from an organizational and environmental perspective [62], [63].

1.6 Intention Behaviour Models

Since the advent of computers and information technology, numerous investigations have been carried out on the use of technology [64]. In addition, numerous models and theories of intentions and behaviour have been developed to better explain the end-user decision making process regarding the use of technology [64], [65]. Some of the most used technology acceptance models are:

1. Extended Theory of Reasonable action (Extended-TRA)
2. The technology Acceptance Model 3 (TAM 3)
3. The Modified Unified Theory of Acceptance and Use of Technology (Modified UTAUT)
4. Integrated Model

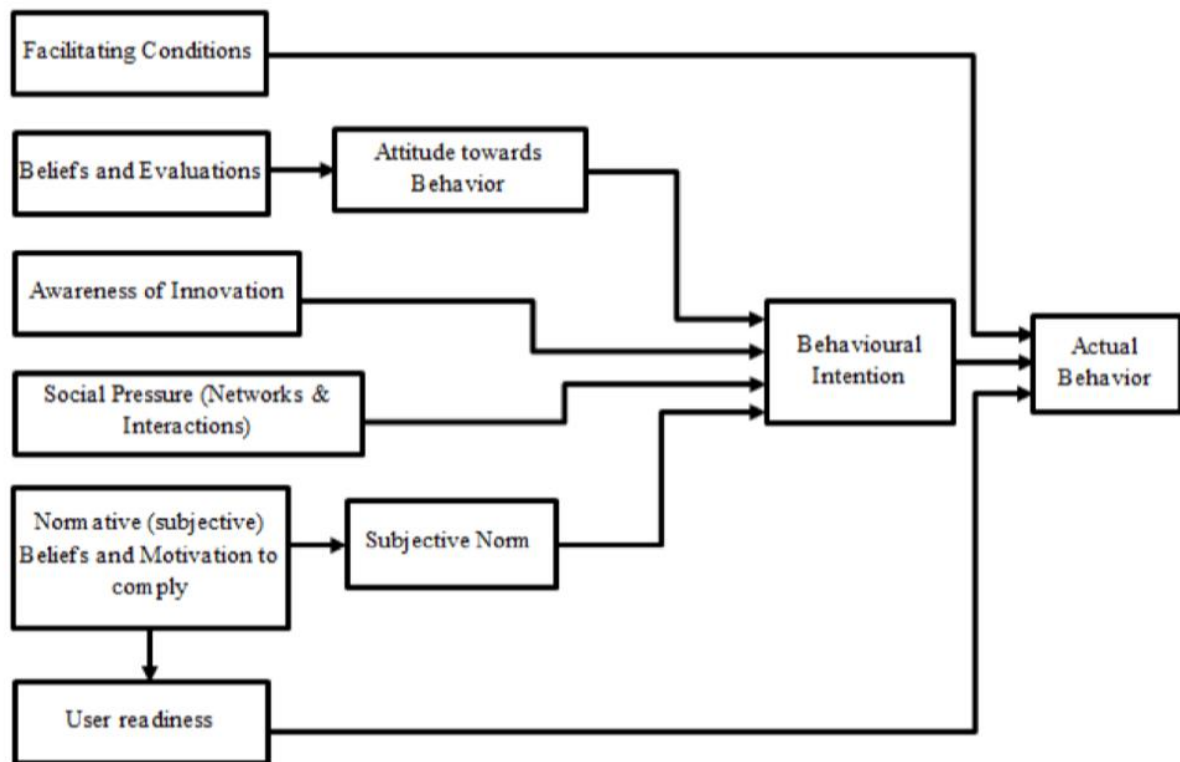
1.7 Theoretical Frameworks

Table 1: Theoretical Frameworks

Theoretical Framework / Model	Factors Affecting Intent to Use Information Technology
Extended Theory of Reasoned Action (Extended TRA) [66]	• Facilitating Conditions • Beliefs and Evaluations moderating Attitude towards Behaviour • Awareness of Innovation • Social Pressure (Network & Interactions) • Normative (Subjective Beliefs & Motivation to Comply) moderating Subjective Norm • User Readiness • Behavioural Intention • Actual Use
Technology Acceptance Model 3 (TAM 3) [67]	• Perceived Usefulness • Subjective Norm, • Image, Job Relevance, Output quality, Result Demonstrability Moderating Perceived Usefulness • Experience, Voluntariness • Perceived Ease of Use • Computer Self-efficacy, Perceptions of External Control, Computer Anxiety, Computer playfulness moderating Perceived Ease of Use • Perceived Enjoyment, • Objective Usability
The Modified Unified Theory of Acceptance and Use of Technology (Modified UTAUT) [68]	• Effort expectancy • Performance expectancy • Social influence • Facilitating conditions Moderated by: age, gender, experience, voluntariness of use
INTEGRATED MODEL [69]	• Perceived Usefulness • Perceived Ease of Use • Personal Identity • Social Norm • Professional Norm • Computer Self-Efficacy • Demonstrability of Results • Information about Change • Resistance to Change

Extended Theory of Reasoned Action (E-TRA)

Figure 1: Extended Theory of Reasoned Action



[66]

The original Theory of Reasoned Action (TRA) [47] was established to describe the connection that exists between attitudes, beliefs, norms, behavioural intention and individual enactment of actual behaviour [66]. Extended TRA assesses behavioural intention by considering an individual's attitude and subjective norms. Behavioural intention is influenced by a system user's *attitude towards the behaviour*, that is, a potential user's individual beliefs and perceptions of the potential results of indulging in a behaviour [70]. This model also states that, behavioural intention is also induced by the *subjective norm*, which translates to a potential user's individual perspective on the social influences that may influence their intention or performance [71].

However, additional constructs were added to TRA to increase the effectiveness of the model. These constructs include the following; Facilitating Conditions, Beliefs and Evaluations, Awareness of Innovation, Social Pressure (Networks and Interactions), Normative (Subjective) Beliefs and Motivation to Comply and User Readiness [66].

“**Facilitating Conditions (FC)**: this is defined as the degree of believing in the existence of the technical and organizational infrastructure to support the usage of a new technology” [72]. Although a user’s **attitude towards a behaviour** is directly influenced by their personal **Beliefs and Evaluations** on the behaviour, the subjective norm of an individual is influenced by whether or not those who are important to an individual approve of the behaviour; **normative (subjective) beliefs**. This is generally weighted by a person’s **incentive to conform** with referents’ opinions and **user readiness** to enact a behaviour [66]. The logical basis for **Social Pressure (Networks and Interactions)** is that an individual may decide to exhibit a certain behaviour even if they do not value that behaviour or its results, but they only engage in that behaviour to please their valued referents [73].

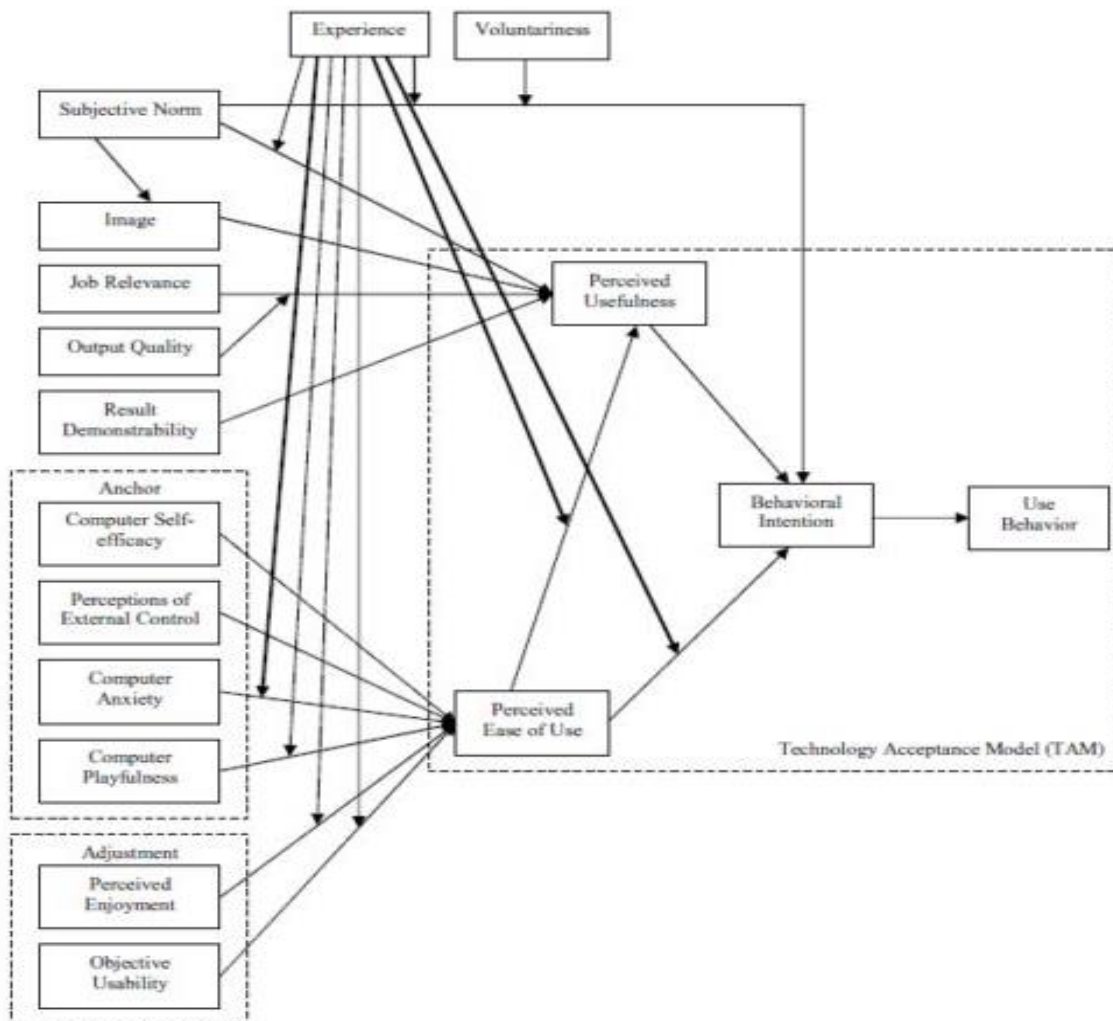
Technology readiness (TR) denotes populaces' proclivity to adopt new technology for personal and work purposes [74]. **Behavioural intention** refers to the likelihood that a person will indulge in a behaviour, while **actual behaviour** is an individual’s post purchase indulgence patterns with an information system [75]. In extended TRA, intention is determined through one’s attitude, awareness of innovation, social pressure (networks and interactions) and subjective norm. On the other hand, this model posits that actual behaviour is influenced by facilitating conditions, behavioural intention and user readiness [66].

Limitations:

- This model works under the assumptions that the evaluated constructs or behaviours are under voluntary control and does not account for behavioural factors that are not under voluntary control [72], [73].
- This model was validated using a very small sample size of 50 participants [66].

Technology Acceptance Model 3 (TAM3)

Figure 2: Technology Acceptance Model (TAM 3)



[67]

Technology Acceptance Model (TAM) delivers a framework that is based on user intent [76], which was developed by Davis [77]. TAM presents a model that seeks to describe and predict the behavioural intent of a potential information technology user to use a particular technological system, based on the TRA and the TPB [78]. TAM was proposed for consideration by Davis in 1986 [79] to assess and address the rationale for prospective technology end-users rejecting or accepting new technologies [79]. TAM proposes that behavioural intention is determined by a potential user's perceived usefulness and perceived ease of use of information technology [80]–[82]. With additional constructs, TAM evolved into TAM3 [67] as a combination of TAM2 [73] along with the determinants of the perceived ease of use [83]. Self-Efficacy, perceptions of external control, anxiety, and playfulness are

theorized in TAM3 to predict inceptive believes pertaining the ease of information systems usability.

Perceived Usefulness

Perceived usefulness refers to “the degree to which a person believes that using a particular system would enhance his or her job performance” [82]. Individuals are more likely to choose electronic health systems when they believe these systems will aid them to accomplish their job task faster or achieve efficiency.

Perceived Ease of Use

Perceived Ease of Use: this is “the degree to which a person believes that using a particular system would be free of effort” [82]. Preliminary studies have shown that the likelihood that prospective end-users accept and use new technology depends on their discernment the associated ease of system use. Therefore, when technology users view it as user-friendly, they tend to invest time in learning more system functionalities and decide to continually use the technology [81].

Social Influence Processes

- i. **Subjective Norm:** an individual’s behaviour is influenced by their perception of what those important to them think about that particular behaviour [73]. Although a study conducted by Mathieson shows no significant effect of subjective norm [84], a study conducted by Todd revealed a remarkable influence of subjective norm on behavioural intention [85].
- ii. **Voluntariness & Compliance with Social Influence:** subjective norm has been shown to influence behavioural intention more in obligatory settings than in voluntary settings [86]. The concept of direct compliance to the subjective norm comes into effect when a system user realises that a social actor requires them to exhibit a behaviour, followed by a reward or punishment for non-compliance [87], [88].
- iii. **Image and Social Influence:** Image is "the degree to which use of an innovation is perceived to enhance one's status in one's social system" [89]. People generally strive to create and maintain a favourable outlook or image amongst their peers in their **social** group due to the social normative effects experienced [73], [87].

- iv. **Experience:** before the development and implementation of technologies, the subjective norm has a strong influence on behavioural intent. This is because, prior to system implementation, users' credence and knowledge about the system is vague, so they tend to rely on what others in their social circle have to say about the system to form a basis of behavioural intent. However, the normative effect diminishes over time after system implementation as now users can base their intent on direct experience of system usage [73], [90]–[92].

Cognitive Instrumental Processes

- i. **Job Relevance:** this is a user's perception how relevant a proposed system is to their job description. A user will assess the importance of a system and how it is applicable to individual elements of their job description in order to form an opinion on how relevant the proposed system is [73], [93].
- ii. **Output quality:** User perception of output quality is a construct that bases its premise on how relevant a system is to accomplish the tasks of a particular job. This also has to do with how well the system in question performs certain functions to warrant its use, and consequently intent to use [73].
- iii. **Result Demonstrability** is the “tangibility of the results of using the innovation” [89]. Since this construct is about identifying the direct gains of using a system, systems in which users have difficulty identifying job performance benefits from will fall out of favour [73].

Self-Efficacy: a person's discernment about their own capability to complete their job. This is a significant factor in the adoption of technology as it has been established to have a positive effect on perceived ease of use [94].

Perceptions of External Control: this is the individual perceptions about the technical and organizational tools that are available to aid users or to support and enable seamless use of a system [74]. This is an essential variable that affects acceptance and has been shown to positively affect users' views about the ease of use of a system.

Computer anxiety: this is the rate at which a potential system user of the system becomes more anxious and is submerged into fear about the possibility of acquiring or using a technological system. The more anxious a user feels in relation to using a system, the worse

the outcome, as anxiety has been proven to have a significantly negative influence on the uptake of technology [73], [94].

Computer Playfulness: this is how spontaneous a system user is in a moment of system use. This is an important variable that has been shown to affect acceptance, as it significantly influences user-perceptions on how user-friendly technological system is [74].

Behavioural Intention: BI refers to the probability of a prospective system-user to perform a behaviour in question [95]. A substantial measure of behavioural intention signifies that the individual has accepted a technological system, while a weak behavioural intention indicates poor acceptance and use [47]. According to this model, BI is determined by perceived ease of use, perceived usefulness, and social norms [67].

Use Behaviour: this is the measure of the rate at which an individual indulges in a behaviour, which is influenced by behavioural intention [95]. Use behaviour is solely influenced by one's behavioural intention [67].

Limitations:

- Studies also point out that there are inconsistencies as this model has proved not to serve equally across cultures [96].
- There are too many relationships between variables that have been recorded to yield inconsistencies [97].

The Unified Theory of Acceptance and Use of Technology

UTAUT is an integration of the following theories and models: Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Innovation Diffusion Theory (IDT), Social Cognitive Theory (SCT), Theory of Reasoned Action (TRA), Motivational Model (MM), Model of PC Utilization (MPCU) and the Combined Theory Planned Behaviour /Technology Acceptance Model (C-TPB-TAM) [68], [98], [99].

Table 2: Constructs of UTAUT

UTAUT Determinant	The Sub-Determinant	The Source of Integrated Model
Performance Expectancy	Perceived Usefulness	TAM/TAM2/C-TAM-TPB
	Extrinsic Motivation	MM
	Job-Fit	MPCU
	Relative Advantage	IDT
	Outcome Expectations	SCT
Effort Expectancy	Perceived Ease of Use	TAM/TAM2
	Complexity	MPCU
	Ease of Use	IDT
Social Influence	Subjective Norm	TRA/DTPB, C-TAM-TPB
	Social Factors	MPCU
	Image	IDT
Facilitating Conditions	Perceived Behavioural Control	TPB/DTPB, C-TAM-TPB
	Facilitating Conditions	MPCU
	Compatibility	IDT

[68]

UTAUT is used to explain the variations in the intention to use information technology systems by determining the effect of Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitating Conditions (FC) that have a significant effect on behavioural intention to use [68]. Performance Expectancy (PE) can be likened to the perceived usefulness (PU) of TAM, while Effort Expectancy can be likened to perceived ease of use (PEOU). Social Influence and Facilitating Conditions were attained from the Theory of Planned Behaviour [100].

Performance Expectancy is the “degree to which an individual believes that using a system will help him or her to attain gains in job performance” [68]. PE outweighs all other constructs as the leading predictor of behavioural intention, and its effects remain notable in both voluntary and obligatory settings [73], [101], [102].

Studies conducted on **gender** disparities highlight that males seem to favour and exhibit task-oriented behaviour, hence performance expectancies which are tailored at achieving set job tasks tend to be very important to males [68]. However, gender differences are not a result of

biological gender as implied, but of the different gender roles, social programming and expectation as stated by the gender schema theory [103]–[105].

Age: studies indicate that youthful professionals prioritize and value intrinsic rewards [68]. Although gender and age have been confirmed by independent studies to be present in technology acceptance [101], [102], studies indicate that research may be misguided if it makes reference of age or gender without the other [68].

Effort Expectancy refers to how easy the user believes it is to use the system [68]. This construct appears similar to the PEOU in TAM and TAM2, complexity in MPCU, and ease of use in IDT. The similarity of these constructs across models is reflected in their definitions and measurement scales as indicated in studies [106]–[109]. Although the Effort Expectancy construct is important both in **voluntary** and obligatory settings (across all the models in which it appears), it is only notable and applicable for first-time use of the system. Its effects disappears as the user gains some **experience** in using a system [79], [87], [92], [104]. As an effort-based construct, EE will be important at the time when a user is learning to navigate the system in question, as this is the stage where the system processes can be challenging for new users. However, over time, performance issues come into play and overshadow effort-oriented constructs [79], [110].

Social Influence: this is a person's beliefs about their integral social circle members' perception on whether or not to use a system in question [68]. In other models, similar constructs are:

- i. Image as it appears in IDT
- ii. Social factors as it appears in MPCU
- iii. subjective norm as it appears in TRA, TAM2, TPB/DTPB and C-TAM-TPB [68]

In TRA, a construct similar to social influence denotes a system end-user's subjective norm, as conceded by [107]. This construct, and similar constructs mentioned in other models, state that a user's behavioural intent to use is affected by their discernment of how key figures they interact with will think of them for using a system. Social influence constructs are applicable to obligatory settings [68] as compliance aspects found in obligatory settings directly influence behavioural intention to use [73]. However, as a result of identification and internalization, social influences in **voluntary** settings work by influencing perceptions of a group regarding a technology in question. In an obligatory context, social influence is only significant at the time

an individual is new to the system, and this effect diminishes as the user gains **experience** [73]. Studies [73], [88] show that social influence affects a person's behaviour, and consequently influences behavioural intent through identification, internalization and compliance. Through internalization and identification, a person's behaviour is changed with the hope of gaining approval from those who are important to the user. With compliance, a person significantly changes their behaviour or intent due to social pressure [68]. People may also comply with the behavioural expectations of their social environment if they believe that they can be rewarded or punished for adopting a new behaviour [88].

The element of reward or punishment for adopting or non-adoption of a certain behaviour is supported by studies that contend that individuals look to others on how to behave only in obligatory settings [86], particularly in uninformed new users with little or no **experience** [83], [87], [96], [104]. As far as **gender** is concerned in social influences, women seem to value social approval as evident in their consideration of other people's opinions before developing a behavioural intention to use new technology [111]. The significant effects of social influences decrease over time as they gain experience [110]. As with PE and EE, gender roles can be the result of societal values and expectations rather than being biological [104]. A Study indicates that older professionals are more vulnerable to social influences. Studies show that the need to affiliate increases significantly with **age** [112]. This effect also fades as the individual gains experience using technology, and the experience forms the basis of their behavioural intention [113].

Facilitating Conditions

“Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” [68]. This construct is similar to:

- ‘Perceived behavioural control’ in TPB/DTPB and C-TAM-TPB
- Facilitating conditions as described in MPCU
- Compatibility as defined in IDT

All the aforementioned constructs across their respective models and theories have been developed to have technological or organizational environment features that are responsible for eliminating usage barriers [68]. The research conducted acknowledged these similarities by

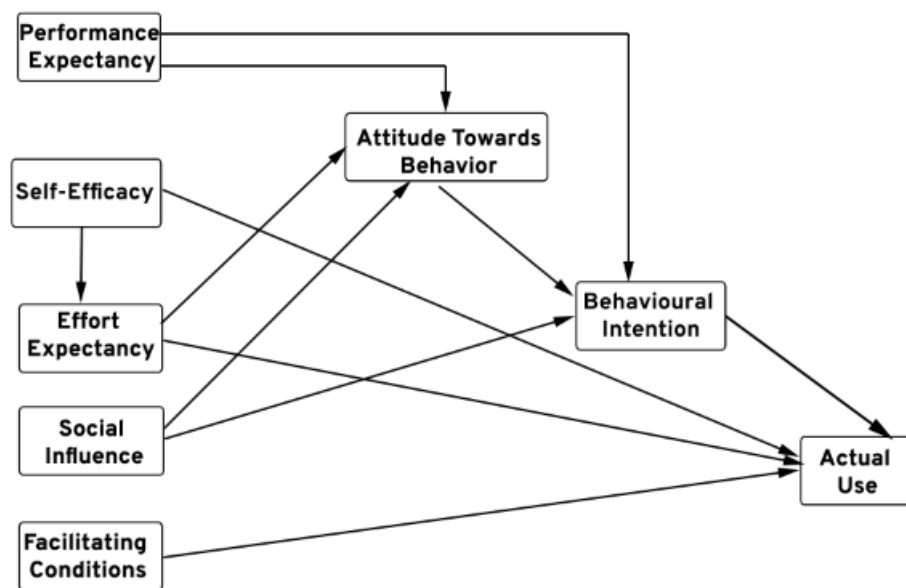
conceptualizing supportive conditions as an integral module of perceived behavioural control [85]. It is important to note that in a scenario where both PE and EE are applicable, the facilitating conditions are insignificant. The effects of facilitating conditions will increase over time as the individual gains user experience, realising numerous support systems, thereby eliminating barriers to continued use of the system [114]. Older professionals are known to value and consider other people's opinions, help and add value to their everyday job tasks [68]. The facilitating conditions construct has a notable influence on the actual use behaviour enacted when associated with **age** and **experience** as moderators [68], [113].

Behavioural Intention

Behavioural Intention: this is the rate to which a prospective system user plans to utilize a technology in question. This measure is influenced by individual, technological and organizational factors. An increased behavioural intent measure implies a significant level of acceptance and use of a particular system, whereas a weak measure indicates low levels of acceptance and use. This makes behavioural intention a reliable predictor for user behaviour [47], [74], [95]. On the other hand, once the technology is purchased and implemented, the observable patterns of system usage are referred to as **Actual Use** [95].

Modified Unified Theory of Acceptance and Use of Technology (Modified UTAUT)

Figure 3: Modified UTAUT [23]



(Based on UTAUT [68])

The modified UTAUT Model [23] expounds behavioural intentions in healthcare settings by proposing four (4) predictive variables, namely: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitating Conditions (FC) [68]. However, as per the literature review conducted, a study [23] revised the original UTAUT model with the addition of ‘**Self-Efficacy** and **Attitude Towards Behaviour**’ to the four fundamental UTAUT technology acceptance constructs.

1. Self-Efficacy (SE)

Self-Efficacy refers to the user’s perception and assessment of their ability to use an EHR system effectively [115]. In addition, Self-Efficacy as a determinant of technology acceptance forms the basis for knowledge and skills to execute a system function. As a result, studies on computer anxiety found that EHRs users in resource-limited settings lack the necessary skills and knowledge to perform EHRs functions effectively [116]. Studies indicate that because the original UTAUT model is not suited to expound the phenomenon of technology acceptance in developing countries as it was established for developed countries as opposed to low-income or undeveloped countries [23]. Since EHRs implementation is still considered to be at its inception stage in undeveloped countries, the integration of constructs such as self-efficacy can help to better expound on the acceptance and use of technology in low-income settings [117].

2. Attitude towards using EHRs

The uptake of health technology in low-income countries is slow due to digital inequality, which is a reflection of the social and economic differences amongst countries [118]. Due to the correlation between socio-economic variables [119]–[121] and the implementation of health technologies, EHRs uptake of EHRs is even slower in Sub-Saharan Africa [122]–[124]. As a result, studies reported that nurses in sub-Saharan Africa as the most resistant batch of information systems users [35], [125]–[128]. There are various reasons that have been advanced to justify why nurses are resistant to technology acceptance. These include nurses’ perceptions that new health technologies would inflate their daily duties, nurses’ presumptions that the adoption of new health technology should accrue a salary increase, and the requirement to be autonomous. These influence nurses’ attitude towards the use of new health technology [35], [55], [127]–[131]. In the context of developing countries, factors such as

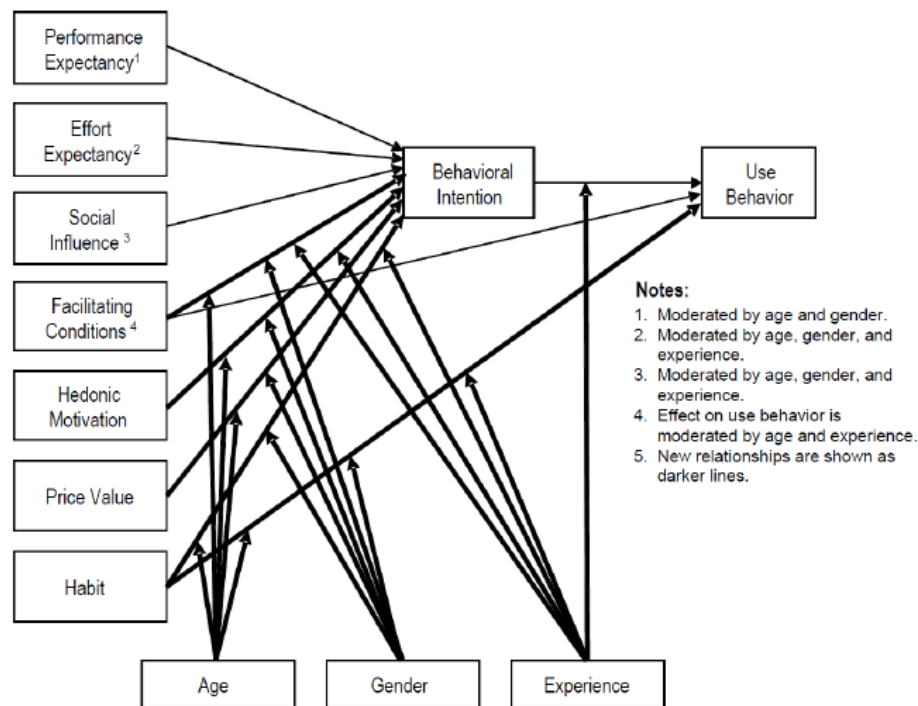
knowledge and access to technology are influential to the formation of attitudes, leading to acceptance and use [120], [126].

Limitations

- This model did not take into consideration the significance of the moderating constructs.
- Studies have reported inconsistencies in individual characteristics [115], [116], [127], [130].
- Studies also reported inconsistencies in the significance of social influence [131] and performance expectancy (perceived usefulness) [130].

Unified Technology Acceptance and Use Theory 2 (UTAUT 2)

Figure 4: UTAUT 2



[132]

Hedonic Motivation (HM): “can be defined as the intrinsic motivation such as fun, enjoyment or pleasure when using a technology because of technology for its own sake, and it is an important construct in defining technology acceptance and use” [132]. This construct can also be described as the excitement, amusement or pleasure that is experienced by a system user as

a direct result of engaging in technology use. It is important that a system user has a relatively high degree of enjoyment in using technology, since users generally adopt technology voluntarily [133]. HM is found in the Motivational Model represented as Perceived enjoyment or Playfulness and as an element of Intrinsic Motivation in TAM [134] [135]. This additional construct was reported to produce a noteworthy improvement in Behavioural Intention variance in UTAUT2 compared to UTAUT [132].

Price Value (PV) “can be defined as learners’ cognitive trade-off among the seeming benefits of the applications and the economic cost” [132]. This construct dictates that consumers are drawn to a product that has more benefits than its costs [134].

Habit (HT): this is the level of an individual’s inclination to apply behaviours consistently [132].

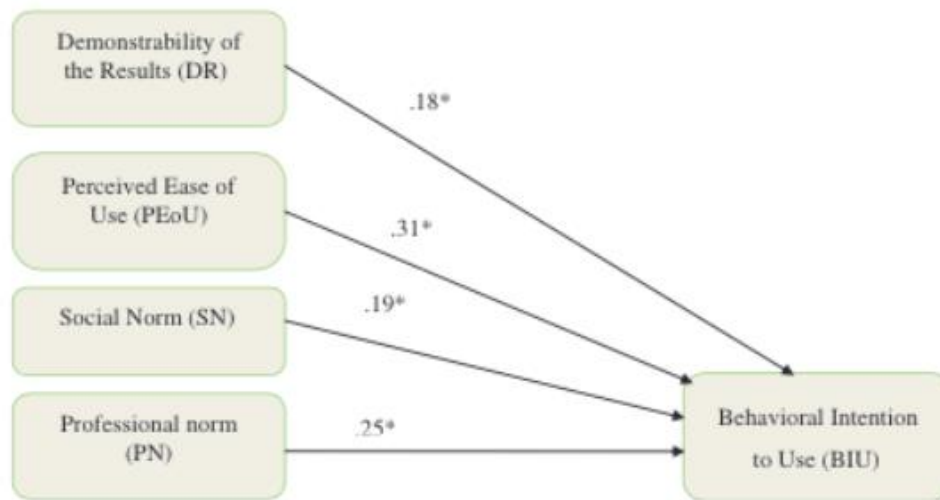
Limitations:

- Studies have reported inconsistencies on individual differences such as age and gender [115], [116], [127], [130]. Studies also reported inconsistencies in the significance of social influence [131], performance expectancy and perceived usefulness [130].

Integrated Model

The Integrated model encompasses the Psychosocial Model which comprises concepts from the Theory of Interpersonal Behaviour (TIB). The TIB builds on elements of other models and pays close attention to the cultural, social, and moral factors that are neglected in many other concepts of technology acceptance. The Integrated model combines the TAM and the Psychosocial Model as well as Demonstrability of results (DR) [69]. However, ***Demonstrability of results*** is a highly influential technology acceptance construct which addresses the ability to demonstrate the impact and results of an implemented EHRs system.

Figure 5: Integrated Model



[69]

Perceived Usefulness & Perceived Ease of Use

This model proposes that the intended behaviour of the user of a system predicts what they will actually use the system for. It posits that a system user's behavioural intention (BI) is determined by their **Perceived Usefulness (PU) and Perceived Ease of Use (PEoU)**. The model also focuses on the ability of external factors (e.g. social influences) to influence a potential user's attitude towards a proposed system by influencing their perception of how useful and easy to use the system can be [69].

Social Norm- Normative and role beliefs create social norms in people over time. Normative beliefs have to do with how an individual accepts and absorbs the behavioural opinion of their social group. However, role beliefs encompass the degree to which a person believes that someone in their set of qualities should or should not perform the learnt behaviours.

Professional Norm- this refers to the association and identification of the individual with the professional standards of their affiliate group [69]. However, Behavioural Intention to use is the measure of how likely it is to engage in a behaviour [95], [136]. According to this model, **Behavioural intention to use (BIU)** is determined by professional norm, social norm, perceived ease of use, and demonstrability of results.

Limitations:

This model does not take into consideration the influence of Social Norm on Perceived Usefulness, Computer Self-Efficacy on Perceived Ease of Use and Demonstrability of Results

on Perceived Usefulness because the model was designed to assess the direct influence of the constructs on the Behavioural Intention to Use [69].

Comparing Models

Table 3: Summary of Model comparisons

MODIFIED UTAUT	EXTENDED TRA	TAM 3	INTEGRATED MODEL	UTAUT 2
Performance Expectancy		Perceived Usefulness		Performance Expectancy
Effort Expectancy		Perceived Ease of Use	Perceived Ease of Use	Effort Expectancy
Social Influence	Subjective Norm, Social Pressure	Subjective Norm	Social Norm, Professional Norm	Social Influence
			Demonstrability of Results	
Facilitating Conditions	Facilitating Conditions			Facilitating Conditions
Self-Efficacy	User Readiness			Self-Efficacy
Attitude Towards Behaviour	Beliefs, Attitude Towards Behaviour			Attitude Towards Behaviour
Behavioural Intention to Use	Behavioural Intention	Behavioural Intention	Behavioural Intention to Use	Behavioural Intention to Use
Actual Use	Actual Behaviour	Use Behaviour		Actual Use
				Habit
				Hedonic Motivation
				Price Value

Various technology acceptance models and theories have been the subject of discussion in numerous researches that investigate and explain technology adoption. In this segment, Extended-TRA, TAM 3, Modified UTAUT and Integrated model were reviewed, scrutinised and compared to establish which should be selected to examine nurses 'acceptance and use electronic health record in Botswana rural public health facilities.

Technology Acceptance Model 3 (TAM3) and Extended-Theory of Reasoned Action (TRA) UTAUT 2 and Modified UTAUT Comparison

The modified UTAUT, UTAUT 2 and TAM3 all incorporate Performance Expectancy (Perceived Usefulness) and Effort Expectancy (Perceived Ease of Use) as factors that directly and significantly influence Behavioural Intention (BI). However, the Integrated model only posits perceived ease of use as significant for revealing behavioural intention, while Extended TRA does not incorporate either performance expectancy or effort expectancy at all [66], [67], [69], [96]. Studies emphasize that performance expectancy is the most substantial factor influencing behavioural intention in both voluntary and obligatory settings [73], [101], [102], [137]. In addition, studies have highlighted Effort Expectancy (Perceived Ease of Use) as a significant factor in explaining behavioural intention to use technology [21], [60], [61], [126]–[128], [132], [133]. Because perceived usefulness was reported to have insignificant effect on the resultant behavioural intention, it was excluded from the integrated model, which tested only direct influences, although this construct proved significant when tested within TAM in the same study [69].

Perceived Ease of Use and Perceived Usefulness

TAM3 has been reported to expound between 52% and 67% of the variance in Perceived Usefulness, between 43% and 52% of variance in perceived ease of use, and consequently between 40% and 53% of the variance in intention to use information technology to highlight the significance of both perceived ease of use and perceived usefulness [67]. The Integrated model also posited that its TAM segment expounded 44% (similar to other findings in UTAUT and UTAUT 2 [138] and TAM3 [67]) of the variance in behavioural intention to use information technology, further emphasizing the significance of perceived usefulness and perceived ease of use, although perceived usefulness was later excluded in the final model for its lack of direct significant influence to behavioural intention. This finding is in line with other

studies that reported a strong explanatory power for performance expectancy and effort expectancy. Without incorporating Performance Expectancy and/or Effort Expectancy, Extended- TRA and integrated model prove to be inadequate in comparison to Modified UTAUT, UTAUT 2 and TAM3. The modified UTAUT model was reported to expound 40.2% of the variance in behavioural intention to use information technology, and 58.5% of the variance in information technology actual use [23]. The findings of the modified UTAUT model also posit that Effort expectancy and performance expectancy have a direct and significant influence on attitude towards use.

Social influence

The modified UTAUT, UTAUT 2, TAM3, the Integrated model, and the extended TRA all account for social influences as significant determinants of behavioural intention to use EHRs. The study on modified UTAUT revealed that social influence is amongst the strongest predictors of behavioural intention to use and has a strong influence on attitude. The integrated model posits professional norm as the second most significant factor, while social norm is ranked as the third most significant factor influencing behavioural intention to use EHRs [69]. The significance of the professional norm and the social norm is supported by other studies [138], and [139], respectively. The TAM3 posits that although the subjective norm is a significant determinant of behavioural intention, the effects of the subjective norm decrease as nurses gain experience using EHRs, with the influence of the subjective norm being stronger in obligatory setting [67]. A study on extended TRA stated that while social pressure has a significant and direct influence on behavioural intention, the peer influence social pressure in general have an insignificant influence on actual usage behaviour [66].

Facilitating Conditions

A study on extended TRA highlighted that facilitating conditions have a substantial effect on actual usage behaviour [66]. In addition, the findings of a study on modified UTAUT and UTAUT2 revealed that facilitating conditions, for example, organizational settings and system quality, are integral in predicting actual EHRs usage [23]. However, TAM3 [67] and the integrated model [69] do not take into account the facilitating conditions to expound system actual usage behaviour.

Attitude towards use

The findings of a study based on the modified UTAUT indicated that attitude towards using EHRs was a strong determinant of behavioural intentions [113]. Morris and Venkatesh also highlighted that attitude towards the use of EHRs was amongst the most significant determinant of behavioural intentions [23]. These findings were supported by previous studies that found that attitude is a determinant of behavioural intention [64], [65], [127], [141], [142]. A study on Extended TRA also found that attitude towards EHRs use is a significant factor influencing behavioural intention to use. This study highlights that attitude is influenced by beliefs of system users about the outcome of indulging in a behaviour, which is moderated by assessments about the outcomes of that indulgence [66].

Self-efficacy

The modified UTAUT model reported that self-efficacy directly influenced actual use and effort expectancy [23]. **Computer Self-Efficacy**, on the other hand, addresses an individual's view and assessment of their own capacity to use an EHR [102]. Although self-efficacy in developed countries is easily correlated with system usability, quality, continuity and functionalities [143]–[145], studies emphasize its significance in low income settings as the findings reveal that self-efficacy predicts usability in developing countries [23]. In addition, it has been reported that nurses in developing countries show frustration and computer anxiety due to their lack of knowledge and the necessary skills required to operate EHRs, making self-efficacy an important factor to consider in developing countries [116], [117]. This is supported by other studies that also found a significant correlation of self-efficacy in low-income settings [146]–[149]. In the context of low resource settings, self-efficacy is a significant factor influencing acceptance and use, and it is only found in modified UTAUT and not considered in TAM3, Integrated model or Extended TRA. However, the extended TRA model incorporates user readiness, which has been stated to have a weak effect on actual usage behaviour [66].

Behavioural Intentions (BI)

The modified UTAUT model findings highlight that behavioural intention is determined by attitude towards use, social influence, and performance expectancy. This is contrary to the Original UTAUT model that postulates that performance expectancy has a direct and significant influence on behavioural intention. In modified UTAUT, it was reported that effort expectancy has no significant effects on behavioural intention. Effort expectancy was found to have a significant influence on attitudes towards behaviour and on actual use. This model

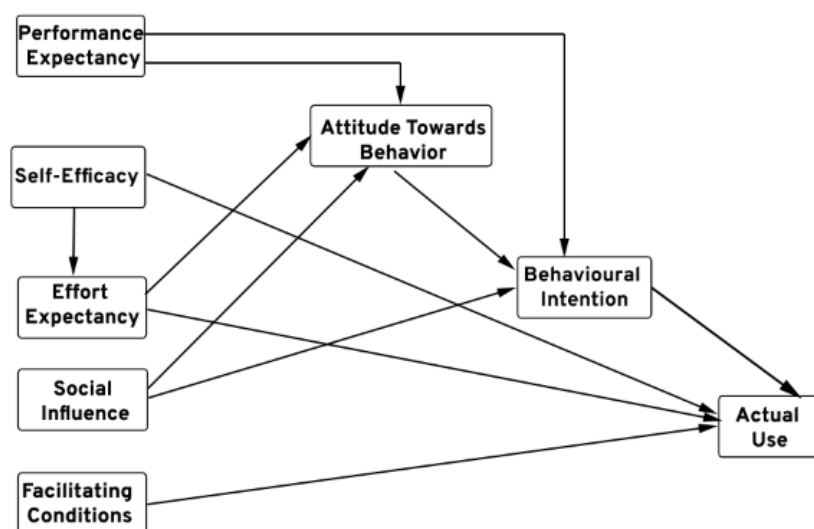
explains 40.2% of the variance in behavioural intention. The extended TRA model found that behavioural intention to use is determined by attitude towards behaviour, awareness of innovation, social pressures (networks & interactions), and subjective norms. However, amongst all extended TRA constructs, social pressures (networks and interactions) were reported to have a weak effect on behavioural intentions. TAM3 posits that perceived usefulness, perceived ease of use, and subjective norms have a substantial and direct effect on behavioural intention while the Integrated model found that social norms, professional norms, perceived ease of use, and demonstrability of results are the predictors of behavioural intentions.

Actual use

The modified UTAUT model suggests that facilitating conditions, intentions, effort expectancy, and self-efficacy have a significant influence on actual use of EHRs while explaining 58.5% of the variance in EHRs actual use patterns. A study on the Extended TRA model found that facilitating conditions, user readiness, and behavioural intention are determinants of actual use, while TAM3 only reported that behavioural intention is the sole determinant of actual use.

Selected Model: Modified UTAUT

Figure 6: The Modified Unified Technology Acceptance and Use Theory (UTAUT)



[23]

Why choose it

The modified UTAUT was established to expound the acceptance and use of information systems in developing countries or low-income settings, as the original UTAUT was specifically designed for developed countries [23]. Similar to the original UTAUT, the modified UTAUT combines the Motivational Model (MM), Social Cognitive Theory (SCT), Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Innovation Diffusion Theory (IDT), Theory of Reasoned Action (TRA), the Model of PC Utilization (MPCU), Combined Theory Planned Behaviour /Technology Acceptance Model (C-TPB-TAM) and has been proven to show significantly good accuracy and statistical significance in comparison to the individual theoretical models it encompasses [68]. In addition, the modified UTAUT model incorporates attitudes towards using technology and self-efficacy, adopted from the TRA and SCT respectively, to better explain technology acceptance and use in developing countries.

