ISSN No:-2456-2165

A Model for Acceptance and Use of Health Information Systems for South African Health Practitioners

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Abstract:- This paper discusses the acceptance and use of Health Information Systems in the context of South African Health Practitioners. The paper argues that ideally, Health Practitioners who adopt HIS are poised to significantly improve their operations and services, and thereby offering patient satisfaction and adequately cover operational costs. Despite the continued investment in information system, there is still limited research and knowledge into what influences or affect the use of the system by health practitioners. The paper addresses the inadequacy of literature in addressing the use of health information system by health practitioners, especially in the context of South Africa. To this point this study sought to explore and explain what affects the use of HIS by individuals.

Keywords:- *Health Information Systems, Technology Acceptance , Technology Use ,UTAUT Framework, Task Technology Fit* **.**

I. INTRODUCTION

The research paper is about why Health Information Systems (HIS) are used or not used by health practitioners in the context of South Africa. Despite the continued investment in information system, there is still limited research and knowledge into what influences or affect the use of the system by health practitioners. That is literature inadequately addresses the use of health information system by health practitioners, especially in the context of South Africa.

The inadequacy of literature means that there is still little knowledge as to which factors influence health practitioners to use or effectively use the information system. There is a research vacuum, which needs to be filled by an empirically developed and validated model, particularly addressing south African health practitioner's context. The research problem is that of not fully being able to explain the factors influencing the use and non-use of the system. To this point this study sought to explore and explain what affects the use of HIS by individuals.

II. BACKGROUND TO THE RESEARCH

A. Health Care and IT Strategy Alignment

Implementation of HIS has become the strategic solution to the call for service quality improvement and healthcare consumer satisfaction in the health sector (Sligo et al, 2017). HIS use also eased the institutional ability to cope up with changes in the epidemiological and demographic profiles of the societies in which they operate (Sligo et al, 2017). Technology adoption in the health sector has significantly transformed the industry by fulfilling organisation strategic objectives of quality and efficiency improvement and guaranteeing of safety (Catwell, 2009; Department of Health UK, 2014).

B. Evaluation of HIS

The effectiveness of a HIS can only be realised after going through systematic and rigorous evaluation. Ammenwerth (2004) defines HIS evaluation as "the act of measuring or exploring attributes of a health information system (in planning, development, implementation, or operation), the result of which informs a decision to be made concerning that system in a specific context". It leads to better comprehension of the circumstances surrounding the operation of HIS with the aim of demining its safety, efficiency, and effectiveness (Ammenwerth, 2003; Brender, 2006).

C. Human Factors in HIS Evaluatiuon

Characteristics and issues that make individuals more inclined to accept and use the system are known as human factors (Li et al, 2013). The perception of the benefits of the technology is the most commonly cited enabling element, which affect use acceptance and adoption. The involvement of end users as key stakeholders is a crucial element throughout the whole system life cycle. Health professionals and patients ought to be given opportunities to test prototypes to ensure system usability (Avison, 2007).

D. HIS Acceptance and Use

The acceptance of health information systems by health personnel is an important topic of interest to both physicians and scholars. The subject of HIS acceptance is widely covered in literature but the focus on physicians' perspectives on HIS adoption is superficial. Despite the extensive benefits expected from technological innovations, Wyatt & Wyatt (2003) postulates that new technology is frequently not well accepted. Ifinedo (2012) applied the UTAUT model and indicated moderate changes to it in order to evaluate the elements, which influence HIS acceptance among Canadian physicians. Ifinedo (2012) concluded that acceptance of HIS could be enhanced by critical factors such as social influence and organizational support.

III. SURVEY OF SCHOLARSHIP

Since HIS is a topic that grasped the interest of both governmental and private researches, several scholars in various research contexts have taken interest in a wide range of aspects concerning HIS. Several studies have been done in several broad areas that include; the adoption of HIS, development of research models for HIS adoption, evaluation of non-adopters of HIS, HIS acceptance in developed countries, HIS acceptance in developing countries, measurement of end user satisfaction in HIS usage, and the user friendliness of HIS in South African hospitals. The following sections critically discuss the findings of these various researches.

A. HIS Adoption

Three prior research works have been analysed in a tabular form below. The table shows the investigation topic, authors, and year of study, study location, findings, and other issues that were not addressed by the research.

Author \ Year \ Place	Finding\Implication	Research Results
Ahmadi et al; 2015; Malaysia	Identified main factors in the decision-making process of adoption. HIS is beneficial to patient community and the hospitals.	Concluded that Perceived Technical Competence; Hospital Size; Relative Advantage; and Government Policy were major factors affecting the adoption if HIS
Handayani et al; 2016 Indonesia	Studied human behaviour, technological characteristics and organisational policies and government support in adoption of in eHealth	Identified non-technological factors, e.g. human, organisational etc. to be affecting the HIS acceptance of each in a hospital
Chena & Hsiao; 2012 Taiwan	Identification of main influences affecting physicians in the acceptance of HIS. Evaluation perceived ease of use of potential information systems as an important issue for consideration by managers and planners.	Physicians' acceptance of HIS was mainly affected by perceived ease of use. System quality, top-management support, and project-team competency are of significance in the extended Technology Acceptance Model.

Table 1:- HIS Adoption

Researchers tabulated above which include Ahmadi et al (2015), Handayani et al (2015) and Chen & Hsiao (2012) who focused their efforts on exploring factors which affect the adoption of HIS. Ahmadi et al (2015) explored the factors such as "Perceived Technical Competence", "Relative Advantage," "Hospital Size" and "Government Policy" as the major factors considered by an organisation when adopting a HIS. Handayani et al (2015) expanded the research and came up with a model for supporting government eHealth programs, which focused on "human, technological, and organizational characteristics." Chen & Hsiao (2012) further investigated the acceptance of HIS by physicians their findings further corroborated Ahmadi et al (2015)'s findings of perceived ease of use as a major determinant of HIS acceptance by the key health professionals. In searching factors that validate the TAM model, Chen & Hsiao (2012) illustrated the critical roles played by project-team proficiency, system quality, and senior management support and play a critical role.

B. Research Models of User Adoption

Other researchers developed theoretical models for the user adoption of HIS. Busha & Harter (1980) describe research model development as a scientific method by which researchers can mathematically or graphically illustrate the constructs that represent a phenomenon. The constructs of the developed models are briefly illustrated in the table below:

Author \ Year \ Place	Finding\Implication	Research Results
Bunker; 2017; Armenia	Explored EHR implementation barriers of from physician's perspective. Developed a model to explain how EHRs are accepted by physicians.	Reconciliation of individual and environmental factors explain technology acceptance in organizational and health care settings. Proposed tripolar model integrates three pillars of the healthcare, i.e. patients, practitioners, and organizations.
Handayani et al; 2016 Indonesia	Studied human behaviour, technological characteristics and organisational policies and government support in adoption of eHealth	Identified non-technological factors, e.g. human, organisational etc. to be affecting the HIS acceptance of each in a hospital
Sezgin, 2014; Turkey	WIP study; to determine influencing factors that affects user adoption of PSS by a new research model,	Through statistical analysis, the WIP model under development passed the strength and reliability tests. The forecasted results were on course to determine factors related with the pharmaceutical services adoption.

