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An Empirical Investigation of Health Practitioners Technology Adoption: The Mediating Role of Electronic Health

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ABSTRACT

Health technology innovation integration is rapidly growing in global health-care settings. However, research on factors driving technology adoption intention is limited. On this note, it has become important to investigate and understand the complex factors underpinning practitioners' technology adoption intentions. Drawing on the Technology Acceptance Model and The Institutional Theory, we propose a model to empirically investigate technology adoption and its potency in driving universal health coverage, mediated by electronic health technology. We used data collected from 416 health sector practitioners to empirically test the model. Using the Structural Equation Modeling technique, the study found that perceived ease of use and relevant technology infrastructure all have significant positive relationship with universal health coverage.

However, perceived usefulness, management support and adequate practitioner training were found to have negative relationship with universal health coverage. The results further revealed that perceived-ease-of-use, perceived usefulness, management support, adequate practitioner training and relevant technology infrastructure also have positive relationship with electronic health technology. Moreover, electronic health technology as a mediator was also found to have significant relationship with universal health coverage. The implications of the findings are discussed and suggestions for future research are subsequently highlighted.

KEYWORDS

Technology integration; universal health coverage; mediating role; electronic health; health practitioners' technology adoption; Ghana

Introduction

Technology has become indispensable to improving service delivery and outcomes. The health sector is not an exclusion in this regard. For the benefits that technology usage in the health sector (which has been conceptualized as electronic health) provides, different systems within the health sector in different countries, like never before have assigned some degree of paramountcy and prominence to electronic health (e-health) technology innovation. Consequently, this has robustly driven health sector outcomes monumentally (Chang et al., 2004; Cline & Haynes, 2001; Kreps, 2006; Lorence, Park, & Fox, 2006; Neuhauser & Kreps, 2003; Rippen & Yasnoff, 2004). Technology deployment into the health sector is a strategy which obviously has implications for performance and outcomes.

Research (Eysenbach & Jadad, 2001; Napoli, 2001) have underscored the pertinence of health technology deployment. In as much as these research findings affirm the positive impacts of health technology, they equally report on underlying complexities and subtle nuances that characterize their utilization. In the face of the challenges that confront health technology adoption

and utilization, more especially in developing countries, researchers and practitioners alike have over the years endeavored to identify factors that propel adoption and utilization decisions. However, the relativity of technology usage and adoption across diverse sectors, strata (individual, organizational and inter-organizational) and populations have rendered such an endeavor challenging (Merrell, 2013; Rogers, 2003; Sugarhood, Wherton, Procter, Hinder, & Greenhalgh, 2014).

Moreover, studies have ascribed social, cultural, financial, legal and ethical barriers to the challenges coming up at the individual and organizational level making up: users' lack of awareness of the benefits, low e-health literacy, interoperability and a deficiency of evidence of cost-effectiveness as well as security concerns (Currie & Seddon, 2014). Some aspects of e-health that threatens adoption and utilization consist of economic resources constraints (Chinnock, Siegfried, & Clarke, 2005), exorbitant costs of usage fees, income disparities, excessive charges for even primary health information systems (Ashraf, 2005), shortage of human resources (Oak, 2007), inadequate government policies for a well-defined health system that incorporates e-health (Ahern,

Kreslake, & Phalen, 2006), culture and conflicts relative to the usage of technology for health delivery (Lee, 2014).

Given the relevant, but varying identifications pointed out in prior research, it is important to note that, technology adoption is influenced by certain characteristics comprising user-related, technology-specific characteristics, social, cultural and economic dimensions. Therefore, being conversant with, and at the same time gaining an understanding of influential factors with regards to health technology adoption and utilization is a sine qua non to a successful implementation of any form of corporate innovation plan and strategy, particularly in developing countries where technology deployment and usage are at a nascent stage (Achampong, 2012). This makes health technology adoption a subject matter worthy of investigation. Part of the reason is predicated on how such a discourse will help provide sufficient policy indicators, and at the same time, serve as a guide in devising strategies and interventions geared towards developing an extensive and practical framework to regulate the use of health technology.