UTAUT posits that performance expectancy, effort expectancy, and social influence determine intention while intention and facilitating conditions determine the resulting actual user behaviour. UTAUT is a theory that covers a broad individual difference constructs including the moderating effects of age, experience, gender, and voluntariness of use. Although there is some inconsistency in previous studies on individual differences, scholars have reported significant moderating effects by individual differences such as gender [68], [113], [150], age [113], prior experience [151], and voluntariness of use [68]. Studies have clarified that the UTAUT model has strong explanatory power. It has the capacity to explain up to 70% of the variance in behavioural intentions. Therefore, the UTAUT model and its adaptations are commonly utilized in diverse areas incorporating the EHR system usage [152]–[154].

1.8 Problem Statement

Although the importance of EHR is recognized globally, most developing countries have weak and disintegrated EHR systems [36], [155]. EHRs increase staff efficiency, reduce average hospital length of stay, achieve better management of materials, and are important in the achievement of pharmaceutical efficiencies such as decreased adverse drug events [156]. These perceived benefits are particularly important for nurses, who constitute the largest group of EHR users [157]–[159]. Despite the EHR benefits, a study reported restrictions in terms of

usability, performance, end-user self-efficacy and interactivity amongst EHRs systems [160] that result in to low behavioural intention amongst nurses [53]–[58]. Low intention to use EHR can hinder nurses from accessing up-to-date patient care data, resulting in uninformed patient care decisions, poor quality nursing, and unexpected patient health outcomes [161]. Meaningful and wise use of EHR is important to archive improved and better access to timely patient information and quality of care, while limited or low EHRs usage aor non-use means EHRs have little or no value [52].

Although there has been an increase in the attempt to understand the phenomenon of acceptance and use of EHRs in terms of nurses' perceptions and intent, studies suggest that there is limited empirical evidence in the context of resource limited settings [23]. ***The problem that this study seeks to address is the resistance of nurses to the acceptance and use of EHRs in Botswana's public health facilities in resource-limited setting.***

1.9 Objective

This study seeks to identify, understand and assess factors that affect nurses' acceptance and use and to explore nurses' perceptions and intention to use of EHRs in Botswana's public health facilities in resource-limited settings.

Specific Objectives

- i. To investigate factors that affect nurses' behavioural intentions, actual usage behaviour and comfort with EHRs usage in Botswana's public health facilities in resource-limited settings.
- ii. To theorise the identified factors, to obtain a broader understanding of EHRs acceptance and meaningful use by nurses in Botswana's public health facilities in resource-limited settings.

Research Questions

- i. What factors influence nurses' behavioural intention to use EHRs in Botswana's public health facilities in resource-limited settings?
- ii. What are the main factors affecting nurses' actual use behaviour of electronic health record in Botswana's public health facilities in resource-limited settings?

- iii. What are the associations of individual and professional attributes, and respective perceptions of the technological and organizational attributes with their behavioural intention to use EHRs in Botswana's public in resource-limited settings?

1.10 Significance of the study

According to Shiferaw and Mehari, the integration of electronic health records in rural settings is an emerging concept. As a result, only a limited number of studies in EHRs acceptance and use have been conducted in low-resource settings [23]. Ibrahim emphasized the need to assess factors that affect nurses' perceptions, acceptance and usage behaviour as nurses play an important role in achieving the benefits associated with the use of EHRs [127]. Therefore, this study primarily focuses on nurses as the largest group of EHRs users[157]–[159]. Compared to users based in healthcare facilities in urban areas, health caregivers in rural healthcare facilities are known to lag behind in terms of technology adoption [162]–[164], further emphasizing the need for this study.

To the researcher's knowledge, this study was the first to identify, understand, and assess the factors that affect nurses' acceptance and use of EHRs, and to explore nurses' views and behavioural intentions to use EHRs in resource-limited settings in Botswana. A comprehensive understanding and appreciation of nurses' perceptions, factors that influence acceptance and use in rural settings will help the Ministry of Health and Wellness in its efforts to improve healthcare across public health clinics and health posts in rural areas in Botswana. The findings of this study propose possible solutions to help the Ministry of Health with strategic approaches to address the individual, technological, and organizational factors that were reported to influence EHRs usage. This would help improve EHRs usage while improving the quality and efficiency of nursing care, and decision making. Lastly, the research findings also add to the available empirical evidence on the acceptance and use of EHRs by nurses in resource-limited settings, and it establishes a basis for future research.

1.11 Structure of the thesis

- **Chapter 1 (Introduction to the Study):** comprises of an introduction to EHRs in the healthcare system, background information on healthcare and EHRs in Botswana. This chapter also presents an overview of the association between intention and actual usage behaviour, nurses' intentions to use EHRs, and a brief comparison between existing theoretical models. In addition, the chapter also presents the problem statement, as well as the study main objective, specific objectives and research questions.
- **Chapter 2 (Literature Review):** presents a review of the literature on factors influencing the acceptance and use of EHRs by nurses. This chapter also consists the research hypotheses, and the proposed additions to the chosen model.
- **Chapter 3 (Research Methodology):** comprises of the research design, target population, sample, research instrument, data collection process, data analysis and ethical considerations.
- **Chapter 4 (Measurement Scale Analysis):** this chapter describes measurement scales utilized to assess the reliability and validity of the main study variables.
- **Chapter 5 (Predicting Nurses' Behavioural Intentions and Actual User Behaviour):** contains of the study findings on demographic and personal characteristics of the nurses, and the research findings, and the main study variables. This chapter also includes discussions of factors that were found to influence nurses' acceptance and use, barriers, and facilitators to EHRs use. This chapter also presents the hierarchical multiple regression analysis on factors reported to influence nurses' acceptance and use of EHRs, the implications and conclusions derived from these findings.
- **Chapter 6 (Nurses' Comfort Levels with EHRs in Botswana's public health facilities in resource-limited settings):** this chapter describes findings on comfort levels with EHRs use. This chapter also presents a discussion on the individual, technological and organizational attributes that were found to effect nurses' comfort levels with EHRs usage in Botswana's public health facilities in resource-limited settings.
- **Chapter 7 (Conclusions and Recommendations):** this chapter summarizes the study findings, and presents indications for future research. In addition, this chapter presents the strengths, limitations and conclusions of the study.

2 CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The literature review provides an understanding of theoretical and scientific knowledge on a topic of choice [165], [166]. A review of the current and related scholarly knowledge helps to establish what is known and unknown about a topic of choice and the apparent knowledge gap [167]. This chapter presents an analytical assessment of the scholarly literature through an extensive review of the related research to attain more understanding of the acceptance and use of EHRs by nurses. The selected literature is prearranged into key premises of developed settings, international and local studies about Botswana to inform the scope of this study while reflecting on the progressive nature of ICT.

2.2 Factors Influencing Acceptance and Use of EHRs

Studies have indicated the following as factors effecting behavioural intentions:

1. Individual factors
2. Technological Factors
3. Organizational Factors

2.2.1 Individual Factors

Nurses' Individual & Demographic Characteristics

Regarding nurses' demographic characteristics, studies inferred that age, education level, years of working experience and technology-related experience influenced nurses' behavioural intention to use EHRs [129], [130], [168]–[171].

Age has been assessed and identified to be a probable factor that influences behavioural intentions [172]–[174]. A study assessing the influence of nurses' demographic and individual attributes on the acceptance of IS in Canada found that age had an insignificant indirect effect on behavioural intentions to use EHRs, or their attitudes towards EHRs [65]. Another study on factors influencing EHR usage in Thailand found that gender and age were insignificant with little or no influence as moderators of factors that affect behavioural intentions [128].

Age and personal innovativeness: A study by Kummer et al posits that age substantially influences image, qualitative, quantitative overload, and personal innovativeness [168]. Further, the study found that there is lower personal innovativeness as age increased. Also, Kummer et al concluded that age does not affect subjective norm, while the effect of image was significantly affected by age, as it was recorded to rise with age. Kummer et al also highlighted that older nurses are more likely to suffer as more technical tasks increase (quantitative overload). Lastly, older nurses are more likely to have inadequate technical skills leading to qualitative overload.

Age and Social influence: Studies report increased pressure to adhere to social pressure among nurses over the age of 40 [129], [130]. A study by Kummer et al reported that social influence has a negative influence on behavioural intentions, which decreases with age [168]. This means that older nurses use the system more independently, which is contrary to studies that suggest that social influence increases with age. These findings were supported by Holtz and Krein who also found that, contrary to most findings, younger nurses were exposed to increased social influence [9]. Thus, it is attributed to younger nurses' need to fit in while older nurses were independent in their decision to adopt EHRs.

Regarding the **relationship between age and resistance to change**, a study by Khan et al found that there is significantly higher resistance to change in older nurses in comparison to younger nurses [175]. These findings were also supported by Khalifehsoltani and Gerami who reported a decreased probability of older nurses being motivated to adopt EHRs compared to younger nurses [176]. Khalifehsoltani and Gerami's findings were cross-referenced with an earlier study by Fitzgerald et al who reported the reluctance of elderly nurses in adopting EHRs [177]. Supporting studies also found an increased resistance to change in older nurses compared to younger nurses as a result of long-established practice [178], [179]. A study by Bazile also reported that age had a statistically substantial influence on resistance to change. The study reported that older nurses were less likely to adopt EHRs [180]. Lastly, Kummer et al indicated that there is an increase in resistance to the use of EHRs with an increase in age [168].

However, a study by Ifinedo in 2016 reported that age had insignificant moderating effects on attitudes or behavioural intentions [65]. Another study emphasized that age has no moderating effect, while self-efficacy and computer anxiety are involved [181]. In contrast, a study by Holtz and Krein reported that age has a statistically significant effect, and reported that younger

nurses had more efficacy than older nurses [9], revealing some inconsistencies in the findings of different research studies.

The influence of **age on performance expectancy and effort expectancy** was also reported. Studies have shown that age is substantially linked to effort expectancy, social influence, and behavioural intentions, with nurses over the age of 40, reporting lesser effort expectancy and more social influence [129], [130]. A study by Holtz and Krein reports that younger nurses found it relatively easy to use EHRs [9]. This is contrary to studies that reported that age has no effect on self-efficacy and computer anxiety [181]. To further compound the discrepancy, Czaja et al reported that younger nurses had higher levels of self-efficacy compared to their older counterparts. Furthermore, a study by Odom found that although age is not substantially connected to perceived ease of use and attitude, older nurses are more likely to view EHRs as ‘not useful’ [171]. On the other hand, Aldosari et al reported that age has a statistically significant influence on perceived usefulness and perceived ease of use [182].

However, a study examining nurses’ behavioural intentions towards barcode medication administration [169] found the negative effect of age on behavioural intentions and behavioural use of EHRs. A study by Ifinedo reported did not find the moderating effects of age on the connection between nurses’ perceived ease of use and attitudes as well as on nurses’ perceived usefulness and attitudes towards IS [65]. In general, the findings on the effect of age on the behavioural intentions were inconsistent and contradictory.

Computer training is reported to have a significant influence on perceived usefulness and perceived ease of use. A study by Aldosari et al reported that the strongest moderator of perceived usefulness is training [182].

Out of the reviewed research papers that examined the effect of the **level of education, nurses’ professional experience and nurses’ technology-based experience** on behavioural intentions [65], [123], [124], [183], [184], no study found any direct link between these proposed influences and intent to use.

However, some studies established that **level of education** had a positive effect on the association between perceived ease of use and perceived usefulness with attitude and behavioural intentions. This connection proved to be more significant for nurses who were more educated [65], [185], [186]. Contrary, Aldosari et al also stated that educational level had

a significant correlation with perceived usefulness. However, Aldosari et al found an insignificant influence on perceived ease of use [182]. Other studies also found that level of education has a statistically insignificant influence on behavioural intentions, and this further reveals some inconsistencies in research [15], [127], [187].

A study on the acceptance of sensor-based medication systems by nurses established that the more **professional experience** the nurses have gained, the weaker the subjective norm, indicating that the nurses' years of practice had negative effects on the connection between subjective norm and behavioural intentions [168]. In 2016, a study by Odom found that years of practice are not substantially connected to perceived ease of use, perceived usefulness and attitudes [171]. However, Ifinedo found that nurses' professional experience had statistically insignificant influence on behavioural intention to use EHRs or attitudes towards technology [65]. A study assessing the factors that influence acceptance of EHRs in a hospital in Saudi Arabia among nurses reported that years of experience had a statistically significant and positive influence on perceived usefulness and perceived ease of use [182].

A study conducted on the analysis of factors affecting the acceptance and use of e-healthcare systems in Thailand using UTAUT [128] found that **IT knowledge and experience** was reported to have a statistically significant impact on behavioural intention to use e-healthcare systems. Krueklai, Kiattisin, and Leelasantitham went on to suggest, that the probability of nurses with more IT-based knowledge to use EHRs was high, as IT knowledge positively influenced intent to use technology. Moreover, studies reported that computer knowledge has a statistically significant moderating influence on perceived ease of use [188], [189] and perceived usefulness [65], [190]. Kipturgo et al also reported that increased exposure to the use of computers and EHR systems significantly influenced attitudes towards computerization compared to a limited exposure [185]. Another study found that nurses with increased technology usage experience exhibited a had more intent and actual use behaviour than those with limited technology experience. As a result, nurses' experience with technology use influences the connection between the associated intent and use behaviour [187]. An assessment of nurses with less technology experience compared to those who had previously used technology found that nurses with experience in the application of technology had positive attitudes towards EHRs and higher intent to use them. Furthermore, it was found that IT experience had a moderating influence on the connection between social influence and behavioural intentions [127]. Moreover, a study by Ifinedo reported that the effect of nurses'

perceived usefulness' on attitudes is moderated by computer knowledge. Ifinedo further reports that the influence of perceived ease of use and attitudes of nurses is also moderated by computer knowledge [65]. However, these findings contradicted the findings of a study by Garland and Noyes who reported that IT experience was not a significant determinant of positive attitudes towards the use of technology [191].

EHR Experience refers to the total amount of time elapsed using EHRs systems. Prior experience with using information systems was found to be an important factor in determining actual usage behaviour [136]. A study [192] suggested that system experience has an additional influence on actual use through habit formation. The study in question also stated that system experience helps empower the user, diminishing the effects of social influence on system use. In addition, a study [193] argued that system experience can be used to determine a system user's knowledge of the system thus use. Moreover, previous studies [194], [195] found a positive influence of system experience on a systems user's performance while using an information system for their job task. Lastly, a study [196] found that system users with more system experience exhibit more confidence in their ability to use information systems effectively.

In summary, only system-based experience was shown to have a direct relationship with actual usage behaviour while all other studies revealed no connection or impact of education levels, years of working experience and IT-based experience on either nurses' behavioural intentions or EHRs actual usage behaviour.

Nurses' Traits

Research shows that nurses' distinctive attributes significantly influence nurses intent to use of EHRs [61], [168], [170], [197]–[199]. Studies that assessed personal innovativeness reported that **personal innovativeness** positively affected facilitating conditions, perceived ease of use, and nurses' intention to use EHRs [61], [116], [168], [198], [200]–[202] In addition , a study by [203] found that PI had moderating effects on PEOU, result demonstrability, the subjective norm as well as on perceived behavioural control. Furthermore, a study [204] indicated that an increase in personal innovativeness in IT meant a higher effect on performance expectancy. This study further established a positive influence of personal innovativeness on intention to use, while rejecting the influences of personal innovativeness on effort expectancy, subjective norm, and facilitating conditions.

Trust was also reported to significantly influence behavioural intention. Nurses who were found to have more trust were found to portray a significantly higher intention to use EHRs. As a result, nurses' trust in the overall attributes and consistency of the EHR system plays an important role, as this has been found to determine the behavioural intentions in terms EHRs usage [197].

Self-Efficacy was also reported to be a factor affecting the behavioural intentions. **Computer Self-Efficacy** addresses an person's view and assessment of an individual's own capacity to use an EHR system [102]. Studies indicate that self-efficacy positively and directly influenced intention to use EHRs [199], [205], [206]. It has also been reported that Self-efficacy has a statistically significant effect on the connection between effort expectancy and intention to use EHRs [23], [51].

The **attitude** was reported to significantly affect nurses' behavioural intentions. Attitude can be defined as a system user's positive perception exhibited in connection with the potential use of EHRs [71]. All studies reviewed reported that the probability of nurses who displayed positive behaviours towards the potential use of EHRs systems was significantly higher than nurses with negative perceptions towards the use of EHRs [54], [126]–[130], [189]. In addition, another study stated that attitude is the most important and influential construct affecting nurses' behavioural intentions outside of the defined UTAUT concepts [207].

Studies reported that **computer anxiety** negatively impacted perceived usefulness and attitudes towards use. In addition, anxiety was found to have an indirect negative influence on behavioural intention to use technology [116], [205], [208]–[212]. Studies have also shown that an increase in anxiety leads to a significant decrease in effort expectancy [211], [213]. Furthermore, it has also been reported that computer anxiety had a negative impact on PEOU [212] moderated by experience [67], [94]. Other studies reported that anxiety influenced nurses' resistance to change [180], [214]–[216].

However, computer anxiety was reported to have no influence on behavioural intention [217]. Another study reported that technology anxiety negatively affects perceived usefulness (performance expectancy) and attitude, but has no influence on perceived ease of use (effort expectancy) [208], contradicting earlier studies that reported significant effects of anxiety on

effort expectancy [213]. Similarly, a study by Lazuras and Dokou also reported that computer anxiety is an insignificant predictor of behavioural intention [210].

Resistance to change (RC) has also been reported to have influence on nurses' behavioural intention. *Resistance to Change* refers to the characteristic of having difficulty in breaking out of routine which is coupled with an emotional response to routine change [218]. However, studies [202], [208] reported that RC had statistically insignificant effect on behavioural intention to adopt EHRs. This is dissimilar to other studies that found that RC had statistically significant but negative influence on intent to use EHRs [116], [219]. As a result, some research studies link resistance to change with age, claiming that older nurses are less willing to adopt EHRs compared to younger nurses [175]–[179]. A study on factors contributing to resistance to change found that resistance to change is influenced by attitudes towards use, anxiety, and perceived complexity. In addition, another study revealed relationships between computer self-efficacy and anxiety, attitudes, and anxiety as well as a significant relationship between attitude and perceived complexity [180]. Furthermore, studies also found a connection between resistance to change and perceived threat. The perceived threat was found to have moderating effects on resistance to change, explaining up to 29% of the variance in nurses' resistance to change. In addition, this study reported that resistance to change had negatively predicted behavioural intentions and a significant but negative effect on both PEOU and PU [189], [208], [217].

2.2.2 Technology

In the reviewed literature on the attributes of technology, as many as 23 studies indicated that PE and EE are significant factors that directly influence behavioural intention to use EHRs and actual behaviour [15], [22], [129], [131]–[133], [172], [174], [189], [220]–[222], [32], [223]–[225], [50], [60], [61], [64], [124], [127], [128]. These studies indicate that intent is a function of individual beliefs on how easy a technological system is to use (effort expectancy/perceived ease of use) and how useful technology is to a user's job description (performance expectancy/perceived usefulness). This direct connection shows that nurses who regard EHRs as easy to use (perceived ease of use) and those who regard EHRs as useful (perceived usefulness) are more likely to use EHRs than those who regarded EHR systems as difficult to use and as 'not useful.'

2.2.3 Organisational factors

Studies have examined and reported the potential influence of the organizational elements on nurses' intent and actual use behaviour [14], [21], [48], [52], [58], [59], [123], [124], [126], [127], [128], [130]–[132], [168], [169], [188]. It has been reported that nurses' behavioural intention to use EHRs was higher when the organization provided or availed training and support to nurses. In addition to organizational factors, nurses showed higher intent to use EHRs when adequate IT support, resources and equipment were provided. This finding is consistent with a study by Galani that reported that, IT support is helpful and able to solve most problems if availed within close proximity [227]. This showed that organizational elements (FC) made for an imperative factor that influences nurses' intention and EHRs usage behaviour. These studies also recorded high nurses' intent to use when their peers aided, persuaded, and encouraged one another to use EHRs, indicating that social influence was a central factor influencing nurses' behavioural intention to use EHRs.

2.2.4 Comfort Levels

Studies show that nurses' comfort levels with electronic health records usage is an important factor to consider [228]–[230]. Individual, technological, and organizational factors were also found to effect nurses' comfort levels with the use of EHRs [127]. Although EHRs usage has notable benefits [2] numerous studies [10]–[12] found EHRs underutilized in facilities where there were reports of low intentions and discomforts with electronic health documents usage. As a result, it is vital to comprehend nurses' comfort levels with electronic health documents usage to curb underutilization [231]. It is also imperative to explore nurses' comfort levels with EHRs usage to add to the limited empirical evidence available for more understanding on the topic [232].

A study by Kossman reported that nurses were comfortable with EHRs usage as EHRs enhanced nursing work, increased access to patient information and efficiency and improved organization [232]. Pera, Kaur and Rao reported high EHRs utilization in a study that found that 75% of the study participants were comfortable with EHRs usage [233] highlighting the importance of level of comfort to EHRs utilization. A study by Huryk found that age is a factor influencing nurses' attitudes and comfort with EHRs usage. Huryk went on to suggest that nurses' comfort levels influence overall satisfaction and system usage [234]. According to

Miller et al. Abell et al., and Yontz, Zinn, and Schumacher, nurses' comfort with EHRs usage increases with adequate education and training [235], [236].

However, studies by Jaspersen, Carter, and Zmud, O'Mahony et al., Colligan et al., and Pera, Kaur, and Rao found that information systems were underutilized in facilities where low levels of comfort with EHRs usage were recorded [190], [233], [237]. Huryk also reported that EHRs slowness, hardware shortage, downtime and poor system design led to discomfort with EHRs usage [234]. Huryk went on to insist that lack of/ inadequate training increases discomfort with EHRs usage, leading to system underutilization. Kossman also found that EHRs hinders nursing work, slows down nursing processes, decreases time with patients and limited communication among nurses and doctors, leading to discomforts with EHRs usage [232].

2.2.5 Analysis

The intention of nurses' to use EHRs is a complex topic that should be looked at from an individual, social and technical perspective, rendering the implementation, adoption, acceptance and use a non-linear progression as it is influenced by numerous factors [34], [238]. Intention to use EHRs by nurses has been found to be affected by individual, technological, and organizational attributes. Individual attributes include the demographic attributes of nurses using technology. The age attribute yielded conflicting results across the available literature, indicating uncertainty regarding the direct/ and indirect effects of the connection of nurses and their intention to use EHRs in healthcare facilities. These uncertainties can be clarified by the rise in the personal and professional use of IT-systems, driven by education, support and training despite the age of the nurses [135], [137]. Routine and regular training of the nurses on technology-based knowledge updates are more influential than age, hence nurses have been found to be technologically competent regardless of their age [239].

Level of education as a factor influencing nurses' experiences, comfort levels and behavioural intention to use EHRs turned out to be a less popular factor among the five studies that were reviewed. Therefore, current researchers [127] recommend that nurses' level of education should be explored further to determine whether the level of education influences, directly or indirectly, the intention of nurses to use EHRs. Other studies found and reported that nurses' work-related experience is a viable factor influencing their intention to use EHRs. A study by Ibrahim found that subjective norms negatively affected nurses' intention to use EHRs when

reviewed in relation to the work-related experience [127]. The findings on the connection between work-related experience and nurses' behavioural intentions indicated that nurses with more work-related experience exhibited higher levels of independence concerning system use and were less susceptible to influence by their colleagues regarding system use. Inferences could not be drawn as other reviewed studies contradicted these findings, reporting that younger nurses were less susceptible to influence. As a result, the work-related experience needs to be evaluated to validate it as a factor influencing intent to use EHR systems. Nurses with added work-related experience tend to favour their experience over their colleagues' opinions on EHRs because they have been exposed to EHR, and therefore they are acquainted with the system functionalities, making them less susceptible to influence from colleagues.

However, personal innovativeness and computer self-efficacy as elements that influence nurses' behavioural intentions have emerged as the subject of regular studies. Studies have shown that personal innovativeness directly and significantly influenced nurses' perceived usefulness, perceived ease of use and behavioural intentions, in a positive way. The study outcomes also showed that personal innovativeness positively influenced organizational support for EHRs use. Also, the study findings indicate that the probability of nurses with higher personal innovativeness to use EHRs was higher as they regard EHRs as useful. Moreover, computer self-efficacy was reported to have a statistically significant and positive impact on nurses' behavioural intention to use EHRs in healthcare settings. Nurses who are confident in their ability to complete tasks using EHR systems tend to show increased behavioural intention. However, conflicting outcomes were found, with other studies rejecting the impact of personal innovativeness on facilitating conditions and effort expectancy, while other studies reported the effects of personal innovativeness on effort expectancy and facilitating conditions. Therefore, there is a need to further investigate the influence of personal innovativeness on behavioural intentions.

Research reported that computer anxiety negatively affected effort expectancy, performance expectancy and behavioural intention. Also, computer anxiety was found to affect resistance to change. However, other studies reported that computer anxiety did not have a statistically significant effect on behavioural intentions. Other studies reported that computer anxiety does not affect effort expectancy, contradicting previous findings. Further examination of the influence of computer anxiety on effort expectancy and behavioural intentions must be conducted to validate the influence of this construct.

It has also been reported that resistance to change is an element that effects behavioural intention to use information systems in healthcare settings. The studies reported that resistance to change influenced behavioural intentions negatively, such that an increase in nurses' resistance to change resulted in a decrease in behavioural intention. However, other studies contradicted these findings by reporting that resistance to change has no impact on behavioural intention to use. To validate resistance to change as a factor influencing behavioural intention to use, more research is needed to ascertain the impact of resistance to change on behavioural intention.

Further review of the literature shows the quality and reliability of the EHRs were integral as they were found to have a positive impact on nurses' behavioural intentions. Nevertheless, no conclusions can be drawn as only one study was evaluated. In addition, research suggested that the probability of nurses with positive attitudes towards EHRs were portraying increased intent to use EHRs were notably higher. Therefore, attitudes towards EHR usage were reported as a strong determinant in nurses' intention to use EHRs.

Nurses who believed that EHRs helped them to perform their jobs better, improved their efficiency, is relatively easy to navigate through, and user-friendly, reportedly had increased behavioural intentions. This indicates that performance expectancy and effort expectancy have a substantial influence on behavioural intentions to use EHRs. It was also found that organizational environmental attributes such as the subjective norm and facilitating conditions have a significant influence on the EHRs use-based intentions. In addition, the studies also found that there was a correlation between nurses' perceptions and the opinions of their peers on the use of EHRs and actual EHRs usage. Nurses who perceived their HER use as accepted and preferred by their peers had increased intention to use. Furthermore, nurses who felt that organizational training and support were available to assist them in using EHRs showed increased intention to use EHRs. Similarly, nurses who believe that the organization has all the necessary infrastructure or machinery needed to adequately access and operate EHR systems tend to have a strong intention to use EHRs.

The review of the literature identified the following attributes that generally effect nurses' behavioural intention to use EHRs:

1. the individual attributes of nurses using EHR
 - a. personal innovativeness

- b. self-efficacy
- c. attitudes
- d. computer anxiety
- e. resistance to change
- 2. attributes of technology
 - a. performance expectancy
 - b. effort expectancy
- 3. organizational environment
 - a. social influence
 - b. facilitating conditions

Nonetheless, it is worth noting that most of the reviewed literature was drawn from studies based on the acute-care sector. This was also the case for another researcher, who found that 42.5% of the reviewed literature was derived from acute-care settings, compared to only 3.7% of the literature, which was from studies based on home-care settings [127]. This is important to ensure that the inconsistencies found are directly applicable to this study, and this highlights the need for further research to clarify inconsistencies found in the available literature.

2.2.6 Inferences

The results derived from this research can help to shape the formation of informed strategies and supportive approaches that can help stimulate nurses' behavioural intentions to boost the actual usage behaviour of EHRs [54], [116]. This can be facilitated by providing training that takes into consideration nurses' professional experience and knowledge, from novice training to 'tech-savvy' users, and at all levels of professional experience. Training and equipping nurses with technology-oriented skills can positively influence nurses' intention to use EHRs by improving their literacy levels and attitudes towards the use of EHRs [240]. Through training and group interactions, nurses with higher self-efficacy and technological skills are better able to use EHRs than those lagging behind as they were once inexperienced users and understand first-hand the difficulties of dealing with EHR systems.

Nurses with higher personal innovativeness and self-efficacy should have input in the design specifications and processes of EHRs as they can help design a system that addresses the requirements and expectations of nurses. EHR systems are often designed by parties who do not have clinical or practical healthcare experience, resulting in systems that do not fit the needs and workflow of nurses [241]. Systems are more likely to be aligned with nurses' expectations,

needs and healthcare practices of nurses when they are involved in the design stages of EHRs [158]. This can positively affect intent and actual usage behaviour by taking into consideration personal innovativeness, self-efficacy, performance expectancy and effort expectancy.

Furthermore, healthcare centres should work to achieve an organizational culture that is driven by the use of EHRs. This can be attained by formulating effective and well-functioning user feedback channels that contribute to the development of user-driven EHRs systems. Nurses should be trained before system implementation to facilitate adoption. Beyond system implementation, nurses should be continuously trained to facilitate improvements in self-efficacy [158]. Moreover, system IT support should also be availed to nurses in order to address system issues and technology-based difficulties in a timely and efficient manner [21].

Table 4: Summary of Reviewed Literature

Study	Year	Factors influencing nurses' intention to use	Factors with insignificant influence on nurses' Intention	Model
[220]	2020	perceived ease of use, perceived usefulness and Subject Norm		TAM3
[221]	2022	performance expectancy, social influence, facilitating conditions, self-efficacy and user satisfaction	Effort Expectancy	UTAUT
[226]	2020	Social Influence, Attitude towards the Use of Technology, Facilitating Conditions	Performance Expectancy and Effort expectancy	UTAUT
[222]	2022	Performance Expectancy and Attitude	effort expectancy, social influence, and facilitating condition (age, years of experience, professional role)	UTAUT
[223]	2020	Performance Expectancy, system operation experience	effort expectancy, social norms, facilitating conditions, and training	UTAUT & DoI
[174]	2021	performance expectancy and effort expectancy, (age)	Social Influence	UTAUT
[224]	2022	Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions	Top Management support	UTAUT

[225]	2021	performance expectancy and attitude	Facilitating conditions, Social Influence, Effort expectancy	UTAUT
[64]	2009	Performance Expectancy; Effort Expectancy; Social Influence; Facilitating Conditions; Experiences; Voluntariness; IT knowledge moderating Facilitating conditions.		UTAUT
[15]	2012	Perceived Usefulness; Facilitating Conditions; Compatibility; Subjective Norm	Age; Level of Education; Technology Experience	Chau and Hu's model of telemedicine & TAM
[187]	2017	Perceived Behavioural Control; Normative Beliefs; Attitude	Age; Level of Education; Technology Experience	TPB
[65]	2016	Perceived Usefulness; Perceived Ease of Use; Attitude; Computer knowledge; Level of Education	Age; Technology Experience; Working Experience	TAM
[128]	2013	IT Knowledge, Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, moderated by Experience and Voluntariness of use.	Gender; Age	UTAUT
[168]	2013	Subjective Norm, Image, Experience, Demonstrability, Voluntariness, Perceived Usefulness, Qualitative Overload & Quantitative Overload		TAM 2
[199]	2016	Perceived Usefulness; Computer self-efficacy, Subjective Norm; Attitude		TAM & TPB
[242]	2012	Perceived Usefulness; Facilitating Conditions; Compatibility; Subjective Norm		
[198]	2015	Optimism; Innovativeness; Insecurity; Discomfort; Computer Self-efficacy; Work experience; Facilitating Conditions; Social Influence; Attitude; Perceived Ease of Use; and Perceived Usefulness		UTAUT
[169]	2015	Age; Teamwork within hospital unit; Perceived Usefulness		TAM
[61]	2011	Age; Teamwork within hospital unit; Perceived Usefulness		TAM & TPB
[50]	2014	Performance Expectancy; Effort Expectancy; Social Influence; Facilitating Conditions		UTAUT
[170]	2016	Prior Experience		TAM3 & Theory Behaviour

[243]	2013	Performance Expectancy; Effort Expectancy; Social Influence	ADAPTED UTAUT
[129]	2013	Performance Expectancy; Effort Expectancy; Facilitating Conditions; Social Influence; Gender; Age	UTAUT
[187]	2012	Perceived Behavioural Control; Normative Beliefs; Attitude	TPB
[244]	2011	Attitude; Subjective Norm; Perceived Behavioural Control	DTPB
[245]	2011	Years working in the hospital; Social Influence; Perceived Usefulness; Perceived Ease of Use; Attitude	TAM
[60]	2012	Facilitating Conditions; Compatibility; Perceived Usefulness	TAM& Hu's model of telemedicine
[54]	2014	Compatibility; Trust; Perceived Usefulness; Attitude; Social Influence	TRA
[246]	2012	Perceived Ease of Use; Relevance; Subjective Norm	TAM
[65]	2016	Perceived Usefulness; Perceived Ease of Use; Attitude; Computer knowledge; Level of Education	TAM
[141]	2016	Performance Expectancy; Attitude	UTAUT
[197]	2014	Social Influence; Trust	MODIFIED UTAUT

2.3 Conclusion

In summary, the literature review identified influences that effect nurses' behavioural intention to use EHRs as: ***Attributes of nurses using EHRs*** (attitude, age, personal experience, IT experience, level of education, self-efficacy, computer anxiety and personal innovativeness), **attributes of technology** (effort expectancy and performance expectancy) **and attributes of the organizational environment** (social influence and facilitating conditions). However, since this literature review identified some inconsistencies in the impact of individual, technological, and organizational factors on nurses' behavioural intention, uncertainties arise as to whether these inconclusive findings can be applied to the acceptance and use of EHRs in resource-limited settings in Botswana.

2.4 Theoretical Model

Nurses use the majority of their time attending to patients than with their colleagues, so nurses must use EHRs to achieve an enhanced quality of care for their patients [159]. The quality of nursing care delivered to a patient by a nurse is directly affected and determined by EHRs usage as it enables nurses to retrieve timely, complete, and accurate patient information to facilitate accurate decision-making in patient care [247].

The Modified Unified Theory of Acceptance and Use of Technology (Modified UTAUT) model was adapted to examine nurses' acceptance and use of EHRs in resource-limited public health facilities in Botswana through the examination of influences that effect nurses' behavioural intentions. The Modified UTAUT was developed by K. B. Shiferaw and E. A. Mehari [23] as an extension of the UTAUT model [68] which was advanced by Venkatesh and affiliates as a theoretical advancement over its predecessors; acceptance and diffusion theories and models [100]. The Modified UTAUT Model theorizes that performance expectancy, effort expectancy, self-efficacy, attitude towards behaviour, social influence, and facilitating conditions have a significant and direct effect on behavioural intention and actual use. However, the modified UTAUT does not take into consideration age, professional experience, IT experience, level of education, or any other moderating factors in comparison with the original UTAUT model. By studying and analysing these variables in a real-life setting, investigators and practitioners will be able to determine an individual's intent [248].

Definitions of behavioural intention, individual, technological, and organizational attributes as utilized in the UTAUT model to determine behavioural intention to use:

Behavioural Intention: This is the amount of effort that a potential system user is willing to apply to successfully bring about an intended and desired behavioural goal [71]. This research regards behavioural intention as the result parameter deduced from nurses as their intention to use EHRs in Botswana's public health facilities in resource-limited setting.

Individual components: are individual nurses' personal attributes and attitudes towards the use of technology. Personal attitudes are unique to an individual and may be favourable or unfavourable as perceptions of the potential results of carrying out a behaviour [71].

Technological components: in the Modified UTAUT, technological components involve performance expectancy and effort expectancy. Performance expectancy is an person's discernment of how the information system will help them to do their job better, while effort expectancy is how easy the individual system user perceives the system to be [68].

Organizational components of Modified UTAUT involve:

- a. *Social influence (Social Norm)*- Normative and role beliefs create social norms in people over time. Normative beliefs have to do with how an individual accepts and absorbs the behavioural opinion of their social group [66]. However, role beliefs encompass the degree to which an individual system user supposes that someone in their set of qualities should or should not perform a learnt behaviour.
- b. *Facilitating Conditions*-“Facilitating conditions are defined as the degree to which an individual believes that organizational and technical infrastructure exists to support the use of a given system” [113].

To address the identified shortcomings and inconsistencies, other influences such as age, gender, personal innovativeness, IT experience, professional experience, job characteristics, job position, habit, system compatibility, and organizational support could be integrated into the proposed research model to improve understanding about the acceptance and use of technological systems by nurses in their practice. Reports with a similar approach and design to this study are needed to increase understanding in this area [65].

In this study, three revisions were made to the Modified UTAUT model as shown in figure 7 below.

- 1) Firstly, **resistance to change (RC)** was added as a fourth predictive factor that influences behavioural intention. This addition to the modified UTAUT model was premised on the literature review conducted. The review of the literature involved an examination of the influences of acceptance and use of EHRs in healthcare facilities. From the literature review, RC was reported to have a negative but significant influence on behavioural intention, while other studies reported that resistance to change has an insignificant influence. As a result, since these findings are inconclusive and the available literature on rural settings was limited, resistance to change was added as a fourth factor influencing the acceptance and use of EHRs in Botswana’s public health facilities in resource-limited setting.
- 2) The second modification was the addition of age, professional experience, IT experience, level of education, personal innovativeness, and computer anxiety as factors with moderating effects on the relationships of the proposed influences that have been found to impact the acceptance and use of EHRs in Botswana’s public health facilities in resource-limited settings by nurses.

- i. This study proposes the addition of **age** as a factor moderating the relationships between:

a) *resistance to change and behavioural intention*

The rationale for adding the moderating effects age on the relationship between resistance to change and attitude is based on studies that found that RC changes with age. These studies noted that youthful nurses are more open to adopting EHRs in comparison to older nurses [175]–[180]. Most studies on resistance to use do not take into consideration the effects of any moderating factors, hence the need to explore the relationship between age and resistance to use [116], [202], [208], [217], [249].

b) *effort expectancy and attitude*

The literature review revealed that nurses above 40 show less effort expectancy compared to their younger counterparts [129], [130]. However, a study by [171] found no connection between perceived ease of use, attitude and age, hence conflicting findings were uncovered.

c) *social influence and behavioural intention*

More social influence was reported amongst nurses above the age of 40 compared to their younger counterparts [129], [130]. However, a study [168] found that age does not influence subjective norms, hence the findings are inconclusive.

d) *personal innovativeness and behavioural intention*

The rationale for this addition is based on studies that reported lower personal innovativeness as age increases [168]. This connection has limited literature attached to it, prompting further research into this relationship.

e) *Performance expectancy and attitude*

The rationale for adding age as a factor that mitigates the link between performance expectancy and attitude was informed by the literature review. Studies found that older nurses are more likely to regard EHRs as ‘not useful’[171] while other studies found a significant influence of age on performance expectancy[182], hence some conflicting findings were identified from the review of related literature.

Numerous studies reported that age is a significant causal factor of acceptance and use of technology as a moderating construct [129], [185], [250], [251] while other researchers found that age has no impact on behavioural intention. Therefore, the results are inconclusive and cannot be readily applied to this study [15], [65], [127],

[128], [168], [185], [187]. These inconsistencies prompt further research into age and its moderating effects on intention to use.

- ii. In the case of the proposed moderators, it was also found that the **level of education** has a substantial effect on the relationships between effort expectancy, performance expectancy, and attitude towards use, as reported in the literature review [65], [185]. Because there is limited literature on the influence of level of education as a moderating factor on the relationships between effort expectancy, performance expectancy and attitude towards use as opposed to the direct connection to behavioural intention, level of education was included as a second moderating factor to examine its influence on the following relationships:
 - a. Effort expectancy and attitude towards use
 - b. Performance expectancy and attitude towards use.

Inconsistencies have also been identified as several studies found that the level of education has significant moderating effects [251], while other studies found that level of education has no significant influence towards behavioural intention [65], [127], [187].

- iii. The findings on **professional experience** were inconclusive as studies reported that professional experience had negative but significant effects on social influence. However, other studies found that professional experience has no significant influence on attitudes [65], [185], [252].
- iv. The rationale for adding **IT Experience** is premised on the outcomes of the review of the literature. Most studies reported that computer knowledge had a significant influence as a moderator of connections between perceived usefulness, perceived ease of use and attitude towards IS [65], [185], [189], [251]. This study proposes IT experience as a moderator between the following relationships:
 - a) Effort expectancy and attitude towards use
 - b) Performance expectancy and attitude towards use
- v. The findings of the review of literature informed the addition of **personal innovativeness** as both a moderating factor and a factor directly influencing behavioural intention to use. Studies reported that personal innovativeness has a

substantial, positive and direct impact on nurses' behavioural intention and a moderating effect on facilitating conditions and effort expectancy (perceived ease of use). As a result of the inconsistencies identified, and the limited literature available, personal innovativeness was included as a predictor thus:

- a) Personal innovativeness and behavioural intention
 - b) Personal innovativeness as a determinant of effort expectancy
 - c) Personal innovativeness as a determinant of facilitating conditions
- vi. The sixth addition to the proposed model is **computer anxiety** as a determinant of behavioural intention, effort expectancy and resistance to change. This addition was informed by the literature review. The findings of the review of the literature reported that an surge in computer anxiety results in a decline in effort expectancy. It has also been reported that behavioural intention, performance expectancy and attitude are negatively affected by an increase in computer anxiety. However, some inconsistencies were identified as other studies reported no impact of computer anxiety on behavioural intention, while other studies reported no effects of computer anxiety on perceived ease of use. Computer anxiety was selected in this study as an additional construct to the proposed model because the literature proposes that computer anxiety is a reliable causal factor of computer usage in both personal and professional settings [180], [253] and to address some inconsistencies identified in the review of the literature. The following relationships were proposed for this study to find the influence of:
- a) Computer anxiety on resistance to change
 - b) Computer anxiety on behavioural intention
 - c) Computer anxiety on effort expectancy

2.5 Hypotheses

This study's proposed hypotheses are:

1. Personal innovativeness, computer anxiety, social influence, resistance to change, computer self-efficacy, performance expectancy and attitude are directly correlated to nurses' behavioural intentions to use EHRs.
2. Effort expectancy, computer self-efficacy, facilitating conditions and behavioural intentions were hypothesized to directly determine actual use behaviour.