Table 2:- Research Models of User Adoption

Other researchers including Sezgina (2014) and Bunker (2017) developed models of technology user acceptance but both researches looked at the issue from difference perspectives. Bunker (2017)'s Tripolar model focused on Hospital based physicians' perspective on Electronic Health Records (EHR) which focused on what physicians perceived to be barriers to EHR implementation. On the other hand, Sezgina's model that is currently in the Work in Progress (WIP) stage focuses toward the Healthcare Personnel's adoption of an e-Health Application.

C. Computing Satisfaction from end User's perspective

Another view brought by prior researchers is the evaluation of computing satisfaction from end user's perspective. There were two research summaries tabulated and briefly discussed below:

Author \ Year \ Place	Finding\Implication	Research Results
Aggelidis and Chatzoglou 2012 Greece	Tested prior models with the aim of suggesting new frameworks on how EUCS is achieved among HIS users.	Users rated Training, system speed; outsourcing support; documentation and insourcing support as lowest contributors of end user computing satisfaction. Users recommended that HIS require large capital investments, learning time, and high level of expertise
Prasanna & Huggins; 2016 New Zealand and USA	A focus to develop a model mediated by performance expectations and moderated by user characteristics.	Identified Performance expectancy; Effort expectancy, Social influence, facilitating conditions, Information quality as key factors affecting IS acceptance in using EOCIS software packages in emergency operations centres

Table 3:- Technology Use Satisfaction from end User's perspective
Source: Own Compilation

Aggelidis and Chatzoglou (2015) introduced the element of measuring End User Computing Satisfaction (EUCS) in evaluating the use of HIS. The researcher tested prior models and suggested new conceptual frameworks on how EUCS is formed among HIS users. From the research, training, documentation, outsourcing support, system speed and insourcing support were identified as the least contributors while issues like system quality, top-management support, and project-team competency were noted as critical players in EUCS. The findings validate the key concept of the extended Technology Acceptance Model (TAM2).

D. HIS Acceptance in Developing Countries

HIS has also gained attention and support of government and institutions in developing countries. Mahmoud (2015) findings further support that the early stages of HIS introduction, HIS was mainly used by physicians but as the systems gained popularity, nurses and other support staff got involved and eventually patients now can access, maintain and use HIS.

Author \ Year \ Place	Finding\Implication	Research Results
Krickeberg 2007 Vietnam	Identified 11 Principles of HIS in developing countries	Eleven principles include: description of the underlying variables; no list of indicators to be fixed in advance; only one register per target population; technical coordination between registers and reports etc.
Esmaeilzadeh 2015 Malaysia	Developed an integrated framework for DSS and tested in a developing country.	Study identified Physicians' attitude toward knowledge sharing, interactivity perception and computer self-efficacy of physicians play a crucial role in influencing their perceived threat to professional autonomy.

Table 4:- HIS Acceptance in Developing Countries
Source: Own Compilation

Krickeberg (2007)'s studies in Vietnam identified eleven principles for designing or reforming a HIS in a developing country. Such principles include "explicit description of the underlying units (target population) and variables; no list of indicators to be fixed in advance; only one register per target population; technical coordination between registers and reports; correction algorithms; local use of data and indicators; autonomy of health institutions regarding the information that concerns them; and novel use of registers for various studies" (Krickeberg 2007).

The key principle in Krickeberg (2007) finding was that there must be flexibility of HIS to adjust to variations in dynamic socio-economic conditions, variations of the health conditions of its surrounding population. Krickeberg (2007) also recommended that HIS must also be able to influence the development of suitable medicines through application of recent technological innovations. Similar analysis was done by Esmaeilzadeh in Malaysia, but it failed to produce a validated model for use in other developing countries.

E. HIS in South African Contextual Researches

Some studies like those discussed in the sections above have also been carried out in the South African contexts. These researches provided an insight into the adoption of HIS as tabulated below:

Author \ Year \ Place	Finding\Implication	Research Results
Tokosi; 2016; South Africa	Developed a framework for EPR adoption by hospital management and its use by clinicians where is operational	Found high impact relationships between attitude and perceived usefulness, complexity, perceived ease of use, facilitating condition, use behaviour. Use behaviour had high impact relationships with storage and retrieval
Garrib; 2008; South Africa	Assessed data quality, the utilisation for facility management, perceptions of work burden, and usefulness of the system to clinic staff	High association between work burden and data collection and collation. The DHIS had been implemented in all 10 clinics, and the supporting organisational infrastructure was in place.
Mbananga et al; 2002; South Africa	Assessed the efficiency and effectiveness of HIS in a South African Province	There were no improvements in the time taken to serve clients in both hospitals that implemented HIS and this which did not implement HIS. HIS adopters recorded an increase in revenue collection as compared to non-adapters

Table 5:- South African Contextual Researches

The table above shows South African studies carried by Tokosi & Naicker (2016), Garib (2008), and Mbananga (2002). Tokosi & Naicker developed a Conceptual Framework for Electronic Patient Record System for Clinician Use. The framework highlights a high impact of relationships between attitude and perceived usefulness, perceived ease of use, complexity, facilitating condition, use behaviour. Mbananga (2002) evaluated Hospital Information System in a South African, Northern Province. The scholar assessed the efficiency and effectiveness of HIS and observed no changes in the median time spend to serve patients.

Health practices that adopted HIS recorded an increase in amounts of revenue collected as compared with those that have not implanted HIS. Studies done by Garib (2008) showed a high association between work burden and data collection and collation. The research realised improved efficiencies in the 10 district hospitals where HIS was implemented.

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IV. THEORITICAL FRAMEWORK

Several researchers in the field of IT adoption have concentrated on the individual user by clarifying the factors that specifically influence them in their behavioural intentions to use a specific technology.

A. Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is the developed model from the Theory of Reasoned Action (TRA). The TRA was proposed by Fishbein (1975), for the purpose of illustrating a person's behavioural tendency, predicting, altering, and deducing an individual's behaviour (Ajzen 1995). According to Ajzen and Fishbein (1975), TRA postulates that "individual behaviour is driven by behavioural intentions where behavioural intentions are a function of an individual's attitude toward the behaviour and subjective norms surrounding the performance of the behaviour."

