Determinants of mobile health (M-Health) application adoption, usage and discontinuity among corporate workers diagnosed with hypertension and diabetes

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Abstract

Purpose – This study examined the determinants of mobile health (M-Health) application, adoption, usage and discontinuation among corporate workers diagnosed with hypertension and diabetes in Ghana.

Design/methodology/approach – The diffusion innovation and reasoned action theories were employed using an exploratory design. Three hundred corporate workers diagnosed with diabetes and hypertension from three health facilities for the past six months were sampled for the study using a multi-stage sampling technique and administered questionnaires. Descriptive statistics and logistic regression tools were employed in the analysis of data.

Findings – The study found a significant number of factors influencing m-health applications adoption, usage and discontinuity. These factors include nature and demand of job, perceived advantage, compatibility, complexity, triability, aesthetics and trust. Aesthetics emerged as the strongest predictive factor for the adoption, usage and discontinuity of use among diabetic and hypertensive corporate workers. With the adoption of M-Health applications, compatibility, as well as nature and demand of job, were significant predictors. With the usage of M-Health applications, complexity, triability, aesthetics and trust were significant predictors. Moreover, perceived advantage, compatibility, complexity and triability influenced significantly the choice to discontinue using M-Health applications. The study concluded that M-Health application functionalities play a valuable role in patients' intention to adopt, use and discontinue the use of an M-Health application in Ghana.

Originality/value – This exploratory study offers in-depth insight into how major M-Health application features affect its adoption, usage and discontinuity, providing crucial information for future research and the improvement of chronic condition healthcare delivery.

Keywords M-Health, Adoption, Usage and discontinuity, Diabetes, Hypertension

Paper type Research paper

1. Introduction

The World Health Organization (WHO) estimated that by 2020, Diabetes and Hypertension will account for more than 50% of the global burden of diseases, resulting in 5 out of every 10 deaths in developing countries. This is because, in recent years, non-communicable diseases (NCDs) such as hypertension, diabetes and cancers have become an emerging pandemic globally with disproportionately higher rates in developing countries (Gowshall and Taylor-robinson, 2018) (Latif *et al.*, 2018). Ghana is said to be experiencing a double burden of disease thus a higher incidence and prevalence of both communicable and non-communicable diseases (Tutu and Busingye, 2020). The diabetes prevalence in Ghana is 5% in females and 4.6% in males (WHO, 2016). The prevalence of adult hypertension is consistently high in both urban and rural areas ranging between 19 and 48% (Bosu and Bosu, 2021). Despite this, recent statistics have shown a rise in hypertension cases in Ghana with the prevalence rate

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being 27.0% (Anderson, 2017). Consistent with this (Bosu and Bosu, 2021), using meta-analysis indicated that in individual studies, the prevalence of hypertension, defined in most cases as blood pressure ≥140/90 mmHg, ranged from 2.8% to 67.5%. The pooled prevalence from the meta-analysis was 27.0% (95% CI 24.0–30.0%), being twice as high in the coastal (28%, 95% CI: 24.0–31.0%) and middle geo-ecological belts (29%, 95% CI: 25.0–33.0%) as in the northern belt (13%, 95% CI: 7.0–21.0%) of Ghana (Bosu and Bosu, 2021). Additionally, statistics show that the overall prevalence of diabetes mellitus among adult Ghanaians was high at 6.64% (95% CI: 4.66–8.26%) based on the inverse-variance random-effects model (Asamoah-boaheng *et al.*, 2019).

Poor Diabetes and hypertensive care can lead to complications which are the major cause of morbidity and mortality (Peres *et al.*, 2018). The major factors that contribute to this disappointing situation are, namely: (a) an inefficient health system unable to cope with the care of chronic diseases and unwilling to invest in appropriate technology; (b) inadequate knowledge and experience of health care providers on the quality management of chronic conditions, (c) inappropriate providers' attitude toward application of guidelines, (d) limited patient access to care, (e) poor compliance with self-care and treatment (Holman, 2020) (Schwarz *et al.*, 2022). These factors influence the rate of morbidity and mortality of diabetes and hypertensive cases in Ghana. This (Climie *et al.*, 2019) argued can lead to damage to the arteries, and high blood pressure, which if not treated, can lead to trouble including blood vessel damage, heart attack, and kidney failure.

There are numerous innovations to improve the quality of hypertension and diabetes care, of which the application of M-Health is key. M-Health refers to the practice of medicine and public health supported by mobile devices (Adibi, 2015). The most common application of M-Health is the use of mobile devices to educate patients about preventive healthcare services. However, M-Health is also used for disease surveillance, treatment support, epidemic outbreak tracking and chronic disease management. The use of mobile phones (M-Health) to access healthcare including treatment, management, emergency medical response and education is gaining attention worldwide as a complementary strategy for strengthening health systems emphasizing the role of current environmental and technological improvements in the lives of people (Peprah *et al.*, 2019). Mobile devices and the Internet are growing rapidly in the low-and middle-income countries (LMICs) and have been recognized as powerful tools for improving efficiency in the health sector (Peprah *et al.*, 2019). The increasing growth and availability of mobile devices have the potential to contribute to improving chronic disease management in which self-management is crucial, for example in the management of hypertension and diabetes; functions like chatting and messaging with services providers, connections to external devices, for example, heart rate measurement and monitoring of blood glucose or blood pressure, support of medication, as well as physical activity tracking and nutrition behavior is very important.