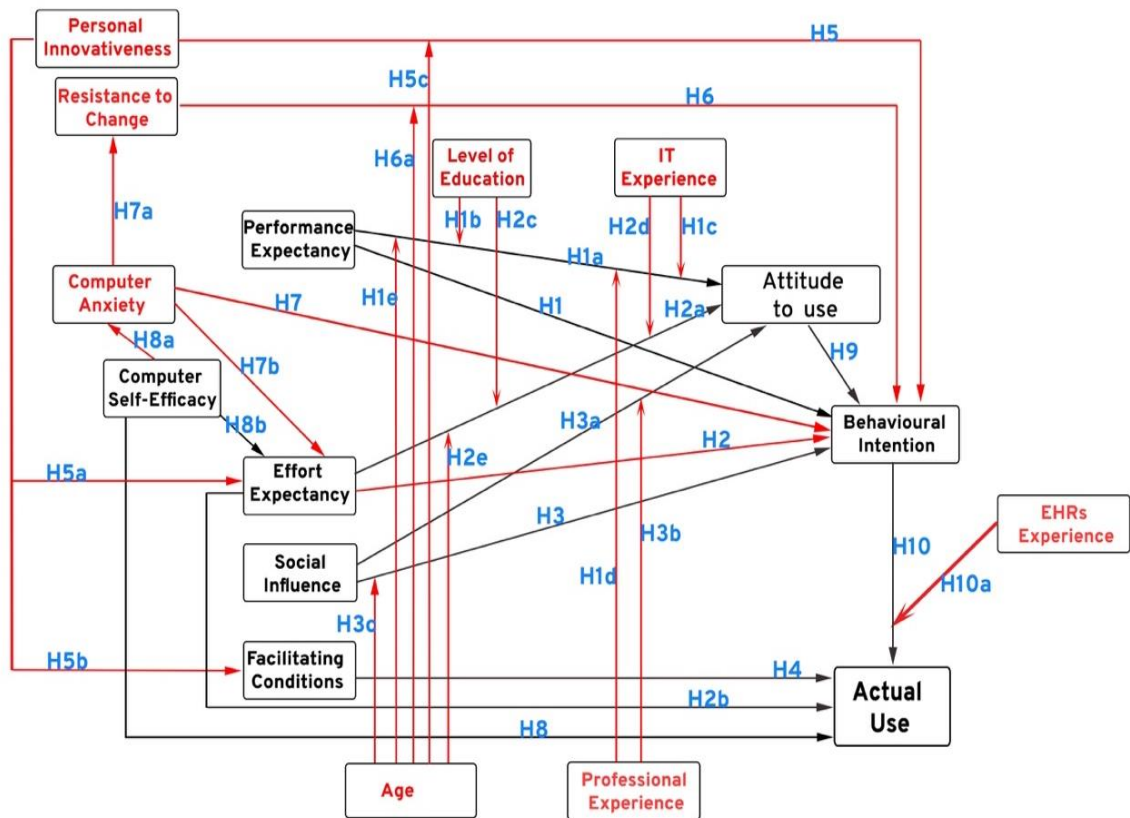
Age, professional experience, IT experience, level of education, effort expectancy, computer self-efficacy, computer anxiety and personal innovativeness have an indirect effect on behavioural intention.

Table 5 : Research Hypotheses

Hypothesis	Relationship
H1: Performance Expectancy will have a positive influence on Behavioural Intention	PE $\longrightarrow$ BI
H1a: Performance Expectancy will have a positive influence on attitude towards use	PE $\longrightarrow$ ATT
H1b: Performance expectancy will be moderated by level of education such that the effects will be stronger for more educated nurses	PE*LOE $\longrightarrow$ ATT
H1c: Performance expectancy will be moderated by IT experience, such that the effects will be stronger for more computer savvy-nurses.	PE*ITExp $\longrightarrow$ ATT
H1d: Performance expectancy will be moderated by professional experience, such that the effects will be stronger for nurses with more professional experience	PE*PE _x $\longrightarrow$ ATT
H1e: Performance expectancy will be moderated by age, such that the effects will be stronger for older nurses.	PE*AGE $\longrightarrow$ ATT
H2: Effort Expectancy will have a positive influence on Behavioural Intention to use	EE $\longrightarrow$ BI
H2a: Effort Expectancy will have a positive influence on attitude towards behaviour	EE $\longrightarrow$ ATT
H2b: Effort Expectancy will have a positive influence on the actual use	EE $\longrightarrow$ AU
H2c: Effort expectancy will be moderated by level of education, such that the effects will be stronger for more educated nurses	EE*LOE $\longrightarrow$ ATT
H2d: Effort expectancy will be moderated by IT experience, such that the effects will be stronger for more computer savvy-nurses	EE*ITExp $\longrightarrow$ ATT
H2e: Effort expectancy will be moderated by age, such that the effects will be stronger for older nurses	EE*AGE $\longrightarrow$ ATT
H3: Social Influence will have a positive influence behavioural intention to use EHRs	SI $\longrightarrow$ BI
H3a: Social Influence will have a positive influence on attitude towards behaviour	SI $\longrightarrow$ ATT
H3b: Social influence will be moderated by Professional Experience, such that the effects will be stronger for older nurses	SI*PE _x $\longrightarrow$ ATT

H3c: Social influence will be moderated by age, such that the effects will be stronger for older nurses	SI*AGE → BI
H4: Facilitating Conditions will have a positive influence on the actual use	FC → AU
H5: Personal innovativeness will have a positive influence on Behavioural Intention	PI → BI
H5a: Personal innovativeness will have a positive influence on effort expectancy	PI → EE
H5b: Personal innovativeness will have a positive influence on facilitating conditions	PI → FC
H5c: Personal innovativeness will be moderated by age, such that the effects will be stronger for older nurses.	PI* AGE → BI
H6: Resistance to change will have a negative influence on nurses' behavioural intention to use	RC → BI
H6a: Resistance to change will be moderated by age, such that the effects will be stronger for older nurses.	RC* AGE → BI
H7: Behavioural intention will be negatively influenced by computer anxiety	CA - → BI
H7a: Resistance to change will be positively influenced by computer anxiety	CA → RC
H7b: Effort expectancy will be negatively influenced by computer anxiety	CA - → EE
H8: Self-Efficacy will have a positive influence on the actual use	SE → AU
H8a: Self-Efficacy will have a negative influence on nurses' Computer Anxiety	SE → CA
H8b: Self-Efficacy will have positive influence on Effort Expectancy	SE → EE
H9: Attitude towards behaviour will have a positive influence on Behavioural Intention	ATT → BI
H10: Behavioural Intention will have a positive influence on nurses' Actual Use	BI → AU
H10a: EHRs Experience will positively and directly influence Actual Use	BI*EHRExp → AU

Figure 7: Proposed Additions



3 CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the basic guidelines and systematic order of undertakings implored to address the research objectives and hypotheses. Also, this chapter seeks to explain the selection of research methodology that outlines how data was collected and analysed. Lastly, this chapter unveils the research design, target population, sample, research instrument, data collection process, data analysis and ethical considerations for this study.

3.2 Research Design

Research is a methodical advancement of investigation that encompasses data collection, analysis, interpretation and the results obtained that can be used to either prove or disprove existing knowledge [254]. Methodical, therefore, implies a formal investigation guided by scientific methods that can be replicated under specific variables to obtain similar results [255]. However, a research methodology is defined as a compilation of approaches and processes used to undertake a study within a defined paradigm [256], [257].

According to a study by Rindfleisch et al, research can be categorized as cross-sectional or longitudinal survey research [258]. This study utilizes a cross-sectional survey design [259]–[261], and data were collected from nurses in resource-limited settings at a single chosen point [262], [263] as opposed to recurrently over time. This study combines the quantitative and qualitative methods through the use of close-ended questions and an open-ended question in the same research questionnaire. Thus, this study utilizes a convergent mixed-methods design, collecting the quantitative and qualitative data at the same time to answer the research questions [264], [265]. This study proposes the use of the modified UTAUT model [23] as well as additional variables influencing acceptance and use of information systems as divulged by the literature review conducted to better understand factors influencing nurses' acceptance and use of EHRs in resource-limited settings.

3.2.1 Quantitative Data

This study gathered quantitative data by making use of close-ended questions used closed-ended questions. Quantitative data was gathered on nurses' demographic and work-related attributes, EHRs use status, and on experiences with software and hardware use. In addition,

nurses were assessed with standard questions on prior experience with EHRs use, EHRs current use and frequency of use, reasons for EHRs use, barriers to EHRs use, and nurses' comfort levels with EHRs usage. A quantitative technique was used to analyse the research findings. Statistical Packages for Social Science (SPSS 26) software was used to analyze the collected data, making use of coded entries. The data was coded, checked for errors, and analysed. The data was analysed using descriptive statistics, mainly by frequencies, mean and correlation coefficient. In addition, a multiple regression analysis was conducted to find factors affecting nurses' acceptance and EHRs usage in resource-limited settings. The outcomes of the multiple regression analysis also detailed the resultant model and its explanatory power.

3.2.2 Qualitative Data

This study also used an open-ended question in the same research instrument to collect qualitative data. Open-ended questions help to avoid the bias that occurs from suggesting responses [266]. Unlike close-ended questions which limit the respondents to a set of options availed in the questionnaire, open-ended questions allow participants to freely articulate their views inviting elaborated responses to gain more clarity [267]. The open-ended question on why participants felt comfort or discomfort with the use of EHRs was aimed at gaining more understanding of nurses' comfort levels with the use of EHRs (complementarity and expansion) [268].

This data was analysed using NVivo 12 qualitative data software to conduct inductive content analysis. As a result, groups emerged from the gathered information without using theory-based classification matrices [269]. This process involved carefully reading the open-ended responses and taking notes to outline key phrases and allow for the formulation of categories [270]. These categories were combined taking into account their close relationship, formulating more generalized categories [270]. The replication of the emergent categories signified data saturation and this was also used to verify data completeness and comprehensiveness, paving a way for the final stage of abstraction [269]. The broader categories that emerged were structured into principal categories in the data abstraction stage [127], [269], [271]. The outcomes of the analysis were presented in tables for easy viewing to facilitate easy data discussion.

3.3 Research Paradigm

Research may either be categorized as **positivism, interpretive or critical** paradigms depending on the basis for assumptions [272]. Positivism refers to studies that deal with social reality through observation and reason basing assumptions on observable facts [273]. This paradigm is based on the supposition that substances exist autonomous of humans and happen naturally [274]. Also, this paradigm helps positivist researchers to establish the connection of the independent variable to the dependent by causal extrapolations [275]. However, scholarly critics condemn positivism highlighting that while positivism is ideal for studying natural phenomena, they further posit that the positivist approaches are not ideal for studying social occurrences [276]. Lastly, a study posited that the positivism paradigm is not ideal for use in social research projects as it could be impossible to measure phenomena related to behavioural intentions, attitudes and human thought as these concepts cannot be measured with sense experience or without substantiation [273], [277].

However, interpretivism was developed to address the over-dominance of positivism [278], and to dismiss the perception that there is a single demonstrable truth that is independent of our senses [272]. Instead, interpretivism attempts to study social occurrences through multiple composite realities, while considering multiple viewpoints for a more holistic approach [279]. The aim of interpretivism is to understand the different ways of seeing and experiencing the world in different contexts leading to human behaviour [273], [280]. By creating opportunities to experience the context directly, the interpretive approach facilitates empathetic understanding of how particular values and norms influence perceptions and behaviours [272]. One advantage of using interpretivist methods of research is that the responses are valid and close to the truth [273]. The objective of interpretivism is to appreciate the individual human experiences and to isolate reasons for their behaviour in their natural environment using nonscientific, flexible and informal methods using non-representative sample techniques [275], [281]–[283]. However, interpretivism was not chosen for this study because of its weakness in yielding theories that are not generalizable [279].

The critical paradigm posits and recognizes the influence of cultural, political, ethnic, gender and religious elements in modelling a functional social system [272]. In addition, the critical paradigm is known for its ability to understand society, and to influence or make transformations in society [284]. Although both positivism and interpretivism are integral to research, neither approach resolves to transform society [285]. While positivists and

interpretivists merely produce knowledge about society as it subsists, critical paradigm aims to analytically address principles, viewpoints and actions that limit behaviour in society to make some societal transformations [285]–[287]. Although the critical paradigm allows for multiple viewpoints, yields multiple results, and recognizes factors influencing social system formation, it is not easy to discern these transformations as outcomes of action may take considerable time for reflection in reality [273].

In accordance with Lather and St Pierre [288], this study associates mixed-methods studies with positivism [289]. This position is supported by McGregor and Murnane who also advanced that, positivism can be used for both quantitative and qualitative studies [281]. This study is consistent with the positivist paradigm approach as it seeks to create knowledge using a scientific approach to research (sampling, data collection and analysis) while considering reliability and validity [281]. As a result, this study adopted the positivism paradigm to ascertain, understand, and assess elements that effect nurses' acceptance and use and to explore nurses' perceptions and intent to use EHRs in resource-limited settings. This choice was also based on similar studies that used the positivist paradigm [290]–[292].

3.4 Target Population

The target population was primarily made up of healthcare practitioners employed in rural public health facilities (clinics and health posts) across District Health Management Teams in Botswana. Healthcare practitioners were considered to be eligible to take part in this investigation if they met the following criteria at the time of participation:

- i.) Legally accredited and currently practising in Botswana's public health facilities in limited-resource setting;
- ii.) employed on a fixed-term contract, part-time or as full-time employees in Botswana's public health facilities in limited-resource setting;
- iii.) either worked with or familiar with electronic health records;
- iv.) if they were found to be part in the delivery nursing care to patients in Botswana's public health facilities in limited-resource setting.

Using the above-mentioned selection criteria, healthcare practitioners who met the selection criteria above were deemed eligible to take part in this study; Registered Nurses

(senior/principal/chief), Mid-Wives, Healthcare assistants, Nursing Officers (I and II), Ophthalmic Nurses, Medical Officers, Pharmacy Technicians, Health Information Officers and Health Education Officers.

Sample

Sampling involves the selection of a segment that represents a whole [293]. This study used a mixed sampling design, involving both the quantitative and qualitative data gathered from the same respondents at the same time. The mixed sampling design utilized in this study was a Concurrent Design using Identical Samples [294]. Sampling approaches are devised to generate information-rich cases in order to better understand the topic under study [295]. For this reason, convenience sampling was adopted for this [296], taking the various departments and service delivery points into consideration to gather the information that best reflects healthcare workers' perceptions of EHRs. Convenience sampling is a non-probability sampling in which participants are selected based on meeting set criteria such as easy access to participants, participants' geographical predisposition, participants' availability at the time the study is conducted, and their willingness to take part [297]. This form of sampling was selected for its simplicity and ease, economic nature and the time constraints involved.

Hill recommends a 10% margin of error as a rule of thumb and hints that the money and time invested in obtaining a margin of error of less than 4% are not worth the compromise [298]. The sample size of this investigation was calculated using a priori sample size calculator for multiple regression with a probability level of 0.05, 14 determinants, anticipated effect size of 0.15 and a desired statistical power level of 0.8. The sample size of this study was calculated to be a minimum of 135 healthcare workers. This is also in line with other related works with sample sizes of 156 [127] and 129 participants respectively [164].

Resource-Limited Setting

A healthcare facility in resource-limited settings is characterized by fewer trained personnel, less developed infrastructure, and limited access to medication, equipment, supplies and devices [299]–[302]. That is, healthcare facilities in limited-resource settings have limited financial, technical and organizational resources [303]. A study by Love insisted that a healthcare facility in limited-resource setting is characterized by 100 or fewer beds or has 4000

or fewer admissions [164]. Moreover, resource-limited settings are usually characterized by a population of less than 10000 inhabitants [304], [305].

This definition which includes either bed count or population size was adopted for the purpose of this study. In addition, resource-limited facilities resource limited settings covered all health posts. The World Health Organization defines health posts as health environments with low bed count and limited curative and preventative care resources [306]. As a result, this study considered all health posts as healthcare facilities in resource-limited settings. This study was conducted across Greater Mahalapye, Serowe, Palapye, Kgatleng, Kweneng, Southern, Greater Francistown and Greater Selibe-Phikwe District Health Management Teams in the following facilities:

Table 6: Health facilities where the study was conducted

DHMT	VILLAGE	POPULATION	FACILITY
GREATER MAHALAPYE [307] [308]	Ramokgonami	4486	Ramokgonami Health Post
	Chadibe	2973	Chadibe Clinic
	Shoshong	9678	Shoshong Clinic
	Shoshong	9678	Sheleketla clinic
	Ikongwe	533	Ikongwe Health Post
	Mosolotshane	2017	Mosolotshane Health Post
	Mmutane	854	Mmutane Health Post
	Bonwapitse	635	Bonwapitse Health Post
	Kalamare	2196	Kalamare Clinic
	Tewane	459	Tewane Health Post
	Maape	1319	Maape Health Post
	Pilikwe	1282	Pilikwe Health Post
	Mokobeng	2535	Mokobeng Health post
	Ngwapa	487	Ngwapa Health Post
	Moshopha	1373	Moshopha Health Post
	Matlhako	752	Matlhako Health Post
	Letoreng	Under 500	Letoreng Health Post
	Mhalapitsa	1019	Mhalapitsa Health Post
	Sefhare	4602	Sefhare Primary Hospital
	Machaneng	2537	Machaneng Health Post
SEROWE [309] [308]	Mogorosi	2716	Mogorosi Health Post
	Thabala	2429	Thabala Clinic
	Moiyabana	3571	Moiyabana Clinic
	Motshegaletau	958	Russle May Clinic
	Mabeleapodi	2247	Mabeleapodi Clinic
	Mmashoro	2834	Mmashoro Clinic
	Paje	2507	Paje Health Post
PALAPYE [309][308]	Lecheng	3344	Lecheng Health Post
	Malaka	1044	Malaka Health Post
	Matlhakola	996	Matlhakola Health Post

KGATLENG [308], [310]	Morwa	3566	Morwa Clinic
	Bokaa	5680	Bokaa Clinic
	Pilane	1795	Pilane Helath Post
	Artesia	2365	Artesia Clinic
KWENENG [311]	Kgope	507	Kgope Health Post
	Lentsweletau	4916	Lentsweletau Clinic
	Mmatseta	513	Mmatseta Health Post
SOUTHERN (KANYE) [308]	Moshana	1512	Moshana Health Post
	Selokolela	1610	Selokolela Health Post
	Lotlhakane East	4828	Lotlhakane East Clinic
GREATER FRANCISTOWN [308]	Shashe Mooke	3380	Shashe Mooke Health Post
	Tlhalogang		Tlhalogang Health Post
	Jamataka	650	Jamataka Health Post
	Makobo	1268	Makobo Health Post
	Natale	1288	Natale Health Post
	Mandunyane	3589	Mandunyane Health Post
	Shashe/ Semotswane	3136	ShasheBridge Health Post
	Shashe Station	3380	Shashe Station Health Post
	Borolong	5184	Borolong Health Post
	Manyanda		Manyanda Health Post
	Tati-Siding	8112	Tati-Siding Clinic
	Mathangwane	5075	Mathangwane Clinic
GREATER SELIBE PHIKWE [308]	Mmadinare	10086	Mmadinare
	Manga	10086	Manga Clinic
	Sefhophe	6062	Sefhophe Clinic

3.5 Research Instrument

This study used a questionnaire adapted from a study by Ibrahim [127] to collect research data from nurses (respondents) in Botswana's public health facilities in resource-limited. Additions were made to this questionnaire to include questions on the influence of the proposed additions as per the literature review conducted. Before participating, nurses were presented with a detailed verbal description of the study, followed by an information sheet containing details about the study and an informed consent form to sign upon agreeing to participate. This information sheet entails a detailed description of the study background, an invitation to take part in the survey, a description of how the participants were selected and the possible advantages and risks of taking part in this survey. In addition, the information sheet also included confidentiality (data integrity), voluntary participation, withdrawal rights, how the data collected will be used, and contact information of the research team based on Dillman et al.'s method [312], [313]. The first section of the questionnaire collects data on participants'

current position, name of their health facility and its corresponding DHMT. This section also entails questions on participants' gender, age, education, employment status, work experience and prior experience with computing hardware and software use. Lastly, Section A of the questionnaire entails questions on nurses' prior experience with EHRs usage, EHRs current use, EHRs usage frequency, reasons on why nurses use EHRs, barriers to EHRs usage and on nurses' comfort levels with EHRs usage. Section B of the questionnaire entails questions on the main study variables as adapted from other previous UTAUT-based studies.

This study chose a survey questionnaire utilizing a five-point Likert scale to measure the main study variables varying from (1) Strongly Agree to (5) Strongly Disagree [314]. To respond or provide an answer to a Likert scale questionnaire, a respondent indicates how much they agree with a given statement. Likert scale was chosen as they are the most common means of collecting data on information technology in rural healthcare settings [163]. Negatively worded items were also included in the questionnaire to act as a cognitive bump aimed at minimizing response bias [315]. The five-point Likert scale was selected as it is common and simple to understand and use in surveys, allows participants choices without overwhelming them, and produces reliable quantitative data that can be easily analysed [316], [317].

3.6 Main Study Variables

3.6.1 Validity

The **validity of a research instrument** refers to the correctness and relevance of the conclusions drawn from the research results [318]. The selected research material must be directly relevant to addressing the identified research gaps for the data collection instrument to be considered valid. This study used and extended the UTAUT research instrument adapted from Ibrahim (2019) [127] based on empirical evidence on the influences impacting the acceptance and use of information systems. To validate the research instrument, detect, and correct errors beforehand, a pilot questionnaire was administered to a selected group of participants with dynamics similar to the intended participants on the field. This was done to determine if there were any recurring mistakes or potential problems. It is important to conduct a pilot study to establish a preliminary test of the set hypotheses leading to more accurate hypotheses in the main investigation. In addition, a pilot study can provide alternate methods, viewpoints, and suggestions that may not have been considered before piloting the study.

The selected group of participating nurses were requested to review the questionnaire and complete a questionnaire validation tool (Appendix B). The questionnaire validation tool measured the questionnaire in terms of clarity, wordiness, negative wording, overlapping responses, balance, use of jargon, appropriateness of listed responses, use of technical language, application to praxis and relationship to the problem. This tool was anchored on a scale ranging from Not Acceptable (1), Below Expectations (2), Meets Expectations (3) and Exceed Expectations (4). In addition, the questionnaire validation tool measured constructs performance expectancy, effort expectancy, social influence, facilitating conditions, self-efficacy, attitude towards use, personal innovativeness, resistance to change, computer anxiety, behavioural intention, and actual use on the same scale. Using the scores from this pilot study, the Content Validity Index (CVI) for each main study variable was calculated [127] [319]. This study recorded a good content validity index (Content Validity Index ≥ 0.83) per main study variable measured, demonstrating that the items addressed the facets of the concepts of the research as shown in Table 7. The recorded average score (Content Validity Index ≥ 0.94) meets the recommended minimum score in acceptable CVI scores on six experts (Content Validity Index ≥ 0.83) [320].

Table 7: Questionnaire Validation Tool: Content Validity Index

Item Description	N	Range	Content Validity Index
Clarity	6	1-4	1
Wordiness	6	1-4	0.83333333
Negative Wording	6	1-4	0.83333333
Overlapping Responses	6	1-4	0.83333333
Balance	6	1-4	1
Use of Jargon	6	1-4	0.83333333
Appropriateness of Responses Listed	6	1-4	0.83333333
Use of Technical Language	6	1-4	1
Application to Praxis	6	1-4	1
Relationship to Problem	6	1-4	1
Measure of Construct: (Performance Expectancy)	6	1-4	1
Measure of Construct: (Effort Expectancy)	6	1-4	1
Measure of Construct: Social Influence	6	1-4	0.83333333
Measure of Construct: Facilitating Conditions	6	1-4	1
Measure of Construct: Self Efficacy	6	1-4	1
Measure of Construct: Attitude	6	1-4	0.83333333
Measure of Construct: Personal Innovation	6	1-4	0.83333333
Measure of Construct: Resistance to change	6	1-4	1

Measure of Construct: Computer Anxiety	6	1-4	1
Measure of Construct: Behavioural Intention	6	1-4	1
Measure of Construct: Actual Use	6	1-4	1
0.93650794			

3.7 Data Collection and Analysis

The entire data collection process, which involved sending and receiving questionnaires, and making follow-ups, was conducted and completed over a period of approximately eight (8) months. Ethical considerations were duly observed before administering the research instrument. Prior to participating in this study, potential respondents were presented with a brief introduction to the study and research permit approvals from the Ministry of Health and the District Health Management Teams. This was followed by informed consent requests and the corresponding questionnaires for nurses to participate in this study and its corresponding questionnaire.

Due to time constraints and how dispersed the research sites were, questionnaires were distributed to the available participants to complete at their convenience and return the scripts. Follow-up questionnaires were sent to those who failed to respond to maximize the response rate. In addition, follow-ups were made through phone-calls to ensure that all eligible potential participants were reached. In the end, 193 responses were collected from participating nurses. A word of appreciation was sent to each group of respondents per facility to acknowledge, recognize and appreciate their efforts and contribution to this study [313], [321].

3.8 Ethical Considerations

Ethical conduct in research is essential. Prior to scientific research, numerous ethical principles and conditions must be taken into consideration. This study was determined to be within the bounds of acceptable ethical considerations, and therefore required no additional steps to ensure the safety of study participants. This study adheres to and subscribes to the ethical principles of the Belmont Report [165], [322]. Also, the study considers the ideologies of non-maleficence, respect for participants and persons, beneficence, and fairness as required participant selection and recruitment, assessment, investigation, and debriefing processes.

Consideration of these ideologies was important to guarantee, safeguard and promote the dignity of all participants in this study.

Beneficence in scientific research ethics dictates that researchers must aim for the welfare of the research participants as an objective while maintaining courtesy and protecting research participants from harm. This study upholds treating the participants with respect, in a dignified and professional manner. All participants are treated equally, without any form of discrimination or propagation of stereotypes [323]. Detailed descriptions of the study were provided to participants in this study, as well as the benefits of conducting this research. In addition, the participants were accorded a chance to review a detailed description of the consent information which clearly states participants' rights, confidentiality, and anonymity. Participation was based on voluntary and informed consent, and no participant was forced to participate in any way [324].

This study was sanctioned by the Human Research Ethics Committee at the Ministry of Tertiary Education through the Botswana International University of Science and Technology (BIUST) and by the Ministry of Health through its DHMTs.

Chapter Summary

This chapter discussed the research methods utilized in this study. Also, this chapter expounded on the reasons for the selection of the research methods, respondents and how the research instrument was designed and distributed. Lastly, this chapter explained on data collection, analysis, reliability, validity and the ethical considerations of the study.

4 CHAPTER 4: MEASUREMENT SCALE ANALYSIS

This chapter delineates the attributes and outcomes of the measurement scales used in this investigation to examine the proposed variables in the theoretical model. The main study variables were measured to determine their reliability. Also, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were carried out on the main study variables to analyze and verify the validity and unidimensionality of the proposed constructs.

4.1 Construct Reliability

Construct reliability may be defined as the extent to which a construct can generate consistent findings upon administering repetitive tests [318], [325]. It measures the extent to which a repeated analysis of a construct yields consistent results. It also refers to the situation where the research findings can be replicated when using the same methodology [143], [144]. That is, repeat analysis of an unmodified construct should yield similar results. According to the selected model (modified UTAUT) and the proposed additions, the following main variables of the study were established:

- Performance expectancy
- Effort Expectancy
- Social Influence
- Facilitating Conditions
- Attitudes towards use
- Personal Innovativeness
- Resistance to Change
- Computer Anxiety
- Self-Efficacy
- Behavioural Intention

The performance expectancy constructs [82] derived from perceived usefulness, consisted of 6 items that measured nurses' perceptions of how EHRs improve job performance. In addition, the effort expectancy [82] consisted of 6 items that measured nurses' perceptions on how easy they expected the use of EHRs to be. Performance expectancy and effort expectancy were

measured using a five-point Likert scale ranging from (1) ‘strongly agree’ to (5) ‘strongly disagree’ with higher scores indicating negative perceptions that the use of EHRs would not be beneficial to nurses’ job performance, and that it would be difficult learn and use. Earlier studies [54], [65], [212], [240], [243], [116], [127], [202], [204], [206], [208], [210], [211] applied Cronbach’s alpha coefficient [326] on these items and showed a good reliability score (0.70-0.91). This study also applied Cronbach’s alpha coefficient on these constructs and the results were consistent with previous studies, recording a Cronbach’s alpha coefficient above 0.70 as shown in Table 52.

The social influence variable [138] consisted of four items that measured what nurses believe about the perceptions of their integral social circle members on whether or not they should use EHRs in their practice. Social influence was anchored on a five-point Likert scale ranging from Strongly agree (1) to Strongly Disagree (5). Lower scores indicated nurses’ positive perceptions, while higher scores indicated nurses’ negative perceptions on social circle members’ views on the use of EHRs. Subscales in other studies assessing social influence demonstrated a satisfactory reliability score: (Cronbach’s alpha coefficient ≥ 0.70) [51], [54], [215], [116], [127], [170], [180], [197], [202], [204], [206] Social influence subscales in this study also demonstrated a good reliability score (Cronbach’s alpha coefficient ≥ 0.70).

Computer anxiety was made up of seven items that measure the rate at which nurses experience fear upon acquiring or using EHRs. Lower scores indicated that nurses experienced increased fear related to the use of EHRs, while higher scores indicated lower levels of fear related to the use of EHRs. Subscales in other studies assessing Computer Anxiety demonstrated a satisfactory reliability score: (Cronbach’s alpha coefficient ≥ 0.70) [116], [180], [206], [208]–[212]. The computer anxiety subscales in this study also demonstrated a good reliability score (Cronbach’s Alpha ≥ 0.70) as shown in Table 52.

This study also measured nurses’ personal Attitudes Towards the use of EHRs using the Nurses’ Computer Attitude Inventory (NCATT) scale [327]. Attitudes are unique and vary from one nurse to another, so they can result in favourable or unfavourable perceptions towards EHRs use. The ‘Attitude Towards use’ construct consisted of 22 adapted questions that measured nurses’ perceptions of EHRs usage in terms of ease of use, effects on job performance, efficiency, confidentiality, time issues and enjoyment to work with EHRs or job satisfaction. These questions were anchored on a 5-point Likert scale ranging from Strongly

Agree (1) to Strongly Disagree (5) with higher scores signifying unfavourable attitudes, while lower scores indicated favourable attitudes towards EHRs usage. This study revealed a low reliability score on attitudes using Cronbach's alpha coefficient (≤ 0.70). This was inconsistent with previous studies that also revealed a good reliability measure using Cronbach's alpha coefficient (≥ 0.70) [127], [180], [205], [206], [208], [210], [249]. This finding suggests that this variable has factor loadings below 0.6. This calls for the assessment of factor loadings on this variable to determine if each item measures attitudes adequately (factor loadings 0.6) [328]. In accordance with a study by Ximinez, factor loadings below 0.6 were removed [329] to achieve a good reliability score.

The facilitating conditions construct consisted four (4) items that were adapted to measure nurses' perceptions of the presence of infrastructure to support the use of EHRs. This subscale was adapted and anchored on a five-point Likert scale ranging from Strongly Agree (1) to Strongly Disagree (5). Lower scores indicated nurses' positive perceptions, while higher scores indicated a negative perception on the availability of infrastructure and technical maintenance to support EHRs meaningful use. A study on the Facilitating Conditions revealed a good reliability score using Cronbach's alpha coefficient (≥ 0.70) as shown in Table 52. This was also consistent with other subscales in recent studies which also indicated a good reliability score (Cronbach's alpha ≥ 0.70) [51], [54], [116], [127], [170], [197], [205], [206], [211], [215].

The adapted self-efficacy subscale comprised of eight items anchored on a five-point Likert scale to measure nurses' perception of their own ability to perform their job. The scale ranged from Strongly Agree (1) to Strongly Disagree (5) with higher scores indicating negative perceptions, while lower scores indicate positive perceptions on nurses' individual ability to use EHRs. This study recorded an acceptable reliability score (Cronbach's alpha ≥ 0.70), which was consistent with other reliability scores in recent studies on the self-efficacy subscale [94], [180], [206], [211].

In this study, personal innovativeness was measured to find out the extent to which a nurse adopts new ideas relatively early than other members of their social circle. This variable entailed four (4) items anchored on a five-point Likert scale ranging from Strongly Agree (1) to Strongly Disagree (5). Higher scores indicated negative perception, while lower scores indicated positive perceptions of nurses' early adoption of new ideas and information

technologies in Botswana's public health facilities in resource-limited settings. This study recorded an acceptable reliability score (Cronbach's $\alpha \geq 0.70$) that was consistent with other reliability scores in recent studies on the personal innovativeness [202], [203], [217].

Resistance to change was measured to determine nurses' actions when they sense change occurring as a threat to them. This subscale was measured using three items anchored on a five-point Likert scale varying from Strongly Agree (1) to Strongly Disagree (5). Higher scores indicate less resistance to change, while lower scores indicate an increase in resistance to change. This study recorded an acceptable reliability score (Cronbach's $\alpha \geq 0.70$) that was consistent with other reliability scores in recent studies on the resistance to change subscale [116], [202], [208], [217], [249].

Lastly, the behavioural intention subscale was entailed three (3) questionnaire items anchored on a five-point Likert scale ranging from Strongly Agree (1) to Strongly Disagree (5). This variable was used to measure the probability of a nurse to use EHRs in their practice in Botswana's public health facilities in resource-limited setting. Higher scores indicate lower behavioural intention, while lower scores indicate higher behavioural intention to use EHRs. However, actual use was implored to measure nurses' observable EHRs usage patterns using two items.

4.2 Construct Validity

Construct validity is the measure of how well the research instrument correlates with the subject that is being examined [330], [331]. To analyze nurses' acceptance and use, Kaiser-Meyer-Olkin is utilized to quantify the suitability of the gathered data for the factor analysis conducted [332]. Comparably, the Bartlett's test of Sphericity, the correlation matrices conducted on items, and the determinant scores were calculated to determine the suitability of the gathered data to conduct a factor analysis [333].

4.2.1 Exploratory Factor Analysis (EFA)

This is a systematic interpretation of interdependent quantifications. EFA was used as a theory generating process to assess data. In addition, EFA was used to establish the nature of elements that account for the variation between constructs and to examine relationships among variables [334]. In this study, exploratory factor analysis was conducted using SPSS 26.

4.2.1.1 Analysis of Performance Expectancy Scale (PE)

Table 8 presents the correlation matrix for the six items on performance expectancy (PE). The correlation matrix conducted on PE items illustrates that the inter-correlations > 0.3 between the items achieve the set score. Therefore, the hypothetical factor construct appears appropriate for factor analysis [335]. In addition, the determinant score of the correlation matrix conducted on performance expectancy items is $0.003 > 0.00001$, indicating that there is no multicollinearity or singularity [336].

Table 8: Correlation Matrix and Determinant Score (Performance Expectancy)

		PE1	PE2	PE3	PE4	PE5	PE6
Correlation	PE1	1.000	.754	.817	.769	.704	.737
	PE2	.754	1.000	.809	.747	.687	.663
	PE3	.817	.809	1.000	.825	.744	.737
	PE4	.769	.747	.825	1.000	.770	.773
	PE5	.704	.687	.744	.770	1.000	.774
	PE6	.737	.663	.737	.773	.774	1.000
	PE6	.737	.663	.737	.773	.774	1.000
		a. Determinant Score: 0.003					

Table 9 shows that the value of the KMO statistics of performance expectancy items is $0.921 > 0.6$, indicating that the sample is satisfactory and that the factor analysis conducted is suitable for this data [337]. Bartlett's test of Sphericity was also found to be substantial at $p < 0.001$. This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for the performance expectancy items was established to be 1084.751 and the degree of significance < 0.00001 . Therefore, this correlation matrix conducted on PE items is not an identity matrix since the PE items are not orthogonal. Lastly, since the significance value is less than 0.05, this suggests that the factor analysis is appropriate for the data set [338].

Table 9: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Performance Expectancy)

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.921

Bartlett's Test of Sphericity	Approx. Chi-Square	1084.751
	df	15
	Sig.	.000

Table 10 shows the initial and extraction values for the performance expectancy items. Extraction values closer to 1 illustrate that the principal component explains more of the item variance since 1 equals the total variance. Although a study [339] recommended a cutoff point of 0.4 for communality extractions, another study recommends only removing communality values below 0.2 [340], and the latter was adopted for the purposes of this study. Performance expectancy recorded good communality extraction values (extraction ≥ 0.757), so all were considered acceptable. Values closer to 1 are considered acceptable because the closer the values are to 1, the better the factors can explain the original data [341].

Table 10: Communalities (Performance Expectancy)

	Communalities	
	Initial	Extraction
PE1	1.000	.799
PE2	1.000	.757
PE3	1.000	.852
PE4	1.000	.835
PE5	1.000	.763
PE6	1.000	.765

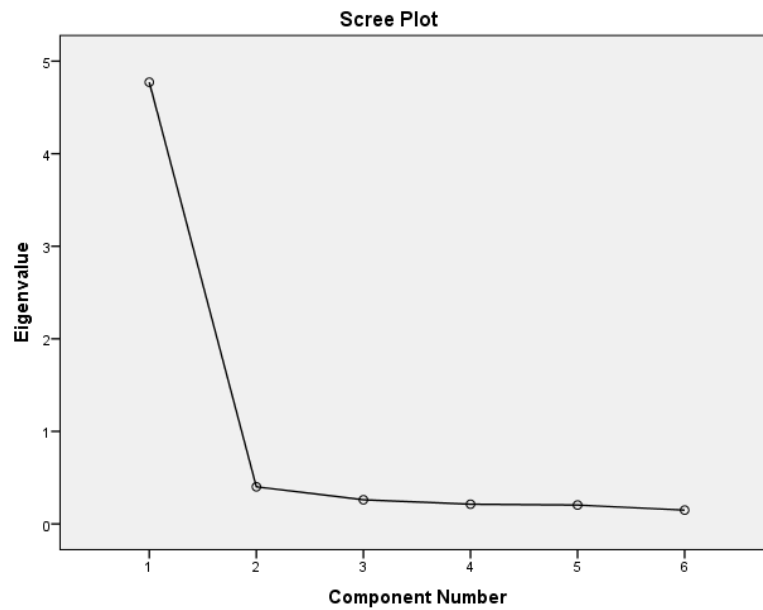
Table 11 illustrates the computed eigenvalues and the total variance explained by the performance expectancy. This study implored principal component analysis as the extraction method for the factor analysis conducted. The extraction indicated that there is one distinctive linear component with eigenvalue >1 . This factor was found to explain 79.5% of the total variance. A study [332] insists that the recommended fraction of the overall variance accounted for by the factors that were retained must be $\geq 50\%$. The 79.5% is in line with, reflecting the value of 0.921 KMO which is reasonable. This also signifies that the factor analysis was suitable for the performance expectancy items [342].

Table 11: Eigenvalues (EV) and Total Variance Explained (Performance Expectancy)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	4.772	79.536	79.536	4.772	79.536
2	.401	6.682	86.219		
3	.261	4.346	90.565		
4	.213	3.553	94.117		
5	.204	3.397	97.514		
6	.149	2.486	100.000		

A study [343] highlighted that as inter-factor correlations increase, the first eigenvalue increases at the expense of other eigenvalues, which causes subsequent eigenvalues to be significantly smaller. This leads to parallel and revised parallel analysis to predict significantly fewer considerable dimensions[343]. A study [344] developed a table of critical values as a basis against which loadings can be matched. This study recommends that loadings for a sample size of 50 should be 0.722 or greater to be considered acceptable. For a sample size of about 100, it is recommended that the loading should be > 0.512 , and > 0.364 for a sample size of 200. In addition, for a sample size of 300, it should be > 0.298 , and for sample size of 600, it is recommended to be > 0.21 , and for 1000 it must be > 0.162 . Table 11 illustrates that only two performance expectancy items exceed the recommended minimum eigenvalue of 0.364. These two items are considered to explain most of the variance.

Figure 8: Scree plot (Performance expectancy)



4.2.1.2 Analysis of Personal Innovativeness Scale (PI)

Personal innovativeness was measured on four items. Table 12 shows the correlation matrix for the four personal innovativeness items. The correlation matrix on the PI items demonstrates that the PI items with inter-correlations > 0.3 . Since the inter-correlations are all above the cut-off score of 0.3, this signifies that the PI construct is appropriate [335]. In addition, the determinant score of the correlation matrix conducted on personal innovativeness items is $0.145 > 0.00001$, signifying no multicollinearity or singularity [336].

Table 12: Correlation Matrix and Determinant Score (Personal Innovativeness)

		PI60	PI61	PI62	PI63
Correlation	PI60	1.000	.530	.642	.620
	PI61	.530	1.000	.628	.566
	PI62	.642	.628	1.000	.723
	PI63	.620	.566	.723	1.000
		a. Determinant = .145			

Table 13 shows that the value of the KMO statistics on the personal innovativeness items equals $0.820 > 0.6$, indicating that the sample is satisfactory and that the factor analysis is suitable for

the gathered data [337]. Bartlett's test of Sphericity was also found to be substantial at $p < 0.001$. This shows that the correlation matrix has significant correlations among the variables, so the data is considered suitable for the factor analysis. The test value for the personal innovativeness items is 367.109 and the degree of significance < 0.00001 . Therefore, this correlation matrix conducted on the PI items is not an identity matrix since the items are not orthogonal. In addition, the significance value is less than 0.05, and this indicates that the factor analysis is appropriate for the data set [338].

Table 13: Personal Innovativeness; Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.820
Bartlett's Test of Sphericity	Approx. Chi-Square	367.109
	df	6
	Sig.	.000

Table 14 illustrates the computed eigenvalues and the total variance explained by personal innovativeness. The principal component analysis extraction conducted indicated that there is one distinctive linear component with eigenvalue >1 . This factor was found to explain 71.5% of the total variance. The 71.5% reflects the 0.820 KMO value, which is reasonable as it is above 50% [332]. This also indicates that the factor analysis was useful for personal innovativeness items [342].