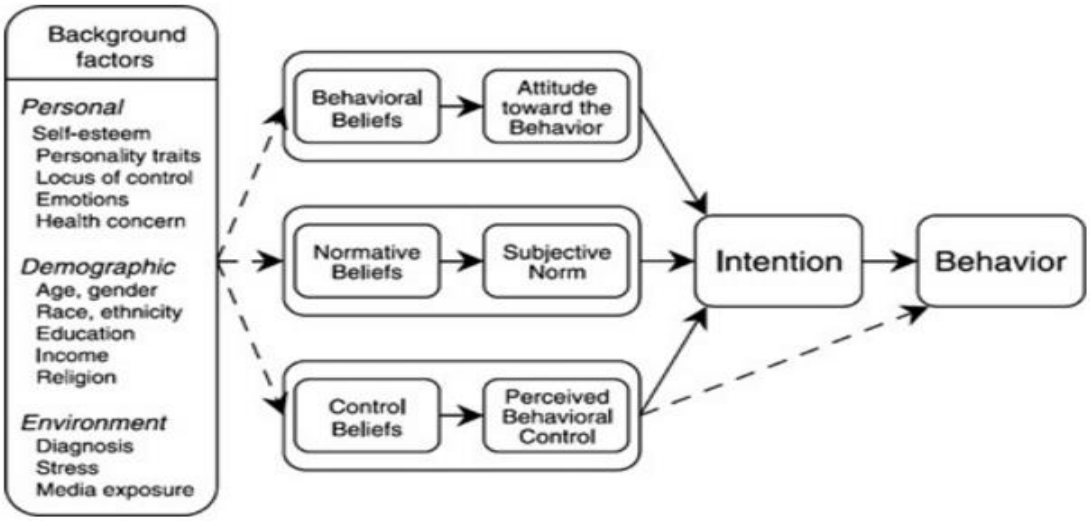

Fig 1:- Theory of Planned Behaviour

In corroborating the constructs of the TPB model, Ajzen (1991) argued that, intentions and behaviour are not only influenced by individuals behavioural, normative and control beliefs. There are other factors called background factors that indirectly influence intention and behaviour by influencing attitude, subjective norm, and perceived behavioural control. Such are mainly socio-demographic characteristics or factors of personal, demographic, and environmental nature, for example, self-esteem, age and media exposure respectively.

B. Task-Technology Fit (TTF) Model (1995)

The task-technology fit (TTF) model was originally proposed by Goodhue and Thompson (1995). The TTF framework focuses on the suitability of the technology to the task at hand. TTF is a popular conceptual model for evaluating how information technology contributes to improved performance, evaluating the impacts of usage, and assessing the relationship between task and technology characteristics. It also assumes that both task characteristics and technology characteristics can have an impact on the task-technology fit, which sequentially controls users' performance and utilization (Widagdo, 2016), (Wu, 2017). Goodhue (1995) argues that information systems, (i.e. systems, policies, and performance) positively influence performance under the permitting circumstance of correspondence between their functionality and user task requirements.

The figure below illustrates the TTF Model developed by Goodhue & Thompson (1995)

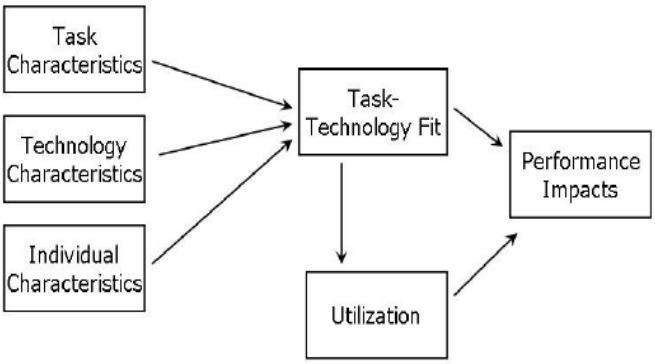

Fig 2 :- TFF Model
Source: Goodhue & Thompson (1995)

Thus, TTF models rely on the appropriateness of the technology to the task (Dishaw and Diane, 1999). TTF is the degree to which IT assists uses in the execution their portfolio of tasks. It explains the relationship between job specifications, human skills and IT usability (Goodhue and Thompson, 1995).

C. Extended Technology Acceptance Model (TAM2) (2000)

Davis (1986) proposed a Technology Acceptance Model (TAM), a widely prevalent theory that postulates that "an individual's intention to use a technology is mainly a function of an individual's cognitive responses to the design features of the technology "(Bunker, 2017). Davis (1986) identified that the framework is based the two pillars referred to as "cognitive responses." The first cognitive response is called of perceived useful-ness Davis (1986) defined "the extent to which an individual has confidence that using a system would improve his or her job performance". Perceived ease of use which Davis (1986) also defines as "the degree to which an individual believes that using a particular system would be free of physical and mental effort."

The fugue below illustrates the Modified TAM2 model by Source: Venkatesh and Davis (2000)

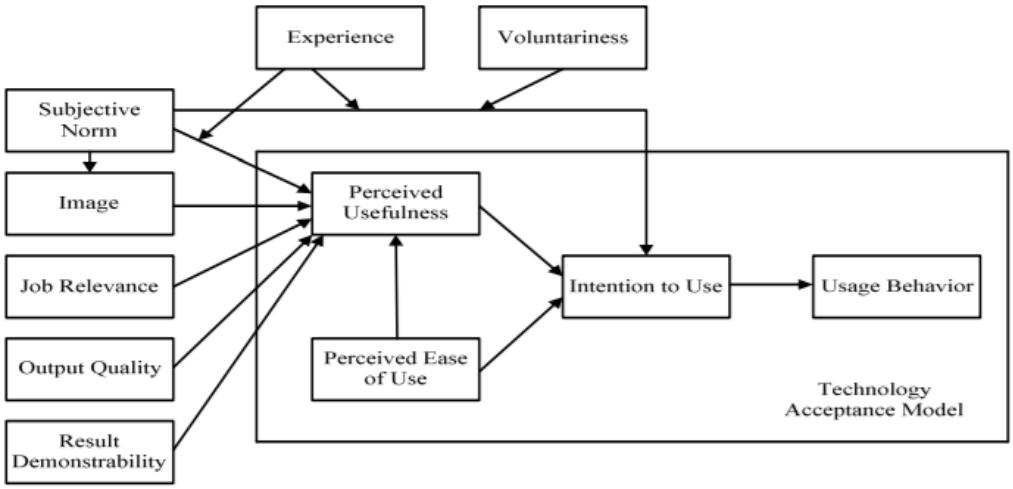

Fig 3 :- TAM2 Model
Source: Venkatesh and Davis (2000)

D. Unified Theory of Acceptance and Use of Technology (UTAUT) Model (2012)

Venkatesh et al (2003) introduced the Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT is based on Ajzen (1985; 1991) theory of planned behaviour (TPB) which states that a particular action in technology use is followed by behavioural intention. Behavioural intention is determined by behavioural norm, perception and control Ajzen (1985; 1991). Several researchers have suggested four cognitive factors, namely performance expectancy, effort expectancy, social influence, and facilitating conditions as essential determinants of an individual decision to accept and use information technology (Macedo, 2017). The UTAUT model is also focused on four moderators of behavioural intention, gender, age, experience, and experience (Venkatesh, 2012).