In light of this, the attention given to mobile device use within our healthcare system has increased considerably. The level of attention by healthcare providers and researchers to mobile health device applications has been attributed to a significant number of factors including pervading and ubiquitous nature of mobile devices. Recent estimates by (National Communication Authority, 2016), show that approximately 20 million phones were used across Ghana. This suggests that the market for M-Health is growing rapidly, bringing hundreds of devices and applications all aimed at improving the health outcomes of patients at the least cost possible. In light of this (Peprah *et al.*, 2019), indicated that M-Health has emerged as a viable solution for wide-ranging challenges in healthcare delivery in low-middle-income countries, including Ghana as a result of high community mobile phone penetration and a shortage in the health workforce.

Studies have been carried out on M-Health in general, looking at various aspects of M-Health. A systemic review by (Han and Lee, 2018) on the effectiveness of M-Health application use to improve health behavior Changes revealed that 16 among 20 studies reported that applications have a positive impact on the targeted health behaviors or clinical health outcomes. In addition, most of the studies, which examined the satisfaction of participants, showed health application users have statistically significantly higher satisfaction. Also (Peprah *et al*., 2019), did a study on Knowledge, attitude, and use of M-Health technology among students in Ghana and the findings revealed that Knowledge of M-Health was moderately high. Specifically, more than half of the sample reported awareness of M-Health although the prevalence of use of M-Health stood at 51%.

It is important to indicate that despite the significant level of attention given to mobile health devices coupled with the proliferation of mobile devices and increasing use of the technology for various purposes in Ghana, the specific knowledge and utilization of mobile devices for health and associated correlates are less explored or understood. In addition, mobile device usage for accessing healthcare in Ghana has been rarely evaluated, limiting evidence-based policy adoption. As a result of the increasing use of mobile phones and related devices in Ghana, it is critical to increase our knowledge and understanding of M-Health and its other dimensions. Further (Abane *et al*., 2021), indicated that despite the high cost of the use of mobile devices for obtaining healthcare services, one of the dominant groups observed to utilize mobile service devices for healthcare services in Ghana is corporate workers. Therefore, it is important to investigate corporate workers diagnosed with diabetes and hypertension to determine mobile health (M-Health) application, adoption, usage, and discontinuity among corporate workers in Ghana. In congruence with this, the study investigated the following questions; What are the determinants of M-Health application, adoption and usage among corporate workers diagnosed with hypertension and diabetes in Ghana? and What are the determinants of the discontinuity of use of M-Health application among corporate workers diagnosed with hypertension and diabetes in Ghana?

2. Literature review

The adoption and continued use of M-Health applications are influenced by a complex interplay of factors. Demographics play a crucial role; age, education, and digital literacy have been identified as determinants of M-Health adoption (Fu *et al*., 2023) (Jangle *et al*., 2023). Younger individuals with higher educational levels and greater digital competence are more likely to embrace these technologies (Tao *et al*., 2023). Additionally, individual health beliefs and attitudes are significant predictors of adoption (Oloveze *et al*., 2022) (Mensah, 2022). Perceived usefulness, perceived ease of use, and the perceived impact of the app on one's health outcomes can drive initial adoption and sustained engagement (Mensah, 2022) (Wu *et al*., 2022). On the contrast, barriers such as privacy concerns, data security, and the fear of technology replacing human interactions can hinder adoption and lead to discontinuity (Jacob *et al*., 2022). Moreover, the design and functionality of M-Health apps themselves are critical factors. User-friendly interfaces, personalized features, and integration with wearable devices have been shown to increase long-term engagement (Stefanicka-Wojtas and Kurpas, 2022) (Jakob *et al*., 2022).

From the theoretical perspective, two theories underpin this study; the Diffusion of Innovations theory and the Theory of Reasoned Action (TRA). The Diffusion of innovations; is a theory that seeks to explain how, why, and at what rate new ideas and technology spread. Everett Rogers, a professor of communication studies, popularized the theory. Rogers argues that diffusion is the process by which an innovation is communicated over time among the participants in a social system. The origins of the diffusion of innovations theory are varied and span multiple disciplines. Rogers proposes that four main elements influence the spread

of a new idea: the innovation itself, communication channels, time, and a social system. This process relies heavily on human capital. The innovation must be widely adopted to self-sustain (Rogers, 1995).