Table 14: Eigenvalues (EV) and Total Variance Explained (Personal Innovativeness)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.859	71.469	71.469	2.859	71.469	71.469
2	.480	12.008	83.478			
3	.393	9.822	93.300			
4	.268	6.700	100.000			

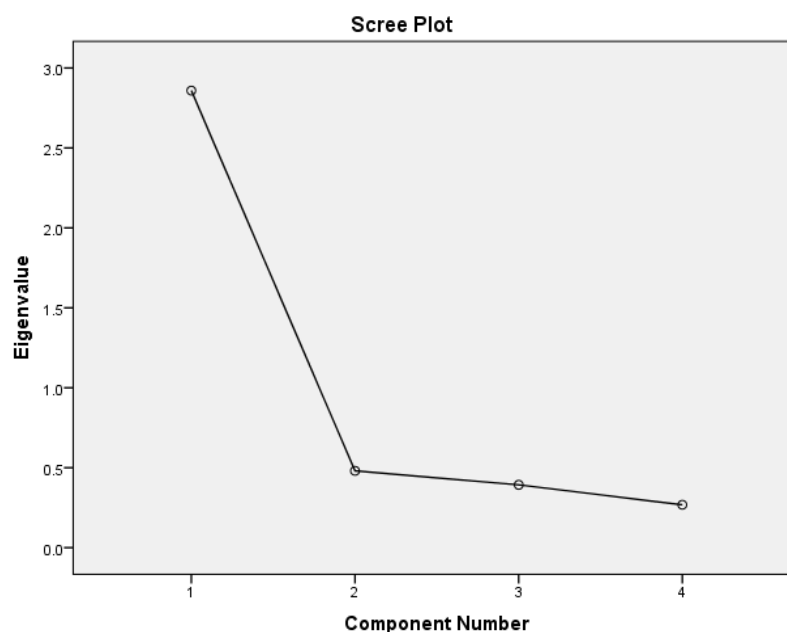
Table 15 shows the related initial and extraction values of the personal innovativeness item. The extraction values are fairly closer to 1, illustrating that the principal components explain more variance of the item as 1 equals the total variance. Personal innovativeness recorded good communality extraction values (extraction ≥ 0.638), so all are considered acceptable as they all exceed the set minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable since the closer the values are to 1, the better the factors can explain the original data [341].

Table 15: Communalities (Personal Innovativeness)

Extraction Method: Principal Component Analysis.		
	Initial	Extraction
PI60	1.000	.679
PI61	1.000	.638
PI62	1.000	.794
PI63	1.000	.748

Table 14 illustrates that three personal innovativeness items exceed the recommended minimum eigenvalue of 0.364. These three items are considered to explain most of the variance, hence retained.

Figure 9: Personal Innovativeness Scree plot



4.2.1.3 Analysis of Effort Expectancy Scale (EE)

Table 16 illustrates the correlation matrix for the six effort expectancy items. This correlation matrix indicates that all effort expectancy items show correlations > 0.3 amongst the items. The inter-correlations being above the cut-off score of 0.3 signify that the hypothetical factor construct is reasonable [335]. Also, the determinant score of the correlation matrix conducted on performance expectancy items is $0.008 > 0.00001$, indicating that there is no multicollinearity or redundant items [336].

Table 16: Correlation Matrix and Determinant Score (Effort Expectancy)

		EE7	EE8	EE9	EE10	EE11	EE12
Correlation	EE7	1.000	.692	.702	.656	.672	.624
	EE8	.692	1.000	.721	.751	.701	.609
	EE9	.702	.721	1.000	.773	.701	.665
	EE10	.656	.751	.773	1.000	.802	.742
	EE11	.672	.701	.701	.802	1.000	.758
	EE12	.624	.609	.665	.742	.758	1.000
a. Determinant = .008							

Table 17 below shows that the value of the KMO statistics on the effort expectancy items is equals $0.908 > 0.6$, indicating that the sample is satisfactory and conducted factor analysis is suitable [337]. The Bartlett's test of Sphericity was also found to be substantial at $p < 0.001$. This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for the effort expectancy items is 924.190, and the degree of significance < 0.00001 . Therefore, this correlation matrix conducted on the EE items is not an identity matrix as the EE items are not orthogonal. Since the significance value is less than 0.05, this signifies that the factor analysis is appropriate [338].

Table 17: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Effort Expectancy)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.908
Bartlett's Test of Sphericity	Approx. Chi-Square	924.190
	df	15
	Sig.	.000

The effort expectancy extraction values as shown in Table 19 are closer to 1, indicating that the principal components explain more variance of the item as 1 equals the total variance. Effort expectancy recorded good communality extraction values (extraction ≥ 0.691); therefore, all are considered acceptable as they all exceed the set minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable since the closer the values are to 1, the better the factors are at explaining the original data [341].

Table 18: Communalities (Effort Expectancy)

	Initial	Extraction
EE7	1.000	.691
EE8	1.000	.737
EE9	1.000	.768
EE10	1.000	.827
EE11	1.000	.794
EE12	1.000	.711

Extraction Method: Principal Component Analysis.

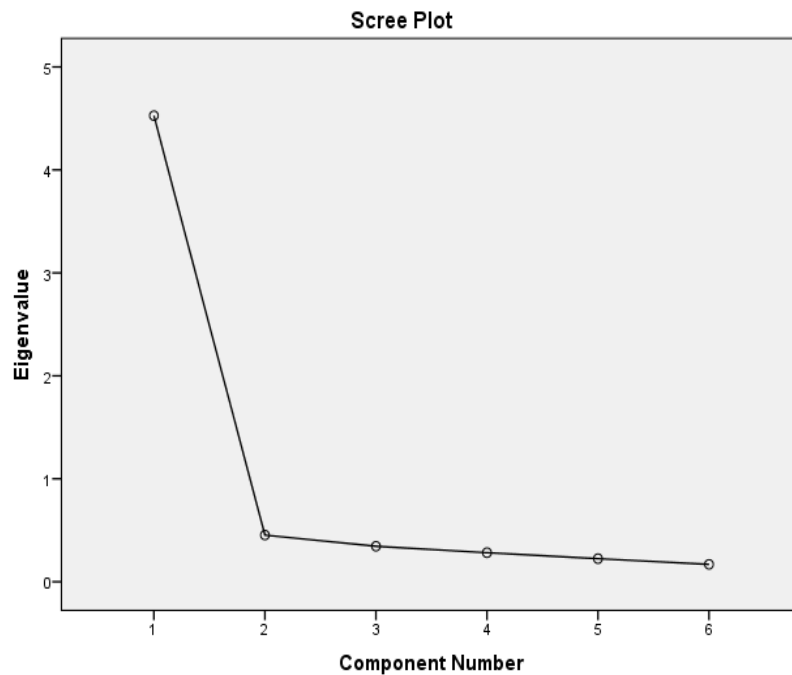
Table 19 illustrates the computed eigenvalues and the total variance explained by effort expectancy. The principal component analysis extraction indicated that there is one distinctive linear component with eigenvalue >1 . This factor was found to explain 75.5% of the total variance. The 75.5% reflects the 0.908 KMO value, which is considered reasonable as it is above the cut-off point of 50% [332]. This also indicates that the factor analysis was useful for effort expectancy items [342].

Table 19: Eigenvalues (EV) and Total Variance Explained (Effort Expectancy)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.527	75.451	75.451	4.527	75.451	75.451
2	.453	7.551	83.002			
3	.345	5.744	88.746			
4	.282	4.701	93.447			
5	.224	3.735	97.182			
6	.169	2.818	100.000			

Table 19 illustrates that two effort expectancy items exceed the recommended minimum eigenvalue of 0.364. These two items are considered to explain the majority of the variance.

Figure 10: Scree plot (Effort Expectancy)



4.2.1.4 Analysis of Resistance to Change Scale (RC)

The correlation matrix shows that all the items used to measure resistance to change recorded an inter-correlation > 0.3 between the variables and they are all above the cut-off score of 0.3. Since the inter-correlations are all above the cut-off score of 0.3, this signifies that the RC construct is appropriate [335]. Also, the determinant score of the correlation matrix conducted on resistance to change items is $0.150 > 0.00001$, indicating that there is no multicollinearity or singularity [336].

Table 20: Correlation Matrix and Determinant Score (Resistance to Change)

		RC64	RC65	RC66
Correlation	RC64	1.000	.730	.774
	RC65	.730	1.000	.758
	RC66	.774	.758	1.000
	RC66	.774	.758	1.000
		a. Determinant = .150		

Table 21 shows that the value of the KMO statistics on resistance to change items is equal to $0.752 > 0.6$, indicating that the sample is satisfactory and the factor analysis is suitable for the data set in question [337]. The Bartlett's test of Sphericity was also found to be substantial ($p < 0.001$). This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for the resistance to change items is 360.960 and the degree of significance < 0.00001 . Therefore, this correlation matrix conducted on the RC items is not an identity matrix as the items are not orthogonal. Since the significance value is less than 0.05, this specifies that the factor analysis is appropriate [338].

Table 21: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Resistance to change)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.752
Bartlett's Test of Sphericity	Approx. Chi-Square	360.960
	df	3
	Sig.	.000

Table 22 shows initial and extraction values of the resistance to change item. The extraction values are closer to 1, illustrating that the principal components explain more variance of the item as 1 equals the total variance. Resistance to change recorded good communality extraction values (extraction ≥ 0.821), therefore all are considered acceptable as they all exceed the set minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable as the closer the values are to 1, the better the factors are at explaining the original data [341].

Table 22: Communalities (Resistance to change)

Communalities		
	Initial	Extraction
RC64	1.000	.833
RC65	1.000	.821
RC66	1.000	.854

Extraction Method: Principal Component Analysis

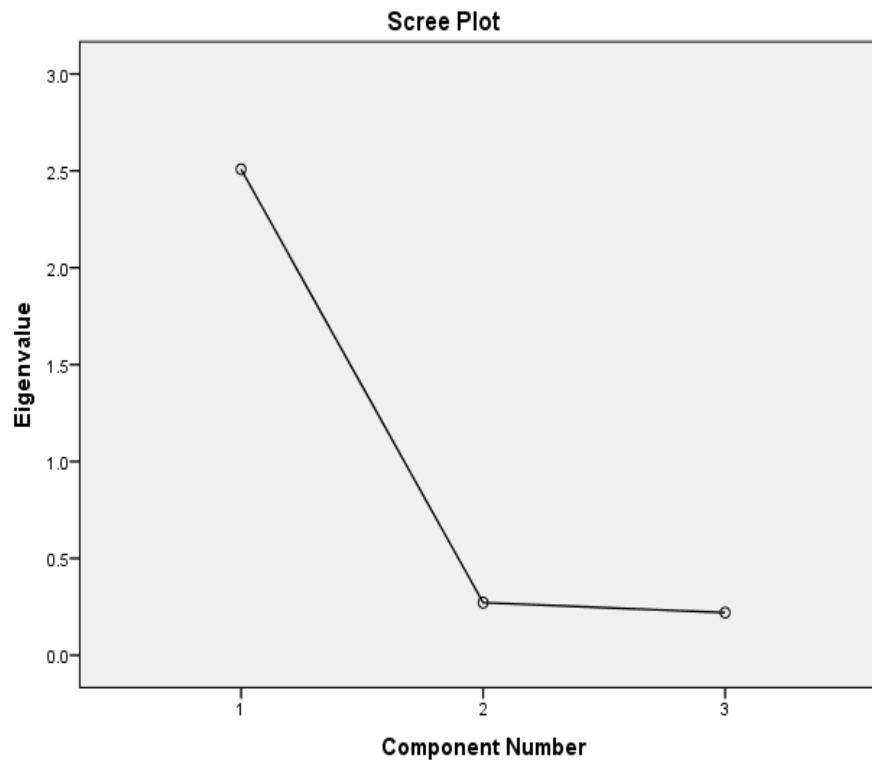
Table 23 below illustrates the computed eigenvalues and total variance explained by resistance to change. The extraction values indicate that there is one distinctive linear component with eigenvalue >1 . This factor was found to explain 83.6% of the total variance. The 83.6% shows 0.752 KMO value was found to be considerable as it is above the cut-off point of 50% [320]. This also indicates that the factor analysis was useful [342].

Table 23: (EV) and Total Variance Explained (Resistance to Change)

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.508	83.616	83.616	2.508	83.616	83.616
2	.272	9.050	92.666			
3	.220	7.334	100.000			

Table 23 illustrates that one resistance to change item exceed the recommended minimum eigenvalue of 0.364. This item is considered to explain the majority of the variance.

Figure 11: Scree plot (Resistance to change)



4.2.1.5 Analysis of Computer Anxiety Scale (CA)

Computer anxiety was measured using seven items as shown in the correlation matrix (Table 24). The correlation matrix conducted on the CA items demonstrates that the computer anxiety items has correlations > 0.3 among the items. The inter-correlations were all found to be above the cut-off score of 0.3, which signifies that the CA construct is appropriate [335]. In addition, the determinant score of the correlation matrix conducted on computer anxiety items is $0.009 > 0.00001$, indicating that there is no multicollinearity or singularity [336].

Table 24: Correlation Matrix and Determinant Value (Computer Anxiety)

Correlation		CA17	CA18	CA19	CA20	CA21	CA22	CA23
	CA17	1.000	.752	.747	.709	.525	.614	.614
	CA18	.752	1.000	.754	.681	.610	.658	.658
	CA19	.747	.754	1.000	.851	.643	.562	.562
	CA20	.709	.681	.851	1.000	.663	.606	.606
	CA21	.525	.610	.643	.663	1.000	.424	.424
	CA22	.049	.146	.111	.057	.094	.221	.221
	CA23	.614	.658	.562	.606	.424	1.000	1.000
	CA23	.614	.658	.562	.606	.424	1.000	1.000
a. Determinant = .009								

Table 25 shows that the value of the KMO statistics on computer anxiety items equals 0.854 > 0.6, indicating that the sample is satisfactory, and the factor analysis is suitable [337]. The Bartlett's test of Sphericity was also found to be substantial ($p < 0.001$). This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for the resistance to change items is 880.359 and the degree of significance < 0.00001 . Therefore, this correlation matrix is not an identity matrix as the items are not orthogonal. Since the significance value < 0.05 , this denotes that the factor analysis is appropriate [338].

Table 25: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Computer Anxiety)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.854
Bartlett's Test of Sphericity	Approx. Chi-Square	880.359
	df	21
	Sig.	.000

Table 26 shows the initial and extraction values of the computer anxiety item. The extraction values are closer to 1 illustrating that the principal components explain more variance of the item as 1 equals the total variance. Computer anxiety recorded good communality extraction values (extraction ≥ 0.621), so all are considered acceptable as they all exceed the set

minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable as the closer the values are to 1, the better the factors are at explaining the original data [341].

Table 26: Communalities (Computer Anxiety)

	Initial	Extraction
CA17	1.000	.750
CA18	1.000	.780
CA19	1.000	.827
CA20	1.000	.812
CA21	1.000	.577
CA22	1.000	.965
CA23	1.000	.621

Extraction Method: Principal Component Analysis.

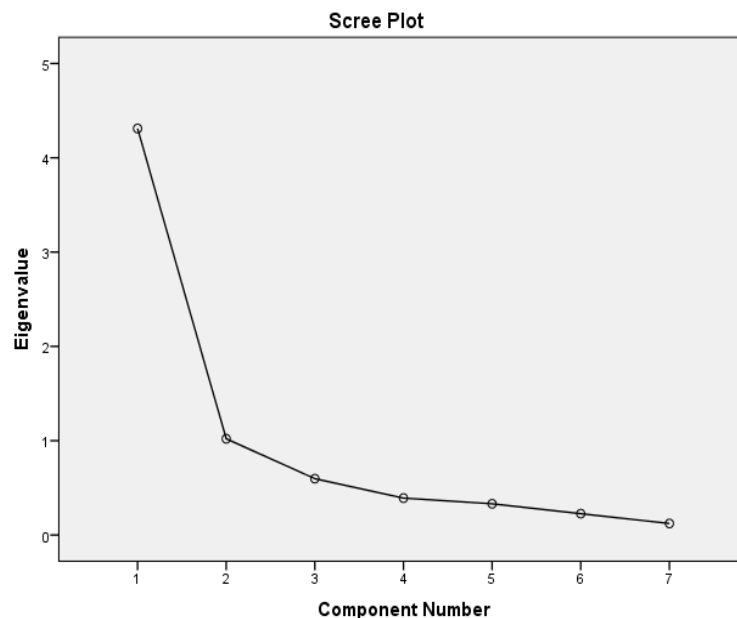
Table 27 below illustrates the computed eigenvalues and total variance explained by computer anxiety. The extraction indicates that there are two distinct linear components with eigenvalue >1. These factors were found to explain 76.2% of the total variance. The 76.2% which is above the cut-off point of 50% [332] reflects the 0.854 KMO value, which is considerable. This also shows that the factor analysis was suitable for computer anxiety items [342].

Table 27: Eigenvalues (EV) and Total Variance Explained (Computer Anxiety)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.311	61.581	61.581	4.311	61.581	61.581
2	1.021	14.579	76.160	1.021	14.579	76.160
3	.597	8.534	84.694			
4	.392	5.594	90.288			
5	.331	4.730	95.018			
6	.226	3.230	98.248			
7	.123	1.752	100.000			

Table 27 and figure 12 illustrate that four resistance to change items exceed the recommended minimum eigenvalue of 0.364. These items are considered to explain the majority of the variance.

Figure 12: Scree Plot (Computer Anxiety)



4.2.1.6 Analysis of Attitude Scale (ATT)

Attitude was measured using twenty-two items as shown in the correlation matrix (Table 28). The correlation matrix shows attitude items with inter-correlations > 0.3 between the variables. The inter-correlations all being above the cut-off score of 0.3 signify that the hypothetical factor construct is appropriate [335]. In addition, the determinant score of the correlation matrix conducted on computer anxiety items is $0.00003448 > 0.00001$, indicating that there is no multicollinearity or singularity [336].

Table 28: Correlation Matrix (Attitude)

	ATT24	ATT25	ATT26	ATT27	ATT28	ATT29	ATT30	ATT31	ATT32	ATT33	ATT34
ATT24	1.000	.478	-.084	.458	.428	-.244	.026	-.213	-.181	-.124	.291
ATT25	.478	1.000	-.040	.593	.570	-.408	-.125	-.463	-.392	-.308	.476
ATT26	-.084	-.040	1.000	-.012	-.076	.311	.243	.234	.166	.082	-.054
ATT27	.458	.593	-.012	1.000	.597	-.306	.018	-.328	-.283	-.289	.470
ATT28	.428	.570	-.076	.597	1.000	-.368	-.071	-.418	-.320	-.284	.469
ATT29	-.037	-.124	.419	-.118	-.132	.506	.261	.286	.308	.235	-.098
ATT30	-.244	-.408	.311	-.306	-.368	1.000	.260	.417	.438	.396	-.213
ATT31	.026	-.125	.243	.018	-.071	.260	1.000	.334	.218	.072	-.026
ATT32	-.213	-.463	.234	-.328	-.418	.417	.334	1.000	.609	.440	-.339
ATT33	-.181	-.392	.166	-.283	-.320	.438	.218	.609	1.000	.554	-.274
ATT34	-.124	-.308	.082	-.289	-.284	.396	.072	.440	.554	1.000	-.237
ATT35	.291	.476	-.054	.470	.469	-.213	-.026	-.339	-.274	-.237	1.000
ATT36	.255	.459	-.125	.448	.470	-.196	-.070	-.359	-.276	-.283	.676
ATT37	.282	.482	-.030	.436	.478	-.271	-.142	-.356	-.340	-.297	.674
ATT38	-.135	-.267	.174	-.301	-.214	.388	.188	.390	.420	.276	-.250
ATT39	.008	.039	.028	.021	-.058	.019	.108	.084	.090	.004	-.022
ATT40	-.125	-.368	.091	-.333	-.213	.289	.213	.514	.518	.438	-.300
ATT41	-.037	-.255	.210	-.219	-.171	.284	.220	.315	.279	.312	-.134
ATT42	.381	.412	-.149	.377	.429	-.262	-.101	-.374	-.231	-.207	.231
ATT43	.236	.399	-.031	.343	.371	-.148	-.075	-.303	-.211	-.134	.292
ATT44	.440	.583	-.072	.536	.526	-.362	-.084	-.447	-.409	-.330	.483
ATT45	.432	.550	-.073	.600	.528	-.331	-.078	-.441	-.404	-.316	.539
ATT45	.432	.550	-.073	.600	.528	-.331	-.078	-.441	-.404	-.316	.539

Correlation Matrix ^a											
	ATT35	ATT36	ATT37	ATT38	ATT39	ATT40	ATT41	ATT42	ATT43	ATT44	ATT45
ATT24	.291	.255	.282	-.135	.008	-.125	-.037	.381	.236	.440	.432
ATT25	.476	.459	.482	-.267	.039	-.368	-.255	.412	.399	.583	.550
ATT26	-.054	-.125	-.030	.174	.028	.091	.210	-.149	-.031	-.072	-.073
ATT27	.470	.448	.436	-.301	.021	-.333	-.219	.377	.343	.536	.600
ATT28	.469	.470	.478	-.214	-.058	-.213	-.171	.429	.371	.526	.528
ATT29	-.098	-.113	-.151	.266	.041	.228	.251	-.058	-.039	-.196	-.226
ATT30	-.213	-.196	-.271	.388	.019	.289	.284	-.262	-.148	-.362	-.331

ATT31	-.026	-.070	-.142	.188	.108	.213	.220	-.101	-.075	-.084	-.078
ATT32	-.339	-.359	-.356	.390	.084	.514	.315	-.374	-.303	-.447	-.441
ATT33	-.274	-.276	-.340	.420	.090	.518	.279	-.231	-.211	-.409	-.404
ATT34	-.237	-.283	-.297	.276	.004	.438	.312	-.207	-.134	-.330	-.316
ATT35	1.000	.676	.674	-.250	-.022	-.300	-.134	.231	.292	.483	.539
ATT36	.676	1.000	.706	-.203	.055	-.244	-.073	.288	.299	.465	.518
ATT37	.674	.706	1.000	-.117	.036	-.310	-.187	.332	.270	.557	.607
ATT38	-.250	-.203	-.117	1.000	-.022	.522	.236	-.149	-.136	-.216	-.247
ATT39	-.022	.055	.036	-.022	1.000	.097	.152	.156	.112	.057	.052
ATT40	-.300	-.244	-.310	.522	.097	1.000	.452	-.224	-.143	-.309	-.298
ATT41	-.134	-.073	-.187	.236	.152	.452	1.000	-.091	-.178	-.250	-.199
ATT42	.231	.288	.332	-.149	.156	-.224	-.091	1.000	.415	.450	.510
ATT43	.292	.299	.270	-.136	.112	-.143	-.178	.415	1.000	.502	.395
ATT44	.483	.465	.557	-.216	.057	-.309	-.250	.450	.502	1.000	.805
ATT45	.539	.518	.607	-.247	.052	-.298	-.199	.510	.395	.805	1.000
a. Determinant = 0.00003448											

Table 29 below shows that the value of the KMO statistics on attitude items equals 0.877 > 0.6, indicating that the sample is satisfactory, and the factor analysis is suitable [337]. The Bartlett's test of Sphericity was also found to be substantial ($p < 0.001$). This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for attitude items is 1888.937 and the degree of significance < 0.00001 . Therefore, this is not an identity matrix as the items are not orthogonal. Since the significance value is less than 0.05, this signifies that the factor analysis is appropriate [338].

Table 29: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Attitude)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.877
Bartlett's Test of Sphericity	Approx. Chi-Square	1888.937
	df	231
	Sig.	.000

Table 30 shows the initial and extraction values (communalities) of the attitude item. The extraction values are closer to 1 indicating that the principal components explain more variance of the item as 1 equals the total variance. Resistance to change recorded good communality extraction values (extraction ≥ 0.468), so all are considered acceptable as they all exceed the set minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable as the closer the values are to 1, the better the factors are at explaining the original data [341].

Table 30: Communalities (Attitude)

Communalities		
	Initial	Extraction
ATT24	1.000	.641
ATT25	1.000	.634
ATT26	1.000	.635
ATT27	1.000	.654
ATT28	1.000	.623
ATT29	1.000	.671
ATT30	1.000	.660
ATT31	1.000	.639
ATT32	1.000	.635
ATT33	1.000	.625
ATT34	1.000	.559
ATT35	1.000	.756
ATT36	1.000	.790
ATT37	1.000	.792
ATT38	1.000	.505
ATT39	1.000	.846
ATT40	1.000	.696
ATT41	1.000	.468
ATT42	1.000	.619
ATT43	1.000	.616
ATT44	1.000	.683
ATT45	1.000	.697

Extraction Method: Principal Component Analysis

Table 31 below illustrates the computed eigenvalues and total variance explained by attitude. The extraction indicated that there are six distinctive linear components with eigenvalue >1 . These factors were found to explain 65.7% of the total variance. The 65.7% which is above the

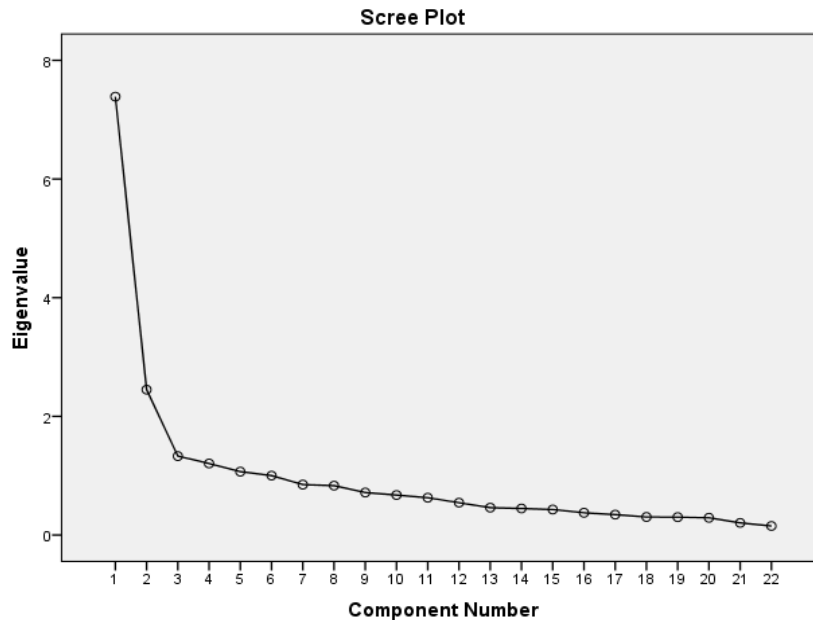
cut-off point of 50% [332] reflects 0.877 KMO value, which is considerable. This also indicates that the factor analysis was useful for attitude items.

Table 31: Eigenvalues (EV) and Total Variance Explained (Attitude)

Component	Total Variance Explained				
	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	7.388	33.582	33.582	7.388	33.582
2	2.450	11.137	44.720	2.450	11.137
3	1.330	6.046	50.765	1.330	6.046
4	1.205	5.478	56.244	1.205	5.478
5	1.068	4.856	61.099	1.068	4.856
6	1.001	4.552	65.651	1.001	4.552
7	.850	3.865	69.516		
8	.832	3.784	73.300		
9	.716	3.253	76.553		
10	.674	3.064	79.617		
11	.629	2.859	82.477		
12	.545	2.476	84.953		
13	.461	2.096	87.049		
14	.448	2.035	89.084		
15	.430	1.953	91.037		
16	.375	1.706	92.742		
17	.344	1.564	94.306		
18	.305	1.384	95.691		
19	.301	1.369	97.060		
20	.290	1.319	98.379		
21	.204	.929	99.307		
22	.152	.693	100.000		

Table 32 and figure 13 illustrate that sixteen attitude items exceed the recommended minimum eigenvalue of 0.364. These items are considered to explain the majority of the variance.

Figure 13: Scree Plot (Attitude)



4.2.1.7 Analysis of Behavioural Intention Scale (BI)

Behavioural intention was measured using three items as shown in Table 32. The correlation matrix shows BI item inter-correlations. The BI item inter-correlations between the variables were all found to be above the cut-off score of 0.3 which indicates that BI is suitable [335]. In addition, the determinant score of the correlation matrix conducted on behavioural intention items stands at $0.235 > 0.00001$ indicating no multicollinearity or singularity [336].

Table 32: Correlation Matrix and Determinant Value (Behavioural Intention)

Correlation Matrix ^a				
		BI67	BI68	BI69
Correlation	BI67	1.000	.593	.759
	BI68	.593	1.000	.650
	BI69	.759	.650	1.000
a. Determinant = .235				

Table 33 below shows the KMO statistics of attitude items ($0.708 > 0.6$) which signifies that the sampling is satisfactory. This also signifies that the factor analysis is suitable [337]. The Bartlett's test of Sphericity was also found to be substantial ($p < 0.001$). This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for attitude items is 275.274 and the degree of significance < 0.00001 . Therefore, this is not an identity matrix as the items are not orthogonal. Since the significance value is less than 0.05, this signifies that the factor analysis is appropriate [338].

Table 33: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Behavioural Intention)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.708
Bartlett's Test of Sphericity	Approx. Chi-Square	275.274
	df	3
	Sig.	.000

Table 34 presents the behavioural intention item related initial and extraction values. The extraction values are closer to 1, indicating that the principal components explain more variance of the item as 1 equals the total variance. Behavioural intention recorded good communality extraction values (extraction ≥ 0.706), therefore all are considered acceptable as they all exceed the set minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable as the closer the values are to 1, the better the factors are at explaining the original data [341].

Table 34: Communalities (Behavioural Intention)

Communalities		
	Initial	Extraction
BI67	1.000	.795
BI68	1.000	.706
BI69	1.000	.836

Extraction Method: Principal Component Analysis

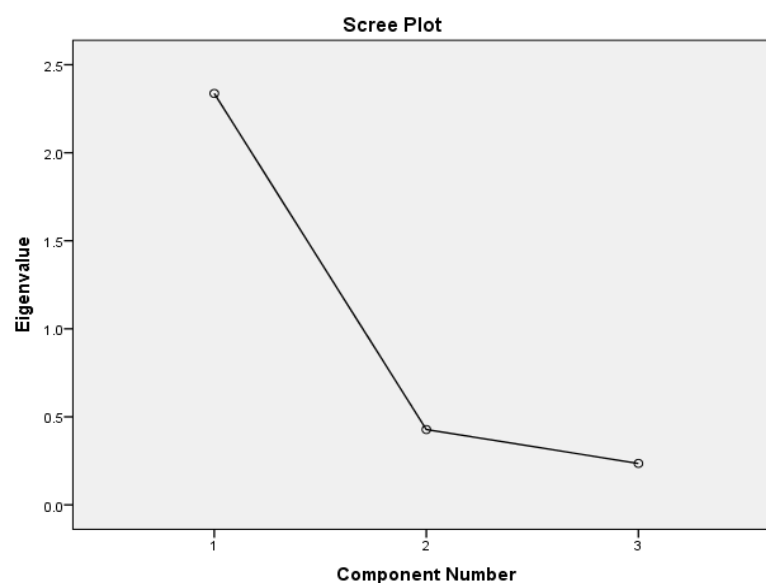
Table 35 below illustrates the computed eigenvalues and total variance explained by behavioural intention items. The extraction indicated that there is one distinctive linear component with eigenvalue >1 . This factor was found to explain 77.9% of the total variance. The 77.9% which is above the cut-off point of 50% [332] reflects the 0.708 KMO value, which is considered appropriate. This also indicates that the factor analysis was useful for attitude items [342].

Table 35: Eigenvalues (EV) and Total Variance Explained (Behavioural Intention)

Total Variance Explained					
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	2.337	77.899	77.899	2.337	77.899
2	.428	14.261	92.161		
3	.235	7.839	100.000		

Table 35 and figure 14 illustrate that two behavioural intention items exceed the recommended minimum eigenvalue of 0.364. These items are considered to explain the majority of the variance.

Figure 14: Scree plot (Behavioural Intention)



4.2.1.8 Analysis of Social Influence scale (SI)

Social Influence was measured using four items. Table 36 presents the correlation matrix for the four items on Social Influence (SI). The correlation matrix indicates that the SI items with correlations > 0.3 amongst the items achieve the set score and this signifies that the hypothetical variable (SI) is appropriate for factor analysis [335]. In addition, the determinant score of the correlation matrix conducted on SI items is $0.106 > 0.00001$, indicating that there is no multicollinearity or singularity [336].

Table 36: Correlation Matrix and Determinant Value (Social Influence)

		SI13	SI14	SI15	SI16
Correlation	SI13	1.000	.860	.435	.371
	SI14	.860	1.000	.469	.395
	SI15	.435	.469	1.000	.685
	SI16	.371	.395	.685	1.000
		a. Determinant = .106			

Table 37 below shows that the value of the KMO statistics of SI items is $0.640 > 0.6$, indicating that the sample is satisfactory and the factor analysis is suitable given the data in question [337]. The Bartlett's test of Sphericity was also found to be substantial (< 0.001). This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for the SI items is 426.111.802 and the degree of significance < 0.00001 . Therefore, this said matrix is not an identity matrix since the items are not orthogonal. Since the significance value is less than 0.05, this specifies that the factor analysis is appropriate [338].

Table 37 :Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Social Influence)

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.640
Bartlett's Test of Sphericity	Approx. Chi-Square 426.111
	df 6
	Sig. .000

Table 38 shows the initial and extraction values for the SI items. Extraction values closer to 1 illustrate that the principal component explains more of the item variance since 1 equals the total variance. Although a study [339] recommended a cutoff point of 0.4 for communality extractions, another study recommends only removing communality values below 0.2 [340], and the latter was adopted for the purposes of this study. SI recorded good communality extraction values (extraction ≥ 0.930), so all were considered acceptable. Values closer to 1 are considered acceptable because the closer the values are to 1, the better the factors can explain the original data [341].

Table 38: Communalities (Social Influence)

	Initial	Extraction
SI13	1.000	.930
SI14	1.000	.930
SI15	1.000	.996
SI16	1.000	.996

Extraction Method: Principal Component Analysis

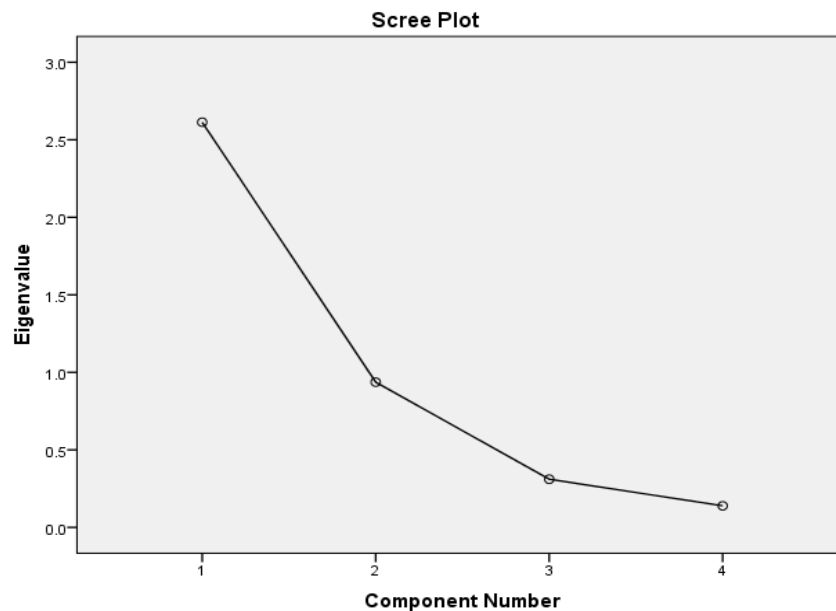
Table 39 below illustrates the computed eigenvalues and the total variance explained by SI. The extraction indicated that there is one distinctive linear component with eigenvalue >1 . This factor was found to explain 65.3% of the total variance. The 65.3% which is above the cut-off point of 50% [332], reflecting the value of 0.640 KMO which is reasonable. This also signifies that the factor analysis was suitable for the SI items [342].

Table 39: Eigenvalues (EV) and Total Variance Explained (Social Influence)

Total Variance Explained					
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	2.613	65.328	65.328	2.613	65.328
2	.937	23.421	88.748		
3	.311	7.770	96.518		
4	.139	3.482	100.000		

Table 39 and figure 15 illustrate that only two SI items exceed the recommended minimum eigenvalue of 0.364. These two items are considered to explain most of the variance.

Figure 15:Scree plot (Social Influence)



4.2.1.9 Analysis of Facilitating Conditions Scale (FC)

Table 40 presents the correlation matrix for the four items of FC. The correlation matrix conducted on the FC items demonstrates that the FC items with correlations > 0.3 among the items achieve the set score and this implies that the hypothetical factor construct is appropriate for factor analysis [335]. In addition, the determinant score of the correlation matrix conducted on SI items is $0.364 > 0.00001$, indicating that there is no multicollinearity or singularity [336].

Table 40:Correlation Matrix and Determinant Value (Facilitating Conditions)

		FC46	FC47	FC48	FC49
Correlation	FC46	1.000	.427	.430	.484
	FC47	.427	1.000	.597	.338
	FC48	.430	.597	1.000	.349
	FC49	.484	.338	.349	1.000
		a. Determinant = .364			

Table 41 below shows that the value of the KMO statistics of SI items is $0.719 > 0.6$, indicating that the sample is satisfactory and the factor analysis is suitable for the data used [337]. The Bartlett's test of Sphericity was also found to be substantial (< 0.001). This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for the FC items is 191.663 and the degree of significance < 0.00001 . Therefore, this is not an identity matrix since the items are not orthogonal. Since the significance value is less than 0.05, this specifies that the factor analysis is appropriate [338].

Table 41: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Facilitating Conditions)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.719
Bartlett's Test of Sphericity	Approx. Chi-Square	191.663
	df	6
	Sig.	.000

Table 42 shows the initial and extraction values of the Facilitating Conditions items. The extraction values are closer to 1 illustrating that the principal components explain more variance of the item as 1 equals the total variance. FC recorded good communality extraction values (extraction ≥ 0.482), so all are considered acceptable as they all exceed the set minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable as the closer the values are to 1, the better the factors are at explaining the original data [341].

Table 42: Communalities (Facilitating Conditions)

	Initial	Extraction
FC46	1.000	.591
FC47	1.000	.618
FC48	1.000	.626
FC49	1.000	.482

Extraction Method: Principal Component Analysis.

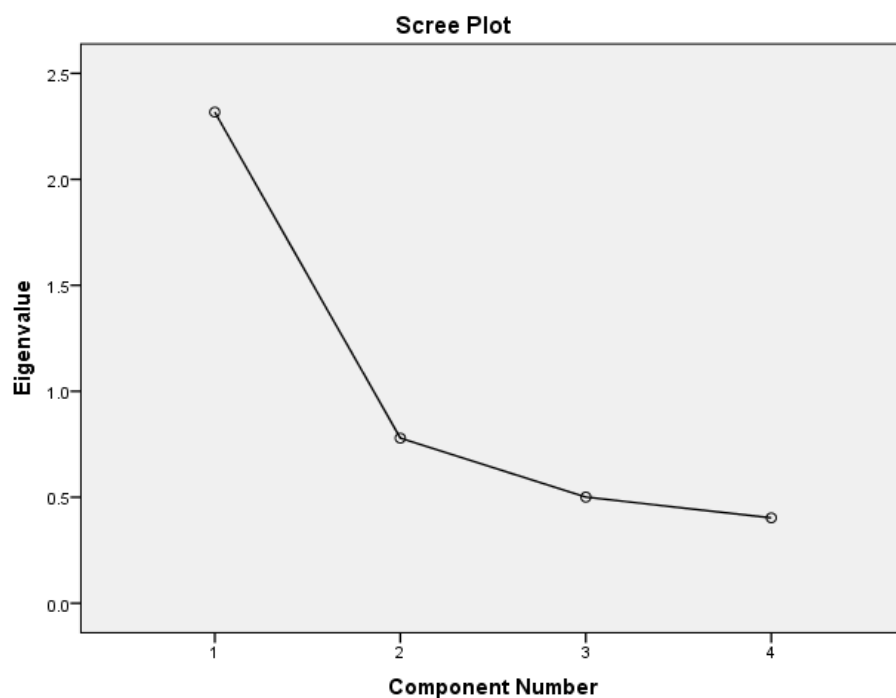
Table 43 below illustrates the computed eigenvalues and the total variance explained by FC. The extraction indicated that there is only one distinctive linear component with eigenvalue >1 . This factor was found to explain 57.9% of the total variance. The 57.9% is above the cut-off point of 50% [332], reflecting the value of 0.719 which is considered as reasonable. This also suggests that the factor analysis was suitable for the SI items [342].

Table 43: Eigenvalues (EV) and Total Variance Explained (Facilitating Conditions)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative%	Total	% of Variance
1	2.317	57.926	57.926	2.317	57.926
2	.779	19.480	77.406		
3	.501	12.520	89.926		
4	.403	10.074	100.000		

Table 43 and figure 16 illustrate that all four FC items exceed the recommended minimum eigenvalue of 0.364. This item is considered to explain most of the variance.

Figure 16: Scree Plot (Facilitating Conditions)



4.2.1.10 Analysis of Self-Efficacy scale (SE)

Self-Efficacy was measured using four items. Table 44 presents the correlation matrix for the four items on Self-Efficacy. Table 44 shows that the SE items with correlations > 0.3 between the items achieve the set score and this shows that the hypothetical factor construct is appropriate for factor analysis [335]. The determinant score of the correlation matrix conducted on SE items is $0.008 > 0.00001$, indicating that there is no multicollinearity or singularity [336].

Table 44: Correlation Matrix (Self-Efficacy)

		Correlation Matrix^a									
		SE50	SE51	SE52	SE53	SE54	SE55	SE56	SE57	SE58	SE59
Correlation	SE50	1.000	.317	.303	.249	.475	.520	.331	.214	.306	.282
	SE51	.317	1.000	.770	.360	.289	.322	.206	.182	.254	.199
	SE52	.303	.770	1.000	.353	.345	.371	.236	.089	.283	.148
	SE53	.249	.360	.353	1.000	.238	.204	.326	.239	.238	.268
	SE54	.475	.289	.345	.238	1.000	.759	.453	.407	.568	.462
	SE55	.520	.322	.371	.204	.759	1.000	.508	.389	.506	.459
	SE56	.331	.206	.236	.326	.453	.508	1.000	.520	.536	.448
	SE57	.214	.182	.089	.239	.407	.389	.520	1.000	.652	.618
	SE58	.306	.254	.283	.238	.568	.506	.536	.652	1.000	.664
	SE59	.282	.199	.148	.268	.462	.459	.448	.618	.664	1.000
		a. Determinant = .008									

Table 45 below shows that the value of the KMO statistics of SI items is $0.811 > 0.6$, indicating that the sample is satisfactory and the factor analysis is suitable for the data set used [337]. The Bartlett's test of Sphericity was also found to be substantial (< 0.001). This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for the SE items is 914.366 and the degree of significance < 0.00001 . Therefore, this is not an identity matrix since the items are not orthogonal. Since the significance value is less than 0.05, this implies that the factor analysis is appropriate [338].

Table 45: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Self-Efficacy)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.811
Bartlett's Test of Sphericity	Approx. Chi-Square	914.366
	df	45
	Sig.	.000

Table 46 shows the initial and extraction values of the Self-Efficacy items. The extraction values are closer to 1 illustrating that the principal components explain more variance of the item as 1 equals the total variance. SE recorded good communality extraction values (extraction ≥ 0.544), so all are considered acceptable as they all exceed the set minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable as the closer the values are to 1, the better the factors are at explaining the original data [341].

