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A study on students' acceptance of mobile phone use to seek health information in South Africa

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Abstract

Background: In South Africa, inequitable access to healthcare information has made many young people with limited resources more vulnerable to health risks. Mobile phones present a unique opportunity to address this problem due to the high penetration of mobile phones in South Africa and the popularity of these devices among young adults. **Objective:** This research sought to examine the adoption of mobile phones to access health information among students at a traditional university in the Eastern Cape, South Africa. **Method:** A cross-sectional survey approach was used to collect information from a convenience sample of 202 university students (58 males; 104 females), the majority (71.3%) of whom were aged between 18 and 27 years and of Black African ethnicity (75.2%). The unified theory of acceptance and use of technology (UTAUT) framework formed the theoretical foundation for the questionnaire. A research model was developed to test the hypotheses that behavioural intention to use a mobile phone to access health information would be influenced by: perceived usefulness (PU), perceived effort, social influence (SI), attitude towards technology (AT) and mobile phone experience. **Results:** Factor analyses indicated that the research model explained 36% of the variance in behavioural intention to use mobile devices to search for health-related queries, with PU being the largest predictor, followed by mobile experience, SI, and AT. Perceived effort did not make a statistically significant contribution. **Conclusion:** Using mobile phones to disseminate health information to students is a useful, convenient, and cost-effective health-promotion strategy. This research has contributed to the body of knowledge concerning the applicability of the UTAUT framework to study the adoption of technology and provided useful information to guide future research and implementation of mHealth initiatives.

Keywords (MeSH)

consumer health information; access to information; health communication; mobile phone; health information technology; young adults; South Africa

Introduction

The continent of Africa has a young and growing population (World Health Organization, 2014), which has given rise to an increase in mobile phone technology (Deloitte, 2016). This proliferation of mobile phones has presented an excellent opportunity for promotion of healthy lifestyles and prevention of illnesses among young adults. Transition into adulthood is a challenging phase, and health risks associated with this young cohort are a particular challenge. In South Africa, sexually transmitted diseases, HIV/AIDS, violence, traffic accidents, and teen pregnancy have been identified as major risks to the health of young people (Hajdu et al., 2016; Chirinda and Zungu, 2016; Patton et al., 2009). To mitigate these health risks, young adults (aged 18–24 years) must have access to quality health information and healthcare (Hampshire et al., 2015; Yu et al., 2006), and the National Department of Health in South Africa has included health promotion as one of its major programs in the community (South African Health Department, 2015).

Sub-Saharan Africa has the highest proportion of young adults worldwide (Boumphrey, 2012). The health profile of this cohort is reported to be the worst in the world due to the significant health challenges and barriers to healthcare that these young adults must overcome (World Health

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Organization, 2014). Limited and inequitable access to healthcare, poor economic prospects, restricted mobility, and low social status are factors contributing to the poor health status of young adults in this region. As formal healthcare options are limited, young adults often choose to turn to the 'informal health sector' of unregulated healers and medicines (Hampshire et al., 2015).

Mobile health technology

Information and communication technologies (ICTs) have been identified as a possible solution to improve not just the quality of, but also access to, health information (Fichman et al., 2011). In particular, the potential for mobile phones to be harnessed for health promotion purposes has led to significant investment in mobile health (mHealth) initiatives (Hampshire et al., 2015). The literature suggests that 79% of young adults own a smartphone, with 70% using the device to stay connected to the community. Mobile phones have evolved from single-purpose communication devices into dynamic tools that support their users in a wide variety of ways (Kinnula and Ijas, 2012). As a result, mobile phones have been described as a 'learn anywhere' resource (Trelease, 2008), which has the potential to add value as an information and communication platform (Shava et al., 2016).

Characteristics of mHealth that can be used to improve health services include the affordability and flexibility of the technology as well as the ubiquitous nature of mobile technology (Akter et al., 2013; Motamarri et al., 2012; Standing and Standing, 2008). However, research into the use of mobile phones to access health information has produced mixed results. There have been suggestions that the adoption of mobile technology in healthcare should increase rapidly but evidence for this has not been found in most healthcare systems (Betjeman et al., 2013).

The adoption of mobile technologies has been ubiquitous in almost every aspect of life, including healthcare. Sarasohn-Kahn (2010) maintained that there are two categories of mobile phone users: those who are more likely to search for 'action-oriented' health information (e.g. the address of a nearby health facility) and those who conduct in-depth research about a specific healthcare topic, making use of their mobile phone.

Mobile technology is a preferred mode of communication for young adults. A recent study suggested that university-age students are the most active mobile phone users, with the functions most often used including text messaging, gaming, and the Internet (Robinson, 2011). Given the popularity of mobile communication among this age group, the potential to access information making use of mobile phones to improve the health objectives of this group is immense. Hampshire et al. (2015) reported that the informal ways in which students use mobile phones for health-related purposes have not been well-documented. Therefore, the student population group remains empirically an uncharted territory (Kazemi et al., 2014).