The UTAUT2 model is diagrammatically illustrated below:

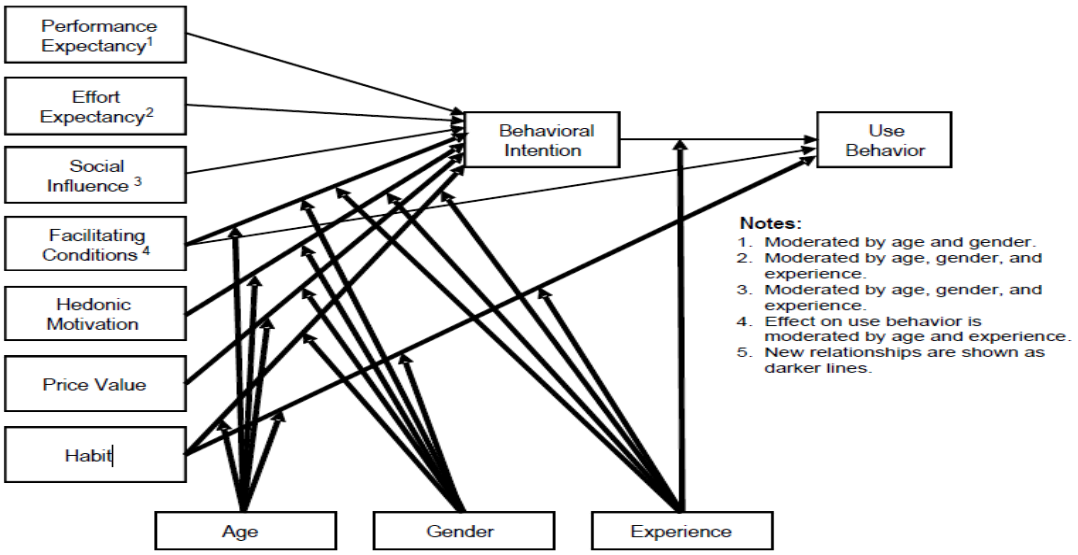

Fig 4 :- UTAUT2 Model
Source: Venkatesh et al. (2012)

The latest UTAUT2 framework is valuable for analysing, various associations between core behavioral structures such as performance expectancy, effort expectancy, and social influence, facilitating conditions, Hedonic Motivation, Price value, Habit, Behavioural Intention and Use behaviour (Venkatesh, 2012). Macedo's latest evaluations (2017) point out that researches that utilized perceived usefulness are more accurate as the updated UTAUT2 is not yet included in modern empiric research.

V. THE UNTESTED RESEARCH MODEL

The initial and untested research model was proposed built from results of hypothesised theoretical framework elements. Results from the 14 hypotheses were analysed to establish the significance of each HIS use determinants. The figure below just illustrates initial stages of the evolution of the Model for acceptance and use of HIS.

A. Hypothesis for this study

The hypothesis used is this study were derived from both the UATUT and TTF Models

1) Hypothesis from the UTAUT2 Model

The latest UTAUT2 framework is valuable for evaluating various correlations between primary behavioural constructs such are performance expectancy, effort expectancy, and social influence, facilitating conditions, Hedonic Motivation, Price value, Habit, Behavioural Intention and Use behaviour (Venkatesh, 2012).

H01:	*Performance Expectancy in Intention to Use has influence on Individual Health Practitioner's Acceptance of HIS*
H02:	*Effort Expectancy in Intention to Use, has a positive influence on individual's behavioural Intention to use HIS*
H03:	*Facilitating Conditions have influence on Individual Health Practitioner's Acceptance of HIS*
H04:	*Price Value has influence on Individual Health Practitioner's Acceptance of HIS*
H05:	*Social Influence in Intention to Use has influence on Individual Health Practitioner's Acceptance of HIS*
H06:	*Social Influence in Actual Use has influence on Individual Health Practitioner's Use of HIS*
H07:	*Hedonic Motivation has influence on Individual Health Practitioner's Use of HIS*
H08:	*Habit has influence on Individual Health Practitioner's Use of HIS*
H09:	*Performance Expectancy in Actual Use has influence on Individual Health Practitioner's Use of HIS*
H10:	*Effort Expectancy in Actual Use has influence on Individual Health Practitioner's Use of HIS*
H14:	*Behavioural Intention has influence on Individual Health Practitioner's Use of HIS*

Table 6:- UTAUT Sources Hypothesis

2) Hypothesis from the TTF Model

The TTF seeks to hypothesize the appropriateness of HIS to health practitioners as it examines how HIS relates to performance efficiency. It assesses the effect of usage and assesses the relationship between task and technology characteristics (Widagdo, 2016), (Wu, 2017 (Wu, 2011)

H11:	*Individual Characteristics have influence on Individual Health Practitioner's Use of HIS*
H12:	*Technology Characteristics have influence on Individual Health Practitioner's Use of HIS*
H13:	*Task Characteristics have influence on Individual Health Practitioner's Use of HIS*

Table 7:- TTF Hypothesis

B. The Model

The resultant goal was the application of AUTAUT2 and TTF models, be it individually or combined, is to explore and explain individual use of HIS.

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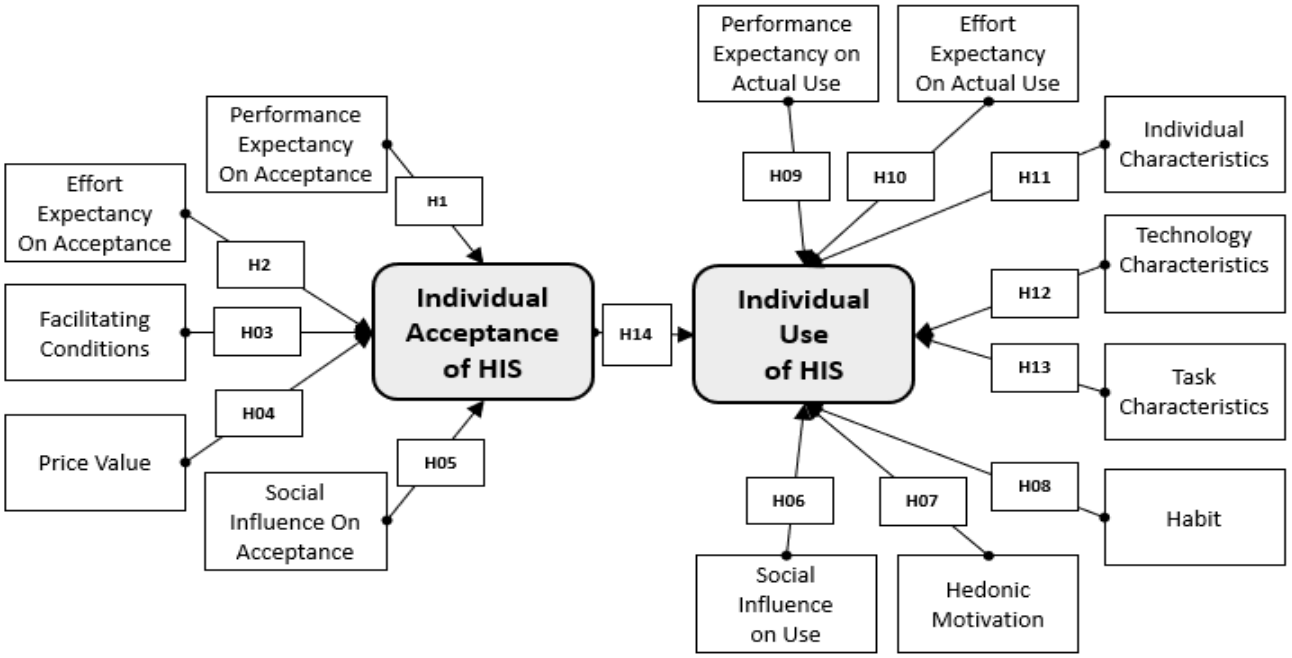