Table 46: Communalities (Self Efficacy)

	Initial	Extraction
SE50	1.000	.600
SE51	1.000	.806
SE52	1.000	.821
SE53	1.000	.544
SE54	1.000	.763
SE55	1.000	.809
SE56	1.000	.549
SE57	1.000	.753
SE58	1.000	.732
SE59	1.000	.693

Extraction Method: Principal Component Analysis.

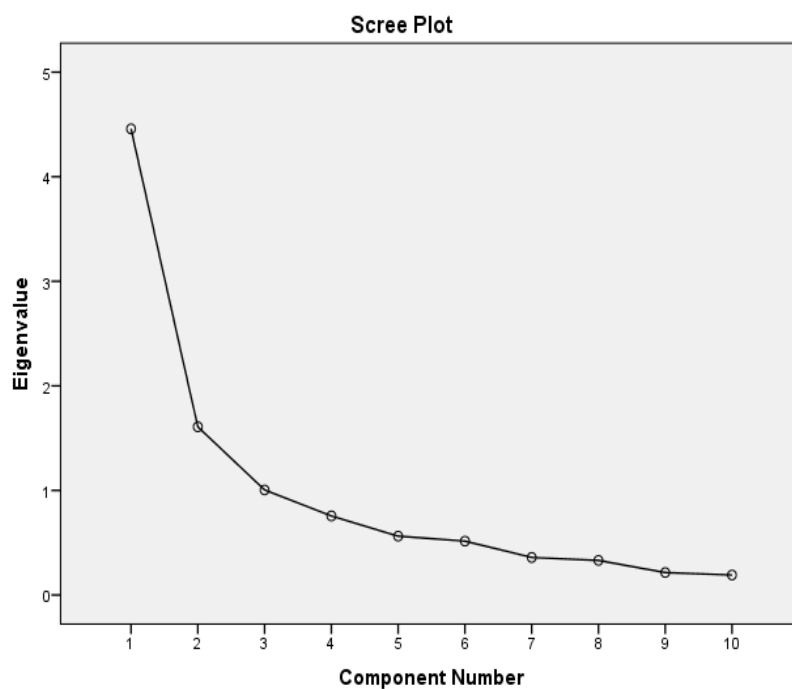
Table 47 below illustrates the computed eigenvalues and the total variance explained by SE. The extraction indicated that there are three distinctive linear components with eigenvalue >1 . These factors were found to explain 70.7% of the total variance. The 70.7% is above the cut-off point of 50%[332], reflecting the value of 0.811 KMO which is reasonable This also implies that the factor analysis was suitable for the SE items [342].

Table 47: Eigenvalues (EV) and Total Variance Explained (Self Efficacy)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	4.458	44.581	44.581	4.458	44.581
2	1.608	16.084	60.665	1.608	16.084
3	1.004	10.044	70.709	1.004	10.044
4	.756	7.561	78.270		
5	.562	5.622	83.892		
6	.515	5.150	89.042		
7	.359	3.589	92.631		
8	.331	3.309	95.941		
9	.215	2.148	98.088		
10	.191	1.912	100.000		

Table 47 and figure 17 illustrate that six SE items exceed the recommended minimum eigenvalue of 0.364. This item is considered to explain most of the variance.

Figure 17: Scree Plot (Self-Efficacy)



4.2.1.11 Analysis of Actual Use Scale (AU)

Actual Use was measured using two items as shown in the correlation matrix. Table 48 demonstrates that AU items have correlations > 0.3 among the items. Since the inter-correlations are all above the cut-off score of 0.3, which shows that the hypothetical factor construct is appropriate [335]. In addition, the determinant score of the correlation matrix conducted on AU items is $0.005 > 0.00001$, indicating that there is no multicollinearity or singularity [336].

Table 48: Correlation Matrix and Determinant Value (Actual Use)

Correlation Matrix ^a			
		AU70	AU71
Correlation	AU70	1.000	.997
	AU71	.997	1.000
a. Determinant = .005			

Table 49 below shows that the value of the KMO statistics of AU items is $0.5 > 0.6$, indicating that the sample is satisfactory and the factor analysis is suitable for the data that was used [337]. The Bartlett's test of Sphericity was also found to be substantial (< 0.001). This confirms the existence of significant correlations among the items in the correlation matrix, hence the data is considered suitable for the factor analysis. The test value for the AU items is 1005.780 and the relative degree of significance < 0.00001 . Therefore, this correlation matrix is not an identity matrix since the items are not orthogonal. Since the significance value is less than 0.05, this indicates that the factor analysis is appropriate for the data set [338].

Table 49: Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity (Actual Use)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	1005.780
	df	1
	Sig.	.000

Table 50 shows the initial and extraction values of the AU items. The extraction values are closer to 1 illustrating that the principal components explain more variance of the item as 1 equals the total variance. AU recorded good communality extraction values (extraction $\geq$ 0.999), so all are considered acceptable as they all exceed the set minimum cut-off value of 0.2 [340]. Values closer to 1 are considered acceptable as the closer the values are to 1, the better the factors are at explaining the original data [341].

Table 50: Communalities (Actual Use)

Communalities		
	Initial	Extraction
AU70	1.000	.999
AU71	1.000	.999

Extraction Method: Principal Component Analysis.

Table 51 below illustrates the computed eigenvalues and the total variance explained by AU items. The extraction indicated that there is only one distinctive linear component with eigenvalue >1 . This factor was found to explain 99.9% of the total variance. The 99.9% is above the cutoff point of 50% [332], reflecting the value of 0.5 KMO which is reasonable. This also denotes that the factor analysis was suitable for the AU items.

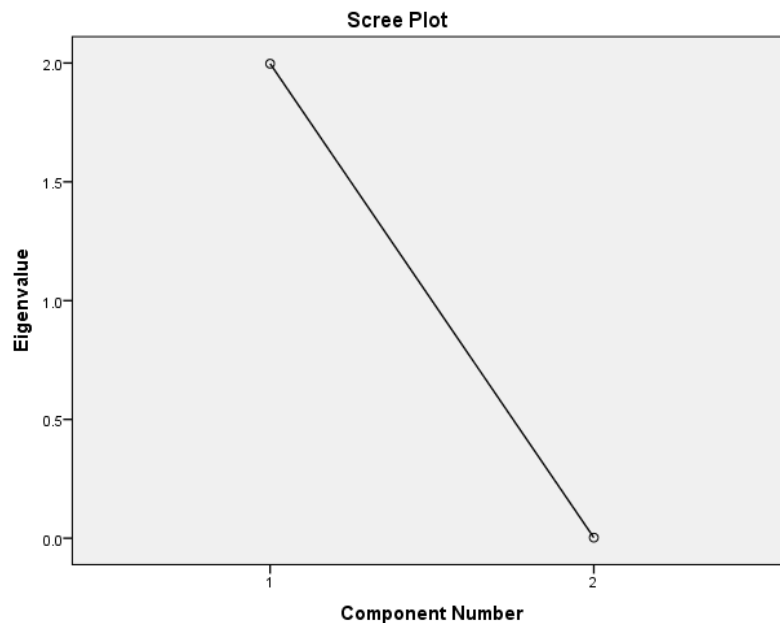
Table 51: Eigenvalues (EV) and Total Variance Explained (Actual Use)

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.997	99.872	99.872	1.997	99.872	99.872
2	.003	.128	100.000			

Extraction Method: Principal Component Analysis.

Table 51 and figure 18 illustrate that only one AU item exceeds the recommended minimum eigenvalue of 0.364. This item is considered to explain most of the variance.

Figure 18: Scree Plot (Actual Use)



4.2.1.12 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis was used to examine the multidimensionality and the factorial validity of the variables. A study recommended CFA as a suitable approach to measure the degree to which the proposed model fits the data (goodness of fit). In this study, CFA was implored to measure convergent and discriminant validity [345].

Factor Loadings

Although a study [345] recommends a stringent cut-off point of 0.7 for factor loadings, this study considered factor loadings above 0.6 as recommended by Ximenez (2006) [329]. As a result, all factor loadings below 0.6 were dropped as they indicated a weak relationship between the variable and its measured indicator. Factor loadings below 0.6 were dropped from attitudes, computer anxiety and self-efficacy.

4.2.1.12.1 Assessment of Construct Validity and Unidimensionality

4.2.1.12.1.1 Convergent Validity

Convergent validity is a quantification of the connection between different item scales measuring a common construct. Convergent validity of a construct was established when observable items of the same construct operated in coherent modus [346]. The average variance extracted (AVE) was used to as a base to determine convergent validity. A study posited the

minimum threshold of an acceptable AVE measure to be 0.5. As a result, AVE above 0.5 commonly indicates an appropriate measure of convergent validity. Furthermore, study variables were reflected to have convergent validity if the recorded composite reliability is above 0.70 [328]. In this study, AVE was calculated using the following formula [345]:

Average variance extracted (AVE) was computed thus =

$$\frac{\sum_{i=1}^n \lambda_i^2}{n}$$

n = total number of items;

λ_i = standardized factor loadings

However, Composite reliability was computed using the following formula [345]:

Composite reliability =

$$\frac{\left(\sum_{i=1}^n \lambda_i\right)^2}{\left(\sum_{i=1}^n \lambda_i\right)^2 + \left(\sum_{i=1}^n \delta_i\right)}$$

n = total number of items;

λ_i = standardized factor loadings;

and δ_i = error variance

In this study, items that were found to have factor loadings < 0.6 were removed to achieve AVE values that meet the minimum recommended threshold of 0.5. Table 52 shows that all constructs recorded composite reliabilities above 0.70 and AVE values above 0.50 signifying no overlap between the items and thus all constructs were retained [328].

Table 52: Convergent Validity of the model

Construct	Items	Standardized Factor Loadings	Cronbach Alpha	Composite Reliability	Average Variance Extracted	Convergent Validity
Performance Expectancy	PE1	0.79	.932	.898	.639	Established
	PE2	0.791				
	PE4	0.803				
	PE5	0.797				
	PE6	0.793				
Effort Expectancy	EE7	0.731	.936	.869	.528	Established
	EE8	0.664				
	EE9	0.773				
	EE10	0.747				
	EE11	0.761				
	EE12	0.675				
Social Influence	SI13	0.84	.818	.883	.653	Established
	SI14	0.859				
	SI15	0.79				
	SI16	0.739				
Computer Anxiety	CA17	0.654	.777	.899	.568	Established
	CA18	0.516				
	CA19	0.784				
	CA20	0.835				
	CA21	0.88				
	CA22	0.829				
	CA23	0.715				
Attitude	ATT25	0.753	.906	.896	.520	Established
	ATT27	0.705				
	ATT28	0.708				
	ATT35	0.663				
	ATT36	0.657				
	ATT37	0.702				
	ATT44	0.78				
	ATT45	0.79				
Facilitating Conditions	FC46	0.769	.757	.846	.579	Established
	FC47	0.786				
	FC48	0.791				
	FC49	0.694				
Self-Efficacy	SE54	0.781				
	SE55	0.785				
	SE56	0.703				

	SE57	0.673	.866	.879	.549	Established
	SE58	0.785				
	SE59	0.71				
Personal Innovativeness	PI60	0.781	.754	.839	.567	Established
	PI61	0.779				
	PI62	0.754				
	PI63	0.694				
Resistance to Change	RC64	0.857	.901	.829	.618	Established
	RC65	0.837				
	RC66	0.829				
Behavioural Intention	BI67	0.805	.878	.834	.627	Established
	BI68	0.758				
	BI69	0.811				
Actual Use	AU70	0.764	.999	.738	.585	Established
	AU71	0.766				

4.2.1.12.1.2 Discriminant Validity

Discriminant validity is the degree to which a scale reflects its corresponding construct differently from the correlation coefficient with other scales [346]. In this study, discriminant validity was examined through inter-factor correlation methods. This involved comparing square root values of AVE to the absolute value of each construct. This study found the square roots of AVEs to be larger than correlations thus satisfying discriminant validity requirements [347]. Table 54 shows the discriminant validity results for the proposed model with all square roots of the AVE greater than the associations between main study constructs. This confirms satisfactory discriminant validity.

Table 53: Discriminant Validity Results for the model

Constructs	PE	EE	SI	FC	ATT	SE	PI	CA	RC	BI	AU
PE	0.799										
EE	0.497	0.726									
SI	0.423	0.406	0.808								
FC	0.321	0.462	0.369	0.761							
ATT	0.229	0.344	0.254	0.319	0.721						
SE	0.315	0.521	0.284	0.475	0.352	0.741					
PI	0.318	0.430	0.227	0.257	0.299	0.554	0.753				
CA	-0.302	-0.286	-0.049	-0.284	0.082	-0.306	-0.209	0.754			
RC	-0.046	-0.068	0.063	0.008	0.191	0.087	-0.046	0.086	0.786		
BI	0.412	0.487	0.251	0.293	0.221	0.411	0.397	-0.330	-0.082	0.792	
AU	0.058	0.114	0.177	0.424	0.152	0.123	0.054	-0.122	0.081	0.046	0.765

4.3 Conclusion

This chapter expounded on the approaches and outcomes of the measurement scale analysis with focus on construct scale reliability and validity. The evaluation of the scale reliability yielded high Cronbach's Alpha values for each main study variable, showing that the measurement scales were reliable. In addition, the Exploratory Factory Analysis was conducted on all main study variables to examine the validity of the resultant model. Lastly, the Confirmatory Factor Analysis was conducted on the main study variables to find and verify the convergent and discriminant validity.

5 CHAPTER 5: PREDICTING NURSES' BEHAVIOURAL INTENTIONS AND ACTUAL USER BEHAVIOUR

This chapter presents the quantitative data analysis. This chapter details the demographics, findings on the effects of main study variables and moderators on nurses' behavioural intentions and actual usage behaviour (Modified UTAUT hypothesized relationships). This chapter also details nurses' perceptions of reasons for EHRs use, nurses' perceived barriers to EHRs use and tests the,

5.1 Demographic and Professional Characteristics

Table 55 presents the demographic and professional characteristics of the research participants. This study was conducted in eight (8) District Health Management Teams (DHMTs) covering 54 public health facilities in resource-limited setting as presented in Table 6. The majority of nurses (90.2%) had a diploma, with females accounting for 74.1% of the 193 respondents. Regarding the nurses' age, 66.9% of the respondents were under 40 years with most of the research respondents (97.4%) employed on a full-time basis.

Table 54: Demographic and Professional Characteristics

	Frequency	Percent	Valid Percent	Cumulative Percent
AGE				
Less than 30	53	27.5	27.5	27.5
30-39	76	39.4	39.4	66.8
40-49	37	19.2	19.2	86.0
50-59	23	11.9	11.9	97.9
Older than 59	4	2.1	2.1	100.0
Total	193	100.0	100.0	
GENDER				
Female	143	74.1	74.1	74.1
Male	50	25.9	25.9	100.0
Total	193	100.0	100.0	
LEVEL OF EDUCATION				
Diploma	174	90.2	90.2	90.2

Bachelor's Degree	19	9.8	9.8	100.0
Total	193	100.0	100.0	

EMPLOYMENT STATUS

Employed Full-Time	188	97.4	97.4	97.4
Contract Worker	5	2.6	2.6	100.0
Total	193	100.0	100.0	

POSITION

Senior Registered Nurse	17	8.8	8.8	8.8
Principal Registered Nurse	96	49.7	49.7	58.5
Chief Registered Nurse	6	3.1	3.1	61.7
Registered Nurse	56	29.0	29.0	90.7
Midwife	4	2.1	2.1	92.7
Senior Nursing Officer	2	1.0	1.0	93.8
Assistant Nursing Officer	2	1.0	1.0	94.8
Ophthalmic Nurse	1	.5	.5	95.3
Nursing Officer I	6	3.1	3.1	98.4
Nursing Officer II	2	1.0	1.0	99.5
Nursing Superintendent	1	.5	.5	100.0
Total	193	100.0	100.0	

DHMT

Greater Mahalapye DHMT	75	38.9	38.9	38.9
Greater Francistown DHMT	51	26.4	26.4	65.3
Serowe DHMT	24	12.4	12.4	77.7
Greater Selebi-Phikwe DHMT	3	1.6	1.6	79.3
Kgatleng DHMT	13	6.7	6.7	86.0
Palapye DHMT	7	3.6	3.6	89.6
Southern DHMT (Kanye)	7	3.6	3.6	93.3
Kweneng East DHMT	13	6.7	6.7	100.0
Total	193	100.0	100.0	

The respondents also reported a total average of 12.6 years working in the healthcare system in Botswana, with females reporting an average of 13.6 years compared to their male counterparts who had an average of 9.5 years.

Table 55: Nurses' Personal Experience

Age	Gender	Mean	N	Std. Deviation
Less than 30	Female	3.2738	37	2.22708
	Male	3.4250	16	2.23532
	Total	3.3194	53	2.20908
30-39	Female	10.0400	50	3.78482
	Male	10.3077	26	3.59743
	Total	10.1316	76	3.69988
40-49	Female	19.2097	31	5.04938
	Male	16.1667	6	7.67898
	Total	18.7162	37	5.54344
50-59	Female	28.3636	22	6.38111
	Male	27.0000	1	.
	Total	28.3043	23	6.24088
Older than 59	Female	35.3333	3	2.88675
	Male	30.0000	1	.
	Total	34.0000	4	3.55903
Total	Female	13.6268	143	10.02946
	Male	9.5360	50	6.84206
	Total	12.5670	193	9.46420

Table 56: Nurses' EHRs Use

	Frequency	Percent	Valid Percent	Cumulative Percent
EHR CURRENT USE				
Yes	145	75.1	75.1	75.1
No	48	24.9	24.9	100.0
Total	193	100.0	100.0	
PAPER-BASED RECORD USED				
Yes	66	34.2	34.2	34.2
No	127	65.8	65.8	100.0
Total	193	100.0	100.0	
EHR NAME				
PIMS	76	39.4	52.4	52.4
IPMS	41	21.2	28.3	80.7
PIMS, IPMS	28	14.5	19.3	100.0
Total	145	75.1	100.0	
N/A	48	24.9	24.9	
Total	193	100.0		
EHR FREQUENCY OF USE				
Daily	110	57.0	75.9	75.9
Every Week	21	10.9	14.5	90.3
Once every 2 Weeks	7	3.6	4.8	95.2
Once a month	2	1.0	1.4	96.6
Less than once a month	5	2.6	3.4	100.0
Total	145	75.1	100.0	
N/A	48	24.9		
Total	193	100.0		

With regard to professional characteristics, 81.9% of the respondents confirmed that they had an average of 5.95 years of experience using EHRs. The majority (76.2%) of the respondents also reported that they currently use EHR, with only 39.4 % who reported that they use PIMS only, 21.2% indicated that they use IPMS only, while 14.5% indicated that they use both IPMS and PIMS. However, of the 34.2% of the respondents who reported using paper-based records, 9.3% indicated that they use both electronic records and paper-based records. Regarding the frequency of use of EHRs, 75.9% of EHRs users indicated that they use the system daily, 14.5% indicated a weekly usage of the system, and 4.8% fortnightly, while 1.4% insisted that they use the system every month, and 3.4% indicated that they use EHRs less than once a month.

Table 57: Nurses' Comfort levels

	Frequency	Valid Percent	Cumulative Percent
Not comfortable at all	20	10.4	10.4
A little comfortable	41	21.2	31.6
Quite Comfortable	60	31.1	62.7
Very Comfortable	72	37.3	100.0
Total	193	100.0	

To evaluate nurses' comfort levels when using EHRs, one close-ended question was asked to participants about their level of comfort in using EHRs. 10.4% of the respondents reported that they were *not comfortable at all* using EHRs, 21.2% reported that they were *a little comfortable*, 31.1% reported that they were *quite comfortable* while a majority (37.3%) reported being *very comfortable* with using EHRs for their job task.

5.2 Main study Variables: Descriptive statistics

Table 58: Main Study Variables

	N	Mean	Std. Deviation
Performance Expectancy	193	2.1287	.88306
Effort Expectancy	193	2.2703	.80968
Social Influence	193	2.7124	3.51525
Computer Anxiety	193	3.7816	.78084
Attitude	193	2.6938	.34376
Facilitating Conditions	193	2.8795	.83467
Self-Efficacy	193	2.4435	.63646
Personal Innovativeness	193	2.2889	.73184
Resistance to Change	193	2.7133	1.09851
Behavioural Intention	193	1.7945	.67342
Valid N (listwise)	193		

Table 59 presents the descriptive results (mean and standard deviation scores). The Effort and performance expectancy variables had significantly lower values, signifying that the participating nurses generally perceived that using EHRs would be beneficial for their

performance in their job and would be easy to use and navigate with less effort. On the other hand, the social influence variable recorded a higher value, signifying that the participating nurses' Social Influence had a positive but limited effect on their perceptions regarding the use of EHRs.

However, Computer Anxiety recorded a high mean score signifying that the participating nurses were not shrouded in anxiety at the possibility of using EHRs. This inverse relationship demonstrates that EHRs users were comfortable with the use of EHRs. The participating nurses demonstrated positive perceptions about the outcomes of using EHRs, as shown by decreased mean scores on their attitude in their responses. Regarding the facilitating conditions in place to enable the use of EHR systems, respondents gave answers that bordered on neutrality.

Furthermore, regarding Self-Efficacy, the participating nurses had fairly positive perceptions of their perceptions on their ability to carry out their job task (using EHRs). Moreover, low values on personal innovativeness amongst the participants were recorded, indicating that they had favorable perceptions about the degree to which they adopt new ideas and technologies at an early stage than other members of their social circle. However, the participating nurses had lower scores for Resistance to change, indicating that they had negative perceptions about the use of EHRs in favor of older systems. Nurses also had very low scores for Behavioural Intention to use EHRs, indicating that there is a high probability for nurses to use EHRs to perform their job tasks in their practice.

5.3 Hypothesized Relationships

Before creating a multiple linear regression model, it is important to ascertain the existence of a linear relationship amongst each independent variable and the dependent variable. These relationships will help ascertain if there is any mediation effects between the independent and the dependent variable. It is also important to determine if there is a problem of multicollinearity. The results of a simple regression conducted are follows:

Table 59: Simple Regression

Hypothesis	Relationship	Standardised path coefficient (Beta)	t-value
H1	PE → BI	.412	6.243***
H1a	PE → ATT	.591	10.113***
H2	EE → BI	.487	7.700***
H2a	EE → ATT	.620	10.928***
H2b	EE → AU	.114	1.580ns
H3	SI → BI	.251	3.583***
H3a	SI → ATT	.300	4.352***
H4	FC → AU	.424	6.469***
H5	PI → BI	.508	8.156***
H5a	PI → EE	.430	6.576***
H5b	PI → FC	.257	3.681***
H6	RC → BI	-.082	-1.136ns
H7	CA - → BI	-.330	-4.830***
H7a	CA → RC	.086	1.192ns
H7b	CA - → EE	-.286	-4.131***
H8	SE → AU	.123	1.716ns
H8a	SE → CA	-.306	-4.445***
H8b	SE → EE	.521	8.441***
H9	ATT → BI	.550	9.108***
H10	BI → AU	.232	3.303**

*<.05, **<.01, ***<.001, ns= “not significant”

5.3.1 Hierarchical Multiple Regression Analysis Results

Table 60: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.564 ^a	.318	.290	.48948
2	.566 ^b	.320	.275	.49446
3	.637 ^c	.406	.322	.47825

Table 61: Hierarchical Multiple Regression Analysis for Variables predicting Behavioural Intentions

Model	Unstandardize		Standardized	t	Sig.	Collinearity	
	d Coefficients					Statistics	
	B	Std. Error	Beta				Tolerance
1	(Constant)	1.050	.274		3.826	.000	
	Computer Anxiety	-.093	.042	-.154	-2.239	.026	.851
	Attitudes	.187	.083	.203	2.268	.025	.503
	Performance Expectancy	.040	.055	.060	.726	.469	.589
	Effort Expectancy	.145	.067	.191	2.165	.032	.515
	Personal Innovativeness	.090	.056	.107	1.616	.108	.909
	Resistance to Change	-.026	.025	-.067	-1.054	.293	.984
	Social Influence	.062	.042	.107	1.465	.145	.751
2	(Constant)	.980	.411		2.388	.018	
	Computer Anxiety	-.091	.044	-.150	-2.086	.039	.787
	Attitudes	.183	.084	.197	2.175	.031	.497
	Performance Expectancy	.042	.056	.064	.754	.452	.572
	Effort Expectancy	.150	.068	.198	2.199	.029	.507
	Personal Innovativeness	.085	.057	.102	1.495	.137	.884
	Resistance to Change	-.029	.026	-.075	-1.120	.264	.923
	Social Influence	.063	.044	.109	1.433	.154	.706
	Age	.060	.082	.106	.733	.465	.197
	Level of Education	.004	.135	.002	.027	.978	.917
	Personal Experience	-.005	.009	-.077	-.535	.594	.198
	IT Experience	-.001	.008	-.008	-.105	.916	.787
3	(Constant)	-.907	.771		-1.175	.242	
	Computer Anxiety	-.070	.044	-.115	-1.584	.115	.730
	Attitudes	.232	.087	.251	2.660	.009	.429
	Performance Expectancy	.358	.262	.539	1.364	.175	.025
	Effort Expectancy	.360	.128	.476	2.813	.006	.134
	Personal Innovativeness	.122	.069	.146	1.758	.081	.556
	Resistance to Change	.002	.063	.004	.027	.978	.149
	Social Influence	.246	.122	.428	2.020	.045	.085
Age	.711	.257	1.254	2.763	.006	.019	

Level of Education	.422	.277	.208	1.523	.130	.205	4.880
Personal Experience	-.072	.028	-1.131	-2.544	.012	.019	51.563
IT Experience	.003	.022	.029	.153	.879	.108	9.239
SI by Age	-.140	.112	-.797	-1.249	.214	.009	106.306
EE by Age	-.036	.049	-.199	-.729	.467	.051	19.443
PE by Age	-.096	.083	-.522	-1.159	.248	.019	52.938
RC by Age	-.012	.026	-.111	-.468	.640	.069	14.595
PI by Age	-.003	.025	-.016	-.110	.913	.174	5.748
PE by PExp	.020	.011	.795	1.788	.076	.019	51.649
SI by PExp	.012	.013	.518	.909	.365	.012	84.756
EE by LOE	-.137	.072	-.468	-1.906	.058	.064	15.728
PE by LOE	-.049	.119	-.192	-.414	.680	.018	56.143
PE by IT Exp	-.018	.011	-.406	-1.698	.091	.067	14.899
EE by IT Exp	.014	.012	.301	1.141	.256	.055	18.169

Dependent Variable: BI

Note: PI= Personal Innovativeness; RC= Resistance to Change; PE= Performance Expectancy; SI= Social Influence; EE= Effort Expectancy; CA=Computer Anxiety; ATT= Attitude; Edu= Education; PExp= Professional Experience; IT Exp= IT Experience

Table 62 presents the outcomes of the hierarchical multiple regression analysis that was conducted. The first block was made up of the main study variables that were hypothesized to be independent causes of behavioural intentions. These were effort expectancy, computer anxiety, social influence, attitude towards use, performance expectancy, and personal innovativeness. Out of these, only personal innovativeness had a noteworthy effect on behavioural intention.

Education, IT experience, age and professional experience were included in the second block as hypothetical moderating variables. Education, IT experience, age, and professional experience did not show substantial direct connections with behavioural intentions. This was signified by the significantly low changes in the adjusted R^2 value from 0.290 to 0.275.

Furthermore, block three (3) consisted of the hypothetical relationships between the independent and the moderating variables. These were the indirect associations between education, IT experience, age, and professional experiences on the hypothesized

relationships. Although not statistically significant, it was found that the influences of age and IT experience on performance expectancy as well as the influence of professional experiences on social influence added to the explanatory power of the model. However, the resultant model was found to have the **multicollinearity** problem.

5.3.1.1 Multicollinearity & Diagnostics in Regression

Multicollinearity refers to a case where two or more independent variables or predictors have a strong linear relationship such that the influence of individual predictors cannot be clearly separated [348]. Since multicollinearity results from x variables (independent variables) being related, it causes the regression model to be unstable and it obscures the effects of the individual predictors, leading to difficulties in building a regression model [349]. When multicollinearity exists between variables, the tolerance values would be less than 0.1 ($T < 0.1$) [350], [351]. In addition, the uncertainty in the influence of the independent variables can be represented by high values of the variance inflation factor (VIF). A rule of thumb is that, VIF ($1/(1-R^2)$) values should not be more than 5 [349], [352], [353].

In this study, VIF was calculated after standardizing or centering the variables. Centred variables generally have decreased intercorrelation thus lowering multicollinearity. Variable-Centering is achieved by subtracting the mean scores of each variable from individual variable scores [353]. As seen in Table 67, the hierarchical multiple regression analysis conducted on the study variables yielded inflated VIF values and tolerance values which are less than 0.1, signifying the existence of multicollinearity. The correlation test conducted (see Table 67) also signaled a multicollinearity, yielding values over 0.9. A study by [354] stated that although multicollinearity has no impact on the assumptions of multivariate statistical techniques, it has a sizeable effect on the generalizability of the resultant model in regression.

In dealing with multicollinearity, this study focused on subset selection [355], [356] which primarily focuses on removing explanatory variables with either inflated VIF values ($VIF > 5$), tolerance values that are less than 0.1, correlation values that are over 0.9 and other multicollinearity indicators, one at a time to eliminate multicollinearity [357].

5.3.1.2 Mediation Testing

A mediation analysis was conducted on the effects of Attitudes mediating the influence Effort Expectancy on Behavioural intentions. Based on the bivariate regression conducted, the estimates showed that there is a significant direct effect between EE and BI ($p\text{-value} = 0.000 < 0.05$, $\beta=0.487$). In addition, the estimates showed that there is a direct effect between EE and ATT ($p\text{-value} = 0.000 < 0.05$, $\beta=0.344$). However, the multiple regression conducted on the influence of EE and ATT on BI showed that the effect of EE was reduced in the presence of ATT ($\beta=.236$, $p\text{-value} = 0.000 < 0.05$).

A mediation analysis was also conducted on the effects of ATT mediating the effect of PE on BI. Based on the bivariate regression conducted, the estimates showed that there is a significant direct effect between PE and BI ($p\text{-value} = 0.000 < 0.05$, $\beta=0.412$). In addition, the estimates showed that there is a direct effect between PE and ATT ($p\text{-value} = 0.000 < 0.05$, $\beta=0.591$). However, the multiple regression conducted on the influence of PE and ATT on BI showed that the influence of PE was not significant in the presence of ATT ($\beta=.133$, $p\text{-value} = 0.075 > 0.05$).

ATT was also found to fully mediate the association between SI and BI. The bivariate regression conducted showed that there is a significant connection between SI and BI ($\beta=.251$, $p\text{-value} = 0.000 < 0.05$). further investigations showed that there is a positive relationship between Si and ATT ($\beta=.300$, $p\text{-value} = 0.000 < 0.05$). However, the multiple regression conducted on the influence of SI and ATT on BI showed that the influence of SI was not significant in the presence of ATT ($\beta=.094$, $p\text{-value} = 0.137 > 0.05$).

In this study, we conducted the mediation analysis by means of the direct and indirect effects based on bootstrap procedures (2000 bootstrap samples) and bias-corrected confidence interval of 95% based on the Baron and Kenny (1986) [358] approach. The results show that Attitudes fully mediates the relationship between Performance Expectancy and behavioural Intentions as indirect effects are statistically significant ($\beta=.279$, $p\text{-value} = 0.000 < 0.05$). In addition, the study findings revealed that attitude fully mediates the relationship between social influence and BI as the indirect effects are statistically significant ($\beta=.157$, $p\text{-value} = 0.000 < 0.05$). Lastly, the results also show that Attitudes partially mediates the relationship between EE and BI ($\beta=.250$, $p\text{-value} = 0.000 < 0.05$).

Table 62: Mediation Analysis

Path	Total Effects	Direct Effects	Indirect Effects	Comments
PE>ATT>BI	.412***	.133(ns)	.279***	Full Mediation
EE>ATT>BI	.487***	.236**	.250***	Partial Mediation
SI>ATT>BI	.251***	0.94(ns)	.157***	Full Mediation

* $<.05$, ** $<.01$, *** $<.001$, ns= “not significant”

5.3.2 Resultant Model

Table 63: Resultant Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.612 ^a	.375	.362	.49775

Table 64: Anova Table

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.929	4	6.982	28.182	.000 ^b
	Residual	46.578	188	.248		
	Total	74.507	192			

Table 65: Resultant Model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.916	.242		3.788	.000		
	Effort Expectancy	.145	.057	.189	2.518	.013	.593	1.687
	Attitudes	.320	.072	.338	4.448	.000	.575	1.739
	Personal Innovativeness	.118	.052	.139	2.262	.025	.883	1.132
	Computer Anxiety	-.100	.040	-.154	-2.496	.013	.873	1.145

Dependent Variable: Behavioural Intention

Correlation Matrix

Table 66: Correlation Matrix (Resultant Model)

		Correlations							
		BI	ATT	PE	EE	CA	PI	SI	RC
BI	Pearson Correlation	1	.550**	.412**	.487	-.341**	.320**	.251	-.082**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.257
	N	193	193	193	193	193	193	193	193
ATT	Pearson Correlation	.550**	1	.591**	.620**	-.335	.313**	.300**	-.044
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.543
	N	193	193	193	193	193	193	193	193
PE	Pearson Correlation	.412**	.591**	1	.497**	-.288**	.139	.423**	-.046**
	Sig. (2-tailed)	.000	.000		.000	.000	.054	.000	.529
	N	193	193	193	193	193	193	193	193
EE	Pearson Correlation	.487**	.620**	.497**	1**	-.302**	.302**	.406**	-.068**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.345
	N	193	193	193	193	193	193	193	193
CA	Pearson Correlation	-.341**	-.335**	-.288**	-.302**	1**	-.120**	-.056**	.005**
	Sig. (2-tailed)	.000	.000	.000	.000		.097	.437	.941
	N	193	193	193	193	193	193	193	193
PI	Pearson Correlation	.320**	.313**	.139	.302**	-.120**	1	.096**	.012**
	Sig. (2-tailed)	.000	.000	.054	.000	.097		.185	.865
	N	193	193	193	193	193	193	193	193
SI	Pearson Correlation	.251**	.300**	.423**	.406**	-.056**	.096**	1**	.063**
	Sig. (2-tailed)	.000	.000	.000	.000	.437	.185		.386
	N	193	193	193	193	193	193	193	193
RC	Pearson Correlation	-.082	-.044	-.046	-.068	.005	.012	.063	1
	Sig. (2-tailed)	.257	.543	.529	.345	.941	.865	.386	
	N	193	193	193	193	193	193	193	193

Note: BI= Behavioural Intention; PI= Personal Innovativeness; PE= Performance Expectancy; EE= Effort Expectancy; CA=Computer Anxiety; ATT= Attitude; RC= Resistance to Change; SI= Social Influence

5.3.3 The Effects of the Main Study Variables (Resultant Model)

The results of the multiple regression analysis on the main study variables partially supported the hypothesized relationships, which were adapted based on the modified UTAUT model. Performance Expectancy, Personal Innovativeness, Attitudes and Effort Expectancy had a statistically significant effect while computer anxiety had a negative effect on nurses' behavioural intention, explaining 37.5% of the variance in nurses' behavioural intention to use EHRs.

Performance Expectancy (PE)

The variable performance expectancy was found to have a positive, direct, and significant effect on behavioural intention to use EHRs. This result indicates that nurses choose to use EHRs when they believe that the system will help them to perform their jobs better or achieve efficiency in their nursing duties [68], [82]. These findings are consistent with numerous other studies [15], [21], [213], [359], [360], [50], [51], [57], [65], [68], [129], [189], [199] that established that performance expectancy (perceived usefulness) had a positive influence on nurses' behavioural intentions. However, these findings are inconsistent with a study [69] that found no significant influence of performance expectancy on behavioural intentions. In the context of the resultant model, the direct influence of performance expectancy was diminished as attitudes fully mediated the influence of performance expectancy on behavioural intentions ($p\text{-value} = 0.075 > 0.05$, $\beta=0.133$).

Performance Expectancy as a determinant of Attitudes

This study established that performance expectancy has a direct influence on Attitudes ($p\text{-value} = 0.000 < 0.05$, $\beta=0.591$). This finding suggests that the degree to which a nurse expects EHRs systems to help attain their job task influences nurses' attitudes which then influence the enactment of a behaviour. This finding is consistent with studies [361], [362] that found a positive influence of performance expectancy on attitudes. However, this finding is inconsistent with other studies [76], [363] that found no significant influence of performance expectancy on attitudes.

The outcomes of the data analysis conducted suggest that attitude fully mediates the association between performance expectancy and behavioural intention as the indirect effects are

statistically significant ($p\text{-value} = 0.000 < 0.05$, $\beta=0.279$) while the direct effects were statistically insignificant ($p\text{-value} = 0.075 > 0.05$, $\beta=0.133$). This finding is in line with a study that found the mediating effects of attitudes on the association between performance expectancy and behavioural intention [23], [361].

Effort Expectancy (EE)

This study established that effort expectancy (EE) has statistically significant effect on behavioural intentions (BI) ($p\text{-value} = 0.028 < 0.05$, $\beta=0.189$). This finding suggests that the ease with which nurses view EHRs influences usage their behavioural intentions [68]. This discovery is in line with other studies [22], [50], [128], [129], [213], [364], [365] that found that effort expectancy had a significant effect on behavioural intentions in similar settings. However, this finding is inconsistent with several other studies [23], [189], [359], [360] that did not find effort expectancy and behavioural intentions to be associated.

The Influence of Computer Anxiety on Effort Expectancy as a determinant

This study also found the influence of computer anxiety on effort expectancy ($p\text{-value} = 0.000 < 0.05$, $\beta = -0.302$) as a determinant. This study found that the association between computer anxiety and effort expectancy has a negative effect on nurses' behavioural intention to use EHRs in resource-limited settings. This association suggests that nurses experience anxiety in association with how easy they believe EHRs use is [208]. This outcome is in line with other studies [116], [211], [212], [366]–[369] which also found a direct and negative influence of computer anxiety on effort expectancy (PEOU).

The Influence of Self-Efficacy on Effort Expectancy

Self-efficacy was examined in terms of its influence on effort expectancy. This study discovered that self-efficacy has a statistically significant effect as a determinant on effort expectancy ($p\text{-value} = 0.000 < 0.05$, $\beta=0.521$). This outcome is in line with previous studies that found that self-efficacy is a determinant of effort expectancy [23], [363].

The findings indicate that attitudes partially mediate the association between effort expectancy and behavioural intention as the direct ($p\text{-value} = 0.002 < 0.05$, $\beta = 0.236$) and indirect effects

($p\text{-value} = 0.000 < 0.05$, $\beta = 0.250$) are both statistically significant. This result is in line with a study that found the mediating effects of attitudes on the correlation between effort expectancy and behavioural intentions [23].

Attitude towards behaviour (ATT)

Attitude towards behaviour has been a widely established variable of behavioural intention to use information systems. In this study, attitudes towards the use of EHRs in resource-limited settings were found to have a statistically significant influence on behavioural intention ($p\text{-value} = 0.000 < 0.05$, $\beta=0.338$) as the strongest determinant. This relationship suggests that a nurse's attitudes towards EHRs use determine behavioural intention to use EHRs [138]. This finding is consistent with other studies [23], [65], [205], [208], [210], [215], [249], [370], [371] that found attitudes to have a significant influence on behavioural intentions.

The Influence of Effort Expectancy on Attitudes as a determinant.

This study also assessed the effect of effort expectancy on nurses' attitudes towards the use of EHRs as a determinant. For the coefficient of the interaction between effort expectancy and attitudes towards behaviour, the results show that Effort Expectancy has a positive and statistically significant influence on Attitude towards use ($p\text{-value} = 0.000 < 0.05$, $\beta=0.620$). For every unit increase in Effort Expectancy, Attitudes towards behaviour increase by 0.503 units. The findings of this study were consistent with other studies that found a positive interaction between effort expectancy and attitudes [84], [372]–[377].

This study also discovered that Effort Expectancy had a statistically significant influence on attitude towards behaviour. This is consistent with other studies that found the effect of effort expectancy on attitudes [205], [361]–[363].

Social Influence (SI)

The effects of social influence have been widely studied and social influence has been reported to be a determining factor of behavioural intention to use information systems. Among nurses, this study found that nurses' social circle influences their perceptions of EHRs use. This relationship suggests that nurses hold higher regard for the perceptions of their integral social circle members on whether or not to use EHRs [68], [135]. This is consistent with other studies

that found social influence to be a determinant of behavioural intentions in similar settings [116], [205]. The correlation between social influence and behavioural intentions was fully mediated by attitudes as the indirect effects were found to be statistically significant ($p\text{-value} = 0.000 < 0.05$, $\beta=0.279$) while the direct effects were statistically insignificant ($p\text{-value} = 0.075 > 0.05$, $\beta=0.133$). This outcome is in line with studies that found the mediating effects of attitudes on social influence [23], [361]. Lastly, it is worth noting that although the directionality of the social influence path was as hypothesized, the variable's explanatory power was reduced when added to the model though it remained influential.

Personal Innovativeness (PI)

In this study, personal innovativeness ($p\text{-value} = 0.019 < 0.05$, $\beta=0.139$) was found to positively effect nurses' behavioural intentions. This positive influence suggests that nurses in Botswana's public health facilities in resource-limited settings are always ready to try new technological systems [200]. The study findings are consistent with a study [204] on intent to use online platforms in the context of rural tourism, which found that personal innovativeness has a substantial effect on behavioural intentions. The effects of personal innovativeness on behavioural intentions is also supported by other researchers who found a direct and positive influence [200]–[202], [204], [217], [378].

Personal Innovativeness as a determinant of Effort Expectancy

The influence of personal innovativeness on effort expectancy has been widely studied. This study found that personal innovativeness positively effects effort expectancy ($p\text{-value} = 0.000 < 0.05$, $\beta=0.302$). This relationship suggests that nurses who adopt the use of EHRs earlier are generally more competent and find it easier to learn, use, imagine and appreciate the benefits of using EHRs [203], [379]. Innovative system users are more likely to be open to information systems usage [202]. The more innovative a system user is the more intense the user's perceptions regarding the use of a particular system [200]. This finding is in line with studies that reported that personal innovativeness has a statistically significant influence on effort expectancy [201], [203], [217], [364], [380]. A study [192] also found that consumer innovativeness has an effect on the perceived ease of use and perceived behavioural control. However, this finding is inconsistent with other studies that did not find the effects of personal innovativeness on effort expectancy [200], [204], therefore the result is inconclusive.