There are more than a 100,000 mHealth solutions available at present (Dehzad et al., 2014). Typical examples of such applications cover education and awareness, including journaling; remote data collection that allows users to log and chart data about their health; remote monitoring making use of pedometers, blood pressure monitors and other devices; communication and training for healthcare workers; disease and epidemic outbreak tracking; and diagnostic and treatment support (Curioso and Mechael, 2010; Hampshire et al., 2015; Varshney, 2014).

In order to distinguish between various mHealth applications, Varshney (2014) proposed a classification system to categorise various mHealth functions (see Table 1). The system distinguishes between different types of users (healthcare worker or mobile user) as well as the purpose of the mHealth application (automating healthcare processes or providing assistance to the mobile user). Varshney (2014) classified mHealth applications as either (a) patient centric (automated: mobile personal health records, human assisted: mobile health monitoring) or (b) provider centric (automated: mobile medical reference, human assisted: mobile decision-making).

Characteristics of mobile health technology

Adoption of mobile devices to access healthcare information has been assisted by the decline in the price of both smartphones and data prices, improved portability of mobile phones, and comfort of students using mobile phones (Dwivedi et al., 2016; Varshney, 2014). Akter et al. (2013) suggested that characteristics of mobile phones include:

- *Accessibility*: Mobile phones use existing ICT infrastructure and thus provide access to healthcare information by lowering cost and providing wider coverage (Curioso and Mechael, 2010; Dwivedi et al., 2016). Coupled with the popularity of mobile communication among students, mobile phones are expected to provide many exciting opportunities to improve the quality of healthcare in this age group.
- *Security concerns*: Confidentiality, data integrity, and availability of stored information. Confidentiality of patient information can be compromised if the mobile device is stolen as it may impact on the security of confidential digital health records or data held on mobile phones. Some studies warn of the security risks of using mobile instant messaging in healthcare, most popular among students (Barnes et al., 2007; Hampshire et al., 2015).
- *Immediacy*: Accessing the Internet on a mobile phone provides immediate relevant, targeted, and timely information (Varshney, 2014).
- *Mobility*: One of the advantages of a mobile phone is that it can be taken with users wherever they go. Mobile phones provide inexpensive health information services across a distance (Akter et al., 2013). Limitations of mobile devices include internal storage capacity, processing power, and screen size, which can require applications to run in a reduced format. However, the increased popularity of cloud computing resources external to the

mobile device may remove these obstacles in future (Kailas et al., 2010).

The current research

To date there has been limited research that has focused specifically on outcome-based evidence for the use of mobile technology to access and promote health information, especially among young adult university students (Betjeman et al., 2013; Kahn et al., 2010; Motamarri et al., 2012). The aim of this study was to evaluate mobile phone usage to access health-related information in young university students at a traditional university in the Eastern Cape, South Africa, in order to provide outcome-based evidence to support initiatives aimed at improving individual and community health (Standing and Standing, 2008).

For the purposes of this article, only the mobile medical reference classification will be referred to, as students were expected to make use of their mobile devices in order to access health information from the Internet.

Theoretical review and hypothesis development

Unified theory of acceptance and use of technology

In order to investigate the students' acceptance of using mobile phones to seek health information in South Africa, the unified theory of acceptance and use of technology (UTAUT) was chosen as an appropriate theoretical framework for the study. The UTAUT can be used to explain behavioural intention to use a technology, as found in previous studies (e.g. Magsamen-Conrad et al., 2015; Parameswaran et al., 2015; Venkatesh et al., 2003). Despite students being the most active mobile phone users, to date few studies have focused on students' adoption of mobile device technology to access health information (Al-Emrana et al., 2016; Dehzad et al., 2014; Khatun et al., 2016). The behavioural intention of students in this area is, therefore, unclear and warrants further investigation. The UTAUT model consists of four key constructs: performance expectancy, effort expectancy, social influence (SI) and facilitating conditions. Since the inception of UTAUT, it has become a baseline model in this area of technology adoption and has been tested in a variety of settings, including health information systems. An overview of the results of these studies follows.

Performance expectancy (perceived usefulness)

Making use of a mobile device to search for health information has been reported to have a high degree of perceived usefulness (PU) among mobile phone users as it provides easy, cost-effective and useful solutions. At a national level, the adoption and use of mobile phones in developing countries stems from the use of existing mobile infrastructure, coupled with the massive penetration of mobile phone networks and availability of low-cost smartphones in these countries (Akter et al., 2013). This is evident from the popularity of mHealth services in developing countries such as India, Mexico, Pakistan and South Africa (Kahn et al., 2010), given the ease of access to mobile services technology (Deloitte, 2016). These services make use of text, video and voice-based mHealth services to provide users with access to both non-emergency (advice about common healthcare conditions) and emergency services (requesting emergency services) from a mobile phone (Akter and Ray, 2010). At the individual level, young adults are also able to upload their health data, for example, exercise data, blood glucose levels or peak flow readings, to health providers' servers in real time, which enables early detection of critical events. In addition, young adults can view their data in user-friendly formats which allow them to take ownership of their own health (Hampshire et al., 2015). Thus the associated hypothesis within this research context can be stated as follows:

> **H1**: Perceived usefulness is a predictor of the behavioural intention to make use of mobile phones to seek health-related information.