Fig 5:-Initial and Untested Model for Acceptance and Use of Health Information Systems for South African Health Practitioners

The resultant goal was the application of AUTAUT2 and TTF models, be it individually or combined, is to explore and explain individual use of HIS. Therefore, the results from all the hypotheses from each theoretical model's constructs were to be further evaluated and assembled into a single comprehensive model. Hypotheses H01 to H10 and H14 contributed AUTAUT2 components in constructing the model while H11-H13 originated from TTF constructs

VI. RESEARCH METHODOLOGY

The research methodology followed was justified by the research purpose, goals and objectives. The table below summarizes the choices and justification of approaches used in terms of Research Philosophies, Research Paradigm, Research Approach, Research Methodology, Research Strategy, Research Design, Data Collection Plan and Procedures and Data Preparation.

Process	Methods & Justification
Research Philosophies	Ontology / Epistemology applied to justify the basis for research
Research Paradigm	Positivist due to required objectivity
Research Approach	Deductive
Research Methodology	Quantitative
Research Strategy	Survey for easy administration
Time Horizon	Cross Sectional
Population	Individual Health Practitioners as users of HIS
Research Instrument	Pilot Study Conducted and Input was obtained from supervisor and health practitioners
Data Collection	Distributed Web based Questionnaire –Monkey Survey. Referrals and Snowballing were key to connect to respondents. Targeted Health Professionals across all specialities of medical practice. Responses were tracked on daily basis and follow up were done on interested participants.
Data Preparation	Valid questionnaires were checked and negative scoring was affected. Results of 209 valid responds were considered (Amin & Chong, 2011 ; Wong, 2016)
Data Analysis	Descriptive Analysis, Linear Regression, SEM Analysis for correlation study

Table 8:- Research Methods

Target respondents were identified into groups by their area of medical practice specialty. The main focal point in the use of HIS is of course health practitioners. The categories specifically comprise of, Dental Therapy & Oral Hygiene; Dietetics & Nutrition; Emergency Care; Environmental Health; Medical & Dental; Medical Technology; Occupational Therapy, Medical Orthotics & Arts Therapy; Optometry & Dispensing Opticians; Physiotherapy, Podiatry & Biokinetics; Psychology; Radiography & Clinical Technology; Speech Language & Hearing professionals, who apply technology into their daily routines in an effort to deliver better healthcare services.

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VII. DATA ANALYSIS AND DISCUSSION OF RESULTS

The discussion of results consists of frequency analysis, reliability test, descriptive statistics as well as data analysis through the structural Equation modelling technique

A. *Frequency Analysis*

Of importance in this research in the is research paper is the strata-based analysis of respondents. The results indicate that Medical & Dental body had the highest affiliation of 17.7%, this was followed by Physiotherapy, Podiatry & Biokinetics that had a total of 14.8%. Optometry & Dispensing Opticians and Psychology were the third and fourth highest with a total of 13.4% and 11.5% of the total sample respectively.

Item	Frequency	Valid Percent	Cumulative Percent
Other (Please Specify)	2	1.0	1.0
Dental Therapy & Oral Hygiene	7	3.3	4.3
Dietetics & Nutrition	17	8.1	12.4
Emergency Care	5	2.4	14.8
Environmental Health	8	3.8	18.7
Medical & Dental	37	17.7	36.4
Medical Technology	3	1.4	37.8
Occupational Therapy, Medical Orthotics & Arts Therapy	9	4.3	42.1
Optometry & Dispensing Opticians	28	13.4	55.5
Physiotherapy, Podiatry & Biokinetics	31	14.8	70.3
Psychology	24	11.5	81.8
Radiography & Clinical Technology	20	9.6	91.4
Speech Language & Hearing	18	8.6	100.0
Total	209	100.0	

Table 9:- Frequency by Health Practice Specialty

The least represented were other professional bodies that were not on the list as well as Medical Technology with a total representation of 1% and 1.4% respectively. Emergency Care was amongst the body that was least represented with a total of 2.4%.

B. *Reliability*

Reliability was computed using Cronbach alpha. The results are shown in Table 10 below and the results indicate that the reliability was found to be 0.951.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.940	.951	77

Table 10:- Reliability Statistics

This Cronbach alpha values mean that the research instrument that was used in this study was found to be reliable as noted by Pallant (2013) that a reliability value that is above 0.7 is deemed reliable. Therefore, the results and conclusions that this study will draw can be relied on.

C. *Descriptive statistics*

The study extracted and explained descriptive statistics for each construct. The constructs whose descriptive statistics was extracted and explained included; Performance Expectancy in Acceptance (PA), Effort Expectancy in Acceptance (EA), Facilitating Conditions – Actual Use (FC), Price Value (PV), Social Influence in Acceptance (SA), Social Influence in Actual Use (SU), Hedonic Motivation (HM), Habit (HB), Performance Expectancy in Actual Use (PU), Effort Expectancy in Actual Use (EU), Individual Characteristics (IC), Technology Characteristics (TE), Task Characteristics (TA), Behavioural Intention (IA) and Use Behaviour (IU).

Each construct had the following statistics extracted, minimum, maximum, mean and skewness. According to Pallant (2013) descriptive statistics provides a detailed information regarding the distribution and central tendency of the data. It is important to note that the questionnaire used in this study was based on 5-likert scale where 1 represented Strongly Disagree, 2 represented Disagree, 3 represented neutral, 4 represented Agree and 5 represented Strongly Agree. Table 11 below shows the summary of descriptive statistics extracted from SPSS.

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Construct	Minimum	Maximum	Mean	Std. Deviation	Skewness
PA	1.00	5.00	4.2584	.68657	-1.284
EA	1.00	5.00	4.4545	.66440	-1.619
FC	2.00	5.00	3.3062	.69477	-.148
PV	1.00	5.00	3.7321	.75637	-.385
SA	2.00	5.00	3.5646	.65552	-.190
SU	1.00	5.00	3.2488	.70391	.026
HM	1.00	5.00	3.0526	.76718	-.090
HB	1.00	5.00	3.0813	.87050	.239
PU	1.00	5.00	3.8804	.74682	-.501
EU	2.00	5.00	3.4402	.70541	-.035
IC	1.00	5.00	3.7129	.79896	-.292
TE	1.00	5.00	3.2057	.74082	-.135
TA	2.00	5.00	3.3923	.64981	-.071
BI (IA)	1.00	5.00	3.7751	.77964	-.382
UB (IU)	1.00	5.00	3.3158	.86923	-.129

Table 11:-Descriptive Statistics of constructs

As indicated in Table 11 all constructs had a maximum of option 5 chosen which stands for strongly agree. This means that on each construct there is at least one person who strongly agree to the questions asked concerning that construct. When it comes to the minimum, 10 out of 15 constructs which are PA, EA, PV, SU, HM, HB, PU, IC, TE, BI and UB had 1 as their minimum option chosen. Option 1 stands for strongly disagree, meaning that there is at least one participant for these constructs who strongly disagree to the questions asked about them. On the contrary, FC, SA, EU and TA had 2 as the minimum option chosen for them, meaning none of the participants strongly disagree to the questions asked about them.