According to (Taherdoost, 2018), the Theory of Reasoned Action (TRA) is one of the theories propounded by Ajzen and Fishbein. The author indicated that the TRA is a core theory in explaining user behavior as far as technology acceptance or adoption as well as utilization is concerned. It describes as the behavioral intention accounted for by an individual's attitude towards behavior and subjective norms. Thus according to (Taherdoost, 2018), the attitudes towards a particular behavior can be in the form of behavioral beliefs, subjective norms, normative beliefs and motivations. Hence this theory on the assumption that an individual possesses voluntary control over his or her behavior is better positioned to explain the elements that affect technology acceptance (Valle-cruz *et al*., 2016). The theory of Reasoned Action (TRA) was concluded as having the ability to predict and explain newly introduced behavior in the area of technology usage by customers or clients. Using the theory (George, 2016), concluded that perceived behavioral control has a direct effect on the user's attitude toward using the Internet for online purchases or obtaining a service. The study adopted this theory in answering the research questions given the intent of the researcher to explore other explanatory elements in M-health technology adoption, usage, and discontinuity.

Mobile health in general is a term for the use of mobile phones and other wireless technologies in medical care. The most common application of mobile health is the use of applications and use of mobile devices to educate consumers regarding preventive healthcare services (Holman, 2019). According to (Holman, 2019), mobile health is very important because it is also employed in disease surveillance, treatment support, epidemic outbreak tracking and chronic disease management (Holman, 2019), posited that for consumers, the major benefit of mobile Health is its convenience. There is also a plethora of applications to choose from. As of 2017, there were 325,000 Mobile Health applications available for download from app stores, according to digital health consulting firm research guidance (Pohl, 2017). Although mobile health provides the means for bridging the gaps in care by allowing patients to communicate with their physician or care team and vice versa without meeting face to face, it also has a significant level of demerits including lag of privacy policies behind that of the mobile applications, presentation of inaccurate information, Internet connection issues among others.

A recent report by World Bank shows that Ghana is rated as the lower middle-income in 2016. Given this, International Monetary Fund (IMF) described the country as having bright economic prospects. However, like many African countries, Ghana is challenged in several areas, not least the health sector (Abane *et al*., 2021). The history of primary healthcare in Ghana can be traced to the Alma-Ata Declaration of 1978 which was captured as "Health-For-All" by the year 2000 (Appiah-Agyekum *et al*., 2022). It is vital to establish that, Ghana through the Ministry of Health around 1977 introduced trained and produced numerous community health workers to provide support to health delivery in rural communities with some being Community Clinic Attendants and others being Traditional Birth Attendants (Nyonator *et al*., 2005). This according to the report, brought health services directly to people in their communities and substantially reduced the referral of cases to secondary health facilities (Abane *et al*., 2021) (Baatiema *et al*., 2016). Contrary to this, studies have reported that a lack of collaboration, cooperation, coordination and poor supervision led to a collapse of these groups of community health workers in the early 1990s (Abane *et al*., 2021) (Agyei-baffour *et al*., 2012). According to (Abane *et al*., 2021), the subsequent introduction of CHPS compounds gave birth to another cadre of trained health workers – Community Health Nurses licensed by the Nurses and Midwifery Council to operate in the CHPS compounds.

Despite this development within the health delivery system in Ghana, mobile technology adoption and utilization have become the way forward for quality healthcare management. Given this, the introduction of mobile phones in formal healthcare delivery in Ghana was preceded by several pilots. According to (Abane *et al.*, 2021), the first was Mobile Technology for Community Health (MoTeCH), a partnership between Ghana Health Service (GHS), Grameen Foundation and Mailman School of Public Health of Columbia University in 2010. The program had funding from the Bill and Melinda Gates Foundation and was piloted in the Upper East region of Ghana. The program used low-cost java-enabled mobile phone technology to capture, transmit and process health service data collected by CHNs in their interactions with patients/clients. Further, the MoTeCH also introduced other mobile phone interrelated services such as the "Mobile Midwife" application for alerts, reminders as well as information and advice to pregnant women and an application which allowed nurses to track the services rendered to women and newborns with opportunities for referrals (Abane *et al.*, 2021). Understanding the unintended costs of using personal mobile phones of CHNs will help address Sustainable Development Goal 3, which seeks to ensure healthy lives and promote wellbeing for all of all ages including CHNs (Abane *et al.*, 2021).

3. Methods

3.1 Setting

The study was conducted in three hospitals in the Greater Accra region of Ghana. Ghana is one of the most formidable countries in West Africa. Recent statistics show that the population of the country is pegged at a little above 30 million people, comprising relatively young people-38% below 15 years and 20% aged 15–24 years (Abane *et al.*, 2021). The target population were corporate workers diagnosed with diabetes and hypertension in 37 Military Hospital, Accra, Anthon Memorial Hospital, Kotobabi and St. John the Evangelist Catholic Church all in Ghana. The choice of these three institutions is because they are places where available data on patients diagnosed with hypertension and diabetes were easier to be obtained especially those concerning corporate workers. Although most health facilities have general records of hypertensive and diabetic patients, those specific to corporate workers are difficult to obtain.