Resistance to change (RC)

This study found that **resistance to change** has no statistically significant influence on nurses' behavioural intentions ($p \text{ value} = 0.257 > 0.05$, $\beta = -.082$). This is consistent with other studies [202], [208] that found that resistance to change has no effect on physicians' behavioural intentions. In addition, this study found that resistance to change has no statistically significant effect on behavioural intentions when moderated by age. However, this finding was surprising, given that numerous studies [173]–[177], [200], [206], [215], [232] reported that RC has a negative direct relationship with behavioural intentions such that the effects are stronger for older nurses [116]. As a result, these relationships were left out of the final model as they were not adding meaningfully to the explanatory power of the model and address the problem of multicollinearity.

The Influence of Computer Anxiety on Resistance to Change

This study found that computer anxiety does not influence resistance to change ($p \text{ value} = 0.505 > 0.05$, $\beta = .086$). This was a surprising finding as it goes against empirical evidence found on the subject. This result suggests that the level of computer anxiety does not influence the level of resistance to change. Although only a few studies [180] [381] have empirically assessed the correlation between resistance to change and computer anxiety, available literature suggests that the use of information systems among users with high levels of computer anxiety may result in information system underutilization compared to users with little to no computer anxiety [212]. This suggests that increased computer anxiety can influence resistance to use new technological systems [214], [382]. Another study [383] found that computer anxiety and resistance to change both increase in response to system users' perception of lack of support. In addition, a study [384] found that an increase in anxiety amongst professionals leads to an increase in resistance to change, as they view information system implementation as a threat to their workflow and they fear overreliance on machines [175], [384].

The studies [385]–[387] found that physicians were concerned about the costs associated with acquiring and maintaining EMRs, while nurses in larger facilities were anxious that the implementation of EMRs might lead to staff downsizing and therefore

resisted the use of EMRs. These fears and concerns have been found to be sufficient to lead to resistance to change to the detriment of information system utilization. A study [388] further highlighted the influence of computer anxiety on resistance to change by imploring that anxiety can arise when learning a new information system and this can result in resistance to change, which negatively impacts cognitive performance. In addition, a study [180] found that anxiety is significantly related to resistance to change, with an upsurge in computer anxiety prompting nurses to reject information system usage.

Computer Anxiety (CA)

In this study, the findings on the influence of computer anxiety showed that computer anxiety had a significant effect on behavioural intentions ($p\text{-value} = 0.019 < 0.05$, $\beta = -0.154$). This result is consistent with studies [208], [212], [389] that found that nurses feel uneasy and confused when faced with EHRs use, fear of causing the computer to lose data, and looking incapable of using EHRs. In addition, numerous other studies found information systems underutilized due to nurses' fear of using technology [213], [366], [390]. Furthermore, a study reported that computer anxiety had significant effects on the adoption of information systems for smaller physician practices compared to larger physician practices [215]. Computer anxiety was reported to have a substantial effects on behavioural intentions to use information systems in comparable fields [116], [205], [370], [391].

The influence of Self-Efficacy on Computer Anxiety

Computer Self-Efficacy has been widely confirmed as a causal factor of information system actual use. The probability of IS users with increased computer self-efficacy experiencing being open to IS use is higher in comparison with IS users with limited computer self-efficacy [370], [392]. This study found that there is a negative influence of self-efficacy on computer anxiety. This study found that self-efficacy negatively impacts computer anxiety [392] ($p\text{-value} = 0.000 < 0.05$, $\beta = -0.340$).

5.3.4 The effect of Moderators

Table 67: The Effects of Moderators

Hypothesis	Relationship	Standardised coefficient (Beta)	path t-value	Sig	Result
H1b:	PE*LOE → ATT	.586	10.004	.000	Supported
H1c:	PE*ITExp → ATT	.248	3.404	.001	Supported
H1d:	PE*PE _x → ATT	.537	8.786	.000	Supported
H1e:	PE*AGE → ATT	.600	10.366	.000	Supported
H2c:	EE*LOE → ATT	.619	10.900	.000	Supported
H2d:	EE*ITExp → ATT	.573	9.302	.000	Supported
H2e:	EE*AGE → ATT	.577	9.772	.000	Supported
H3b:	SI*PE _x → ATT	.205	2.896	.004	Supported
H3c:	SI*AGE → BI	.194	2.732	.007	Supported
H5c:	PI* AGE → BI	.241	3.430	.001	Supported
H6a:	RC* AGE → BI	-.019	-.267ns	.790	Not Supported

From the findings, nurses' individual characteristics namely; nurses' age, IT experience, professional experience and education have statistically substantial moderating influence on the main study variables. However, this study did not find the moderating influence of age on resistance to change. The results obtained altogether with the available empirical evidence on the influence of **education, age, IT experience and professional experience** on behavioural intention to use information systems imply that the effects of the aforementioned individual characteristics of the nurses are inconclusive.

Level of Education

The data showed that the influence of education levels is significant for the assessment of nurses' attitudes towards the use of EHRs. This study found the moderating influence of the education on the relationship between **performance expectancy** and **effort expectancy** with nurses' attitudes towards the use of information systems in their workplace for their practice as shown in table 73. This outcome is in line with other studies [65], [185], [186] that also determined these relationships to be more significant for professionals who were more educated. In addition, a study found that nurses who were degree holders were more comfortable using computer hardware and communication using computers in comparison with

nurses who were diploma holders [393]. However, this finding is inconsistent with numerous other studies found that the level of education had no moderating effects on the relationships between performance expectancy and effort expectancy with nurses' attitudes or behavioural intentions [9], [15], [127], [185], [187], [394]–[397].

IT Experience

This study found the moderating effect of **IT experience** on the correlation between nurses' **performance expectancy** and attitudes towards the use of information systems in their workplace. This finding suggests that nurses with higher IT-based knowledge are more likely to find EHRs to improve their job performance than those little to no IT-based knowledge [65]. This outcome is in line with a study by Terry et al which reported that computer experience had positive effects on the perceived usefulness of EHRs among physicians and nurses in ambulatory care settings [398]. In addition, several other studies found that IT experience has an indirect influence on the correlation between performance expectancy and attitudes such that an increase in IT experience increases nurses' perceptions that the information system will help them to execute their job-task efficiently [234], [395], [399].

This study also found that IT experience has a moderating influence on the association between nurses' **effort expectancy** and attitudes towards the use of EHRs. This finding is in line with a study by Terry et al that found that nurses who had limited experience with IT systems were more likely to be challenged by the process of learning how to use and operate computers and information systems [398]. This influence suggests that the number of years of technology use that a nurse has accrued directly influences how easy they perceive EHRs use to be [65]. This is supported by other studies that found the indirect effects of IT experience [65] [366].

A study by Ifinedo found that computer knowledge has a moderating influence on the connection between the perceived usefulness and the perceived ease of use with nurses' attitude towards the use of technology [63]. This finding on the moderating influence of computer knowledge on performance expectancy and effort expectancy is also supported by several other studies [185], [234], [394]–[397], [399] that found that IT experience has an indirect influence on attitudes towards the use of information systems amongst nurses. However, this finding is inconsistent with other studies [15], [187] that found no indirect influence of IT experience on attitudes or behavioural intention to use information systems, hence inconclusive. The majority (92.7%) of the respondents in this study reported having an average of 9.31 year-experience with using computer hardware or software and this may be a contributing factor to the

significant moderating influence of the IT Experience on the evaluation of nurses' attitudes towards to use EHRs [400], [401].

Professional Experience

This study found that professional experience has an indirect influence on the correlation between **performance expectancy** and **attitudes** towards the use of EHRs. This lends support to a study by Holtz and Krein that found that performance expectancy was significantly different between nurses with more than 10 years of experience and nurses with less than 10 years of working experience. Holtz and Krein found that nurses who had been employed for less than 10 years reported that the use of information systems would increase their job performance in comparison to nurses with more than 10 years of working experience [9]. This discovery is in line with other works [182], [402] that found that professional experience (years of working experience) has a moderating influence on performance expectancy. However, this finding is inconsistent with a study by Ifinedo that found that years of working experience has no statistically significant indirect influence on the association between perceived usefulness and attitudes [65]. Lastly, this finding is also inconsistent with other studies that reported that professional experience has no statistically significant influence on performance expectancy [171], [403]–[406].

This study also established that professional experience moderates the association between **social influence** and attitude towards the use of EHRs in BRPFs. This outcome is in line with other works [73], [168] that found that professional experience mediates the correlation between social influence and attitude towards EHRs. However, the findings on the moderating effects of professional experience are inconsistent with other studies [19], [65], [171], [402] that found that professional **experience** has no indirect influence on nurses' attitudes or behavioural intentions to use information systems in their nursing duties.

Age

This study found that age had a moderating influence on the correlation between **performance expectancy** and nurses' attitudes towards EHRs usage. This finding is supported by other works that found that age has an indirect influence on performance expectancy [171], [251],

[402], [407]. However, this finding is inconsistent with studies [65], [128] that reported that age has no moderating influence on factors that influence behavioural intentions.

This study also found that age moderates the correlation between **effort expectancy** and attitude towards the use of EHRs. This finding is consistent with studies [250], [251], [407], [408] that found that age has a moderating influence on effort expectancy such that the effects will be stronger for youthful practitioners. However, this finding is inconsistent with a study by Odom which reported that age has no association with **effort expectancy** [171]. A study by Ifinedo also found that age moderates the influence effort expectancy on attitude towards IS [65]. This finding also inconsistent with other viewpoints in the literature that found that age has insignificant indirect influence on nurses attitudes [403]–[406], [409].

The results of this report showed that age moderates the association between **social influence** and behavioural intentions to use EHRs. This finding lends support to a study by Rhodes which reported that the need to affiliate while placing great value on other people's opinions increases with age [112]. This outcomes of this work are also in line with studies [9], [129], [130], [168] that found that age has a close association with the increase in pressure to adhere to social pressures among nurses. However, this finding is inconsistent with a study [402] that found that age does not have any association with social influence.

Moreover, this study found that age moderates the relationship between **personal innovativeness** and behavioural intentions. This finding is in line with a study by Kummer et al that reported that age significantly influenced personal innovativeness [168]. This result is also in line with other works [410]–[412] that found that personal innovativeness is closely associated with age.

This study found that age has a statistically insignificant indirect influence on the relationship between **resistance to change** and behavioural intentions. This finding is surprising as numerous studies [168], [176]–[180] found that age moderates the connection between resistance to change and behavioural intentions. This finding is also inconsistent with a study by Khan et al that found that there is higher resistance to change in older nurses in comparison to their younger counterparts [175]. It is worth noting that this work found no correlation between resistance to change and behavioural intentions.

Several reasons might explain why nurses' age was found to have insignificant indirect effects on the correlation between resistance to change and nurses' behavioural intentions. A study by Guba and Lincoln posits that there has been a general upsurge in technological system usage for personal and professional reasons [395]. Nurses in Botswana generally undergo EHRs related training prior to the introduction of EHRs [413]. Therefore, nurses are more likely to have sufficient knowledge to effectively use EHRs [127]. In addition, nurses are expected to continuously familiarize themselves with EHRs thereby improving user efficiency [414]. Moreover, entry-levels in institutions of higher learning have generally been improved to increasingly incorporate technological literacy to enhance nurses' skills and competencies in the use of computers and information systems [415]. Lastly, resistance to change is primarily associated with older nurses while younger nurses are more willing to adopt the use of EHRs [175]. This finding may reflect that in this study, 66.8% of the respondents were younger than 40 years as shown in Table 55. As a result, it is probable that resistance to change is not integral to the outcomes of this work [202].

5.3.5 Factors Affecting Nurses' Actual Use Behaviour of EHRs

Table 68: Simple Linear Regression

Relationship	Standardised path coefficient (Beta)	t-value	Sig	Remark
SE → AU	.138	1.919	.057	ns
FC → AU	.423	6.451	.053	s
EE → AU	.135	1.884	.319	ns
BI → AU	.232	3.303	.001	s
BI*EHRs Experience → AU	.410	6.219	.000	s

i. s= "significant", ns= "not significant"

Table 69: Hierarchical Multiple Regression Analysis for Variables predicting Actual Use

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		Adjusted R Square
	B	Std. Error	Beta			Tolerance	VIF	
1	(Constant)	-2.282	2.315	-.985	.326			.206
	Behavioural Intention	2.513	.842	.214	2.985	.003	.807	
	Effort Expectancy	-1.195	.913	-.105	-1.308	.192	.637	
	Facilitating Conditions	3.948	.625	.482	6.320	.000	.711	
	Self-Efficacy	-1.228	.838	-.120	-1.466	.144	.621	
2	(Constant)	-10.257	2.681	-3.826	.000			.299
	Behavioural Intention	2.552	.791	.217	3.225	.001	.807	
	Effort Expectancy	-.992	.859	-.087	-1.155	.250	.636	
	Facilitating Conditions	3.228	.604	.394	5.345	.000	.672	
	Self-Efficacy	-.941	.789	-.092	-1.192	.235	.618	
	EHRs Experience	7.542	1.481	.317	5.092	.000	.944	
3	(Constant)	-9.512	4.961	-1.917	.057			.296
	Behavioural Intention	2.156	2.353	.183	.916	.361	.092	
	Effort Expectancy	-.972	.869	-.086	-1.118	.265	.625	
	Facilitating Conditions	3.234	.607	.395	5.331	.000	.669	
	Self-Efficacy	-.967	.804	-.094	-1.202	.231	.598	
	EHRs Experience	6.917	3.799	.290	1.821	.070	.144	
	BI By EHRs Experience	.335	1.877	.044	.179	.858	.061	

a). Dependent Variable: Actual Use

Note: BI= Behavioural Intention

Correlation Matrix

Table 70: Correlation Matrix

		EE	BI	FC	SE	AU
EE	Pearson Correlation	1	.376**	.462**	.521**	.135
	Sig. (2-tailed)		.000	.000	.000	.061
	N	193	193	193	193	193
BI	Pearson Correlation	.376**	1	.218**	.389**	.232**
	Sig. (2-tailed)	.000		.002	.000	.001
	N	193	193	193	193	193
FC	Pearson Correlation	.462**	.218**	1	.475**	.423**
	Sig. (2-tailed)	.000	.002		.000	.000
	N	193	193	193	193	193
SE	Pearson Correlation	.521**	.389**	.475**	1	.138**
	Sig. (2-tailed)	.000	.000	.000		.057
	N	193	193	193	193	193
AU	Pearson Correlation	.135	.232**	.423**	.138	1
	Sig. (2-tailed)	.061	.001	.000	.057	
	N	193	193	193	193	193

Note: EE= Effort Expectancy; BI= Behavioural Intention; FC = Facilitating Conditions; SE= Self Efficacy; AU = Actual Use

Table 71: Actual Use Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.521 ^a	.271	.264	7.89696

Table 72: Actual Use Resultant Determinants

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-5.293	1.815		-2.917	.004		
Facilitating Conditions	2.739	.529	.334	5.182	.000	.922	1.085
BI By EHRs Experience	2.418	.492	.317	4.911	.000	.922	1.085

Dependent variable: Actual Use

Note: BI= Behavioural Intention;

Behavioural Intention

Behavioural intention has been widely established as a strong determinant of information systems' actual use ($p\text{-value} = 0.001 < 0.05$, $\beta=0.232$). In this study, it was established that behavioural intention is a determinant of actual use. This relationship suggests that the subjective probability that a nurse will use EHRs determines the observable patterns of nurses' EHRs usage. The research findings are consistent with previous research conducted in a similar setting using the UTAUT model [23], [116], [416], [417]. In addition, the outcomes of this work are in line with other studies [65], [67], [94], [127], [217], [370] that found that behavioural intentions is a determinant of information systems use, applying various other technology acceptance models. However, previous works have found that the effect of behavioural intention on actual use may not always be significant with the influence of attitudes proving to be greater [418]–[420]. This study also found that behavioural intention is not the strongest causal factor of actual use. The minimal measure of the effect of behavioural intention on actual use indicates poor acceptance and use [47].

Behavioural Intention by EHRs Experience

This study found that Behavioural Intentions when moderated by EHRs Experience has a positively significant correlation with nurses' actual usage behaviour ($p\text{-value} = 0.000 < 0.05$, $\beta=0.317$). This relationship suggests that the total amount of time elapsed by nurses using EHRs positively influences nurses' EHRs observable use patterns. These outcomes are in line with works [47], [101] that found that the effects of behavioural intentions on actual usage were greater for experienced system users in comparison to their inexperienced counterparts as experienced users use the understanding gained from prior experience with using information systems to accomplish their job tasks. A study [192] also found a substantial effect of system-based experience on system usage frequency while applying the TAM. In addition, the outcomes of this report are in line with earlier studies [136], [192]–[196] that found a positive and strong influence of system experience on system users' actual usage behaviour. Lastly, studies found that the influence of subjective norm diminishes after the implementation of an information system as users transit to basing their intent on their experience of system use as opposed to the opinions of others [73], [90]–[92].

Effort Expectancy

This study established that effort expectancy had no impact on nurses' actual use behaviour of EHRs ($p\text{-value} = 0.319 > 0.05$, $\beta = 0.135$). This result suggests that the ease with which nurses perceive EHRs does not impact the observable EHRs use patterns. This result is consistent with a study [51] that found no influence of effort expectancy on actual user behaviour. The result of the multiple regression analysis conducted on the influence of behavioural intention, effort expectancy, self-efficacy, facilitating conditions and EHRs experience on actual user behaviour showed that the influence of effort expectancy on actual use is insignificant. As a result, this construct was excluded from the resultant model as it was not adding to the explanatory power of the model.

Self-Efficacy

This study discovered that self-efficacy has no effect on actual use behavior ($p\text{-value} = 0.057 > 0.05$, $\beta = 0.138$). This result suggests that a nurse's individual perceptions about their own ability to execute job tasks do not influence the observable patterns of EHRs use. Although the research findings are inconsistent with earlier works that reported a substantial influence of computer self-efficacy on actual usage [23], [146], a study [421] suggested that the results on the influence of self-efficacy may vary from country to country. Self-efficacy was dropped from the resultant model as this construct did not meaningfully add the explanatory power of the resultant model.

Facilitating Conditions

Previous studies have established the effects of facilitating conditions on information system use behaviour[23]. In this study, it was found that facilitating conditions as an organizational factor is the strongest determinant of nurses' actual usage behaviour ($p\text{-value} = 0.000 < 0.05$, $\beta = 0.334$). This finding suggests that nurses' perceptions of the existence of organizational and technical assistance to enable EHRs use positively influences the observable patterns of EHRs use. This finding is in line with earlier studies [23], [417], [420], [422] that found that there is a substantial influence of facilitating conditions on the actual usage behaviour of information systems.

The multiple regression analysis conducted on the effect of behavioural intention, effort expectancy, facilitating conditions, self-efficacy and association between BI and EHR experience on actual usage behaviour indicated that the influence of facilitating conditions as organizational factors is the strongest determinant of actual usage behaviour. As a result, the construct on facilitating conditions was included in the resultant model and the hypothesis on the effects of facilitating conditions on actual usage behaviour was accepted.

The influence of Personal Innovativeness on Facilitating Conditions

The research findings indicate that personal innovativeness has no significant influence on facilitating conditions as a determinant ($p\text{-value} = 0.123 < 0.05$, $\beta = 0.111$). This relationship suggests that earlier adoption of EHRs does not influence nurses' perceptions of the availability of organizational processes and technical personnel on site to aid with EHRs use.

The proposed Model

To determine a model with the best statistical performance, the directionality of each significant path was analysed. In addition, each path was assessed for multicollinearity and its overall explanatory power and support to the resultant model. A study [282] suggests that a small effect size is defined as an effect size that accounts for only 2% of the Y variance, which can be translated to $R^2 = 0.0196$. However, a medium effect size amounts to an R^2 of 0.13, where $R = 0.36$, which explains a minimum of 13% of the variance. A large effect size is defined as an effect size with a correlation of 0.51 or more [282].

This frame is also supported by a later study that required minimum sample size of 108. The later study [423] defined the values for a small, medium, and large R^2 as 0.0196, 0.1304, and 0.2592, respectively. The study in question further defined the values for a small, medium and large R as 0.14, 0.36, and 0.51, respectively [423]. Therefore, this study has a large correlation effect size with an R^2 of 0.375, R of 0.612 and adjusted R^2 value of 0.362 explaining 37.5% of the variance in behavioural intention. It is also worth noting that the structural model results show that the resultant model has a large correlation effect size with an R^2 of .332, R of 0.521 and an adjusted R^2 value of 0.264, explaining 27.1% of the variance in actual usage behaviour.

Figure 19: Final Model after refinement

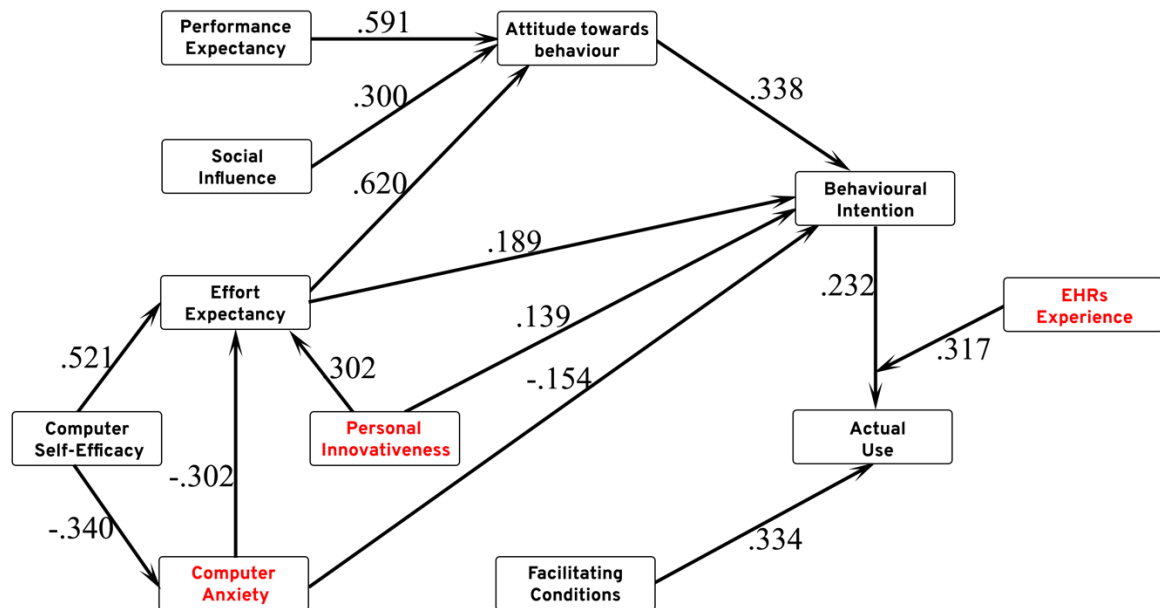


Table 73: Summary of Hypotheses

Hypothesis	Relationship
H1: Performance Expectancy will have a positive influence on Behavioural Intention	Supported
H1a: Performance Expectancy will have a positive influence on attitude towards use	Supported
H1b: Performance expectancy will be moderated by level of education such that the effects will be stronger for more educated nurses	Supported
H1c: Performance expectancy will be moderated by IT experience, such that the effects will be stronger for more computer savvy nurses.	Supported
H1d: Performance expectancy will be moderated by professional experience, such that the effects will be stronger for nurses with more professional experience	Supported
H1e: Performance expectancy will be moderated by age, such that the effects will be stronger for older nurses.	Supported
H2: Effort Expectancy will have a positive influence on Behavioural Intention to use	Supported
H2a: Effort Expectancy will have a positive influence on attitude towards behaviour	Supported
H2b: Effort Expectancy will have a positive influence on the actual use	Not Supported
H2c: Effort expectancy will be moderated by level of education, such that the effects will be stronger for more educated nurses	Supported
H2d: Effort expectancy will be moderated by IT experience, such that the effects will be stronger for more computer savvy nurses	Supported

H2e: Effort expectancy will be moderated by age, such that the effects will be stronger for older nurses	Supported
H3: Social Influence will have a positive influence behavioural intention to use EHRs	Supported
H3a: Social Influence will have a positive influence on attitude towards behaviour	Supported
H3b: Social influence will be moderated by Professional Experience, such that the effects will be stronger for older nurses	Supported
H3c: Social influence will be moderated by age, such that the effects will be stronger for older nurses	Supported
H4: Facilitating Conditions will have a positive influence on the actual use	Supported
H5: Personal innovativeness will have a positive influence on Behavioural Intention	Supported
H5a: Personal innovativeness will have a positive influence on effort expectancy	Supported
H5b: Personal innovativeness will have a positive influence on facilitating conditions	Supported
H5c: Personal innovativeness will be moderated by age, such that the effects will be stronger for older nurses.	Supported
H6: Resistance to change will have a negative influence on nurses' behavioural intention to use	Not Supported
H6a: Resistance to change will be moderated by age, such that the effects will be stronger for older nurses.	Not Supported
H7: Behavioural intention will be negatively influenced by computer anxiety	Supported
H7a: Resistance to change will be positively influenced by computer anxiety	Not Supported
H7b: Effort expectancy will be negatively influenced by computer anxiety	Supported
H8: Self-Efficacy will have a positive influence on the actual use	Not Supported
H8a: Self-Efficacy will have a negative influence on nurses' Computer Anxiety	Supported
H8b: Self-Efficacy will have positive influence on Effort Expectancy	Supported
H9: Attitude towards behaviour will have a positive influence on Behavioural Intention	Supported
H10: Behavioural Intention will have a positive influence on nurses' Actual Use	Supported
H10a: EHRs Experience will positively and directly influence Actual Use	Supported

5.4 Nurses' Perceptions of Reasons for EHRs use (facilitators)

This section presents the findings of nurses' perceptions of reasons for EHRs use as shown in Table 75. This finding will help understand the reasons why nurses use EHRs in BRPFs.

Table 74: Nurses' perceptions of reasons for EHRs use

	Frequency	Percent	Valid Percent	Cumulative Percent
Mandated in your healthcare practice	90	46.6	62.1	62.1
Improves access to up-to-date patient health-related data	130	67.4	89.7	89.7
Improves patient-related decision making	66	34.2	45.5	45.5
Improves collaboration and communication	85	44.0	58.6	58.6
Improves patient care	96	49.7	66.2	66.2
Improves patient outcomes	73	37.8	50.3	50.3
OTHER: Very good in report-taking or consolidation	1	.5	.7	.7
OTHER: Saves time hence improves timely service delivery	1	.5	.7	.7
OTHER: Gives information on disease trends in Botswana hence informs future researches	1	.5	.7	.7
OTHER: To retrieve patient results. Reduces workload and time wasting for patient	1	.5	.7	.7
Total -	145	75.1		
N/A-	48	24.9		
Total: -	193	100.0		

On why they use electronic health records, 46.6% of the respondents insisted that they used EHRs because they were *mandated in their healthcare practice*, 67.4% indicated that EHRs *improve access updated information*, while 34% reported using EHRs because EHRs *improves patient-related decision making* in nurses. In addition, 44% of respondents indicated that they use EHRs for their ability to *improve collaboration and communication*, with 49.7% insisting they use EHRs because it *improves patient care*, while others (37.8%) reported that EHRs *improve patient outcomes*. Furthermore, 1% reported using EHRs because *it is good for report taking or consolidation*, and another 1% insist that EHRs *save time hence improving timely service delivery*. Moreover, 1% of the respondents indicated that they use EHRs as *it gives information on disease trends in Botswana*, thus aiding future research, while another 1% indicated that they use EHRs to retrieve results as it reduces workload and time wasting.

5.4.1 Discussion: Nurses' Perceptions of Reasons for EHRs (facilitators)

The research findings show that this study found seven facilitators to the utilization of EHRs in Botswana's public health facilities in resource-limited setting as follows:

1) Facilitator 1: Mandated in your healthcare practice

This study found that from the total number of nurses who answered this research question, 62.1% of the respondents insisted that they used EHRs in their practice for their job because the use of EHRs was mandatory. This finding suggests that more nurses are striving to be compliant as the use of EHRs is mandated, leading to increased usage [381]. Voluntariness has been extensively studied in relation to behavioural intention and mandatory settings with results showing a correlation between social influence and behavioural intention [24], [425], [426]. Senior management in nursing should maintain the mandatory use of EHRs to boost the adoption of EHRs use [427].

2) Facilitator 2: Improves access to up-to-date patient health-related data

Nurses reported improved access to updated patient data as the most important and valuable reason for using EHRs in Botswana's public health facilities in resource-limited settings. This was evident as 89.7% of the respondents chose this reason. This suggests that most nurses prefer EHRs because of the improved access to timely and up-to-date data as a technological benefit of EHRs use [428]. Access to up-to-date information helps simplify the workflow in nursing [1]. Nursing educators should consider educating nurses on the technological benefits of EHRs use in order to improve acceptance and adoption of the use of EHRs [235]. EHRs help to improve the accessibility of up-to-date patient data and improve the data quality and efficiency [429].

3) Facilitator 3: Improves patient-related decision making

Patient-related decision-making is an important step in patient care. According to 45.5% of the respondents, making decisions on how to care for a patient and what medication or treatment is recommended is facilitated and made easier by the use of EHRs [430]. Nursing educators should emphasize the benefits associated with EHRs during EHRs training to address nurses' needs for patient care decisions [431].

4) Facilitator 4: Improves collaboration and communication

Since patient care data is accessed by all the relevant authorities with authentication, collaboration and communication on nursing care is greatly improved through the use of EHRs [1]. Previous studies have documented the collaboration and communication benefits of EHRs usage [432]. These results are consistent with previous studies that found an extensively improved channel of communication and coordination among nurses using EHRs [6], [429], [433].

5) Facilitator 5: Improves patient care

This study found that the use of EHRs in Botswana's public health facilities in resource-limited settings significantly improves the process of impeding, treating, and managing patient illnesses as well as maintaining good health. In this study, 49.7 % of participating nurses indicated that they use EHRs because it improves patient care. These findings are in line with works that reported an improvement in the quality and efficiency of the nursing care given through the use of EHRs [1], [6], [429], [434].

6) Facilitator 6: Improves patient outcomes

The study findings demonstrate that 37.8% of the participants indicated that they use EHRs as it improves patient outcomes. This finding suggests that a patient's functional status, well-being, comfort, and satisfaction are improved by the use of EHRs [435]. This is congruent with other studies that reported favourable outcomes in nursing care settings where EHR systems were used. [429].

5.5 Nurses' Perceived Barriers to EHRs use

Regarding the factors that the respondents perceive as barriers to using EHRs in their practice, 35.8% of the nurses reported that electronic health records have inaccurate patient information due to periodic updates rather than real-time, regular updates. In addition, 49.7% of the nurses reported that one of the barriers to the use of EHRs is spending too much time entering data and not enough time making eye contact with patients, while 55.4% reported that EHR increase workload. However, only 11.4% cited privacy and confidentiality concerns, and 20.2% indicated that EHRs are more difficult to use compared to paper-based records, while 19.7% of the participating nurses reported that EHRs implementation reduced practice productivity and disturbs workflow.

Table 75: Nurses' Perceived Barriers to EHRs use

	Frequency	Percent
Inaccurate patient information due to periodic and not real-time updates.	69	35.8
Spending too much time keying in data and too little time making eye contact with patients	96	49.7
Increases workload	107	55.4
Privacy and confidentiality concerns	22	11.4
EHRs are more difficult to use than paper-based records	39	20.2
EHRs implementation reduces practice productivity and disturbs workflow (at least initially)	38	19.7
OTHER: Lack of / inadequate EHR training	21	10.9
OTHER: Support and maintenance	19	9.8
OTHER: Poor accessibility	35	18.1
OTHER: Lack of knowledge, experience and use	4	2.1
OTHER: Shortage of staff and computers	11	5.7
OTHER: Increased workload time and redundancy	2	1.0
OTHER: Mismatch	4	2.1
Total:	193	100.0

The following sub-categories emerged as other barriers to EHRs use. (10.9%) of the nurses revealed that they lacked EHR-related training. 9.8 % indicated that maintenance and support and 18.1 % of the respondents indicated that poor EHRs accessibility is another barrier to the use of EHRs. In addition, 2.1 % of the respondents indicated that lack of knowledge, experience and use is another barrier, 5.7% indicated that shortage of staff and computers also contribute as a barrier to the use of EHRs, and 1% indicated that increased workload time and redundancy contribute as a limiting factor in the use of EHRs, and 2.1% indicated that mismatch with job specification is another hindrance to the use of EHRs.

5.5.1 Discussion: Barriers to EHRs use

1) Inaccurate patient information due to periodic and not real-time updates.

The accuracy of patient information in EHRs was a common theme across respondents. For various reasons that include shortage of staff, system freeze or crash, power outages, support and maintenance issues), patient data is not always captured in EHRs in real-time [4]. This leads to a rise in inaccuracies in patient information due to the periodic nature of data updates [436]. Nurses expressed frustrations at the lack of dedicated EHRs personnel

to handle data entry to reduce the workloads. This is consistent with a study that found nurses reluctant to use EHRs due to dedicated data entry personnel [437]. Some health posts are manned by one nurse, therefore, depending on the number of patients on a given day, the nurse may not be able to handle data entry in addition to other nursing care duties[438]. Senior management in healthcare should consider employing more nurses or data entry personnel to help eliminate the barrier of inaccurate patient information through real-time EHR system updates [439].

2) Spending too much time keying in data and too little time making eye contact with patients

Another barrier to the use of EHRs was reported as frustration caused by too much time entering data and limited time making eye contact with patients. The importance of nurses focusing on their patients during the diagnosis stage cannot be overstated [440]. Nurses need to make eye contact and focus on patients to learn patient needs and discomforts through active listening and observation [441]. This contributes to better communication between a nurse and a patient, resulting in a more accurate diagnosis and patient care [442]. The need for more EHRs data entry staff is evident. This would help nurses to better communicate with their patients for a more improved diagnosis [443]–[447].

3) Increases workload

The most common theme among EHRs barriers was nurses' reporting of increased workload as a result of using EHRs. Because health facilities in limited resource settings are generally understaffed, entering data into the system while a patient is being diagnosed generally increases the nurses' workload [448]. As a result, nurses generally prefer paper-based records to speed up processes as opposed to EHRs [449]. Since some nurses cited inadequate training, lack of knowledge and EHRs experience, and shortage of staff in Botswana's public health facilities in resource-limited settings, this leads nurses to view EHRs as a tool that increases their workload [450]. Against the backdrop of the aforementioned, senior management should address nurses' workload that is caused by understaffing in most rural health facilities [445].

4) Privacy and confidentiality concerns

A limited number of nurses were concerned that EHRs could present privacy and confidentiality issues. The need for further training of nurses regarding EHRs

authentication and restricted access to patient data is evident in the responses [451]. Senior management in healthcare should consider including EHR system security, authentication and confidentiality module in nursing training to ensure nurses' data security, privacy and confidentiality [452]. This is consistent with other studies that found nurses to have privacy and confidentiality issues that lead to resistance to using EHRs [444], [445], [453]. This finding underscores the need to educate nurses about the privacy and confidentiality of EHRs and the numerous risks associated with paper-based records [451]. Senior management in healthcare should consider educating nursing staff about the security measures that are in place to protect data in order to improve the use of EHRs [445].

5) EHRs are more difficult to use than paper-based records

Some nurses reported finding EHRs difficult to use compared to paper-based records. A transition to technological advancement is always accompanied by some resistance, motivated by numerous factors [116]. Senior management in healthcare should consider examining factors that may motivate nurses to consider EHRs as difficult [454]. Factors such as inadequate training, lack of experience with EHRs, and organizational issues such as shortage of staff, computers and lack of IT support for EHRs may arise [455]. These issues should be addressed to promote the use of EHRs in Botswana's public health facilities in resource-limited settings [398], [445]. This research finding calls for continued training and the provision of time for nurses to learn how to use EHRs in Botswana's public health facilities in resource-limited settings [456]. This process can also be induced by providing direct and indirect incentives for nurses to achieve improved results [55].

6) EHRs implementation reduces practice productivity and disturbs workflow (at least initially)

Nurses also reported that EHRs reduce productivity and disrupt workflow. This barrier can be caused by the initial phase of learning how to use EHRs [457]. Transiting from paper-based records, where information is filled out on a medical card, to using electronic means with defined steps is a leap that cannot be taken lightly [458]. It takes time to learn a new system and incorporate it into everyday use [459]. For this reason, continued training should be provided to those who are struggling to grasp system functionality and new users to help them grasp EHRs use [460]. This result is consistent with other studies that found that incorporating EHRs in the daily work routine for nurses disrupts workflow [444],

[461]. This barrier necessitates a redesign of the workflow to eliminate unnecessary processes and to accommodate EHRs in everyday use [55].

Other Barriers that came up:

Nurses in Botswana's public health facilities in resource-limited settings also reported a **lack of or inadequate training** as a barrier to EHRs use. Although lack of or inadequate training can be used to justify poor EHRs usability [462], senior management must find a balance between providing adequate training for nurses and facilitating improvements to EHRs [443], [453], [463], [464]. **Support and Maintenance** issues were reported to be a hinderance to the use of EHRs. In addition, this is also consistent with other studies that found that poor support and maintenance of EHRs is a barrier that can result in poor EHRs utilization [443], [445], [453], [465], [466]. **Poor Accessibility** has been highlighted as a barrier to the use of EHRs [447]. The research findings indicate the importance of providing adequate and continual training for nurses, giving them more time to grasp EHRs functionality, and having EHRs support and maintenance personnel to deal with any technical issues that may arise [55].

This result is consistent with other studies that found that most nurses **lack technical skills, understanding and experience** leading to resistance to using EHRs [443]–[445], [453], [464], [465]. Regarding technical skills, knowledge and experience, one study also highlighted computer literacy to be a barrier to EHRs use [447]. **Shortages of staff and computers** have also been reported as barriers to the use of EHRs in Botswana's public health facilities in resource-limited settings. Some research studies also found that the lack of computers and internet connectivity was an important factor that affects the utilization of EHRs in rural and urban settings [444]. Some of the nurses reported that there is a **mismatch** between what they require and what the EHRs system provides in terms of functionality. This has been cited as a common theme in other studies that identified a mismatch in the needs of EHRs users [443]. Since paper-based records are still widely used across Botswana's public health facilities in resource-limited settings, nurses view the combination of paper-based records and EHRs use to be **redundant** record keeping. As a result, some choose to use paper-based records for their convenience and flexibility [447].

5.6 Conclusions

This work pursued to identify, appreciate, and assess factors that affect nurses' acceptance and use and to explore nurses' perceptions and intent to use of EHRs in Botswana's public health facilities in resource-limited setting. This study found that personal innovativeness, computer anxiety, attitudes, effort expectancy, social influence and performance expectancy have statistically significant influence on nurses' behavioural intention to use EHRs. In addition, this work established that age, IT experience, professional experience and education moderate the correlations between the main study variables. Behavioural intentions and facilitating conditions were established to have statistically significant effect on actual use. This study also found the moderating influence of EHRs-based experience on the correlation between behavioural intentions and actual use.

This section also examined how nurses perceive the barriers to EHRs use and the reasons why nurses use EHRs in Botswana's public health facilities in resource-limited setting. The research findings highlighted the need for senior management in healthcare to improve nurses' knowledge of using EHRs and the importance of EHRs utilization through training. This would help to address human or individual barriers such as privacy and confidentiality concerns, lack of knowledge, experience and use, and the barrier of nurses who find EHRs difficult to use. To address technological barriers, the study findings highlighted the importance of performing end-user requirement analysis to tailor make EHRs to the end-user needs. In addition, EHRs providers should integrate nurses into the design process to design EHR systems that meet end-user needs. The research findings also highlight the importance of technology-based courses to help nurses improve their technical know-how. In addition, computer science modules may need to be added to the medical school curriculum to help nurses to build the knowledge and confidence for use of information systems in general [55]. Healthcare facilities should have more IT units and employ more nurses or EHRs dedicated personnel to mitigate the impact of a shortage of staff. The results also emphasize the need for senior management in healthcare to find ways to promote EHRs use by providing nurses with direct or indirect incentives to promote the acceptance and use of EHRs in Botswana's resource-limited healthcare settings [445].

Furthermore, the study findings highlight the importance of the mandatory establishment of the use of EHRs as a provision for **facilitators of EHRs use**. This requirement goes a long way

towards improving the use of EHRs. In addition, the study findings highlight the need to empower nurses and educate them about the benefits of using EHRs. Knowledge and understanding of the benefits associated with using EHRs such as improved outcomes, communication and collaboration, patient care, patient-related decision making and access to data can help improve EHRs use. Therefore, the importance of EHRs related training cannot be overstated, as highlighted by this study.

6 CHAPTER 6: NURSES' COMFORT LEVELS WITH EHRs USAGE

This chapter presents the qualitative data analysis on comfort levels associated with EHRs in Botswana's public health facilities in resource-limited setting. An open-ended question was asked to participants using the same sample and research instrument at the same time to acquire more knowledge and understanding about nurses' comfort levels with using EHRs [267].

The question, which was aimed at collecting qualitative data on nurses' perceptions of their level of comfort prompted nurses to expound on reasons why they felt comfortable or discomfort with EHRs usage. A total of 21 subcategories that explain nurses' level of comfort or discomfort in Botswana's public health facilities in resource-limited settings emerged. Categories and subcategories that emerged are presented in Table 76 below. All the emergent sub-categories were grouped into the following categories:

1. Nurses' Individual Characteristics
2. Technological Characteristics
3. Organizational/ Environmental Characteristics

Table 76: Categories and subcategories of factors influencing nurses' comfort levels

COMFORT			DISCOMFORT		
NURSES' INDIVIDUAL CHARACTERISTICS					
A	1	Nurses' computer self-efficacy & EHRs related knowledge	10	Age	
	2	Experience & frequency of use	11	Lack of technology-related knowledge	
	3	Age	12	Lack of experience	
	4	Technology Educational related training	13	Infrequency of use	
TECHNOLOGY CHARACTERISTICS					
B	<u>IMPROVED COLLABORATION</u>		<u>TECHNICAL DIFFICULTIES</u>		
	5	Improved Accessibility, Communication, Collaborative work & Convenience	14	Poor accessibility: Power Cuts & Network/Connectivity ISSUES	
	<u>EHRs SYSTEM DESIGN PROS</u>		<u>EHRs SYSTEM DESIGN</u>		
	6	User-friendly: Step-by-step guide, Easy to learn & use	15	Software & Hardware; System updates, freeze & crashes	
	7	Effective & Efficient data storage (accurate & timely) & reduces workload	16	Difficult to use; Not User friendly, disturbs workflow	
	8	Improved data integrity, Privacy & Confidentiality	17	Redundant (Time-consuming) & Increased workload, disturbs workflow	
ORGANIZATIONAL CHARACTERISTIC					
C	9	EHRs related training	18	Lack of/Inadequate EHRs related training	

	19	Poor EHRs Support and Maintenance
	20	Shortage of STAFF/manpower
	21	No Computers, Internet, Electricity or EHRs installed

6.1.1 Individual Attributes

This group presents the findings on nurses' individual attributes as factors influencing nurses' level of comfort using EHRs. Under nurses' individual characteristics, four subcategories emerged as the fundamental determinants of nurses' comfort with using EHRs, namely:

- i. nurses' computer self-efficacy and EHRs related knowledge,
- ii. EHRs-related experience and frequency of use,
- iii. nurses' age,
- iv. and technology educational-related training.