D. SEM analysis

The health practitioners' acceptance and use or non-use of Health Information Systems structural model consist of the 15 measurement models discussed earlier. The latent variables are measured by the observable variables as indicted in the measurement models.

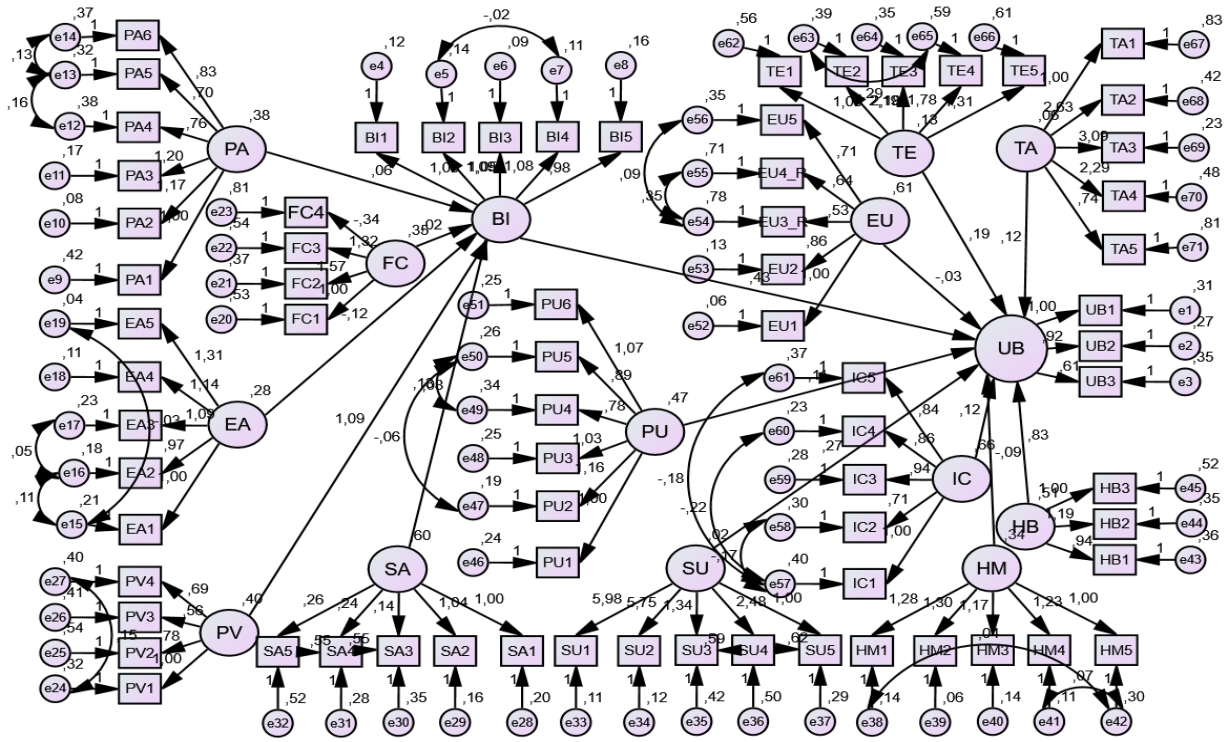

Fig 6:- Structural model of health practitioners' acceptance and use or non-use of Health Information Systems

After the measurement models were found fit, they were put together by means of joining them using single headed arrows are used to define causal relationships in the model, with the variable at the tail of the arrow causing the variable at the point, for example TE influences UB. Using this model, the relationships that existed between constructs were then analysed.

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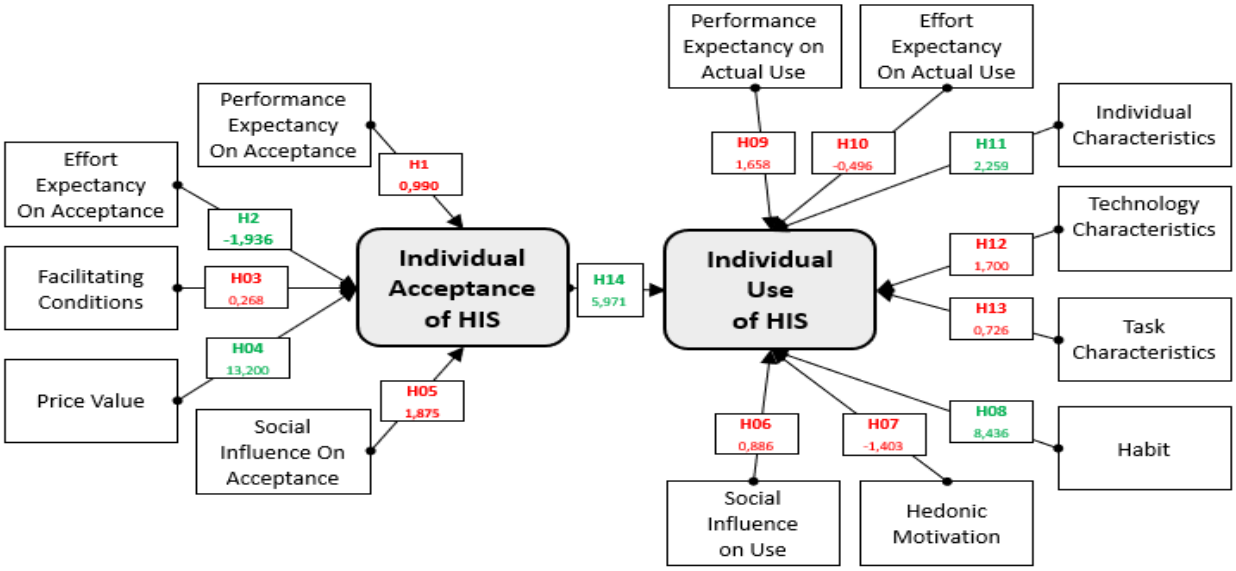

Fig 7:- Graphical Presentation of Initial Model

Table 12 below shows the summary extract from AMOS output for the standardized significance levels obtained after running the structural model. These levels show the hypothesized relationships between the latent variables forming the underpinning causal structure of health practitioners' acceptance and use or non-use of Health Information Systems.

In order to determine the significance of the hypothesized relationship, the researcher Hair et al. (2006) recommended that a threshold of ± 1.96 should be obtained for the values of the critical ratio (CR). This means that for a hypothesis to be significant or supported, its constructs should have a critical ratio value which is greater than ± 1.96. This implies that, for a significant hypothesis, its constructs should produce a critical ratio with a numerical value greater than ±1.96. The hypothesis for the structural model's path with a value above the threshold is then concluded either as supported or otherwise not supported. The results of the hypotheses tests are illustrated in Table 12 below.