Effort expectancy (perceived effort)

Young adults have been referred to as 'digital natives' as they have been born in the era of computers, video games, mobile phones and the Internet. ICT has been a integral part of the lives of young adults from an early age, to the extent that many cannot remember a time before mobile phones and the Internet (Hampshire et al., 2015). Therefore, effort expectancy was not predicted to be a determining factor in the acceptance of mobile devices to search for health information in this age group. Nevertheless, the ease of use of the mobile health technology should still be investigated. Usability factors such as screen size, processor power, memory, bandwidth, and battery life can all influence effort expectancy and acceptance in the mHealth user (Akter and Ray, 2010). Interoperability of applications is another issue to be taken into account, as the user must make use of numerous applications to monitor or obtain information about different conditions. This approach is unlikely to be sustained in the long-term, so the adoption of mobile devices to access health information may depend on the willingness and capability of users to incur costs to make use of the technology (Tomlinson et al., 2013). Telecommunication costs in South Africa are considered expensive (Deloitte, 2016), which creates a barrier to students who would like to make use of mobile devices to access health-related content. With this in mind, the second hypotheses for this study was:

> **H2**: Perceived effort is a predictor of the behavioural intention to make use of mobile phones to seek health-related information.

Social influence

The World Health Organization has identified lack of knowledge and awareness about the availability of health information on the Internet as a barrier to the adoption of mHealth services (Akter and Ray, 2010; Akter et al., 2013).

Knowledge and awareness about technology contribute to the level of comfort students have to search for health information making use of their mobile phones. Therefore, it was hypothesised that:

H3: Social influence is a predictor of the behavioural intention to make use of mobile phones to seek health-related information.

Facilitating conditions

An individual's attitude towards technology (AT) as well as his or her previous experience with mobile technology may facilitate or inhibit the use of a mobile phone to access health information. Conditions that influence against the adoption of mobile devices to search for health information include poor ICT infrastructure and interoperability, lack of legislature, information privacy, and limited technical capacity or poor AT (Chan and Kaufman, 2010). Where mobile coverage is not available or mobile devices have battery or access problems, the use of technology may not even be possible (Chib et al., 2014). Therefore, some scholars caution that the mHealth services appropriate for developing countries must be evaluated in more depth (Varshney, 2014). Hampshire et al. (2015) argued that the many informal ways in which students use mobile phones for health-related purposes have not been well-documented. Their study reported that only a few students had ever heard of mHealth programs and fewer still had participated in such programs. However, most reported they had used their mobile phones to seek healthcare information.

In addition, the very experience of using a mobile device, including the resultant concerns about privacy and security concerns relating to a physical device used to access health information, which may be stolen or misplaced, could influence the attitudes of users and impact on their future use intentions (Akter et al., 2013). Based on literature pertaining to facilitating conditions, the following two hypotheses were formulated:

H4: Attitude towards technology is a predictor of the behavioural intention to make use of mobile phones to seek health-related information.

H5: Mobile experience is a predictor of the behavioural intention to make use of mobile phones to seek health-related information.

Method

The study adopted a cross-sectional survey research design and a quantitative approach to analyses.

Participants and procedure

Data were collected from university students ($n = 202$) at two campuses of a traditional university, using a convenience sampling technique. This type of non-probability sampling technique is often used when study participants are readily available. Students were approached on campus and informed about the nature of the study. Upon agreeing to participate, they were asked to read a set of instructions that explained the purpose of the research and assured each respondent's anonymity. Participation was voluntary, and the students were told they could withdraw at any time.

Research instrument

UTAUT provided the theoretical framework for the study and underpinned the data collection survey instrument, which was adapted for the purposes of the study (Venkatesh et al., 2012). The survey consisted of three sections. Section A (five questions) solicited demographic information from respondents and Section B (30 questions) solicited responses on mobile technology and health statements. Section C (three questions) requested open-ended responses regarding mobile technology/health (see Appendix 1 for a copy of the mHealth questionnaire). Although extensive measures were taken to secure as many completed questionnaires as possible, some participants did not provide responses, especially with regard to the biographical section. Given the study sought to test the model in Figure 1, the omission of biographical data did not affect the testing of the model.

Research model

A research model was formulated to determine which factors influenced the adoption of mobile technology to access health-related content among the student population. Selected potential relationships are described in Figure 1.

The survey instrument was made up of tried and tested scales that measured mobile device acceptance across six variables: (i) effort expectancy (Akter and Ray, 2010); (ii) AT (Compeau and Higgins, 1995; Simonson et al., 1987); (iii) mobile experience (ME) (Lim et al., 2014); (iv) SI (Davis et al., 1989); (v) perceived ease of use (Davis et al., 1989); and (iv) behavioural intention to use (Ajzen, 1991). All variables were measured on a 5-point Likert-type scale (1= *strongly disagree* to 5 = *strongly agree*) (see Appendix 1).