Respondents who reported to have high computer self-efficacy, EHRs-related knowledge, educational-related training, youth, highly experienced with EHRs use and high frequency of EHRs use also reported being comfortable with EHRs use. These nurses reported that they were able to easily navigate and harness the benefits associated with using EHRs. Some of their responses were noted as:

- *“Long-time use of EHRs makes me comfortable (with usage)” (Respondent 1)*
- *“I have expertise in Electronic Information system that makes it very easy and way comfortable in using EHRs” (Respondent 38)*

However, some respondents indicated that they are older, and therefore they are not very conversant with technology altogether, which leads to discomfort with EHRs usage. Others reported being uncomfortable with using EHRs due to a lack of technology-related knowledge and EHRs experience. Some respondents cited the infrequency of the use of EHRs as the main reason for their discomfort with using EHRs. Some of their responses were recorded as:

- *“Not really competent in all aspects of the system” (Respondent 10)*
- *“Lack of training on basic computer knowledge” (Respondent 25)*
- *“Born before technology so I am computer illiterate” (respondent 117)*

- *“Because of lack of use of EHRs in our facility, with lack of experience hence being uncomfortable using EHRs” (Respondent 120)*

6.1.2 Technological Characteristics

This category presents findings on the technological characteristics of EHRs as factors influencing nurses’ level of comfort using EHRs in Botswana’s public health facilities in resource-limited settings. Two subcategories emerged as the underlying factors explaining nurses’ level of comfort using EHRs, these were:

1. Improved collaboration

- 1.1 Improved Accessibility
- 1.2 Communication
- 1.3 Collaborative work & Convenience

2. EHRs System Design Pros

- 2.2 User-friendly: Step-by-step guide, Easy to learn & use
- 2.3 Effective & Efficient data storage (accurate & timely) & reduces workload
- 2.4 Improved data integrity, Privacy & Confidentiality

On the contrary, two more subcategories emerged as the underlying factors explaining nurses’ level of discomfort using EHRs in Botswana’s public health facilities in resource-limited settings. These were:

1. Technical Difficulties

- 1.1 Poor accessibility: Power Cuts & Network/Connectivity Issues

2. EHRs System Design

- 2.1 Software & Hardware
 - 2.1.1 System Updates, Freezes & Crashes
- 2.2 Difficult to use; Not User-friendly, disturbs workflow

Improved Collaboration

Participating nurses reported that using EHRs improved collaboration in their practice. In addition, some of the nurses reported that using EHRs improved accessibility to patient records, improved communication and collaborative work while increasing convenience and saving

time. Some of their comments on improved accessibility, communication and collaborative work included:

- *“Can be accessed and be seen by other health care providers” (Participant 16)*
- *“Makes work easier and fast to access at any time.” (Participant 56)*
- *“It’s convenient to retrieve patients records and reduce resource wastage like sending an ambulance to collect printed patient results from Serule” (Participant 83)*

EHRs System Design pros

A small fraction of the participating nurses reported that the current EHRs design is user-friendly. They highlighted that EHRs were designed to prompt the user to follow a specific step-by-step guide to governing data input. They indicated that this helps to ensure that all necessary data is recorded. Some participants went on to report that EHRs have been designed in a way that makes them easy to learn, comprehend and use. In addition, some of the participating nurses reported that EHRs are effective, and efficient data storage tools because they provide timely and accurate information and they reduce workload. Some of the nurses reported that the use of EHRs has resulted in improved data integrity, privacy and confidentiality. This was noted in the following comments:

- ***User-friendly: Step-by-step guide, Easy to learn & use***
 - *“EHRs assist in full patient management because it guides health care workers in all key practices. It’s not easy to miss any practices” (Participant 6)*
 - *“EHR follows a smooth guideline on how to examine patients” (Participant 7)*
 - *“The system is easy to understand and use” (Participant 66)*
- ***Effective & Efficient data storage (accurate & timely) & reduces workload***
 - *“It reduces workload” (Participant 58)*
 - *“Patient information is kept for reference once. Most patients don’t come with old medical cards which often makes it difficult to see what medication patients have been taking or for patients with chronic illness it’s difficult to see how the patient has been if using old medical cards. EHRs are also time-saving and not tiring as paper data.” (Participant 71)*
 - *“It eases work and reduces paperwork” (Participant 103)*

▪ **Improved data integrity, Privacy & Confidentiality**

- *“I have my own password that I do not share” (Participant 6)*
- *“It’s comfortable because patients’ records are safe in the computers” (Participant 11)*
- *“Improves computer learning skills. Improves privacy and confidentiality of patients since its accessible authorized personnel who can easily account for any tempers.” (Participant 81)*

However, some of the participating nurses reported some discomfort in using EHRs. Discomforts with using EHRs were attributed to technical difficulties and issues concerning software, hardware, and the design of EHRs.

Technical Difficulties: Poor Accessibility: Power Cuts & Network/Connectivity Issues

The participating nurses reported that, EHR systems are not always available for use, hence poor accessibility is attributed to this. Some of the reasons that were advanced as contributing factors for the poor accessibility of EHRs involve power cuts and unreliable network connectivity of EHR systems. Poor accessibility results in the inability to access important information when needed, and this may cause some discomfort with EHR’s use. Some of the participating nurses’ comments were recorded as:

- *“System not available so sometimes it’s not reliable” (Participant 63)*
- *“Sometimes there is no power (electricity) and network” (Participant 89)*
- *“Most times there is no network, and you can’t access most data” (Participant 134)*

EHRs System Design: Software & Hardware; System Updates, Freezes & Crashes

Some of the participating nurses reported their discomfort with using EHRs on account of the EHRs software being slow. In addition, nurses reported that the frequent and unpredictable disruptive system updates further add to their discomfort as they render these systems unusable at the time of the system update. In addition, some of the nurses also reported system freezes and crashes as deterrents to EHR system use and a factor that influences their discomfort with EHRs use. Some of their comments were noted as:

- *“Updating of electronics takes time hence a gap in between implementing” (Participant 59)*
- *“Sometimes electronics take a long time to respond (freezes) which consumes time, more time spent with the client.” (Participant 154)*

Difficult to Use

Responses from a few participating nurses shows that EHRs usage brought about some discomfort because the nurses consider it difficult to use. The difficulty in using EHRs can be attributed to low self-efficacy, lack of or inadequate training and lack of experience with EHRs use. Some of their responses were recorded as:

- *“EHRs are difficult to use” (Participant 8)*
- *“Not easy to use” (Participant 68)*
- *“Some information is difficult to enter into Electronic Health Records” (Participant 110)*

Disturbs Workflow: Redundant, Time Consuming & Increases Workload

Some of the nurses reported discomforts with using EHRs, citing that EHRs usage disrupts their workflow. These nurses highlighted that using EHRs is time-consuming while reducing the quality of care given to the patients. In addition, they reported that EHRs usage brings about patient data redundancy as they have to use EHRs and paper-based records simultaneously, leading to an increase in their workload. Some of their responses were noted as:

- *“It increases workload and also capturing and collecting data takes a lot of time.” (Participant 101)*
- *“Reduces quality of care to the patient, eye contact reduced, more workload as it takes time to enter information since there are more variables to fill” (Participant 126)*
- *“It would have been easier if it is electronic based and not a combination of paper-based and electronic-based” (Participant 158)*

6.1.3 Organizational Characteristics

This group presents findings on the conveyed organizational characteristics of EHRs as factors that affect nurses' comfort levels with EHRs usage in Botswana's public health facilities in

resource-limited settings. Four (4) subcategories surfaced as the underlying organizational and environmental factors explaining nurses' level of comfort using EHRs. These are:

- i. EHRs-related training,
- ii. EHRs support and maintenance,
- iii. shortage of staff/manpower and
- iv. unavailability of EHRs, equipment, electricity, or internet.

EHRs Training

Some participating nurses reported that EHRs related training that their employer provided helped them acquire the right skills and they developed some comfort with using EHRs. This was noted in the following comments:

- *"I'm comfortable using PIMS which I was trained on." (Participant 40)*
- *"Training has been done followed by application on the field hence it improved my comfort and knowledge" (Participant 107)*
- *"I have been trained and practising" (Participant 136)*

Lack of/Inadequate EHRs related training

Some of the participating nurses in Botswana's rural public health facilities reported a lack of or inadequate EHRs related training as an underlying organizational factor that affects their level of discomfort in using EHRs. Some of their responses were noted as:

- *"There hasn't been enough training" (Participant 45)*
- *"Inadequate knowledge. Not trained on the use of EHRs." (Participant 96)*
- *"We were not trained on the relevant module (consultation) for patients. We were therefore expected to implement what we were trained in, and it did not correspond. The training benefited IDCC, ASRN & PMTCT in a nutshell" (Participant 174)*

Poor EHRs Support and Maintenance

The absence of readily available support and maintenance personnel was found to add to nurses' discomfort with EHRs use in Botswana's resource-limited settings. Nurses reported that lack of access to timely IT support when they encounter technical challenges with EHRs

is one of the challenges that affect the quality of their work using EHRs. In addition, some facilities lacked some basic tools to support EHRs use. Some nurses in other healthcare facilities reported that they do not have printers, cartridges, and paper which hinders them from using the EHRs effectively. Some respondents reported that:

- *“When it is damaged, it takes a long time to be repaired” (Participant 2)*
- *“Cartridges, papers and stationery availability” (Participant 25)*
- *“They (EHRs) are not well maintained” (Participant 34)*

Shortage of Staff/Manpower

Some nurses reported shortage of staff is a factor that contributes to their discomfort about the use of EHRs. Filling in information in EHRs while diagnosing patients was reported to slow down patient care. Some of the respondents’ comments were noted as:

- *“Time-consuming due to load and shortage of manpower” (Participant 3)*
- *“Patient-nurse ratio; too many patients, at times patients complain that they spend long hours waiting” (Participant 20)*
- *“Comfortable but time-consuming since there is a shortage of staff” (Participant 155)*

Unavailability of EHRs, Equipment, Electricity or Internet

In some healthcare facilities, EHRs were not installed at all. In addition, some facilities lacked electricity to support EHRs usage. Other nurses reported that a lack of equipment and internet connection to support EHRs usage was a hindrance to the use of EHRs in their healthcare posts. All these were reported as factors inhibiting EHRs usage and causing discomfort with EHRs use in some facilities. Some of the respondents reported as such:

- *“I think after mass training and facility settings/ installation of PIMS/IPMS will be comfortable on using it, eagerly waiting for that” (Participant 28)*
- *“Because of lack of use of EHRs in our facility which lack of experience hence being uncomfortable using EHRs” (Participant 120)*
- *“Out of stock of some equipment” (Participant 164)*

6.1.4 Discussion: Reasons for Nurses' Comfort or Discomfort

This section was targeted at identifying and exploring nurses' comfort levels with regard to the use of EHRs in resource limited settings in Botswana. The research findings indicated that nurses delineated average to high comfort levels. Individual, technological and organizational factors were also found to affect nurses' comfort or discomfort levels with EHRs usage.

Although there is inadequate substantiation on the subject of nurses' comfort levels with using EHRs in rural settings, the research findings are consistent with other studies on nurses' perceived barriers, facilitators, EHRs use perceptions and satisfaction with EHRs use [463], [467]–[469]. For example, a study established that educational quality, technical system quality and service quality positively influence nurses' perceptions of satisfaction which positively influences nurses' EHRs usage behavior [469]. In addition, a study by [301] found that attributes of technology such as IS performance, navigation, system speed, and response time and the effects of EHRs on the workload of the nurses have a negative effect on nurses' perceptions of EHRs use. Furthermore, Maillet et al. established the influence of self-efficacy, facilitating conditions, effort expectancy, and performance expectancy on intentions and actual use [51]. A study by Tropaz et al. identified i) **user-task issues** (such as EHRs system failure to address nursing care needs and system not nursing specific), ii) system issues (such as functionality mismatch, standards and standardization issues, interoperability issues and system usability) and iii) organizational issues (lack of EHRs based training and EHRs pervasiveness) as barriers to EHRs use [468].

The first conclusion that can be drawn from factors that were established to effect nurses' comfort levels with EHRs usage is the importance of prior evaluation on nurses' comfort levels with using EHRs. Before training nurses on EHRs use, senior management in healthcare should concentrate on conducting prior assessments or evaluations to find out nurses' level of comfort with information systems and technology usage in general. The results of this assessment may help enlighten senior management with knowledge and understanding of nurses' level of comfort, identify focus areas on EHRs training, and how to identify the right EHRs training for the nurses.

In this study, nurses' lack of adequate EHRs related training was found to significantly add to nurses' discomfort with the use of EHRs. As a result, senior management can consider incorporating continual training; before, during and after EHRs implementation, to address

discomforts with using EHRs. In addition, a lack of technology-related knowledge was found to contribute to nurses' discomfort with EHRs usage. To address this discomfort, nurses could be provided with additional technology-related education and more training on the use of EHRs so that they get more acquainted with the system. Peer-to-peer education can also be incorporated to allow nurses to acquire more technical skills to help those who may be lagging behind. In order for the technology and EHRs-based training to reach all and be successful, senior management could adopt blended teaching and learning style approach. Blended learning styles incorporate the use of video and audio recordings as learning materials, lecture sessions with a conventional lecturer, demonstrations and practical sessions for a more hands-on approach [456], [470]. This style of learning could be used to train nurses because they present a better opportunity for nurses to grasp content and EHRs learning material that could help improve their comfort levels with EHRs use before, during and post EHR implementation. A study [471] found that nurses were allowed to practice with telehealth technology before implementation in order to improve their comfort levels. This study also found that lack of technology-related knowledge, experience, and infrequency of use are some of the influences that effect nurses' discomfort with using EHRs in resource-limited settings. Since there are nurses who lack knowledge and experience, they may find it hard to learn all the functionalities of a system and reach mastery levels during the initial stages of training. Therefore, senior management should consider encouraging trainees to focus on attaining the basic skills in EHRs before they can attempt to master EHR systems [456]. Continuous training may also benefit nurses who lack knowledge and experience with using EHRs [456].

This study also recorded some discomfort among nurses that is caused by technical difficulties and EHRs system design. The barriers and discomforts that have been identified in this study may be addressed by involving nurses in the process of system design as end-users, alongside the system developers. The involvement of nurses in the design process can result in a better apprehension of the needs of nurses and the development of systems that can better address their needs. It is integral for system designers to assume a user-centred methodology in the initial design stages. Application of initial requirements specifications, formative assessment, system enactment and summative usability assessment are integral. These are assessments made before an information system is implemented, during system implementation and post information system implementation [463]. Although user-centred approaches are quite common in the information system design and implementation in healthcare, there is limited empirical evidence specific to EHRs in rural settings [6], [447], [453]. This design approach

involves gathering feedback from nurses as system users, combining nurses' perceptions and their feedback to integrate them into the features of the EHR system and functionality for a more harmonious output [127], [472]. This integration helps designers to develop information systems that meet the needs of system users that would not disturb nursing care workflow, but rather help nurses to achieve and realize the intended benefits of system use [473]. This further reiterates the need for senior management in healthcare to work with policy makers and EHRs system designers, and involve nurses in the design procedure to advance data quality control and administration [474].

6.2 Conclusion

In conclusion, nurses' level of comfort concerning the use of EHRs in Botswana's public health facilities in resource-limited setting was examined in this chapter. This study found that nurses have individual, technical, and organizational discomforts with the use of EHRs. The research findings emphasize the need to involve nurses in the development of EHRs to facilitate the design of EHRs systems that better meet the needs of nurses as end users. Such an approach can also help system developers to design systems that are easy to use and in accordance with the nursing workflow, resulting in reduced discomfort with EHRs usage among nurses. The study findings also emphasize the need for senior management to evaluate nurses in terms of discomfort before EHRs implementation to help in shaping EHRs training focus points and the need for continuous training. There is also a need for EHR system support and maintenance and timely response to any issues that arise from the use of EHRs.

7 CHAPTER 7: CONCLUSIONS & RECOMMENDATIONS

7.1 Introduction

This chapter advances the suppositions of this study as per the research findings, strengths, limitations, and contributions of the study. The chapter also presents the resultant study implications and recommendations which are based on the conclusions of the study.

7.2 Overview

The assimilation, acceptance and use of electronic health records are transforming health care and the way healthcare professionals retrieve and interrelate with patient and health data[7], [475]. This significant change is reflected in the increasing adoption of EHRs and the resultant changes in the way healthcare data is stored, retrieved, distributed, handled and consumed [476]. In addition, the reliability and efficiency of electronic health record systems in Botswana have been widely documented [477]. EHR was introduced to automate healthcare workflow, reduce adverse drug events, document patient needs, and improve collaborations amongst healthcare professionals while improving information accessibility [4], [5], [54], [180], [386], [393], [429], [465], [478], [479].

While the benefits of electronic health record systems have been noted, empirical evidence suggests that the implementation of electronic health record systems does not always mean that these benefits will be realized [480]. On the other hand, previous studies have reported numerous cases of low behavioural intentions and the actual use of EHRs [57]. To achieve the intended benefits of the EHRs implementation, there should be some system acceptance and the intended end-users of the system should use the system for the intended purposes. Nurses are the largest group of EHRs end-users, and they are an integral part of realizing the benefits of EHRs. As a result, nurses' level of comfort, perceptions, behavioural intentions, and actual use were comprehensively examined to expand knowledge on nurses' acceptance and use of EHRs in resource-limited settings where knowledge is limited.

This study utilizes a convergent mixed-methods design, collecting the quantitative and qualitative data at the concurrently to answer the research questions [264], [265]. Moreover, this study proposes the use of the modified UTAUT model [23] as well as additional variables influencing acceptance and use of information systems as divulged by the literature review conducted to gain a rigorous understanding of the factors affecting nurses' acceptance and use of EHRs in resource-limited settings.

This study used cross-sectional, convergent mixed-methods design survey. In this study, the researcher adopted the positivism paradigm to address the research questions and achieve the objectives of the study. The understanding gained from the analysis of the findings on the main study variables was theorised and this led to the inclusion of additional variables to the Modified UTAUT model to better explain factors influencing nurse's behavioural intention and usage behaviour in resource-limited settings. Lastly, categories emerged from the analysis of the open-ended question. These categories were expanded with available literature to gain an in-depth understanding of the research findings.

7.3 Implications

This study assessed the acceptance and use of EHRs in Botswana's public health facilities in resource-limited settings by nurses and proposed an augmentation of the Modified UTAUT model. This study established the effects of effort expectancy, performance expectancy, attitudes, computer anxiety, social influence and personal innovativeness on behavioural intention and the moderating influence of age, professional experience, IT experience and level of education on the main study variables. In addition, this study found the influence of behavioural intentions and facilitating conditions on nurses' actual usage behaviour of EHRs. Lastly, this study found EHRs Experience moderates the relationship between behavioural intentions and actual use.

The research findings showed that the resultant model explains 37.5% of the variance in behavioural intentions and 27.1% of the variance in nurses' actual use of EHRs. Also, the research findings emphasize the importance and need for further research to explore and establish the most appropriate theoretical framework to better explain nurses' acceptance and use of EHRs.

The theoretical implication of this study is that more than 60% of the variance in nurses' behavioural intention to use EHRs in the Modified UTAUT model and the proposed model were not accounted for. This can be explained by the origins of acceptance models. Although UTAUT and other technology acceptance models were developed to uncover the factors that influence IS usage and how users make decisions on technology use, these acceptance models do not originate from healthcare domain. Acceptance models may be inadequate in terms of explanatory power in nursing and this inadequacy may be due to aspects of their commercial,

psychological and sociological origins [64],[134], [138]. Therefore, UTAUT may not have all the variables needed to fully explain nurses' acceptance and use of information systems, and some of its variables may not be adequate to expound information systems acceptance and use in resource-limited settings [481], [482]. This limitation necessitates further research in this discipline to ascertain the suitable factors that determine nurses' acceptance and use of information technology.

The study findings on the effects of nurses' **performance expectancy** on behavioural intention reiterate the need to involve nurses at every stage of EHRs design and refinement to help system designers to avoid designing and implementing systems that are inconsistent with the general requirements of nurses' needs. Engaging nurses during the requirements gathering, software design, development, testing, and integration phases is integral as they are the most substantial group of EHR system end-users [476]. This will help developers to design systems that are better suited to the nursing workflow and need for improved system utilization [467]. The involvement of nurses as system end-users in the design/delineation and implementation procedures emphasizes the importance of constant contact and collaboration among nurses and system developers[158]. Lastly, system developers should appreciate the nursing care workflow by observing the nurses' daily practice. This would help system developers to better understand the complexities of nursing and its challenges in rural settings. The resultant knowledge of nursing needs and environmental issues would help system developers to develop information systems that better address the needs of nursing care, thereby improving acceptance and use [467].

The research findings on the effects of **computer anxiety and attitudes** on nurses' behavioural intention highlight the need for the Ministry of Health and respective district health management teams to promote or adopt an organizational culture and a general work environment that encourages and supports the use of EHRs [127] to curb the effects of computer anxiety and to encourage EHRs use. This ideal work environment and supportive organizational culture can be achieved by allowing nurses to have more practice on the use of EHRs systems before implementation. This would help nurses to be familiar with EHRs and master the system and its functionality before mandating use [57]. In addition, the findings on computer anxiety suggest that nurses are afraid of making errors that they cannot correct and appear incompetent when using EHRs, making them uncomfortable and confused when using EHRs [208], [389]. Therefore, there is a need for senior management to provide IT support

and adequate EHRs based-training before, during and after EHRs implementation to address issues of nurses' computer anxiety[467], [483]. In terms of attitudes, promoting peer guidance by incentivising EHRs trainers to guide other nurses with the effective application of EHRs in their professional roles can help promote EHRs acceptance and use [484].

The effect of **personal innovativeness** on behavioural intention refers to an individual nurse's willingness to try out an innovation. The research findings highlight the need to classify nurses into innovators, early adopters, early majority, late majority and laggards [200]. These categories will help senior management create separate training priorities and set separate time frames for the expectations about the acceptance and use of EHRs. Since early adopters are known to be more connected and communicate better through interpersonal channels, senior management needs to combine early adopters and late adopters so that they can exchange knowledge and skills on the use of EHRs. This study is consistent with other studies that have found that personal innovativeness is a significant determinant of effort expectancy [380]. This suggests that innovators, early adopters and the early majority find it relatively easy to learn, understand and navigate EHRs [379], therefore should be identified and used to help laggards to fit in EHRs usage.

This study revealed numerous organizational issues affecting EHRs usage. Therefore, senior nursing management must create a work environment that promotes and supports the use of EHRs. This can be achieved by employing more nurses in understaffed facilities to reduce workload and promote the use of EHRs. Management may also consider employing EHRs dedicated data entry personnel to enable real-time data entry rather than periodic updates. Also, facilities should have dedicated system technical support and maintenance engineers on-site at all times to deal with technological issues and faults as they arise in order to promote the use of EHRs [15], [483].

Investing in training can also help promote the use of EHRs. From the study findings, issues related to inadequate or lack of technological (EHRs) training, knowledge, and experience with EHRs were raised. Training nurses on the use of EHRs before, during and post-implementation can help nurses to gain knowledge on EHRs usage and thus drive their use. Previous studies have also suggested the provision of dedicated personnel to provide key user instructions and important information about EHRs, their benefits and their functionality. These can be early adopter nurses who are innovative (peer-to-peer) or EHRs-based educators. These individuals exert a social influence on nurses as EHRs end users to motivate them to accept and use EHRs.

These persons can be stationed in rural facilities to assist in person or they can provide service through other means of communication [485], [486].

The results of this study revealed that healthcare facilities provide EHRs training for nurses in various ways, including conventional instructor-led lectures, video, audio, and delivery of printed or electronic material [470], [487]–[489]. Senior management in nursing should consider implementing a blended learning style that incorporates audio, video, lecture sessions, demonstrations and practical sessions to better train nurses on EHRs [456], [470]. A blended learning style allows nurses to better understand concepts and practice with EHRs through practical sessions for better usage. A study also found that allowing nurses to practice with EHRs before implementation helps improve post-implementation usage by considerably improving nurses' level of comfort in using EHRs and EHRs-related knowledge [471].

Previous studies on nursing education curricula show that nursing care institutions lag behind in terms of incorporating the study and management of health data and the application of nursing concepts to EHRs, to improve nursing [401], [490]. As a result, nursing students should learn about the integration of health information systems in the practical section of their studies [490]. This can lead to inconsistencies in the knowledge acquired, as student training sites differ in the kinds of information systems they utilize, the associated usage frequencies and the training availed to nursing students [491]. Given the above, the incorporation of EHRs-related training into nursing curricula is of the greatest importance to ensure that nursing students graduate with optimal knowledge of the benefits and functionality of EHRs [492]. EHRs-related training can be incorporated into nursing institutions by allowing nursing students to develop their own EHRs concepts and prototypes. This allows students to deepen their understanding of EHRs functionality and benefits [493]. Furthermore, EHRs may be incorporated in a laboratory setting at the simulation level. Simulating various types of EHRs can help students fully understand the functionalities of different types of EHRs and prepare for their use [401], [494].

This research also found that there were rural healthcare facilities with unreliable power or without access to electricity and internet connectivity or electricity. The DHMT leadership should consider working with parastatal telecommunication companies to avail or increase telecommunication connectivity in affected areas. A study Galani et al. suggested that unreliable power may result in data corruption and this may compromise the reliability of

patient data stored in EHRs [495]. Paper-based records are widely used in these areas to combat the unavailability of internet connectivity.

7.4 Future Research

This study sort to explore causal factors that affect nurses' comfort levels, acceptance and usage behaviour in resource-limited setting. Further research is required to examine nurses' behavioural intention to use EHRs in resource-limited setting on larger and diverse setting sample size sample. This can help to ascertain or determine whether the influence of factors found in this study will maintain their influence at the national level, for example, including Botswana's public health facilities in resource-limited settings in other regions that were not covered in this study. Future research should consider examining other factors that influence behavioural intention, such as training and satisfaction that were not captured in this study to add to the explanatory power of the resultant model. The variables in this work that were established to have substantial effects on nurses' behavioural intentions and actual usage behaviour were informed by the existing literature.

7.5 Strengths and limitations of the study

Strengths

This work is the first to identify, understand and assess the causal factors that affect nurses' acceptance, usage behaviour, perceptions of nurses and behavioural intentions to use EHRs in Botswana's public healthcare facilities in resource-limited setting. This aspect is of great significance, and it is hoped that this study expands the body of knowledge on acceptance and usage of EHRs in resource-limited setting.

The Modified UTAUT Model was implored to examine the causal factors that affect the acceptance and use of EHRs with some additions guided by empirical evidence.

This research findings on nurses' experiences can be used in policy design and implementation in healthcare.

Lastly, this study combined both the quantitative and qualitative approaches to collect data. Combining these approaches in the same study helped to avoid bias and to generate information-rich cases to better understand the subject matter.

Limitations

There limitations of this study include:

- This study covered only regions that were in close proximity and easily accessible to the research team. Therefore, dispersed rural facilities with rough terrain and poor road conditions were not covered due to limited resources.
- This study was only open to respondents who were conversant and proficient in the English. In addition, there are some nurses who did not take part in this investigation due to limitations in the set inclusion criteria, who may have different views may from the study participants.
- Lastly, due to Botswana's various cultures and different environmental issues, the views and perceptions of potential participants in other regions not covered may differ from those of the nurses involved in this study, thus this should be considered in the generalizability of the research findings.

7.6 Contribution of the study

This work aims to create knowledge on the acceptance and use of EHRs in healthcare. In addition, the study outcomes deliver a theoretical model that explains the acceptance and use of EHRs for resource-limited settings. The resultant model introduced the effect of perceived innovativeness and computer anxiety as extensions to the modified UTAUT model to better understand the causal factors affecting behavioural intentions in resource-limited settings. The study also introduced the influence of the education, age, IT experience, and professional experience as moderators to better explain behavioural intentions. This research findings also introduce the moderating influence of EHRs experience on the correlation between behavioural intention and the actual usage behaviour of EHRs. After a comprehensive review of the empirical evidence on actual usage behaviour, this work extended the modified UTAUT model by introducing the influence of EHR experience on actual usage. This study also found that the resultant model has a large correlation coefficient for behavioural intention and actual usage behaviour. Studies [6], [447], [453] suggested that the issue of acceptance and use of technological systems in resource-limited settings needs further investigation as there is

inadequate substantiation on the subject [23] [117]. Therefore, this study adds much-needed insights into the subject matter and validates the UTAUT model in resource-limited settings.

A thorough understanding and appreciation of the factors that affect the acceptance and use of EHRs by nurses, as well as nurses' perceptions, will greatly assist the Ministry of Health through DHMT heads, senior nursing management teams and nursing trainers or instructors to come up with strategic methods to incorporate EHRs in rural clinics and health posts. Successful integration will help improve EHRs usage and thus improve healthcare in Botswana.

7.7 Conclusion

This study on nurses' acceptance and use, perceptions and behavioural intention to use EHRs in Botswana's public health facilities in resource-limited settings found and theorised the effect of individual attributes, attributes of technology and organizational attributes on EHRs usage and the formation of perceptions on system usage. Personal innovativeness, performance expectancy, effort expectancy, social influence, attitude towards behaviour, and computer anxiety had a direct effect on behavioural intention. The effect of facilitating conditions, behavioural intention and EHRs Experience was assessed and theorised in relation to system usage.

Some nurses lacked technology-related knowledge to adopt EHRs in their practice. Other nurses cited that they were too old for new technology and could not navigate through EHRs systems. As such, there is a need for senior management to ensure that nurses are adequately trained on EHRs use and create an organizational environment that allows nurses to practice with EHRs use to improve utilization.

In other facilities, frequent power cuts, network connectivity issues, software and hardware issues, system updates, freezes and crashes greatly affected EHRs' use. Also, due to a lack of training, some nurses found EHRs systems to be difficult to use and generally not user-friendly. Nurses also felt that EHRs systems were redundant as they were required to keep both paper-based and electronic records at the same time, increasing their workload while disturbing their workflow. Senior management need to employ more nurses or EHRs data entry personnel to address the issue of shortage of staff and to reduce nurses' workload. Also, periodic training should be availed to nurses to help equip them with knowledge on EHRs use.

Nurses also felt that factors such as poor EHRs support and maintenance, shortage of computer units, internet and EHRs system were found to be the most prominent issue deterring nurses from using EHRs in their practice for their job tasks. This was indicated by facilitating conditions being the most prominent determinant of actual usage as opposed to behavioural intentions or system-related experience. The Ministry of Health should avail EHRs support personnel on-site at every facility to ensure that EHRs systems are functioning properly at all times. Also, adequate computer units should be availed in every facility altogether with the necessary hardware and software to improve EHRs system utilization.

Finally, it is hoped this research has contributed to the understanding of barriers and facilitators of EHRs use, nurses' perceptions of factors that affect acceptance and use, and the phenomenon of nurses' resistance to the use of EHRs in Botswana's public health facilities in resource-limited settings. It is also hoped that the study findings and recommendations can serve as a basis for the formulation of strategies and an organizational culture that will help improve EHRs utilization.

Appendix A: Research Permits

Telephone : 3655400 / 3655483
Fax : 3914271
E-mail: botsamote@gov.bw



Block 6, Government Enclave, Headquarters
Private Bag 00517 Gaborone

MINISTRY OF TERTIARY EDUCATION, RESEARCH, SCIENCE AND TECHNOLOGY

REF: MOTE 1/18/6 VII (53)

23rd September 2019

Oabile Lesley Boitshoko
P O Box 401523
Gaborone

Dear Sir

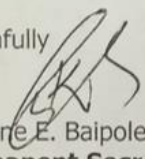
Research Permit Application: Examining Nurses' Acceptance and Use Of Electronic Health Records in Rural Public Health Clinics

Reference is made to your application on the above captioned matter. Your application for Research Permit for the proposed research titled: '***Examining Nurses' Acceptance and Use Of Electronic Health Records in Rural Public Health Clinics***' has been granted. The permit is valid for one (1) year. You are kindly advised to peruse section 4.4 to 5.0 of the 'Guidelines for Application for Research Permit' in Botswana and ensure you comply with any applicable visa and residence permit requirements.

Any changes in the proposed research should be communicated, without fail, to the Permanent Secretary, Ministry of Tertiary Education Research Science and Technology citing above reference. The Botswana Government reserves the right to request at short notice further information during the study.

By copy of this letter, the Director of Research Science and Technology is advised to take note of this development and ensure that deliverables to government are timely met.

Yours faithfully


Dr Kekgonne E. Baipoledi
For/Permanent Secretary

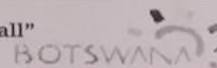
cc: **Director of Research Science and Technology**



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GABORONE
BOTSWANA
REFERENCE:



REPUBLIC OF BOTSWANA

TEL: (+267) 363 2500
FAX: (+267) 391 0647
TELEGRAMS: RABONGAKA
TELEX: 2818 CARE BD

MINISTRY OF HEALTH AND WELLNESS

REFERENCE NO: HPDME 13/18/1

14 August 2020

Health Research and Development Division

Notification of IRB Review: **New application**

Oabile Lesley Othusitse
Private Bag 16
Palapye, Botswana

Dear Oabile Lesley Othusitse

Protocol Title: **EXAMINING NURSES' ACCEPTANCE AND USE OF
ELECTRONIC HEALTH RECORDS IN RURAL PUBLIC
HEALTH CLINICS**

HRU Approval Date:	14 th August 2020
HRU Expiration Date:	13 th August 2021
HRU Review Type:	Expedited Review
HRU Review Determination:	Approved
Risk Determination:	Minimal risk

Thank you for submitting new application for the above referenced protocol. The permission is granted to conduct the study.

This permit does not however give you authority to collect data from the selected sites without prior approval from the management. Consent from the identified individuals should be obtained at all times.

The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to the Health Research and Development Division in the Ministry of Health for consideration and approval.

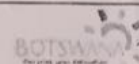
Furthermore, you are requested to submit at least one hardcopy and an electronic copy of the report to the Health Research, Ministry of Health and Wellness within 3 months of completion of the study. Approval is for academic fulfillment only. Copies should also be submitted to all other relevant authorities.

Continuing Review

In order to continue work on this study (including data analysis) beyond the expiry date, submit a Continuing Review Form for Approval at least three (3) months prior to the protocol's

Vision: *A Healthy Nation by 2036*

Values: *Botho, Equity, Timeliness, Customer Focus, Teamwork, Accountability*



Furthermore, you are requested to submit at least one hard copy and an electronic copy of the report to Serowe DHMT IRB within three (3) month of completion of the study. Copies should also be submitted to all other relevant authorities. Approval is for academic fulfillment only.

Continuing Review

In order to continuing work on this study (including data analysis) beyond the expiry date, submit a continuing Review Form for approval at least three (3) month prior to the protocol expiration date. The continuing Review Form can be obtained from the office of Chief Medical Officer, Sekgoma Memorial Hospital, Administration Building 2nd Floor, or Ministry of Health and Wellness website: www.moh.gov.bw or can be requested from Dr. Barnabas Mbogo, email address bmbogo@gov.bw . As courtesy, Serowe DHMT IRB will send you a reminder email about eight (8) weeks before the lapse date, but failure to receive it does not affect your responsibility to submit a timely Continuing Review Form.

Amendments

During the approval period, if you propose any changes to the protocol such as its funding source, recruiting materials, or consent documents you must seek approval from Serowe DHMT IRB before implementing it. Please summarize the proposed change and rationale for it in the amendment form available from the office of Chief Medical Officer, Sekgoma Memorial Hospital, Administration Building 2nd Floor, or Ministry of Health and Wellness website: www.moh.gov.bw or can be requested from Dr. Barnabas Mbogo, email address bmbogo@gov.bw . In addition, submit three (3) copies of an updated version of your original protocol application indicating all proposed changes in bold or "track changes".

Reporting

Other events which must be reported promptly in writing to Serowe DHMT IRB include:

- Suspension or termination of the protocol by you or the grantor
- Unexpected problems involving risk to subject or others
- Adverse events, including unanticipated or anticipated but severe physical harms to subjects.

If you have any question please do not hesitate to contact Dr. Barnabas Mbogo, email address bmbogo@gov.bw or through Telephone: 4630533. Thank you for

expiration date. The Continuing Review Form can be obtained from the Health Research Division Office (HRDD), Office No. 7A.7 or Ministry of Health website: www.moh.gov.bw or can be requested via e-mail from Mr. Kgomotso Motlhanka, e-mail address: kgmmotlhanka@gov.bw. As a courtesy, the HRDD will send you a reminder email about eight (8) weeks before the lapse date, but failure to receive it does not affect your responsibility to submit a timely Continuing Report form.

Amendments

During the approval period, if you propose any change to the protocol such as its funding source, recruiting materials, or consent documents, you must seek HRDC approval before implementing it. Please summarize the proposed change and the rationale for it in the amendment form available from the Health Research Division Office (HRDD), Office No. 7A.7 or Ministry of Health website: www.moh.gov.bw or can be requested via e-mail from Mr. Kgomotso Motlhanka, e-mail address: kgmmotlhanka@gov.bw. In addition submit three copies of an updated version of your original protocol application showing all proposed changes in bold or "track changes".

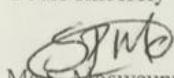
Reporting

Other events which must be reported promptly in writing to the HRDC include:

- Suspension or termination of the protocol by you or the grantor
- Unexpected problems involving risk to subjects or others
- Adverse events, including unanticipated or anticipated but severe physical harm to subjects.

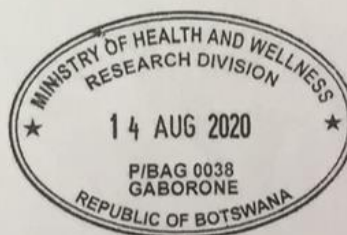
If you have any questions please do not hesitate to contact Ms Seeletso Mosweunyane at smosweunyane@gov.bw, Tel +267-3632018 and Mr. K. Motlhanka at kgmmotlhanka@gov.bw, Tel +267-3632751. Thank you for your cooperation and your commitment to the protection of human subjects in research.

Yours sincerely



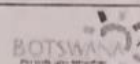
Ms S. Mosweunyane

for **PERMANENT SECRETARY**



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Values: *Botho, Equity, Excellence, Customer Focus, Teamwork, Accountability*



P O BOX 40
SELEBI PHIKWE
BOTSWANA
REFERENCE:



REPUBLIC OF BOTSWANA

TEL: (+267) 2610333
FAX: (+267) 2610064
TELEGRAMS: RABONGAKA
TELEX: 2818 CARE BD

MINISTRY OF HEALTH AND WELLNESS

25th November 2020

Ref: 4/10/6/17 I

Oabile Lesley Othusitse

Dear Sir,

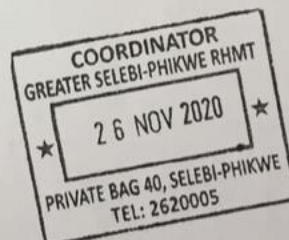
REQUEST TO CONDUCT A STUDY GREATER SELEBI PHIKWE RHMT

Your request to conduct a study in Greater Selebi Phikwe RHMT has been acceded to.

Thank you.

Yours faithfully,

Mpaphi B. Mbulawa
Coordinator.



TELEPHONE: 5443584/5441257
FAX: 5443934



DISTRICT HEALTH MANAGEMENT TEAM
PRIVATE BAG MK 13
KANYE
BOTSWANA

REPUBLIC OF BOTSWANA
MINISTRY OF HEALTH AND WELLNESS

REF: SKDHMT/6/8/5 I (17)

30th March 2021

Oabile Lesley Othusitse
Private Bag 16
Palapye

Dear Othusitse

**EXAMINING NURSES' ACCEPTANCE AND USE OF ELECTRONIC HEALTH
RECORDS IN RURAL PUBLIC HEALTH CLINICS**

The above subject matter refers.

Permission is granted for you to conduct a study on **Examining Nurses' Acceptance and Use of Electronic Health Records in Rural Public Health Clinics**. You are permitted to conduct this study between 14th August 2020 and 13th August 2021.

This permit does not give you authority to collect data from study participants without their consent, therefore you are required to obtain consent from participants at all times. The study should be conducted as outlined in the approved proposal and any changes should be submitted for consideration and approval to the Health Research and Development division in the Ministry of Health and Wellness.

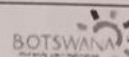
You are requested to submit an electronic copy of the report to kanyedhmt@gmail.com upon completion of the study.

Yours faithfully,

J. K. Mosimanewakgosi
**Coordinator – RHMT
SOUTHERN**



Vision: A Model of Excellence in Quality Health Services.
Values: Botho, Equity, Timeliness, Customer Focus, Teamwork, Accountability



FAX: 4711325
TELEPHONE: (+267) 4718000



DHMT P.O. BOX 49 MAHALAPYE

28 October 2020

REFERENCE MH/DHMT/1/7/7 (56)

To: Oabile Lesley Boitshoko

P.O. Box 401523

Gaborone

Protocol Title: "Examining Nurses Acceptance and Use of Electronic Health Records in Rural Public Health Clinics"

Dear sir,

Notification of IRB Review: New application

Approval Status: **Approved**

Risk Determination: **Low**

The Mahalapye DHMT thanks you for submitting the documents for the above-mentioned protocol for evaluation. The application was reviewed and awarded an approval. This approval is valid for a period of ONE year effective the 29th October 2020. The research should be conducted as outlined in the approved proposal. Please notify the Mahalapye IRB when you start collecting data.

If you have any questions/queries, please contact Dr S.T. Tshitenge (stshitenge@ub.ac.bw, tel: +26763554762, +267 71550036).