In the face of the apparent abundant significance the technology offers, there is no misgiving regarding the pertinence of health technology (Lasker, Humphreys, & Braithwaite, 2014) especially in promoting universal health coverage. The health-care setting is a highly institutionalized and technically complex structure (Scott, Ruef, Mendel, & Caronna, 2000). And considering the pertinence and urgency of health, and by extension, the achievement of the inter-connected global goals, more especially universal health coverage, technology deployment, adoption and utilization, has recently become a hot research domain. There is currently a growing body of literature that has extensively discoursed on health technology acceptance by physicians. Current research on technology adoption have been widely and largely applied to explain adoption intention (Bhattacharjee & Hikmet, 2007; Ilie, Van Slyke, Parikh, & Courtney, 2009; Sherer, Meyerhoefer, & Peng, 2016; Terrizzi, Sherer, Meyerhoefer, Scheinberg, & Levick, 2012; Venkatesh, Morris, & Davis, 2003). These studies have predominantly focused on individual characteristics and how such factors facilitate or militate against technology adoption. Specifically, in a seminal study in Canada using the structural equation modeling approach, Tsai, Hung, Yu, Chen, and Yen (2019) sampled 217 physicians from 15 metropolitan hospitals and academic centers to investigate individual technology adoption incorporating three variables comprising perceived service level, self-efficacy and perceived risk. The study established these variables as significant antecedents to technology adoption.

In another study employing the partial least square method (PLS) in Dhaka using the Unified Theory of Acceptance and Use of Technology (UTAUT) Model,

Hossain, Quaresma, and Rahman (2019) included personal innovativeness in information technology and resistance to change and sampled 300 participants to empirically investigate factors driving physicians' health technology adoption. The study confirmed that social influence, facilitating conditions and personal innovativeness in information technology have significant correlation with physician's behavioral intention to adopt technology. However, the study further revealed that performance expectancy, effort expectancy and resistance to change have no significant influence on technology adoption. Overall, these studies present heterogeneous evidence in research findings which could possibly be due to variations in methodologies and sample populations. Moreover, the study of factors influencing technology adoption has generated mixed results (Oliveira, Martins, & Lisboa, 2011; Venkatesh & Davis, 2000). And this could plausibly be attributed to complexity of the health-care socio-technical systems, attitudinal variations in health-care users and actors in other economies industries, as well as the uniqueness of the health-care structure and composition (Holden & Karsh, 2010).

The institutional theory has become one of the most widely used theory employed to understand organizational activities, strategies and behaviors (Scott, 2005). Researchers have corroborated that, institutional pressures from corporate institutions environment could significantly exert some degree of influence on organizational activities, strategies, behaviors and the overall organizational innovation operation process (DiMaggio & Powell, 1991; Scott, 2005). Considering that technology adoption is mostly an institution-led initiative, it becomes not only suitable, but also appropriate to apply the institutional theory to foster forging a deeper understanding of technology deployment, adoption and usage. Actually, the institutional theory has been employed for several studies across diverse fields including operations management (Badewi & Shehab, 2016; Zhang & Dhaliwal, 2009). DiMaggio and Powell (1991) and Scott (2005) assert that, as much as institutional pressures may engender significant results, ex ante heterogeneity factors, amongst others may influence the generation of various outcomes. Against this background, investigating practitioners' technology adoption from an integrated perspective composed of technology acceptance and institutional perspective will be of much importance to scholarship and policy.

Specifically, with this research, the study seeks to investigate ex-ante heterogeneity across practitioners in institutions and possible organizational coordination. Exploring the effects of these relationships and coordination will be very essential to understanding practitioner's technology adoption which is key to driving

health care. Thus, institutional factors and individual peculiar characteristics may interact well to bring about positive outcomes. Hence, the aim of this research is to empirically explore the interaction between the Technology Acceptance Model and the Institutional Theory and their collective effects on driving health-centered outcomes. The study will make immense contribution to scholarship by exploring the mediating effect of electronic health innovation technology in supporting universal health coverage which is geared towards breaking all forms of geographical divide. The remainder of this paper is structured as follows: Theoretical background and hypothesis discuss relevant study theories and research hypotheses. Research methods and data collection shed light on research methodology. Data analysis and results are captured in the data analysis and results section. Discussion and conclusion segment focuses on study results. The final section concludes the research and highlight study limitations and implications for future research.

Theoretical background and hypotheses

Technology Acceptance Model (TAM)

The prominent theory used to provide a theoretical framework to enhance understanding what informs individual behavior in adopting and utilizing innovation is the technology acceptance model. TAM has evolved into an authoritative model used to explain and predict a system's adoption and utilization (Lee, Kozar, & Larsen, 2003; Legris, Ingham, & Colletette, 2003; Venkatesh et al., 2003). TAM as a favorite, robust, and parsimonious model for predicting user acceptance (Venkatesh & Davis, 2000) constitutes an important determinant of technology acceptance and use behavior. The objective of TAM is to examine how users' attitudes and beliefs influence their acceptance or otherwise of innovation. Its efficacy in determining the prospects of innovation, relative to predicting acceptance or rejection has made its usage a popular one. TAM will foster understanding of innovation, including examination of social systems and individual function within the system (Rogers, 2002). In TAM, derived from the Theory of Reason Action (TRA) from the field of social psychology, Fishbein and Ajzen (1975) proposed systems usage as a reaction that can be anticipated by user's stimulus based on the competencies and structures of actual existing systems (Chuttur, 2009). Dwelling on previous TRA related works, Fishbein and Ajzen (1975), Davis (1989) segmented and simplified the TRA attitude related constructs into two (2) broad constructs: Perceived Usefulness (PU) and Perceived-Ease-of-Use (PEOU).