Hypothesis	Path			C.R.	Comment
H1	PA	→	BI	.990	Hypothesis rejected
H2	EA	→	BI	-1.936	Hypothesis accepted
H3	FC	→	BI	.268	Hypothesis rejected
H4	PV	→	BI	13.200	Hypothesis accepted
H5	SA	→	BI	1.875	Hypothesis rejected
H6	SU	→	UB	.886	Hypothesis rejected
H7	HM	→	UB	-1.403	Hypothesis rejected
H8	HB	→	UB	8.436	Hypothesis accepted
H9	PU	→	UB	1.658	Hypothesis rejected
H10	EU	→	UB	-.496	Hypothesis rejected
H11	IC	→	UB	2.259	Hypothesis accepted
H12	TE	→	UB	1.700	Hypothesis rejected
H13	TA	→	UB	.726	Hypothesis rejected
H14	BI	→	UB	5.971	Hypothesis accepted

Table 12:- Summary of the Standardized Significance Levels of Constructs

Results shown in table 12 indicates that five (5) (H2, H4, H8, H11 and H14) of the 14 suggested hypotheses were accepted. This is so because their CR values were above ± 1.96; their values being -1.936, 13.200, 8.436, 2.259 and 5.971, respectively. On the other hand, hypotheses H1, H3, H5, H6, H7, H9, H10, H12 and H13 were rejected because their CR values were below the threshold of ±1.96. Their values are 0.990, 0.268, 1.875, 0.886, -1.403, 1.658, -0.496, 1.700 and 0.726 respectively.

VIII. INTERPRETATION OF RESULTS AND THE MODEL FOR HIS USE

This section will begin by interpreting the effects of Performance Acceptance, Effort Acceptance, Facilitating Conditions, Price Value and Social Influence on Individual acceptance of HIS. It will then further interpret results on how Use of HIS is influenced Social Influence, Hedonic Motivation, Habit, Task Characteristics, Technology Characteristics, Individual Characteristics, Effort Expectancy and performance expectancy.

A. The influence of Performance Expectancy in Intention to Use on individual health practitioner's acceptance of HIS

The study has revealed that performance expectancy (PA) has no influence on individual health practitioner's acceptance of HIS (BI). The resultant Critical Ratio of 0.990, which is less than the critical z value (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H1** which states that: Performance Expectancy, has significant influence on individual health practitioner's acceptance of HIS. This agrees with findings of Afshan (2016), Dhir (2018), Hassain (2019), McKenna (2013). The researchers above rejected the notion of Performance Expectancy influence on Behavioural Intention.

The results are in contrast with the findings of Aini (2019), Alam, Hoque & Barua (2020), Beza (2018), Jang (2016), Lee (2010), Macedo (2017). This indicates quite a huge number of researchers who supported the notion of Performance Expectancy influence on Behavioural Intention.

B. The influence of Effort Expectancy in Intention to Use on individual health practitioner's acceptance of HIS

The study has revealed that Effort Expectancy in Intention to Use (EA) has influence on individual health practitioner's acceptance of HIS (BI). The resultant Critical Ratio of -1.936, which is less than the critical z value (at p = .05) of 1.96, indicating that the parameter is significant.

This accepts the Hypothesis **H2** which states that: Effort Expectancy in Intention to Use, has significant influence on individual health practitioner's acceptance of HIS. This is in agreement with findings of Aini (2019), Beza (2018), Macedo (2017), Sarosa (2019), Suki & Suki (2017), Wang (2009) and Zhou (2019). The researchers above supported the notion of Performance Expectancy influence on Behavioural Intention.

The results are in contrast with the findings of Afshan (2016), Alam, Hoque & Barua (2020), Wiratmadja et al (2012) and Wu, Tao Yang (2007). These researchers rejected the notion of Performance Expectancy influence on Behavioural Intention.

C. Facilitating Conditions influence on individual health practitioner's acceptance of HIS

The study has revealed that Facilitating Conditions (FC) has no influence on individual health practitioner's acceptance of HIS (BI). The resultant Critical Ratio of 0.268, which is less than the critical z value (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H3** which states that: Facilitating Conditions, have significant influence on individual health practitioner's acceptance of HIS. This agrees with findings of Beza (2018), Dhir (2018) and Hoque & Soswar (2017). The researchers above rejected the notion of Performance Expectancy influence on Behavioural Intention.

The results are in contrast with the findings of Afshan (2016), Aini (2019), Alam, Hoque & Barua (2020), Chipeva (2018), Gunawan (2017), Hassain (2019. Most researchers supported the notion of Facilitating Conditions influence on Behavioural Intention.

D. Price Value influence on individual health practitioner's acceptance of HIS

The study has revealed that Price Value (PV) has influence on individual health practitioner's acceptance of HIS (BI). The resultant Critical Ratio of 13.200, which is less than the critical z value (at p = .05) of 1.96, indicating that the parameter is significant.

This rejects the Hypothesis **H4** which states that: Price Value, has significant influence on individual health practitioner's acceptance of HIS. This agrees with findings of Aini (2019), Beza (2018), Chipeva (2018) and Chiu (2008). The researchers above supported the notion of Price Value influence on Behavioural Intention.

The results are in contrast with the findings of Alam, Hoque & Barua (2020) and Macedo (2017). These researchers rejected the notion of Price Value influence on Behavioural Intention.

E. Social Influence in Intention to Use effect on individual health practitioner's acceptance of HIS

The study has revealed that Social Influence in Intention to Use (SA) has no influence on individual health practitioner's acceptance of HIS (BI). The resultant Critical Ratio of 1.875, which is less than the critical z value (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H5** which states that: Social Influence, has significant influence on individual health practitioner's acceptance of HIS. This agrees with findings of Afshan (2016), Chiu (2008), Sarosa (2019) and Suki & Suki (2017). The researchers above supported the notion of Price Value influence on Behavioural Intention.

The results are in contrast with the findings of Aini (2019), Alam,Hoque & Barua (2020), Wang (2009), Wiratmadja et al (2012), Wu, Tao Yang (2007), and Zhou (2019). Their studies concluded that there is no correlation between Price Value influence and Behavioural Intention

F. Effect of Social Influence in Actual use on individual health practitioner's use of HIS

The study has revealed that Social Influence in Actual use (SU) has no influence on individual health practitioner's use of HIS (UB). The resultant Critical Ratio of 0.886, which is less than the critical z value (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H6** which states that: Social Influence, has significant influence on individual health practitioner's use of HIS. This agrees with findings of Chiu (2008). The researchers above supported the notion of Social Influence on Behavioural Intention.