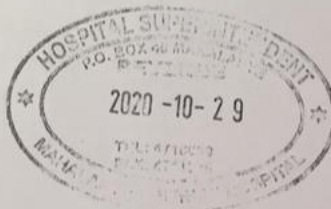
Thank you for your commitment in protecting human subjects in your research at the Mahalapye DHMT.

Yours Faithfully,

pp.

Dr Stephane Tshitenge

Mahalapye DHMT IRB Chair



TEL: 4923049
PALAPYE DHMT
FAX: 4921281
TELEGRAMS:
TELEX:



P O BOX 31
PALAPYE

Republic of Botswana
Ministry of Health and Wellness

REFERENCE NO: PDHMT 3/3/11 I (72)

TO: Oabile Lesley Othusitse
Private Bag 16
Palapye, Botswana

Dear Oabile Lesley Othusitse

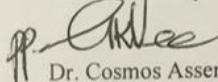
Protocol Title: EXAMINING NURSES ACCEPTANCE AND USE OF HEALTH
RECORDS IN RURAL PUBLIC HEALTH CLINICS

APPROVAL DATE: 14th August 2020
EXPARATION DATE: 13th August 2021

You are hereby granted permission to collect data in Palapye Clinics and Health Posts. This permit is applicable only if you adhere to permit issued by Ministry of Health and Wellness Ref NO HPDME 13/18/1.

Thank you for choosing our DHMT for this study.

Yours Faithfully


Dr. Cosmos Assenga
Chief Medical Officer
Palapye DHMT

GREATER FRANCISTOWN DHMT

ALL CORRESPONDENCE TO
BE ADDRESSED TO DHMT
COORDINATOR



PRIVATE BAG F372
FRANCISTOWN BOTSWANA
TELEPHONE: 2413808

Republic of Botswana

22 October 2020

Greater Francistown Review Board

Oabile Lesley Othusitse
Private Bag 16
Palapye, Francistown

Dear Oabile Lesley Othusitse

PERMIT: EXAMINING NURSE'S ACCEPTANCE AND USE OF ELECTRONIC
HEALTH RECORDS IN RURAL PUBLIC HEALTH CLINICS

Your application for a research permit for the above stated research protocol refers. We note that your proposal has been reviewed and approved by Ministry of health and Wellness Health Research and Development Division.

Permission is therefore granted to conduct the above mentioned study. This approval is valid of 1 year effective 14 August 2020.

This permission gives you authority to collect data from the selected site(s). Consent from the identified individuals should be obtained at all times.

Thank you for your cooperation and your commitment to the protection of human subjects in research.

Yours faithfully

Ms. N Makole
For/DHMT Head

TELEPHONE: 5777837
FAX: 5777346



KGATLENG DHMT
PRIVATE BAG 13
MOCHUDI

REPUBLIC OF BOTSWANA

REFERENCE: DRM 3/1/28 III (22)

30th March 2021

Mr. Oabile Lesley Othusitse
BIUST
Private Bag 16
Palapye

Dear Sir

RESEARCH PERMIT APPLICATION

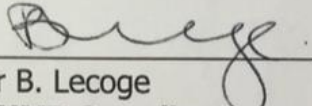
Reference is made to your correspondence on the above subject matter dated 25th March 2021.

Your request to conduct study entitled "**Examining Nurses' Acceptance and Use of Electronic Health Records in Rural Public Health Clinics**" in Kgatleng DHMT facilities is acceded to.

By copy of this letter the facility in-charge is informed of your intentions, and is requested to provide you with the necessary support.

Thank you.

Yours Faithfully


Dr B. Lecoge
RHMT Coordinator

Telephone: 4611000
Reference: Rabongaka
Fax: 4600671



Republic of Botswana

Sekgoma Memorial Hospital
P.O Box 120
Serowe
Botswana

4 September 2020

**Serowe District Health Management Team
Institutional Review Board**

Oabile Lesley Boitshoko
P.O.Box 401523
Gaborone

Dear Sir

**PROTOCOL TITLE: EXAMINING NURSES' ACCEPTANCE AND USE OF
ELECTRONIC HEALTH RECORDS IN RURAL PUBLIC HEALTH CLINICS.**

Serowe DHMT IRB Approval Date:	31 August 2020
Serowe DHMT IRB Expiry Date:	1 st September 2021
Serowe DHMT IRB Review Type:	Expedited Review
Serowe DHMT IRB Review Determination:	Approved
Serowe DHMT IRB Risk Determination:	Minimal Risk

Thank you for submitting new application for the above referenced protocol.
The permission is granted to conduct the study.

This permit however does not give you the authority to collect data from the sites without prior approval from the management. Consent from the identified individuals should be obtained at all times.

The managerial situation analysis study should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to Serowe DHMT Institutional Review Board for consideration and approval.

Thank you for your cooperation and commitment to the protection of human subjects in research.

Yours faithfully,



Dr Phakedi P.
Chief Medical Officer.
Chairperson, Institutional Review Board.
Serowe District Health Management Team

Appendix B: Questionnaire Validity Tool

Questionnaire Validation

Criteria	Operational Definitions	Score				Questions NOT meeting standard (List page and question number) and need to be revised.
		Not Acceptable (major modifications needed)	Below Expectations (some modifications needed)	Meets Expectations (no modifications needed but could be improved with minor changes)	Exceeds Expectations (no modifications needed)	
		1	2	3	4	
Clarity	- The questions are direct and specific. - Only one question is asked at a time. - The participants can understand what is being asked. - There are no <i>double-barreled</i> questions (two questions in one).	1	2	3	4	
Wordiness	- Questions are concise. - There are no unnecessary words	1	2	3	4	
Negative Wording	Questions are asked using the affirmative (e.g., Instead of asking, "Which methods are not used?", the researcher asks, "Which methods <i>are</i> used?")	1	2	3	4	
Overlapping Responses	- No response covers more than one choice. - All possibilities are considered. - There are no ambiguous questions.	1	2	3	4	
Balance	The questions are unbiased and do not lead the participants to a response. The questions are asked using a neutral tone.	1	2	3	4	
Use of Jargon	- The terms used are understandable by the target population. - There are no clichés or hyperbole in the wording of the questions.	1	2	3	4	
Appropriateness of Responses Listed	- The choices listed allow participants to respond appropriately. - The responses apply to all situations or offer a way for those to respond with unique situations.	1	2	3	4	
Use of Technical Language	- The use of technical language is minimal and appropriate. - All acronyms are defined.	1	2	3	4	
Application to Praxis	The questions asked relate to the daily practices or expertise of the potential participants.	1	2	3	4	
Relationship to Problem	- The questions are sufficient to resolve the problem in the study - The questions are sufficient to answer the research	1	2	3	4	

	- questions. - The questions are sufficient to obtain the purpose of the study.					
Measure of Construct: (Performance Expectancy)	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: (Effort Expectancy)	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Social Influence	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Facilitating Conditions	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Self Efficacy	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Attitude	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Personal Innovation	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Resistance to change	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Computer Anxiety	The survey adequately measures this construct.* <i>[Include Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Behavioral Intention	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	
Measure of Construct: Actual Use	The survey adequately measures this construct.* <i>[Includes Operational Definition and concepts associated with construct]</i>	1	2	3	4	

[illegible]

VREP is designed to measure face validity, construct validity, and content validity. To establish criterion validity would require further research.

Construct validity seeks agreement between a theoretical concept and a specific measuring device or procedure. This requires operational definitions of all constructs being measured.

Criterion related validity, also referred to as instrumental validity, is used to demonstrate the accuracy of a measure or procedure by comparing it with another measure or procedure which has been demonstrated to be valid. If after an extensive search of the literature, such an instrument is *not* found, then the instrument that meets the other measures of validity are used to provide criterion related validity for future instruments.

Operationalization is the process of defining a concept or construct that could have a variety of meanings to make the term measurable and distinguishable from similar concepts. Operationalizing enables the concept or construct to be expressed in terms of empirical observations. Operationalizing includes describing what is, and what is not, part of that concept or construct.

Carmines, E. G. & Zeller, R.A. (1991). *Reliability and validity assessment*. Newbury Park: Sage Publications.

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Appendix C: Information sheet, Consent Form and Questionnaire



INFORMATION SHEET

« EXAMINING NURSES' ACCEPTANCE AND USE OF ELECTRONIC HEALTH RECORDS IN BOTSWANA RURAL PUBLIC HEALTH FACILITIES »

Invitation to take part

You are invited to participate in a research study which aims to examine nurses' acceptance and use of electronic health records in Botswana rural public health facilities. Before agreeing to participate in this project, it is important to take time to read and understand the following information. If there are words or sections that you do not understand, please do not hesitate to ask questions for clarification.

Identification

Research Principal: Dr Malatsi Galani Tel: (+267) 493 1106 Botswana International University of Science & Technology Department: Computer Science and Information Systems Address: Plot No. 10071, Boseja Ward, Palapye Private Bag 16 Palapye, Botswana Email address: galanim@biust.ac.bw	Researcher: Oabile Lesley Othusitse Cell: (+267) 76923142 Botswana International University of Science & Technology Department: Computer Science and Information Systems Email: bo18100039@studentmail.biust.ac.bw
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Study Background Information

Botswana has introduced electronic health records in her public hospitals and clinics. Beyond implementation of a technological system lies acceptance and use difficulties altogether with use behavior concerns. Poor usage of electronic health records in public health clinics results in underutilized systems. Hence the benefits are unlikely to be realized. By studying perceptions and factors that influence behavioral intentions and use behavior, we may be better equipped to utilize electronic documentation systems.

Project Objectives

This research project seeks to identify, understand and examine factors that influence nurses' acceptance and use and to explore nurses' perceptions and overall intention to use of Electronic Health Records (EHR) in Botswana rural public health facilities.

Participant requirements:

To take part, you will be required to complete the enclosed questionnaire on nurses' acceptance and use of electronic health records in Botswana rural public health facilities which should take about 30 minutes to complete.

Potential Risks and Harm

There are no known or anticipated risks or discomforts associated with participating in this study. Only time invested in taking part may be lost whilst participating in this study.

Possible benefits:

You will have the advantage of taking a step back to review your perspective on your daily work practices. The results of the study will help to fuel the acceptance and use of electronic health records in Botswana rural health facilities. Your participation will contribute to the advancement of knowledge, by providing a better understanding of nurses' perceptions and factors that influence acceptance and use of electronic health records in rural settings.

**Anonymity and confidentiality**

All information collected as part of this research project is confidential and only the research team will have access to the information. Any information about you or your individual views will be made anonymous so that you cannot be recognized from it. To protect your identity and ensure the confidentiality of the data collected from you, you will always be identified by an alphanumeric code. The code associated with your name will only be known by the research team members only.

Voluntary Participation & Withdrawal Rights

Your participation in this project is voluntary. This means that you accept to participate in this project without any constraints or exterior pressure, and are free at any time to end your participation throughout the course of this project. In this case your collected personal information will be destroyed. Your agreement to participate also implies that you accept that the research team may use the findings of the current research program for the purposes of: articles, student theses, for conferences, and for scientific and professional communications. The information is collected with the condition that you will never be directly identified, nor will any of your personal information be publicly divulged without your explicit consent.

Financial Compensation or Other

It is understood that there is no compensation (financial or otherwise) associated with your participation in this research project.

Liability Clause

By agreeing to participate in this study, you do not renounce any of your rights, nor are the researchers, sponsor or the institution involved free from their legal and professional responsibilities.

For Questions on The Project and Your Rights

For any additional questions on the project, your participation and regarding your rights as a research participant, or to withdraw from the project, you may contact:

Dr. Malatsi GALANI

Tel: (+267) 493 1106

E-mail address: galanim@biust.ac.bw

The Health Research and Development Division of Ministry of Health and Wellness has approved this research project (Reference: HPDME 13/18/1) in which you are a participant. For information concerning the responsibilities of the research team, ethics plan on human research or to make a complaint, you may contact the president of the Committee through secretary intermediary at (+267) 363 2751 or by email: kgmohlhanka@gov.bw

ACKNOWLEDGEMENTS:

We thank you for your collaboration in this project.

Your collaboration is important to the realization of our research project and the research team would like to thank you for your cooperation. Should you wish to obtain a written summary of the primary findings of this research, please provide your contact details to the researcher.

Consent Form



CONSENT FORM

STUDY TITLE: EXAMINING NURSES' ACCEPTANCE AND USE OF ELECTRONIC HEALTH RECORDS IN RURAL PUBLIC HEALTH FACILITIES

I give my consent to use the information I supply to this study on the understanding that:

- I have been given the information sheet and the opportunity to ask questions.
- I confirm that my participation is voluntary and that I am free to withdraw at any time, without giving any reason and my rights will not be affected.
- My decision on whether or not to take part in this study will not disadvantage me or affect my involvement with the Botswana International University of Science and Technology
- Reports and publication from the study will be based on de-identified information and will not identify individuals taking part.
- I agree to take part in the study.

I have been provided with information about this study including how it will gather, store, use and disclose information about me. I have been given an opportunity to ask questions and have been fully informed.

Signature

Date

☐

- Accept

Questionnaire

« EXAMINING NURSES' ACCEPTANCE AND USE OF ELECTRONIC HEALTH RECORDS IN
BOTSWANA RURAL PUBLIC HEALTH FACILITIES »

You have received this questionnaire because you are a Registered Nurse practicing in a rural health facility within Botswana's public healthcare system. To confirm this, please complete the following checklist before you respond to the questionnaire. If any of the listed items do not apply to you, please do not complete the questionnaire, rather return it in the enclosed envelope. If all items below apply to you, kindly complete the questionnaire and return it in the enclosed envelope.

Currently a registered nurse (RN) practicing in a rural health facility within the Botswana public healthcare system.
Involved in the provision of coordinated or delivery of care to patients within the health facility.

SECTION A

The following are items related to your personal characteristics as a Registered Nurse. Please, respond by putting a tick (✓) in the space next to the appropriate answer or writing your answer in the provided space.

- 1) State your current position _____
- 2) State the name of your health facility _____
- 3) State the name of your DHMT _____
- 4) Gender/Sex: Male _____ Female _____
- 5) How old are you?
Less than 30 _____ 40-49 _____ Older than 59 _____
30-39 _____ 50-59 _____
- 6) What is your highest level of nursing education?
Certificate _____ Bachelor's Degree _____ Doctoral Degree _____
Diploma _____ Master's Degree _____ Other, please specify _____
- 7) What's your current employment status?
Casual _____ Employed Part-Time _____
Employed Full-Time _____ Other, please specify _____
- 8) How many years have you been working within the healthcare system? _____ years
- 9) As part of your daily job routine, do you actively provide direct patient care?
Yes _____ No _____
- 10) Do you have any prior experience using computing hardware (e.g., Smartphones, computers) or software applications (e.g., Computerized Provider Order Entry)?
Yes _____ No _____
- 11) If **YES**, which computing hardware or software applications do you have experience using?
Computers _____
Smartphones _____
Computerized Provider Order Entry _____
Other, please specify _____

- 12) If **YES**, how many years have you been using computing hardware and or software applications in your current practice? _____ Years

The following are questions related to **Electronic Health Records**. These are digital patient data storage systems which allow data to be exchanged and accessed by authorized system users. Since EHRs are paperless, nurses are required to enter patient medical data into an information system for storage and dissemination.

- 13) Do you have any prior experience using electronic health records within your workplace for your job?
☐ Yes ☐ No
- 14) If **YES**, how many years have you been using electronic health records within your workplace for your job?
 _____ Years
- 15) Do you currently use electronic health records within your workplace for your job?
☐ Yes ☐ No
- 16) If **YES**, please name and briefly describe the type of electronic health records you currently use:

- 17) If **YES**, how often do you use the electronic health record systems in your healthcare practice?
☐ Daily ☐ Every Week ☐ Once every 2 weeks
☐ Once a month ☐ Less than once a month
- 18) If **NO**, please state and briefly describe the type of documentation system you currently use. (E.g. paper based records or a hybrid documentation system, that is, a combination of paper and electronic documentation.)

- 19) Why do you use an electronic documentation system? (Select all that apply)
☐ Mandated in your healthcare practice
☐ Improves access to up-to-date patient health-related data
☐ Improves patient-related decision making
☐ Improves collaboration and communication
☐ Improves patient care
☐ Improves patient outcomes
☐ Other, please specify _____

- 20) What factors, or do you see as, are **barriers** to using electronic health records in your practice? (Select all that apply)
☐ Inaccurate patient information due to periodic and not real-time updates
☐ Spending too much time keying in data and too little time making eye contact with patients
☐ Increases workload
☐ Privacy and confidentiality concerns
☐ EHRs are more difficult to use than paper-based records
☐ EHRs implementation reduces practice productivity and disturbs workflow (at least initially)
☐ Other, please specify _____

- 21) What is your comfort level with using electronic documentation systems in your healthcare practice?
☐ Not comfortable at all ☐ A little comfortable
☐ Quite comfortable ☐ Very comfortable
- 22) Could you explain why you feel **comfortable or uncomfortable** using electronic documentation systems in your healthcare practice?

SECTION B

The following are statements about your use of electronic health records in your health facility. Please answer the following questions/statements by selecting the most appropriate response based on your experience or opinion with a tick (✓). **NB: EHR is used to refer to 'electronic health record'**

Performance Expectancy: the degree to which a person believes that using a particular system would enhance his or her job performance

Performance Expectancy	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
1. Using EHR in my job improves my job performance.					
2. Using EHR in my job enables me to accomplish my tasks quickly.					
3. Using EHR in my job increases my productivity.					
4. Using EHR enhances my effectiveness in my job.					
5. Using EHR makes it easier for me to do my job.					
6. I find using EHR useful in my job.					

Effort Expectancy: the degree to which a person believes that using a particular system would be free of effort

Effort Expectancy	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
7. Learning to operate EHR in my job is easy for me					
8. I find it easy to get EHR to do what I want it to do.					
9. My interaction with EHR is clear and understandable.					
10. I find EHRs to be flexible to interact with.					
11. It is easy for me to be skillful at using EHR systems.					
12. EHR is easy to adapt to my everyday work.					

Social Influence refers to the level of an individual's beliefs about their integral social circle members' perception on whether or not to use a system in question

Social Influence	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
13. People who are important to me think I should use EHR.					
14. People who influence my behavior think I should use EHR.					
15. The senior management of this health facility have been helpful in the use of EHR.					
16. In general, the organization has supported the use of EHR systems.					

Computer anxiety: this is the rate at which a potential system user is enveloped with fear upon the very possibility of acquiring or using a technological system.

Computer Anxiety	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
17. Using EHR makes me feel uneasy and confused					
18. I have hesitation to use EHR systems fearing that I will make a mistake that I cannot correct.					
19. I feel threatened when others talk about EHR use.					
20. I feel aggressive and hostile towards the use of EHRs					
21. I avoid using EHR systems whenever I can.					
22. I find the challenge of learning EHR systems exciting.					
23. It scares me to think that I could cause the computer to destroy a large amount of information by pressing the wrong key.					

Personal attitudes are unique to an individual and may be favorable or unfavorable as perceptions of the potential results of carrying out a behavior

Attitude	Rating Scale				
	1.Strongly Agree	2.Agree	3.Uncertain	4.Disagree	5.Strongly Disagree
24. The use of EHR improves patient care by giving nurses more time with the patients.					
25. EHRs can be adapted to assist nurses in many aspects of patient care.					
26.The time spent using EHRs is not proportional to the benefits.					
27. Computerization of nursing data through EHRs offer nurses a remarkable opportunity to improve patient care.					
28. EHR helps to make a nurse's job easier.					
29. EHRs cause nurses to give less time to quality patient care.					
30. EHR increases costs by increasing a nurse's workload.					
31. It takes as much effort to maintain patient records in EHR as it does by hand in paper-based records.					
32.EHR create more problems than they solve in nursing practice					
33. The use of EHR systems dehumanizes nursing care.					
34. Part of the increase in costs of healthcare is because of EHRs.					
35. I am comfortable using EHR systems					
36.I do not feel threatened when others talk about EHR systems					
37. EHR systems do not scare me at all.					
38. I have a lot of self-confidence when it comes to working with EHRs.					
39. Confidentiality is nearly impossible if patient records are in EHRs					
40. Confidentiality will not be sacrificed by patient records being entered into EHRs.					
41. EHRs represent a violation of patient privacy					
42. Paper-based records are more efficient than EHRs.					
43. EHR systems can save me time when writing my medical notes.					
44. EHRs can eliminate errors that result from misinterpreting handwritten notes.					
45. I encourage my colleagues to use EHR systems.					
46. I like working with EHR systems.					

"Facilitating conditions: the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of a system"

Facilitating Conditions	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
47. I have the resources necessary to use EHRs.					
48. I have the knowledge necessary to use EHRs.					
49. EHRs are compatible with other systems I use.					
50. A support team or person is available for assistance with EHR system difficulties.					

Self-Efficacy: an individual's perception about his or her own ability to carry out his or her job task.

Self-Efficacy	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
51. I can complete my task using EHR if there was no one else around.					
52. I could complete my task using EHR if I could get support or assistance when I run into an issue.					

Self-Efficacy	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
53. I could complete my task using EHR if I had the proper time to complete my assigned task.					
54. I can complete my task on EHR using a manual as a reference point.					
55. I feel confident pulling patient records from EHR systems.					
56. I feel confident adding patient records in EHR systems.					
57. I feel confident deleting files when they are no longer needed.					
58. I feel confident troubleshooting computer problems.					
59. I feel confident retrieving files from a shared network environment.					
60. I am confident that I could deal efficiently with most problems I could face using EHR.					

Personal Innovativeness is “the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a social system”

Personal Innovativeness	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
61. If I heard about a new information technology, I would look for ways to experiment with it.					
62. Among my peers, I am usually the first to try out new information technologies.					
63. In general, I am not hesitant to try out new information technologies.					
64. I like to experiment with new information technology					

Resistance to change: action taken by individuals or groups when they perceive occurring change as a threat to them.

Resistance to Change	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
65. I don't want the EHR system to change the way I deal with diseases of patients.					
66. I don't want the EHR system to change the way I keep the health records of patients.					
67. I don't want EHR to change the way I interact with other healthcare workers regarding the patients' diseases.					

Behavioral Intention: BI is defined as the probability of an individual to perform a behavior in question.

Behavioral Intention	Rating Scale				
	1.Strongly Agree	2.Agree	3.Neutral	4.Disagree	5.Strongly Disagree
68. I intend to use the EHR systems in future.					
69. I plan to use EHR to a full extent in the next 3 months.					
70. I recommend others to use this EHR systems.					

Post purchase and implementation of EHR, the observable patterns of system use are known as Actual Use

Actual Use	Rating Scale
71. If you are already using EHR, on average, how often do you use the EHR system in your healthcare practice?	Report frequency _____
72. If you are already using EHR in your healthcare practice, on average, how much time do you spend using EHR per shift?	Report total hours _____

This is the end of the questionnaire. Thank you for taking your time to complete this questionnaire.
Please do not forget to sign the consent form.

Appendix D: Results

1. POSITION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SENIOR REGISTERED NURSE	17	8.8	8.8	8.8
	PRINCIPAL REGISTERED NURSE	96	49.7	49.7	58.5
	CHIEF REGISTERED NURSE	6	3.1	3.1	61.7
	REGISTERED NURSE	56	29.0	29.0	90.7
	MIDWIFE	4	2.1	2.1	92.7
	SENIOR NURSING OFFICER	2	1.0	1.0	93.8
	ASSISTANT NURSING OFFICER	2	1.0	1.0	94.8
	OPHTHALMIC NURSE	1	.5	.5	95.3
	NURSING OFFICER I	6	3.1	3.1	98.4
	NURSING OFFICER II	2	1.0	1.0	99.5
	NURSING SUPERINTENDENT	1	.5	.5	100.0
	Total	193	100.0	100.0	

2. FACILITY NAME

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	RAMOKGONAMI CLINIC	3	1.6	1.6	1.6
	CHADIBE CLINIC	4	2.1	2.1	3.6
	SHOSHONG CLINIC	7	3.6	3.6	7.3
	SHELEKETLA CLINIC	3	1.6	1.6	8.8
	IKONGWE HEALTH POST	1	.5	.5	9.3
	MOSLOTSHANE CLINIC	3	1.6	1.6	10.9
	MMUTLANE HEALTH POST	1	.5	.5	11.4
	BONWAPITSE HEALTH POST	1	.5	.5	11.9
	KALAMARE CLINIC	4	2.1	2.1	14.0
	TEWANE HEALTH POST	2	1.0	1.0	15.0
	MAAPE HEALTH POST	1	.5	.5	15.5
	PILIKWE CLINIC	2	1.0	1.0	16.6
	MOKOBENG HEALTH POST	1	.5	.5	17.1
	NGWAPA HEALTH POST	1	.5	.5	17.6
	SHASHEMOOKE HEALTH POST	2	1.0	1.0	18.7
	TLHALOGANG HEALTH POST	4	2.1	2.1	20.7
	JAMATAKA HEALTH POST	2	1.0	1.0	21.8
	MAKOBO HEALTH POST	2	1.0	1.0	22.8
	NATALE HEALTH POST	1	.5	.5	23.3
	MANDUNYANE HEALTH POST	3	1.6	1.6	24.9
	SHASHEBRIDGE HEALTH POST	4	2.1	2.1	26.9
	SHASHE STATION HEALTH POST	4	2.1	2.1	29.0
	BOROLONG CLINIC	8	4.1	4.1	33.2
	MATHANGWANE CLINIC	8	4.1	4.1	37.3
	MOSHOPHA HEALTH POST	1	.5	.5	37.8
	MATLHAKO HEALTH POST	2	1.0	1.0	38.9
	MACHANENG CLINIC	5	2.6	2.6	41.5
	LETORENG HEALTH POST	1	.5	.5	42.0
	MHALAPITSA HEALTH POST	1	.5	.5	42.5
	NGWAPA HEALTH POST	2	1.0	1.0	43.5
	MOGOROSI HEALTH POST	2	1.0	1.0	44.6
	THABALA CLINIC	4	2.1	2.1	46.6
	MOIYABANA CLINIC	4	2.1	2.1	48.7
	RUSSLE MAY CLINIC	4	2.1	2.1	50.8
	MABELEAPODI CLINIC	2	1.0	1.0	51.8
	MMASHORO CLINIC	5	2.6	2.6	54.4
	PAJE HEALTH POST	1	.5	.5	54.9
	TATISIDING CLINIC	15	7.8	7.8	62.7
	SEFHARE PRIMARY HOSPITAL	29	15.0	15.0	77.7
	SEFHOPHE CLINIC	3	1.6	1.6	79.3
	BOKAA CLINIC	4	2.1	2.1	81.3
	MORWA CLINIC	3	1.6	1.6	82.9

	PILANE HEALTH POST	1	.5	.5	83.4
	ARTESIA CLINIC	5	2.6	2.6	86.0
	LECHENG CLINIC	5	2.6	2.6	88.6
	MALAKA HEALTH POST	1	.5	.5	89.1
	MATLHAKOLA HEALTH POST	1	.5	.5	89.6
	LOTLHAKANE EAST CLINIC	2	1.0	1.0	90.7
	SELOKOLELA HEALTH POST	3	1.6	1.6	92.2
	MOSHANA HEALTH POST	2	1.0	1.0	93.3
	KGOPE HEALTH POST	1	.5	.5	93.8
	MMATSETA HEALTH POST	2	1.0	1.0	94.8
	LENTSWELETAU CLINIC	10	5.2	5.2	100.0
	Total	193	100.0	100.0	

3. DHMT NAME

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	GREATER MAHALAPYE DHMT	75	38.9	38.9	38.9
	GREATER FRANCISTOWN DHMT	51	26.4	26.4	65.3
	SEROWE DHMT	24	12.4	12.4	77.7
	GREATER SELEBI PHIKWE DHMT	3	1.6	1.6	79.3
	KGATLENG DHMT	13	6.7	6.7	86.0
	PALAPYE DHMT	7	3.6	3.6	89.6
	SOUTHERN DHMT (KANYE)	7	3.6	3.6	93.3
	KWENENG EAST DHMT	13	6.7	6.7	100.0
	Total	193	100.0	100.0	

4. GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FEMALE	143	74.1	74.1	74.1
	MALE	50	25.9	25.9	100.0
	Total	193	100.0	100.0	

5. AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 30	53	27.5	27.5	27.5
	30-39	76	39.4	39.4	66.8
	40-49	37	19.2	19.2	86.0
	50-59	23	11.9	11.9	97.9
	Older than 59	4	2.1	2.1	100.0
	Total	193	100.0	100.0	

6. LEVEL OF EDUCATION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	DIPLOMA	174	90.2	90.2	90.2
	BACHELOR'S DEGREE	19	9.8	9.8	100.0
	Total	193	100.0	100.0	

7. EMPLOYMENT STATUS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed Full-Time	188	97.4	97.4	97.4
	Contract Worker	5	2.6	2.6	100.0
	Total	193	100.0	100.0	

8. YEARS OF EXPERIENCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.10	1	.5	.5	.5
	.33	1	.5	.5	1.0
	.50	1	.5	.5	1.6
	.70	1	.5	.5	2.1
	.80	1	.5	.5	2.6
	1.00	8	4.1	4.1	6.7
	1.50	2	1.0	1.0	7.8
	2.00	18	9.3	9.3	17.1

3.00	3	1.6	1.6	18.7
4.00	6	3.1	3.1	21.8
5.00	13	6.7	6.7	28.5
6.00	4	2.1	2.1	30.6
7.00	11	5.7	5.7	36.3
8.00	11	5.7	5.7	42.0
9.00	5	2.6	2.6	44.6
10.00	9	4.7	4.7	49.2
11.00	7	3.6	3.6	52.8
12.00	8	4.1	4.1	57.0
13.00	7	3.6	3.6	60.6
14.00	7	3.6	3.6	64.2
15.00	10	5.2	5.2	69.4
16.00	7	3.6	3.6	73.1
17.00	4	2.1	2.1	75.1
18.00	2	1.0	1.0	76.2
19.00	4	2.1	2.1	78.2
20.00	5	2.6	2.6	80.8
22.00	4	2.1	2.1	82.9
23.00	2	1.0	1.0	83.9
24.00	3	1.6	1.6	85.5
25.00	3	1.6	1.6	87.0
26.00	2	1.0	1.0	88.1
27.00	6	3.1	3.1	91.2
28.00	2	1.0	1.0	92.2
30.00	3	1.6	1.6	93.8
31.00	2	1.0	1.0	94.8
32.00	3	1.6	1.6	96.4
33.00	1	.5	.5	96.9
35.00	3	1.6	1.6	98.4
37.00	2	1.0	1.0	99.5
39.00	1	.5	.5	100.0
Total	193	100.0	100.0	

9. DIRECT PATIENT CARE

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	193	100.0	100.0	100.0

10. COMPUTER EXPERIENCE

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	179	92.7	92.7	92.7
NO	14	7.3	7.3	100.0
Total	193	100.0	100.0	

11. COMPUTER EXPERIENCE

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	173	89.6	89.6	89.6
NO	6	3.1	3.1	92.7
N/A	14	7.3	7.3	100.0
Total	193	100.0	100.0	

11. SMARTPHONES EXPERIENCE

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	138	71.5	71.5	71.5
NO	41	21.2	21.2	92.7
N/A	14	7.3	7.3	100.0
Total	193	100.0	100.0	

11. CPOE EXPERIENCE

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid YES	24	12.4	12.4	12.4
NO	155	80.3	80.3	92.7

	N/A	14	7.3	7.3	100.0
	Total	193	100.0	100.0	

11. OTHER: TABLET EXPERIENCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	2	1.0	1.0	1.0
	NO	177	91.7	91.7	92.7
	N/A	14	7.3	7.3	100.0
	Total	193	100.0	100.0	

11. OTHER: MS OFFICE EXPERIENCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	2	1.0	1.0	1.0
	NO	177	91.7	91.7	92.7
	N/A	14	7.3	7.3	100.0
	Total	193	100.0	100.0	

11. OTHER; PIMS IPMS EXPERIENCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	2	1.0	1.0	1.0
	NO	177	91.7	91.7	92.7
	N/A	14	7.3	7.3	100.0
	Total	193	100.0	100.0	

11. N/A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	14	7.3	7.3	7.3
	NO	179	92.7	92.7	100.0
	Total	193	100.0	100.0	

12. YEARS OF HARDWARE/SOFTWARE EXPERIENCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.0	5	2.6	2.6	2.6
	2.0	10	5.2	5.2	7.8
	2.1	1	.5	.5	8.3
	2.5	1	.5	.5	8.8
	2.9	1	.5	.5	9.3
	3.0	6	3.1	3.1	12.4
	4.0	7	3.6	3.6	16.1
	5.0	21	10.9	10.9	26.9
	6.0	10	5.2	5.2	32.1
	7.0	11	5.7	5.7	37.8
	8.0	14	7.3	7.3	45.1
	9.0	3	1.6	1.6	46.6
	10.0	8	4.1	4.1	50.8
	11.0	4	2.1	2.1	52.8
	12.0	39	20.2	20.2	73.1
	13.0	8	4.1	4.1	77.2
	14.0	1	.5	.5	77.7
	15.0	11	5.7	5.7	83.4
	16.0	4	2.1	2.1	85.5
	17.0	5	2.6	2.6	88.1
	18.0	2	1.0	1.0	89.1
	19.0	2	1.0	1.0	90.2
	20.0	2	1.0	1.0	91.2
	22.0	2	1.0	1.0	92.2
	25.0	1	.5	.5	92.7
	99.0	14	7.3	7.3	100.0
	Total	193	100.0	100.0	

12. 12. YEARS OF HARDWARE/SOFTWARE EXPERIENCE N/A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	13	6.7	6.7	6.7
	NO	180	93.3	93.3	100.0
	Total	193	100.0	100.0	

13. EHR EXPERIENCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	158	81.9	81.9	81.9
	2	35	18.1	18.1	100.0
	Total	193	100.0	100.0	

14. EHR YEARS OF USE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.1	1	.5	.5	.5
	.5	2	1.0	1.0	1.6
	.7	1	.5	.5	2.1
	.8	1	.5	.5	2.6
	YES	13	6.7	6.7	9.3
	1.5	1	.5	.5	9.8
	NO	20	10.4	10.4	20.2
	3.0	10	5.2	5.2	25.4
	4.0	12	6.2	6.2	31.6
	5.0	31	16.1	16.1	47.7
	6.0	8	4.1	4.1	51.8
	7.0	13	6.7	6.7	58.5
	8.0	3	1.6	1.6	60.1
	9.0	3	1.6	1.6	61.7
	10.0	18	9.3	9.3	71.0
	11.0	5	2.6	2.6	73.6
	12.0	7	3.6	3.6	77.2
	13.0	1	.5	.5	77.7
	14.0	1	.5	.5	78.2
	15.0	4	2.1	2.1	80.3
	17.0	2	1.0	1.0	81.3
	20.0	1	.5	.5	81.9
	99.0	35	18.1	18.1	100.0
	Total	193	100.0	100.0	

14. EHR YEARS OF USE N/A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	35	18.1	18.1	18.1
	NO	158	81.9	81.9	100.0
	Total	193	100.0	100.0	

15. EHR CURRENT USE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	147	76.2	76.2	76.2
	NO	46	23.8	23.8	100.0
	Total	193	100.0	100.0	

16. PAPERBASED RECORD USED

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	66	34.2	34.2	34.2
	NO	127	65.8	65.8	100.0
	Total	193	100.0	100.0	

17.EHR NAME

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	PIMS	76	39.4	39.4	39.4
	IPMS	41	21.2	21.2	60.6
	PIMS, IPMS	28	14.5	14.5	75.1
	N/A	48	24.9	24.9	100.0

Total	193	100.0	100.0
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18. EHR FREQUENCY OF USE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	110	57.0	57.0	57.0
	Every Week	21	10.9	10.9	67.9
	Once every 2 Weeks	7	3.6	3.6	71.5
	Once a month	2	1.0	1.0	72.5
	Less than once a month	5	2.6	2.6	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19. Mandated in your healthcare practice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	90	46.6	46.6	46.6
	NO	55	28.5	28.5	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19. Improves access to up-to-date patient health-related data

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	130	67.4	67.4	67.4
	NO	15	7.8	7.8	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19. Improves patient-related decision making

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	66	34.2	34.2	34.2
	NO	79	40.9	40.9	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19. Improves collaboration and communication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	85	44.0	44.0	44.0
	NO	60	31.1	31.1	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19. Improves patient care.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	96	49.7	49.7	49.7
	NO	49	25.4	25.4	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19. Improves patient outcomes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	73	37.8	37.8	37.8
	NO	72	37.3	37.3	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

OTHER: VERY GOOD IN REPORT TAKING OR CONSOLIDATION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	1	.5	.5	.5
	NO	144	74.6	74.6	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19. OTHER: SAVES TIME HENCE IMPROVES TIMELY SERVICE DELIVERY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	1	.5	.5	.5
	NO	144	74.6	74.6	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19.OTHER: GIVES INFORMATION ON DISEASE TRENDS IN BOTSWANA HENCE INFORMS FUTURE RESEARCHES

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	1	.5	.5	.5
	NO	144	74.6	74.6	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

19.OTHER: TO RETRIEVE PATIENT RESULTS. REDUCES WORKLOAD AND TIME WASTNG FOR PATIENT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	145	75.1	75.1	75.1
	N/A	48	24.9	24.9	100.0
	Total	193	100.0	100.0	

20. Inaccurate patient information due to periodic and not real-time updates.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	69	35.8	35.8	35.8
	NO	124	64.2	64.2	100.0
	Total	193	100.0	100.0	

20. Spending too much time keying in data and too little time making eye contact with patients

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	96	49.7	49.7	49.7
	NO	97	50.3	50.3	100.0
	Total	193	100.0	100.0	

20. Increases workload

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	107	55.4	55.4	55.4
	NO	86	44.6	44.6	100.0
	Total	193	100.0	100.0	

20. Privacy and confidentiality concerns

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	22	11.4	11.4	11.4
	NO	171	88.6	88.6	100.0
	Total	193	100.0	100.0	

20. EHRs are more difficult to use than paper-based records

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	39	20.2	20.2	20.2
	NO	154	79.8	79.8	100.0
	Total	193	100.0	100.0	

20. EHRs implementation reduces practice productivity and disturbs workflow (at least initially)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	38	19.7	19.7	19.7
	NO	155	80.3	80.3	100.0
	Total	193	100.0	100.0	

20. OTHER: LACK OF / INADEQUATE EHR TRAINING

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	8	4.1	4.1	4.1
	YES	21	10.9	10.9	15.0
	NO	164	85.0	85.0	100.0

Total	193	100.0	100.0	
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20. OTHER: SUPPORT AND MAINTENCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	19	9.8	9.8	9.8
	NO	174	90.2	90.2	100.0
	Total	193	100.0	100.0	

20. OTHER: POOR ACCESSIBILITY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	35	18.1	18.1	18.1
	NO	158	81.9	81.9	100.0
	Total	193	100.0	100.0	

20. OTHER: LACK OF KNOWLEDGE, EXPERIENCE AND USE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	4	2.1	2.1	2.1
	NO	189	97.9	97.9	100.0
	Total	193	100.0	100.0	

20. OTHER: SHORTAGE OF STAFF AND COMPUTERS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	11	5.7	5.7	5.7
	NO	182	94.3	94.3	100.0
	Total	193	100.0	100.0	

20. OTHER: INCREASED WORKLOAD TIME AND REDUNDANCY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	2	1.0	1.0	1.0
	NO	191	99.0	99.0	100.0
	Total	193	100.0	100.0	

20. OTHER: MISMATCH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	4	2.1	2.1	2.1
	NO	189	97.9	97.9	100.0
	Total	193	100.0	100.0	

21. COMFORT LEVEL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not comfortable at all	20	10.4	10.4	10.4
	A little comfortable	41	21.2	21.2	31.6
	Quite Comfortable	60	31.1	31.1	62.7
	Very Comfortable	72	37.3	37.3	100.0
	Total	193	100.0	100.0	

Nurses' technology-related training

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	190	98.4	98.4	98.4
	YES	3	1.6	1.6	100.0
	Total	193	100.0	100.0	

Nurses' computer self-efficacy & knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	175	90.7	90.7	90.7
	YES	18	9.3	9.3	100.0
	Total	193	100.0	100.0	

EHR Experience & frequency of use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	191	99.0	99.0	99.0
	YES	2	1.0	1.0	100.0
	Total	193	100.0	100.0	

Improved Accessibility, Communication, Collaborative work & Convenience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	152	78.8	78.8	78.8
	YES	41	21.2	21.2	100.0
	Total	193	100.0	100.0	

User-friendly: Step by step guide, Easy to learn & use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	165	85.5	85.5	85.5
	YES	28	14.5	14.5	100.0
	Total	193	100.0	100.0	

Effective & Efficient data storage (accurate & timely) & reduces workload

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	151	78.2	78.2	78.2
	YES	42	21.8	21.8	100.0
	Total	193	100.0	100.0	

Improved data integrity, Privacy & Confidentiality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	184	95.3	95.3	95.3
	YES	9	4.7	4.7	100.0
	Total	193	100.0	100.0	

Training

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	187	96.9	96.9	96.9
	YES	6	3.1	3.1	100.0
	Total	193	100.0	100.0	

Age Related difficulties

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	192	99.5	99.5	99.5
	YES	1	.5	.5	100.0
	Total	193	100.0	100.0	

Lack of EHR knowledge, experience and frequency of use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	184	95.3	95.3	95.3
	YES	9	4.7	4.7	100.0
	Total	193	100.0	100.0	

Privacy & Confidentiality Concerns

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	193	100.0	100.0	100.0

Poor accessibility: Power Cuts & Network/Connectivity ISSUES

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	186	96.4	96.4	96.4
	YES	7	3.6	3.6	100.0
	Total	193	100.0	100.0	

SOFTWARE & HARDWARE; System updates & crashes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	191	99.0	99.0	99.0
	YES	2	1.0	1.0	100.0
	Total	193	100.0	100.0	

Privacy & Confidentiality Concerns

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	193	100.0	100.0	100.0

Difficult to use; Not User friendly, disturbs workflow

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	187	96.9	96.9	96.9
	YES	6	3.1	3.1	100.0
	Total	193	100.0	100.0	

Lack of training

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	168	87.0	87.0	87.0
	YES	25	13.0	13.0	100.0
	Total	193	100.0	100.0	

Redundant, Time consuming & Increased workload

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	167	86.5	86.5	86.5
	YES	26	13.5	13.5	100.0
	Total	193	100.0	100.0	

POOR EHR Support and Maintenance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	188	97.4	97.4	97.4
	YES	5	2.6	2.6	100.0
	Total	193	100.0	100.0	

No EHR Installed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	193	100.0	100.0	100.0

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