In the views of Davis (1989), perceived usefulness (PU) refers to the individual's expectation that using a particular technology would increase and enhance his or her work performance (Venkatesh & Davis, 2000; Venkatesh et al., 2003). Perceived-Ease-of Use (PEOU), on the other hand, refers to the degree to which a user anticipates the usage of a technology to be free from difficulties or effort. TAM theorizes that PU and PEOU determines an individual's behavioral intention to use a system. These beliefs act as facilitators between external variables and intention to use (Davis, 1989).

Research literature is replete with findings that underscore the potency of TAM in predicting prospective users' acceptance of technology (Amadu, Syed Muhammad, Sadiq Mohammed, Owusu, & Lukman, 2018; Sarwar, Zulfiqar, Aziz, & Ejaz Chandia, 2019). TAM, widely applied in many industries, has been used to explain the adoption of e-health technology (Bhattacharjee & Hikmet, 2007; Melas, Zampetakis, Dimopoulou, & Moustakis, 2011; Terrizzi et al., 2012; Walter & Lopez, 2008), but with mixed results (Holden & Karsh, 2010). For the purposes of this research, the study employs perceived-ease-of-use and perceived usefulness as study variables....

Universal Health Coverage (UHC)

Within the context of reemerging novel universalistic approaches to healthcare, universal health coverage (UHC) is widely recognized as essential to enhancing health, social cohesion, human and economic development (Evans, Marten, & Etienne, 2012). The core components of the policy encompass accelerating effectiveness, high-quality services and population coverage (WHO, 2017). As a catalyst for change with a massive prospect for efficiency and equity, the world health organization referred to UHC as "*the single most potent concept public health has to offer*" (WHO, 2017). Health structures therefore owe it a responsibility to provide universal and equitable access to health services to further ensure improved outcomes (Ghebreyesus, 2017) as it is linked to other sectors and expressly, expected to foster healthy sustainable development. As an integrated approach to improving health outcomes, UHC embraces the whole health system and puts rights and equity at the center of its vision. Implicit in the definition of UHC is equity, access, and inclusiveness (World Health Organization & World Bank, 2017). It is therefore essential that health systems integrate e-health with UHC to address inherent systemic inequalities. In this regard, TAM, alongside the Institutional Theory, are used to measure health practitioners' adoption and utilization of electronic health technology in promoting UHC in Ghana.

The Institutional Theory (IT)

The Institutional Theory which has received prominent academic usage has widely been used in studies on organizational technology innovation adoption and practices. (Dimaggio, 1991; DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Tolbert & Zucker, 1983). Institutional theorists are of the view that modern social structures and institutions as complex and complicated organizations are seen as systems of rationally ordered rules and activities where the ready acceptance of policies and practices is pivoted on legitimate and rational means to attain organizational goals. This presupposes that, institutions, even including health dispensing systems, are susceptible to changes (Meyer & Rowan, 1977; Scott et al., 2000).

Institutional theorists also contend that the institutional environment can strongly influence structures. (Dimaggio, 1991; Gibbs & Kraemer, 2004; Orlikowski & Barley, 2001; Scott et al., 2000). Institutional effects are dispersed across mimetic, normative, and coercive isomorphism. (DeNavas-Walt, Proctor, & Smith, 2013; DiMaggio & Powell, 1983). The institutional theory model has been applied to explain adoption of technologies and enterprise applications (Liang, Saraf, Hu, & Xue, 2007; Soares-Aguiar & Palma-dos-Reis, 2008), e-commerce and supply chains (Gibbs & Kraemer, 2004; Jeyaraj, Balser, Chowa, & Griggs, 2004).