3.2 Design

The study adopted an exploratory design which was built on quantitative methods. Exploratory research because the subject of M-Health has not been fully explored in Ghana, especially in the context of the management of chronic conditions.

3.3 Sample size

The target population was 1,200 corporate workers diagnosed with diabetes and hypertension. The study employed the Yamane (1967) formula to estimate the sample size from the population. The sample size was determined using the estimated formula;

$$n = \frac{N}{1 + N + (e)^2}$$

where

(1) n = sample size

(2) N = target population of top level officers = 1,200

(3) e = the acceptable sampling error = (0.05)

Therefore;

$$n = 1200/1 + 1200 * 0.05 * 0.05 = 300$$

The sample size for the study is 300 corporate workers diagnosed with diabetes and hypertension. This was later distributed among the three hospitals with probability proportionate to size.

3.4 Sampling strategy

The study employed a multistage sampling technique to arrive at participants. The three facilities were selected purposely based on their key characteristics outlined earlier. Secondly, upon obtaining the sampling frame from the three hospitals, respondents were identified on the days and months of their visit for treatment. In light of this, those selected through the sampling strategy were identified and marked during the time that they visited the health facilities. Specifically simple random sampling technique was used to select respondents since the study only applies to corporate workers diagnosed with diabetes and hypertension who have been on treatment for the past six months.

3.4.1 Inclusion criteria.

(1) Corporate workers who have been diagnosed with diabetes and hypertension and have been receiving treated in for the past six months

(2) Corporate workers who have received any healthcare service through M-health technology or the mobile phone

3.4.2 Exclusion criteria.

(1) Corporate workers who have been diagnosed with diabetes and hypertension within the last 5 months or below 6 months within the period of this study

3.5 Data collection

A structured questionnaire was used to collect data from the respondents. This enabled the researcher to collect factual information from respondents concerning M-Health. The questionnaire was in four sections; Section 1 captured respondents' bio-data, M-Health Application Adoption, M-Health Application Use, and the discontinuity of use of M-Health Application were measured in Sections 2, 3 and 4, respectively. Each respondent was informed about the study and the purpose was explained to them before informed consent was provided for them to sign. In light of this, questionnaires were made available to all respondents. The collection of data lasted for six months using one on one or face to face. Respondents were promised anonymity and confidentiality of data.

3.6 Analysis

Data obtained from the respondents were coded using SPSS version 21. The data were managed using the same software. The data obtained was generated from the structured questionnaire and was analyzed with Statistical Package for Social Science (SPSS Version 21). In addition, analysis was carried out using descriptive statistics, correlation and regression models.

4. Results

4.1 Socio-demographic and economic characteristics of the respondents

The majority (33.8%) of the respondents were between the ages of 41–50 years, with those aged 66 and above being the least represented (3%). The majority of the respondents were

females, representing 54.3%, while the remaining 45.7% were males. On the religious characteristics Christians formed 66.6% of the respondents, Muslims 27%, Traditional African worshipers 4.6% and other religious affiliations 1.7%. For marital status, 54% of the respondents were married, Single 30%, divorced 12% and other relationships 2.6%. The majority of the respondents 29.8% had a first degree, 23.5% Higher National Diploma, and 23.5% Master's Degree and other qualifications were 23.2%. On the sector of the economy the respondents worked, Civil Service and Insurance sectors had the highest number of respondents with 21% each, Industrial workers were 19.5%, banking and other financial workers were 15.9%, Healthcare workers 14.6%, Education and other service oriented 6%. Most of the respondents were permanent employees; 72.5%, contract employees; 17.5%, Part-Time 7.0% and others 2.6% (see Table 1).

Demographic characteristics	Category	Frequency	Percent
Age	30–40	77	25.5
	41–50	102	33.8
	51–60	73	24.2
	61–64	41	13.6
	66>	9	3.0
Gender	Male	138	45.7
	Female	164	54.3
Education	HND	71	23.5
	1st degree	90	29.8
	Masters	71	23.5
	Others	70	23.2
Marital status religion	Single	91	30.0
	Married	164	54.0
	Divorced	38	12.6
	Other	8	2.6
	Christianity	201	66.0
	Islam	82	27.0
	Traditional African	14	1.7
Sector	Financial service	48	15.9
	Civil service	63	20.9
	Healthcare	44	14.6
	Industrial	195	59.0
	Other service sector	25	8.0
	Permanent	219	54.0
	Contract	54	17.9
	Part-time	21	7.0
	Other	8	2.6
Department	Administration	120	39.7
	Finance	66	21.7
	Operations	22	7.3
	Agriculture	19	6.3
	Government	2	0.7
	Marketing	14	4.6
	Medical	32	10.6
	Education	23	7.6
Working experience	1–10 years	83	27.5
	11–20 years	79	26.2
	21–30 years	49	16.3
	31–40 years	40	15.9
	Above 40	40	15.9