Reliability scores for scales included in the survey instrument were as follows: AT (3 items), $\alpha = 0.73$; ME (4 items), $\alpha = 0.83$; PU (3 items), $\alpha = 0.76$; SI (2 items), $\alpha = 0.64$; behavioural intention to use (3 items), $\alpha = 0.70$; and effort expectancy (4 items), $\alpha = 0.58$. As these scores demonstrate, empirical reliability for the majority of variables met the recommended threshold for reliability, as suggested by Nunnally (1978), apart from *effort expectancy*, which reported a low reliability reading of 0.58. Attempts to improve the reliability of this scale did not yield visibly improved results. However, because 'effort expectancy' occupies a pivotal role in UTAUT theory, as well as being an independent variable in this study, a decision was made to retain the scale in its current form and continue with a factor analysis to test validity.

Pre-testing and pilot testing of the instrument was conducted using a sample of students fitting the same profile and status as the sample used in the current research. Items were

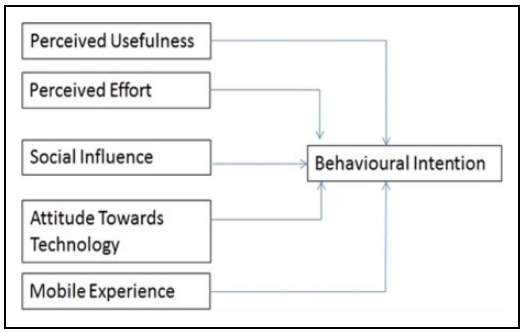

Figure 1. Research model.

modified for relevance to the aims of the research based on feedback provided. Ethical clearance was obtained from the University of Fort Hare Ethics Committee.

Data analyses

Statistical analyses were carried out using IBM SPSS V22. Based on Cronbach alpha coefficients (α), which provided verification of the internal consistency of measuring instruments (Clark and Watson, 1995; Nunnally, 1978) and of reliability and mean inter-item correlations for testing internal construct consistencies in study, and results of the Kaiser-Meyer-Olkin measure of sampling adequacy (Kaiser, 1970; Kaiser, 1974) and Bartlett's test of sphericity (Bartlett, 1954), the data were deemed suitable for factor analysis. Thus, an exploratory factor analysis and confirmatory factor analysis were conducted to determine the validity of the constructs and relevant scales.

Results

Demographic data

Sample characteristics of the 202 respondents to this study are shown in Table 1. Of those who responded to the relevant question, 51.5% were female and 28.7% were male; the majority (71%) were between 18 and 27 years of age; 75% were of Black African ethnicity, and 67.8% reported that their mobile phone usage experience was either *good* or *excellent.*

Statistical analyses

Summary statistics provided counts, percentages and distribution of measures at factor level. Exploratory and confirmatory factor analyses were used to test for unidimensionality and content validity of constructs. Linearity and directionality of relationships were established, firstly via correlation and, secondly, by regression analysis.

Suitably high correlations between the independent and dependent variables ensured that an excessive degree of multicollinearity between the independent variables did not exist (see Table 2); and tolerance values were significantly large enough (0.902, 0.834, 0.839 and 0.811) to demonstrate a lack of multi-collinearity, and variable inflation factor values (1.109, 1.200, 1.191 and 1.233) were also

Table 1. Characteristics of respondents ($n = 202$).

Item	Category	Frequency	%
Gender	Male	58	28.70
	Female	104	51.50
	Did not indicate	40	19.80
Age	18–27	144	71.30
	28–37	13	6.44
	38 or older	1	0.50
	Did not indicate[a]	44	21.80
Ethnicity	Black African	152	75.20
	Coloured	5	2.50
	White	5	2.50
	Did not indicate[a]	40	19.80
Mobile phone usage experience	Excellent	64	31.7
	Good	73	36.1
	Average	19	9.4
	Poor	2	1
	Did not indicate[a]	44	21.8

[a]Respondents did not specify.

deemed acceptable (Pallant, 2013), thus demonstrating that the assumption of multicollinearity would not be violated in the resulting model. Other assumptions pertaining to outliers, normality, linearity, homoscedasticity, and independence of residuals were considered by examining the normal probability plot of the regression standardised residual and scatterplot. These assumptions appeared to also have been met (see Table 2).

Table 3 shows the rotated component matrix with Varimax adopted as a rotation method. Several items were removed from some of the independent variables in order to achieve this factor analysis result. The attitude technology scale was reduced to three items, the ME scale was reduced from five to four items, PU was also reduced to three items and while SI was reduced from five to two items. Empirical reliability was then re-checked in order to ensure that satisfactory Cronbach α was achieved. Overall reliability and validity for these variables were considered satisfactory at the recommended threshold of 0.70 (Clark and Watson, 1995; Nunnally, 1978). The perceived effort scale was once again deemed to be weak as it reflected minimal validity across items; thus, the scale and variable were removed from the model. A possible explanation for this could be that using a mobile phone, especially for the student community, does not require much effort. This could possibly reflect the weak reliability and validity for this scale.

In terms of the analysis of variance results, the R^2 value indicated that the proposed model explained 0.356 (36%) of the variance in behavioural intention to use mobile devices to search for health-related queries. This result was deemed acceptable and the proposed model was considered statistically significant at 0.000, indicating that multiple R in the population did not equal 0.