The results are in contrast with the findings of Isaac (2019), Wu, Tao Yang (2007) and Zhou Lu Wang (2010). Their studies concluded that there is no correlation between Price Value influence and Use Behaviour

G. Hedonic Motivation influence on individual health practitioner's use of HIS

The study has revealed that Hedonic Motivation (HM) has no influence on individual health practitioner's us of HIS (UB). The resultant Critical Ratio of -1.403, which is less than the critical z value (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H7** which states that: Hedonic Motivation, has significant influence on individual health practitioner's use of HIS. This agrees with findings of Beza (2018) and Dhir (2018). The researchers above supported the notion of Hedonic Motivation influence on Behavioural Intention.

The results are in contrast with the findings of Chipeva (2018), Dajani (2019), Macedo (2017) and Shyu (2011). Their studies concluded that there is no correlation between Hedonic Motivation influence and Use Behaviour

H. Habit influence on individual health practitioner's use of HIS

The study has revealed that Habit (HB) has influence on individual health practitioner's use of HIS (BI). The resultant Critical Ratio of 8.436, which is above the critical z value (at p = .05) threshold of 1.96, indicating that the parameter is significant.

This accepts Hypothesis **H8** which states that: Habit, has significant influence on individual health practitioner's use of HIS. This agrees with findings of Chipeva (2018) and Macedo (2017). The researchers above supported the notion of Habit influence on Behavioural Intention.

The literature review has not picked up researchers who contradict this hypothesis

I. Performance Expectancy in Actual Use influence on individual health practitioner's use of HIS

The study has revealed that Performance Expectancy (PU) has no influence on individual health practitioner's use of HIS (UB). The resultant Critical Ratio of 1.658, which below the critical z value threshold (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H9** which states that: Performance Expectancy, has significant influence on individual health practitioner's use of HIS. The literature review has not picked up researchers who contradict this hypothesis

The results are in contrast with the findings Afshan (2016), Wu, Tao Yang (2007) and Zhou Lu Wang (2010). Their studies concluded that there is no correlation between Performance Expectancy influence and Use Behaviour

J. Effort Expectancy in Actual Use influence on individual health practitioner's use of HIS

The study has revealed that Effort Expectancy (EU) has no influence on individual health practitioner's use of HIS (UB). The resultant Critical Ratio of -0.496, which below the critical z value threshold (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H10** which states that: Effort Expectancy, has significant influence on individual health practitioner's use of HIS. This agrees with findings of Zhou Lu Wang (2010). The researchers above supported the notion of Effort Expectancy influence on Behavioural Intention.

The results are in contrast with the findings of Afshan (2016), Isaac (2019), Shiferaw (2019), Wu and Tao Yang (2007). Their studies concluded that there is no correlation between Effort Expectancy influence and Use Behaviour

K. Individual Characteristics influence on individual health practitioner's use of HIS

The study has revealed that Individual Characteristics (IC) has no influence on individual health practitioner's use of HIS (UB). The resultant Critical Ratio of 2.259, which above the critical z value threshold (at p = .05) of 1.96, indicating that the parameter is significant.

This accepts the Hypothesis **H11** which states that: Individual Characteristics, has significant influence on individual health practitioner's use of HIS. This agrees with findings of Dajani (2019) and Shiferaw (2019). The researchers above supported the notion of Individual Characteristics influence on Behavioural Intention. The literature review has not picked up researchers who contradict this hypothesis.

L. Technology Characteristics influence on individual health practitioner's acceptance of HIS

The study has revealed that Technology Characteristics (TE) has no influence on individual health practitioner's use of HIS (UB). The resultant Critical Ratio of 1.700, which below the critical z value threshold (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H12** which states that: Technology Characteristics, has significant influence on individual health practitioner's use of HIS. The literature review has not picked up researchers who contradict this hypothesis

The results are in contrast with the findings of Afshan (2016), Said (2015), Tam (2016), Yen et al. (2010) and Zhou Lu Wang (2010). Their studies concluded that there is no correlation between Technology Characteristics influence and Use Behaviour

M. Task Characteristics influence on individual health practitioner's acceptance of HIS

The study has revealed that Task Characteristics (TA) has no influence on individual health practitioner's use of HIS (UB). The resultant Critical Ratio of 0.726, which is below the critical z value threshold (at p = .05) of 1.96, indicating that the parameter is insignificant.

This rejects the Hypothesis **H13** which states that: Task Characteristics, has significant influence on individual health practitioner's use of HIS. The literature review has not picked up researchers who contradict this hypothesis

The results are in contrast with the findings of Afshan (2016), Said (2015), Yen et al (2010) and Zhou Lu Wang (2010). Their studies concluded that there is no correlation between Task Characteristics influence and Use Behaviour

N. Behavioural Intention influence on individual health practitioner's acceptance of HIS

The study has revealed that Behavioural Intention (BI) has no influence on individual health practitioner's use of HIS (UB). The resultant Critical Ratio of 5.971, which is above the critical z value threshold (at p = .05) of 1.96, indicating that the parameter is significant.

This accepts the Hypothesis **H14** which states that: Behavioural Intention, has significant influence on individual health practitioner's use of HIS. This agrees with findings of Alam, Hoque & Barua (2020), Shiferaw (2019), Suki & Suki (2017), Wang (2009), Wu, Tao Yang (2007) and Zhou (2019). The researchers above supported the notion of Behavioural Intention influence on Behavioural Intention.

The literature review has not picked up researchers who contradict this hypothesis.

IX. A MODEL FOR ACCEPTANCE AND USE OF HEALTH INFORMATION SYSTEMS FOR SOUTH AFRICAN HEALTH PRACTITIONERS

Hypotheses and constructs that failed the SEM validation have been dropped from the conceptual model, leaving only, Effort Expectancy, Price Value, Habit and Behavioural Intention as relevant factors influencing the acceptance and use of HIS.

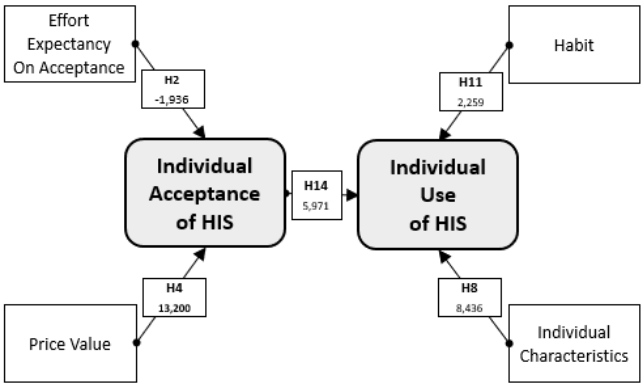

Figure IX-1: A Model for Acceptance and Use of Health Information Systems for South African Health Practitioners

The final Model for Acceptance and Use of Health Information Systems for South African Health Practitioners illustrated above shows only validated and accepted research constructs.

X. CONSLUSION

South African Health practitioners have been found to be significant users of HIS. Their acceptance and use of HIS is influenced by several factors whose evaluation are backed by renowned UTAUT and TTF Frameworks. Of all the theoretical framework constructs, this paper concluded that acceptance of HIS is influenced by Effort Acceptance and Price Value of HIS. On the other hand, Use of HIS is affected by habit and individual characteristics of HIS users.

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