Source(s): Constructed by authors based on field data

Table 1. Socio-demographic and economic characteristics

The majority of the respondents work in a factory or industrial hands 31.8%, financial service providers 19.5%, teachers, 15.6%, administrative staff 14.6%, and healthcare professionals 6.6%. On the number of years worked 27.5% of the respondents have worked between 1 and 10 years, 11–20 years 26.2%, 21–30 years 16.2%, 31–40 years 13.2%.

4.2 Mobile health application usage

Concerning the Mobile Health applications used by respondents, the majority of the respondents used Samsung 31.5%, iPhone 20.9%, Techno 17%, Huawei 13%, Nokia 2%, Itel 5.6%, and others 7.6%. 52.6% of the respondents have ever used any mobile health application and 47.7% never to have used any mobile health application before. The most common applications used by the respondents are Google Fit 13.6%, Huawei Health 13.2%, Fit Bit 6.3%, BP Checker 8.6%, MI Fit 3.6%, and My Health 6.3% (see Table 2).

From Table 2, for the reason for using the application, 19.2% use it to track their health status, 16.2% to improve their health, 3% to improve their nutrition and 7.0 to help adhere to their medication regime. 57.3% of the respondents are diabetic only, 75% are hypertensive only and 41% are both diabetic and hypertensive. Majority; 23.5% of the respondent had a gross monthly income 1,100–2,000, 17.5% had 2,100–3,000, 16.6% had 3,100–4,000, 10.3% 4,100–5,000 and the least earner of 1,000; 8.6%. 63% of the respondents were engaged in daily exercise and 32.1 did not engage in any kind of daily exercise.

4.3 Response rate for dimensions determining M-Health application adoption, usage and discontinuity

In trying to establish the determinant of M-Health application adoption, usage and discontinuity among corporate workers diagnosed with hypertension and diabetes, key dimensions used include the nature and demands of their job, Perceived advantage, Compatibility, Complexity, Triability Aesthetics, Trust of M- Health applications.

The results from the analysis, Nature and Demand of job dimension show that on the issue of My job is physically demanding; 20.9% strongly disagreed, 24.2% disagreed, 25.5% fairly

Table 2.
Use of mobile health applications and sickness

Statements	Categories	Frequency	Percent
Why do you use the application	To track health Status	58	19.2
	To improve my health	148	49.0
	To improve my nutrition	49	16.2
	Helps me to adhere to my medication	21	7.0
Diabetic	Yes	173	57.0
	No	118	39.0
Hypertensive	Yes	229	75.8
	No	63	20.9
Both diabetes and hypertension	Yes	125	41.4
	No	158	52.3
Have time to exercise daily	Yes	75	24.8
	No	97	32.1
	Somewhat	118	39.1
Gross monthly income	1,000	26	8.6
	1,100–2,000	71	23.5
	2,100–3,000	53	71.5

Source(s): Constructed by authors based on field data

agreed, 14.6% agreed and 9.3% strongly agreed. My job is emotionally demanding; 17.5% strongly disagreed, 26.5% disagreed, 28.8, % fairly agreed, 15.6% agreed and 6% strongly agreed. My job requires long hours of sitting; 26% strongly disagreed, 29% disagreed, 29% fairly agreed, 13.9% agreed and 3% strongly agreed. My job offer's good work life balance; 2.6% strongly disagreed, 14.9% disagreed, 29.5% fairly agreed, 36% agreed and 25% strongly agreed. The physical environment of my job is safe; 5% strongly disagreed, 28% disagreed, 20.9% fairly agreed, 43% agreed and 13.6% strongly agreed. I believe my work schedule has exposed me to health problems; 9.6% strongly disagreed, 21% disagreed, 34.8% fairly agreed, 17.2% agreed and 8.3% strongly agreed. The result shows that fairly agree and agree dominated the nature and demand of job. This evidence shows that majority of the diabetic and hypertensive patients utilized by the study have their job demand being fair or moderate.