Table 4 reveals how the variables in the model contributed to the prediction of the intention to use mobile devices to search for health-related queries. The β value for PU was 0.387, making it the largest contributor to the model, and

Table 2. Correlations of variables.

	Behavioural intention	Attitude towards technology	Mobile experience	Perceived usefulness	Social influence
Pearson correlation: Behavioural intention	1.000	−0.106	0.388	0.516	0.304
Attitude toward technology	−0.106	1.000	0.083	−0.045	0.287
Mobile experience	0.388	0.083	1.000	0.347	0.293
Perceived usefulness	0.516	−0.045	0.347	1.000	0.254
Social influence	0.304	0.287	0.293	0.254	1.000
Sig. (1-tailed): Behavioural intention	–	0.077	0.000	0.000	0.000
Attitude toward technology	0.077	–	0.164	0.278	0.000
Mobile experience	0.000	0.164	–	0.000	0.000
Perceived usefulness	0.000	0.278	0.000	–	0.000
Social influence	0.000	0.000	0.000	0.000	–
N: Behavioural intention	192	184	141	177	187
Attitude toward technology	184	194	142	177	186
Mobile experience	141	142	145	138	142
Perceived usefulness	177	177	138	182	177
Social influence	187	186	142	177	193

Table 3. Component matrix rotation.

Variable	Component 1	Component 2	Component 3	Component 4
ME1	0.84			
ME2	0.78			
ME3	0.78			
ME4	0.77			
PU2		0.85		
PU1		0.83		
PU3		0.73		
AT1			0.79	
AT2			0.76	
AT3			0.70	
SI1				0.86
SI2				0.85

ME: mobile experience, PU: perceived usefulness; AT: attitude towards technology; SI: social influence

the largest predictor of behavioural intention to use mobile devices to search for health-related information. Mobile experience was the second highest predictor of intention to use, with a β coefficient of 0.211. Social influence and AT occupied third and fourth predictor positions, with β values of 0.190 and 0.160 respectively. With respect to the significance of these relationships, all four predictor variables made statistically significant contributions to the equation (0.030, 0.006, 0.000 and 0.015).

With respect to the hypotheses, hypotheses 1–5 were supported, while hypothesis 2 was rejected.

Discussion

The study examined students' acceptance of using mobile phones to seek health information in South Africa. The receptiveness of students to seek health information on their mobile phones was investigated by applying the UTAUT framework and its variables (Ajzen, 1991; Compeau and Higgins, 1995; Davis et al., 1989; Lim et al., 2014). The study not only concurs with past literature regarding the strong predictive power of UTAUT framework and its applicability in studying technology adoption (Compeau and Higgins, 1995) but also showed support for this mobile technology-related framework (Akter and Ray, 2010; Akter et al., 2013). Furthermore, the study also demonstrated the popularity of mobile phones amongst the student population (Robinson, 2011) particularly with regard to seeking health information.

The majority of the students (77.2%) indicated that they considered their experience with smartphones as above average. Based on these findings, students were likely to use their mobile phones to access health information if they perceived their devices to be useful and easy to use for this activity. Thus, the usage of mobile devices was directly related to aspects covered in the UTAUT framework. Subsequently, this related to behavioural intention to use. The implication here could be that the use of mobile phones to access health information is related to the utility offered by this activity. As a result, it can be assumed based on the findings of this work that the UTAUT serves as a useful conceptual tool for understanding technological adoption.

Limitations and future research directions

Our study had several limitations. First, we used a convenience sample, which suggests that its findings may not be generalisable to the larger population. Future research could make use of a larger sample from more universities in order to compare the results between the various institutions and their respective provinces in South Africa. Second, we used cross-sectional data, which limits our ability to establish causality. Third, we used self-report data. As such, social desirability may be a potential threat to the validity of this study. In future, researchers should brief participants on what kind of sensitive information they will have to share in a study if privacy concerns and risk beliefs are included as constructs in the model.

Future research should examine additional covariates (e.g., geographic locale, educational background) to

Table 4. Summary of research model.

Coefficients					
	Unstandardized coefficients		Standardized coefficients		
Model	*B*	Standard error	β	*t*	Sig.
Constant	4.352	1.033		4.212	0.000
Attitude toward technology	−0.137	0.062	−0.160	−2.189	0.030
Mobile experience	0.109	0.039	0.211	2.770	0.006
Perceived usefulness	0.403	0.079	0.387	5.102	0.000
Social influence	0.220	0.090	0.190	2.458	0.015

determine if these variables influence risk perception and technology adoption. As technology-based interventions are diffused into society, future studies should assess individuals who have used a mobile phone to determine if there are specific components of the intervention that are perceived as barriers to use. For example, Youn (2009) found that privacy-concerned students avoided online sites that required registration as a strategy to protect privacy. Thus, it may be that the specific concerns of students making use of mobile phones warrants investigation before widespread implementation. Further research into the types of health information students seek when using mobile devices also needs to be carried out.