Secondly, on the dimension of Perceived Advantage; Using M-Health Applications enables me to track my health status; 2% strongly disagreed, 7.3% disagreed, 26% fairly agreed,25% agreed and 12% strongly agreed. Using M-Health application improves my health; 2% strongly disagreed, 3.3% disagreed, 30% fairly agreed, 26% agreed and 9.6% strongly agreed. Using M-Health application enables me to control my weight; 8% strongly disagreed, 7% disagreed, 32% fairly agreed, 23% agreed and 7.9% strongly agreed. Using M-Health application helps me to adhere to my medication regime; 2% strongly disagreed, 7.3% disagreed, 27.5% fairly agreed, 24% agreed and 11% strongly agreed. The use of M-Health application has given me greater control and understanding of my health condition; 4% strongly disagreed, 3% disagreed, 28% fairly agreed, 27.5% agreed and 10.2% strongly agreed. Over all, the use of M-health application is beneficial; 10% strongly disagreed, 20.5% disagreed, 30.5% fairly agreed, 24.5% agreed and 18.9% strongly agreed. The result suggests that the use of m-health applications enable is important and critical to diabetic and hypertensive patients in the areas such as tracking of health status, improvement in their health condition, ensure weight control, adherence to medication regime, gives control and comprehension of health situation and M-Health application being beneficial.

Thirdly, on the dimension of Compatibility; Adoption and usage of M-health application is compatible with my desire to adopt modern technology in managing my health; 3.3% strongly disagreed, 7.6% disagreed, 19.2% fairly agreed, 36% agreed and 4% strongly agreed. Usage of the m-health application is compatible with all aspects of my life; 2% strongly disagreed, 34% disagreed, 31.5% fairly agreed, 24.2% agreed and 8% strongly agreed. Using M-health application fits well with my way of life and work; 6% strongly disagreed, 7.2% disagreed, 28.1% fairly agreed, 26.6% agreed and 18% strongly agreed. Usage of M-health application fits into my experience of maintaining a healthy life; 10% strongly disagreed, 4% disagreed, 27.5% fairly agreed, 24% agreed and 11% strongly agreed. The evidence from the result suggests that adoption and use of m-health are highly compatible with to desire to adopt modern technology in health management, with all aspects of life; fits well with the way of life and work, and fits into the experience of maintaining a healthy life.

Further, On the Complexity dimension; The use of M-health applications is often frustrating; 23.2% strongly disagreed, 35.3% disagreed, 40.6% fairly agreed, 25% agreed and 15.8% strongly agreed. The use of the m-health application requires so much technical IT knowledge; 3% strongly disagreed, 21.2% disagreed, 22.2% fairly agreed, 9.3% agreed and 15.9% strongly agreed. The M-Health application is difficult to use; 0.7% strongly disagreed, 12.3% disagreed, 24.3% fairly agreed, 14.8% agreed and 18.6% strongly agreed. I have difficulty understanding all the features of the M-Health application; 4.6% strongly disagreed, 19.9% disagreed, 19.9% fairly agreed, 18.3% agreed and 13.2% strongly agreed. I feel burdened using the M-Health to manage my condition; 11.9%

strongly disagreed, 18.9% disagreed, 20.9% fairly agreed, 20.5% agreed and 20.5% strongly agreed. Generally, using the M-Health application to manage my condition is complex; 6% strongly disagreed, 11.9% disagreed, 215% fairly agreed, 17.5% agreed and 17.5% strongly agreed. The result suggests that the use of M-Health is not highly complex in relation to healthcare services obtained by diabetic and hypertensive patients.

Moreover, On the dimension of Triability; Before deciding whether to use the M-Health application, I was able to properly try it out; 4% strongly disagreed, 13% disagreed, 21% fairly agreed, 25% agreed and 6% strongly agreed. The M-Health application has been tried and tested to be effective; 2% strongly disagreed, 3% disagreed, 33% fairly agreed, 25% agreed and 6.6% strongly agreed. I personally tried the m-health application long enough to determine what it could do before adopting it; 3.3% strongly disagreed, 42% disagreed, 20.5% fairly agreed, 27.5% agreed and 5.3% strongly agreed. I had the opportunity to try other mobile applications before adopting the one I am using; 8.3% strongly disagreed, 12.6% disagreed, 22.9% fairly agreed, 23.5% agreed and 3.33% strongly agreed. The result suggests some level of triability on the part of diabetic and hypertensive patients in relation to the adoption and usage of the technology.

Furthermore, On the dimension of Aesthetics; I like the design of the M-Health application; 6% strongly disagreed, 4.3% disagreed, 29% fairly agreed, 20.2% agreed and 15% strongly agreed. The M-Health application interface is user friendly; 2% strongly disagreed, 6.3% disagreed, 34.8% fairly agreed, 16.6% agreed and 10.6% strongly agreed. The M-Health application clearly visualizes my health data; 2% strongly disagreed, 3.6% disagreed, 29.5% fairly agreed, 23.8% agreed and 12.5% strongly agreed. In relation to aesthetics of the applications, the result suggests that the application is very attractive, friendly to use and provides good visualization resulting in higher level of adoption and usage.

Also, with regards to the trust dimension; I can trust the m-health application in managing my condition; 3.6% strongly disagreed, 4.3% disagreed, 27.3% fairly agreed, 21.5% agreed and 13.2% strongly agreed. The M-Health application is reliable to use; 3.3% strongly disagreed, 4.3% disagreed, 27.2% fairly agreed, 29.5% agreed and 7.3% strongly agreed. The M-Health application is able to provide effective help to my condition when needed; 3.3% strongly disagreed, 2.3% disagreed, 29.8% fairly agreed, 21.5% agreed and 13.9% strongly agreed. The result suggests some level of trust in the adoption, and usage of the application for healthcare service delivery.

The result further shows that all indicators in relation to adoption obtained a Yes score, with similar results from usage and discontinuity. The determining indicators of M-Health Application adoption, usage and discontinuity are analyzed using a logistic regression model.

4.4 Determinants of M-Health application adoption, usage and discontinuity

A logistic regression model was used to determine the predictive effect of seven dimensions of M-Health application from the factor analysis on the adoption, usage and discontinuity of the M-Health application. The results are presented as follows (Table 3).

The logistic regression results showed that the nature of job, compatibility and aesthetics were significant predictors of the adoption of M-Health applications. Further, concerning the usage of M-health application, the result shows that out of the seven factors indicating M-health application, four predicted the usage of M-Health application. These are complexity, triability, aesthetics and trust. Similarly, five factors significantly predicted the discontinuity of M-health applications usage. These factors were perceived advantage, compatibility, complexity, triability and aesthetics.

M-Health determinants	Dependent variables: Adoption Coef(β)	Adoption Std	Adoption Odds ratio	Usage Coef(β)	Usage Std	Usage Odds ratio	Discontinuity Coef(β)	Discontinuity Std	Discontinuity Odds ratio
Nature/ demands of job	0.204**	0.092	1.227	−0.014	0.195	0.986	−0.124	0.087	0.883
Perceived advantage	−0.019	0.066	0.981	0.173	0.154	1.189	−0.372***	0.086	1.451
Compatibility	0.295**	0.121	0.745	−0.164	0.229	0.849	−0.383***	0.112	0.682
Complexity	−0.011	0.036	1.011	−0.424***	0.122	1.528	0.279***	0.046	0.756
Triability	0.085	0.087	1.088	0.662***	0.244	1.939	0.171**	0.083	1.187
Aesthetics	0.279*	0.159	1.322	−1.315***	0.411	0.268	−0.288**	0.140	0.750
Trust	0.066	0.125	1.068	0.511*	0.277	1.667	−0.136	0.112	0.873
Constant	−2.331	2.268	0.097	−4.595	4.971	0.010	8.388***	2.493	4,392.235
Number of observations		199			199			199	
Pseudo *r*-squared		0.079			0.332			0.451	
Chi-square		13.878*			85.576***			38.365***	

Note(s): ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$
Source(s): Constructed by authors based on field data

Table 3. Determinants of M-health application adoption, usage and discontinuity

5. Discussion

With the first research question of this study, it is important to indicate that the use of mobile information communication technology to provide and access health care services is growing rapidly in both advanced and developing countries. The study found significant number of indicators influencing M-health applications including perceived advantage, compatibility, complexity, triability, aesthetics and trust. Perceived advantage emerged as a significant negative predictor of discontinuity of use among diabetic and hypertensive corporate workers. Perceived Advantage is related to M-Health users' perception that M-Health application will improve their health care management and consequently improve their quality of life. This indicates that the ability of M-Health applications to provide useful functionalities will reduce the likelihood of users discontinuing the use of these applications. Thus, when this perceived advantage is not met after adopting and using the application the user will discontinue the use of the application. This is congruence with the insight through the theory of reasoned action given by (Taherdoost, 2018), who indicated that the attitudes towards a particular behavior can be in the form of behavioral beliefs, subjective norms, normative beliefs and motivations. Hence this theory on the assumption that an individual possesses voluntary control over his or her behavior is better positioned to explain the elements that affect technology acceptance (Valle-cruz *et al.*, 2016).

Further, another significant predictive factor is Complexity. The analysis indicated that for wider usage and continuity of use of an M-Health application, the users must perceive the technology as being simple, easy to learn, and convenient for accomplishing necessary tasks (Dwivedi *et al.*, 2016), argued that in the context of M-Health, complexity has to do with the degree of ease associated with the remote and self-use of the information system. So for wider adoption, actual use and continued use of an m-health application among diabetic and hypertensive corporate workers, Application Developers must consider the following: the use of M-health application is not frustrating, requires very minimal technical IT knowledge, not difficult to use, have difficulty understanding all the features and not feel burdened using the m-health to manage their condition. Designers should provide the users with ownership of the system with minimal need for organizational support. Complexity should be avoided and simplicity should be sought in the design of the application. This is also congruence with the

study by (Aikins *et al.*, 2010), who argued that issues of aesthetics, trust, perceive advantage are critical indicators influencing the application of M-health.