Conclusion

The current study has answered calls for an empirical focus on work that seeks to investigate the adoption of mobile phones to seek health information among young adults from a micro to macro level (Dehzad et al., 2014; Kazemi et al., 2014). This research extends beyond the acknowledgement of the contribution of ICT to the access of healthcare (Fichman et al., 2011) by uniquely showing how mobile devices can be used in seeking health information. In essence, the findings of this study suggest that when used to seek health information, the mobile phone served not only as a monitoring device but also as a diagnostic and treatment tool (Curioso and Mechael, 2010; Varshney, 2014). Another contribution of this study is its use of a sample group of students who remain an understudied population (Varshney, 2014), especially within a developing country such as South Africa.

This research has implications for theory and practice. First, the research supports and adds to the body of knowledge concerning the use of the UTAUT framework and its applicability in studying technology adoption. This helps advance understanding about the relevance of such a framework as far as technology adoption is concerned (Akter et al., 2013; Kahn et al., 2010; Venkatesh et al., 2003). By subjecting this framework to scrutiny, as has been done by this research, constant improvement of the framework is facilitated. Second, the findings of this research can be considered useful for other universities and similar contexts, given the limited empirical evidence in the implementation of mHealth initiatives. Health programs for students could benefit immensely if they include mobile phones as a channel to distribute information. The study has led to the conclusion that the marketing of health information to students can be achieved via mobile phones in a cheaper and more convenient way for students to access health information. This has specific implications for the South African National Department of Health's marketing budget and their approach to the healthcare of young people in South Africa.

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References

Ajzen I (1991) The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50(2): 179–211.

Akter S and Ray P (2010) mHealth – an ultimate platform to serve the unserved. *Medical Yearbook of Informatics* 75–81.

Akter S, D'Ambra J and Ray P (2013) Development and validation of an instrument to measure user perceived service quality of mHealth. *Information and Management* 50(4): 181–195.

Al-Emrana M, Elsherifa HM and Shaalana K (2016) Investigating attitudes towards the use of mobile learning in higher education. *Computers in Human Behavior* 56: 93–102.

Barnes E, Hasvold P, Henriksen E, et al. (2007) Risk analysis of information security in a mobile instant messaging and presence system for healthcare. *International Journal of Medical Informatics* 76: 677–687.

Bartlett MS (1954) A note on the multiplying factors for various chi square approximations. *Journal of the Royal Statistical Society* 16(B): 296–298.

Betjeman T, Sognoian S and Foran M (2013) mHealth in Sub-Saharan Africa. *International Journal of Telemedicine and Applications*. http://dx.doi.org/10.1155/2013/482324

Boumphrey S (2012) Special report: the world's youngest populations. Euromonitor International Market Research, News & Resources. Available at: http://blog.euromonitor.com/2012/02/special-report-the-worlds-youngest-populations.html (accessed 25 March 2017).

Chan C and Kaufman D (2010) A technology selection framework for supporting delivery of patient-orientated health

interventions in developing countries. *Journal of Biomedical Informatics* 43(2): 300–306.

Chib A, van Velthoven M and Car J (2014) mHeatlh adoption in low-resource environments: a review of the use of mobile healthcare in developing countries. *Journal of Health Communication: International Perspectives* http://dx.doi.org/10.1080/10810730.2013.864735

Chirinda W and Zungu N (2016) Health status and years of sexually active life among older men and women in South Africa. *Reproductive Health Matters* 24(48): 14–24.

Clark LA and Watson W (1995) Constructing validity: basic issues in scale development. *Psychological Assessment* 7: 309–319.

Compeau DR and Higgins CA (1995) Computer self-efficacy: development of a measure and initial test. *MIS Quarterly* 19: 189–211.

Curioso W and Mechael P (2010) Enhancing m-health with south to south collaborations. *Health Affairs* 29(2): 264–267.

Davis FD, Bagozzi RP and Warshaw PR (1989) User acceptance of computer technology: a comparison of two theoretical models. *Management Science* 35(85): 982–1003.

Dehzad F, Hilhorst F, de Bie C, et al. (2014) Adopting health apps, what's hindering doctors and patients? *Health* 6: 2204–2221.

Deloitte's (2016) *Deloitte's Mobile Consumer Survey: Game of Phones*. Available at: https:www2.deloitte.com/ . . . /Deloitte/ . . . /technology . . . /ZA_Deloitte-Mobile Consumer. (accessed 18 April 2017).

Dwivedi T, Shareef MA, Simintiras AC, et al. (2016) A generalised adoption model for services: a cross-country comparison of mobile health (m-health). *Government Information Quarterly* 33: 174–187.

Fichman R, Kohli R, Krishnan R, et al. (2011) Editorial overview - the role of information systems in healthcare: current research and future trends. *Information Systems Research* 22(3): 419–428.

Hajdu F, van Blerk L and Robson E (2016) AIDS-affected young people's access to livelihood assets: exploring 'new variant famine' in rural Southern Africa. *Journal of Rural Studies* 46: 23–34.

Hampshire K, Porter G, Owusu SA, et al. (2015) Informal m-health: how are young people using mobile phones to bridge healthcare gaps in Sub-Saharan Africa? *Social Science and Medicine* 142: 90–99.