The compatibility of M-Health applications increases and reduces the likelihood of adoption and discontinuity of use by users of M-Health applications. These findings support the findings of earlier studies by (Peprah *et al.*, 2019). When users find an M-Health application compatible, it is easier to adopt and there is no urge to discontinue using the application given its compatibility. The aesthetic features of M-Health applications also increase the chances of users adopting them. It, however, reduces the chances of its usage and discontinuity. Triability of M-Health applications is another significant predictor of M-Health application usage and discontinuity. Triability increases the chances of M-Health applications, while the more triable a M-Health application is, the less users are inclined to discontinue its usage.

Also, one predictive factor is trust, given the sensitive and private nature of data that m-health application captures and stores, security and privacy greatly affect how users perceive M-Health applications and subsequently affect their intention to use M-Health. From the results, trust increases the chances of people using M-health applications. Developers should pay close attention to the type of security and privacy measures they add to their health applications and inform the users about these measures to assure them that their data will remain secure and confidential. Also, M-Health developers and designers need to make sure that their applications conform to local and international laws and regulations that govern how personal health data are collected, processed, and stored. This support the argument by (Peprah *et al.*, 2019), who reported that Knowledge, attitude, and use of M-Health technology among students in Ghana and the findings revealed that Knowledge of M-Health was moderately high. The authors also indicated that issues of trust and compatibility are vital indicators in enhancing m-health applications in relation to usage.

The second question is what are the determinants of the discontinuity of the use of M-Health applications among corporate workers diagnosed with diabetes and hypertension in Ghana? Results from the data analysis provide support for our proposed conceptual model most especially regarding the discontinuity of use of M-Health application. Out of the seven factors we proposed in the model, five were statistically insignificant predictors of the discontinuity of M-Health application usage. This finding suggests that indicators such as complexity, triability, and aesthetics were found to be critical determinants influencing the usage and discontinuity of use of M-Health applications. The findings provide support to three indicators within the conceptual model or framework following existing literature such as (Venkatesh *et al.*, 2003).

There is a rapid interest in using M-health applications to leverage healthcare delivery. However, with numerous M-Health applications on the market, service providers and patients need guidance on selecting the application that provides good information, and services, and are easy to use, safe, secure and effective. This research can help service providers and M-Health system developers and designers to better understand the strengths and weaknesses of existing M-health applications from users' perspectives, which will inform developers about the expectations of users. With the widespread availability of mobile technologies and services and the growing demand for M-Health applications, our research can help guide the development of the next generation of M-Health applications with a focus on the needs of patients in developing countries. Following a patient-centered design, we have uncovered a set of facilitators and barriers for the adoption of M-Health services from patients' perspectives; we have identified the patients' functional requirements, needs, and expectations from M-Health applications.

Multiple practical and managerial implications could be drawn from this study. Firstly, M-Health application functionalities play a very valuable role in patients' intention to adopt, use and discontinue the use of an m-health application. System developers must pay attention

to what type of functions they provide in their applications and how these functions could be customized to satisfy the needs of different categories of patients. Secondly, given the sensitive nature of the data that M-Health applications store and process, security and privacy greatly affect how users perceive M-Health applications and subsequently affect their intention to use M-Health. Developers should pay close attention to the type of security and privacy measures they add to their health applications and inform the users about these measures to assure them that their data will remain secure and confidential. If the applications are not fully developed or request additional unneeded information from the user, this will negatively affect users' perception of how their medical and health private information is being handled and thus affect the intention to use M-Health applications. M-Health developers and designers need to make sure that their applications conform to local and international laws and regulations that govern how personal health data are collected, processed, and stored.

6. Conclusion

The findings of this study show the important role played by M-Health applications in Ghana concerning the intention to adopt, use and discontinue the use of these applications within the health system. It is important to indicate that M-health applications are being adopted by corporate workers because of its propensity in enhancing diagnosis, treatment, monitoring and education of patients leading to increased patient engagement, improved health outcomes and reduced costs. Despite this, patients' intention to adopt, use and discontinue the use of an M-Health application in Ghana is underpinned by issues such as data privacy, and security. Given this, there is the need for health officials, system developers, government, and M-Health system managers to pay attention to what type of functions the applications contain and how these functions could be customized to satisfy the needs of different categories of patients to ensure effective management and security protection. It must be noted that the ability of M-Health applications to provide useful functionalities will positively contribute to users' adoption and usage of these applications.

7. Limitations of the study

This study admits some limitations to be addressed by future studies in the area of M-Health. First, the study was only conducted in Ghana as a case of a developing country, which may raise concerns about the generalizability of the findings to other developing countries. Future research should give more attention to collecting data from various countries, developed and developing alike. Second, the study considered only those diagnosed with hypertension and diabetes. Future research could investigate M-Health adoption, usage and discontinuity of use among other populations. Third, the research model was tested from the patients' perspective but not from the perspective of medical professionals. Future research could consider the factors influencing the adoption, usage and discontinuity use by medical professionals and compare the resulting outcome with that of patients' perspectives.

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