Kahn J, Kahn J and Yang J (2010) Mobile health needs and opportunities in developing countries. *Health Affairs* 29(2): 254–261.

Kailas A, Chong CC and Watanabe F (2010) From mobile phones to personal wellness dashboards. *IEEE Pulse* 7(8): 57–63.

Kaiser H (1970) A second generation Little Jiffy. *Psychometrika* 35: 401–415.

Kaiser H (1974) An index of factorial simplicity. *Psychometrika* 39: 31–36.

Kazemi D, Cochran A, Kelly J, et al. (2014) Integrating mHealth mobile applications to reduce high-risk drinking among underage students. *Health Education Journal* February: 73–79.

Khatun F, Heywood AE, Ray PK, et al. (2016) Community readiness for adopting mHealth in rural Bangladesh: a qualitative exploration. *International Journal of Medical Informatics* 93: 49–56.

Kinnula M and Ijas T (2012) On the brink of adulthood: a qualitative study of adolescent engagement with the Internet. In: *Proceedings of the 7th Nordic conference on human-computer interaction: making sense through sesign*, 14 October 2012, Copenhagen, Denmark, pp. 418–428. Copenhagen: ACM.

Lim S, Xue L, Yen CC, et al. (2014) A study on Singaporean women's acceptance of using mobile phones to seek health information. *International Journal of Medical Informatics* 80: 189–202.

Magsamen-Conrad K, Upadhyaya S, Joa CY, et al. (2015) Bridging the divide: using UTAUT to predict multigenerational tablet adoption practices. *Computers in Human Behavior* 50: 186–196.

Motamarri S, Akter S, Ray P, et al. (2012) Mhealth: a better alternative for healthcare in developing countries. *Pacific Asia Conference on Information Systems*, pp. 117–134, Vietnam, AISeL.

Nunnally JC (1978) *Psychometric Theory*. New York: McGraw-Hill.

Pallant J (2013) *SPSS Survival Manual*. Berkshire: McGraw Hill.

Parameswaran S, Kishore R and Li P (2015) Within-study measurement invariance of the UTAUT instrument: an assessment with user technology engagement variables. *Information & Management* 52: 317–336.

Patton G, Coffey C, Sawyer S, et al. (2009) Global patterns of mortality in young people: a systematic analysis of population health data. *The Lancet* 374: 881–892.

Robinson E (2011) *Generation mobile: cell-phone use overwhelming in college students*. Available at: http://www.wxyz.com/dpp/news/generation-mobile-cellphone-use-overwhelming-in-college-students (accessed 11 August 2014).

Sarasohn-Kahn J (2010) *How Smartphones are Changing Health Care for Consumers and Providers*. Oakland: California HealthCare Foundation.

Shava H, Chinyamurindi W and Somdyala A (2016) An investigation into the usage of mobile phones among technical and vocational educational and training students in South Africa. *South African Journal of Information Management* 18(1): 1–8.

Simonson MR, Maurer M, Montag-Torardi M, et al. (1987) Development of a standardised test of computer literacy and technology anxiety index. *Journal of Educational Computing Research* 3(2): 231–247.

Standing S and Standing C (2008) Mobile technology and healthcare: the adoption issues and systemic problems. *International Journal of Electronic Healthcare* 4(3/4): 221–236.

South African Health Department (2015) *mHealth Strategy: 2015 – 2019*. Pretoria: Government Printers.

Tomlinson M, Rotheram-Borus M, Swartz L, et al. (2013) Scaling up mHealth: where is the evidence? *PLoS Med* 10(2): 1–5.

Trelease RB (2008) Diffusion of innovations: smartphones and wireless anatomy learning resources. *Anatomical Sciences Education* 1: 233–239.

Varshney U (2014) A model for improving quality of decision in mobile health. *Decision Support System* 62: 66–76.

Venkatesh V, Morris M, Davis G, et al. (2003) User acceptance of information technology: toward a unified view. *MIS Quarterly* 27(3): 425–478.

Venkatesh V, Thong JYL and Xu X (2012) Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly* 36: 157−178.

Youn S (2009) Determinants of Online Privacy Concern and its Influence on Privacy Protection Behaviors among Young Adolescents. *The Journal of Consumer Affairs*, 43(3): 389–418.

Yu P, Wu MX, Yu H and Xiao GQ (2006) The Challenges for the Adoption of M-Health. In: *Proceedings of the 2006 IEEE International Conference on Service Operations, Logistics and Informatics*, 21–23 June 2006, Shangai, China, pp. 181–186.

World Health Organization (2014) World Health Statistics 2014. Available at: http://apps.who.int/iris/bitstream/10665/112738/1/9789240692671_eng.pdf?ua=1 (accessed 05 January 2017).

Appendix 1

mHealth Questionnaire

Dept of Business Management / Dept of Information Systems Oct 2014
Questionnaire: The use of mobile technologies to search for health-related information

Dear Respondent,

We are currently conducting research on the use of tablets and mobile phones (collectively referred to as mobile devices) to search for health or medical information. It would be greatly appreciated if you could complete the below questionnaire; it will only take 5 min of your time. All you need to do is indicate the correct answer in relation to the statement provided; either tick or cross the answer relevant to you. Please try to be as honest as possible when answering the questions. We assure anonymity to all participants in the survey.

If you have any questions regarding this study please do not hesitate to contact Dr Kim Viljoen (kviljoen@ufh.ac.za). We thank you for your contribution to this research project.

Yours sincerely,

Dr Willie Chinyamurindi, Dr Liezel Cilliers and Dr Kim Viljoen

A. Demographic information (please tick/cross the appropriate block)

Gender	Male		Female	
Age	18–27	28–37	38–47	48 or older
Ethnicity	African	Coloured	White	Indian
Home language	Xhosa	English	Afrikaans	Other
Please indicate your level of experience at working mobile devices	Excellent	Good	Average	Poor

B. Mobile technology/health statements (please tick/cross the appropriate block)

Statement codes	Statement number	Please put a cross/tick in the appropriate block indicating whether you strongly disagree, disagree, neither agree nor disagree, agree or strongly agree with each of the following statements	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
TA1	1	Using my mobile device to seek health information would make me very nervous	1	2	3	4	5
PEU1	2	I expect that learning how to use my mobile device to access health information would be easy for me	1	2	3	4	5
PU1	3.	Using my mobile device can be useful in managing my daily health	1	2	3	4	5
PU2	4.	Using my mobile device to search for medical information can be beneficial to me	1	2	3	4	5

(continued)

Appendix (continued)

Statement codes	Statement number	Please put a cross/tick in the appropriate block indicating whether you strongly disagree, disagree, neither agree nor disagree, agree or strongly agree with each of the following statements	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
MEMD1	5.	Over the past 6 months, I have used my mobile device to search the Internet to browse health-related content (e.g. on illness, general physical and mental well-being, exercise, diet and nutrition)	1	2	3	4	5
TA2	6.	Using my mobile device to seek health information makes me worried	1	2	3	4	5
SE1	7.	I can see myself using my mobile device to seek health information if I have used a similar application before	1	2	3	4	5
PEU2	8.	I expect that my interaction with my mobile device to access health information would be clear and understandable	1	2	3	4	5
PU3	9.	Using my mobile device can be valuable to my healthcare	1	2	3	4	5
SE2	10.	I can see myself using my mobile device to seek health information if someone teaches me how to	1	2	3	4	5
PEU3	11.	I would find using my mobile device to access health information to be easy to use	1	2	3	4	5
BI1	12.	I intend to use my mobile device features in the future to search for medical information	1	2	3	4	5
TA3	13.	Using my mobile device to seek health information may make me feel uncomfortable	1	2	3	4	5
PEU4	14.	I expect that it would be easy for me to become skilful at using my mobile device to access health information	1	2	3	4	5
BI2	15.	I expect that I would use my mobile device features in the future to search for health-related information	1	2	3	4	5
MET2	16.	Over the past 6 months, I have used my tablet to search the Internet for health-related information	1	2	3	4	5
TA4	17.	Using my mobile device to seek health-related information may make me feel confused	1	2	3	4	5
UTAUT1	18.	People who influence my behaviour think I should use my mobile device to seek medical advice	1	2	3	4	5
UTAUT2	19.	People who are important to me think I should use my mobile device to seek medical advice	1	2	3	4	5
BI3	20.	I expect to use my mobile device features frequently in the future to search for medical information	1	2	3	4	5
PU4	21.	Using my mobile device can be advantageous in better managing my health	1	2	3	4	5
UTAUT3	22.	I have access to resources that can assist me if I experience difficulties while using my mobile device to search for medical information	1	2	3	4	5
SE3	23.	I can see myself using my mobile device to seek health information if I have time to try it out	1	2	3	4	5
UTAUT4	24.	Making use of a mobile device to seek health information is a good idea	1	2	3	4	5
UTAUT5	25.	I like making use of my mobile device to seek health information	1	2	3	4	5
MEMP1	26.	Over the past 6 months, I have used my mobile phone to search the Internet for health-related information	1	2	3	4	5
SE4	27.	I can see myself using my mobile device to seek health information if I can afford it financially	1	2	3	4	5
MET1	28.	Over the past 6 months, I have used my tablet as a source of medical information	1	2	3	4	5
MEMP2	29.	Over the past 6 months, I have used my mobile phone as a source of medical information	1	2	3	4	5
MEMD2	30.	Over the past 6 months, I have used my mobile device to search the Internet for health-related information	1	2	3	4	5

C. Mobile technology/health open-ended questions

(please fill in your answers in the spaces provided below)

31. In the past what types of health-related queries have you searched for?

_____

_____

32. What kinds of apps do you generally use for health-related queries?

_____

_____

33. What are the most popular websites that you consult for health-related queries?

_____

_____

Thank you very much for your participation in this survey!!

KEY:

UTAUT: Unified theory of use and acceptance of technology
SE: Self-efficacy
TA: Technological anxiety
PU: Perceived usefulness
PEU: Perceived ease of use
BI: Behavioural intention
MEMD: Mobile experience mobile device
MEMP: Mobile experience mobile phone
MET: Mobile experience tablet