In the views of (Dimaggio, 1991), coercive pressures resulting from both formal and informal sources are placed on organizations by other organizations upon which they are dependent on, in the broader context of the society within which these organizations function. In other words, coercive pressure emanates from authorities or other organizations that have power over other organizations. This pressure comes into force when organizations are under compulsion to adopt structures or rules. Coercive pressure may come from government, parent company, official governing or regulatory agency, partners and customers. Organizations seem more susceptible to coercive influences. This influences technology adoption. In the case when innovation is needed to fulfill some requirements, organizations often have little or no other option than adopting. On this basis, the existence of relevant infrastructures and accessories within organisational settings tend to influence technology adoption.

In the case of health technology adoption and utilization by practitioners, developments in other health sectors in different settings or geographical areas may push authorities to implement appropriate strategies like putting in place relevant technology infrastructure. As such, health outfits are more likely to comply because of the

need to maintain good cooperative relationship with regulatory authorities. Resisting such changes may damage relations between subordinate health institutions and superordinate regulatory authorities. From the foregoing discourse, the research designates relevant technology infrastructure as a coercive force.

Mimetic forces are borne out of pressures to copy or emulate other organizations' activities, systems or structures. Dimaggio (1991) posit that "*once a field becomes well established, there is an inexorable push toward homogenization*". It is easier for organizations to transact with other organizations, to attract career-minded staff acknowledged as legitimate and reputable. Some organizations "copy" or imitate other organization's model (structure, process, or forms) whenever deemed successful. Some mimetic behaviors are sometimes inadvertent and unplanned and may happen during staff transfer or turnover, or from consultant inputs. The desire to emulate can significantly impel institutions to provide training for personnel. Mimetic forces elucidate on the widespread adoption of, for example, management practices (Abrahamson, 1996).

This logic can be extended to technology adoption by health practitioners. Technology benefits users by helping to increase organizational dexterity and performance. Within the corporate health sector, actors are likely to imitate competitors whenever the advantages and benefits of technology deployed by other users are realised. And by so doing, health actors are likely to seek for adequate practitioner training on the use of the technology, so as to gain the requisite knowledge to ably utilize technology to improve outcomes. In this view, adequate practitioner training, within the research model represents a mimetic force.

Normative pressures emanate from the collective expectation of players within a particular organization. These expectations, likely to stem from suppliers and competitors may develop into corporate standards, norms and conventions (Scott, 2005) and may further induce normative effects on institutions to act in line with contemporary corporate practices since they are in sync with legitimacy (Scott, 2005). Institutions by nature are dynamic. This institutional dynamism exerts pressures on institutions and enables them to act in line with shared standards and norms within the corporate space (Berrone, Fosfuri, Gelabert, & Gomez-Mejia, 2013). Given this situation, change resisting, non-complying actors or sector players are likely to be jettisoned. As such, actors are expected to comply. For this reason, managerial heads may tend to conform and support technology adoption practices. Accordingly, practitioners' adoption will be driven by networks including

management which contributes to establishing an institutional or organizational norm. In the light of the above, the research proposes management support as a normative pressure.

Electronic health

Studies over the years have buttressed the overwhelming contribution of innovation adoption and utilization. It is in this respect that the potency of the innovation's integration into the health sector and its contribution to universal health coverage is investigated. Bossen, Jensen, and Udsen (2013; Khalifehsoltani et al., 2010) in a study attest that electronic health does not only improve but also strengthens the quality of care given to patients. Chaudhry et al. (2006) also confirm the significance of technology in health-care delivery. According to Agrawal (2002); Khan, Shahid, Hedstrom, & Andersson (2012), e-health innovation improves productivity and efficiency in healthcare delivery. Similarly, evidence abounds that e-health tools have a positive effect on users (Bedeley & Palvia, 2014). It thus improves efficiency and results in enhancing behavioral outcomes as compared to non-users (Murray, Burns, Tai, Lai, & Nazareth, 2004). Furthermore, as observed by (Burton, Anderson, & Kues, 2004), health innovation advances an improved level of communication and facilitates overall improved coordination of healthcare (Bodenheimer, Wagner, & Grumbach, 2002).

Hypotheses

From the above discussions, the following hypotheses are formulated for the various study constructs;

H1: PEOU of e-health technology has a positive relationship with UHC

H2: PU of e-health technology has a positive relationship with UHC.

H3: MS of e-health technology has a positive relationship with UHC

H4: APT on e-health technology has a positive relationship with UHC

H5: RTI of e-health technology has a positive relationship with UHC

H6: PEOU of e-health technology has a positive relationship with EHT

H7: PU of e-health technology has a positive relationship with EH Adoption

H8: MS of e-health technology has a positive relationship with EH adoption

H9: MS of e-health technology has a positive relationship with UHC

H10: RTI has a positive relationship with e-health technology adoption

H11: E-health as a mediator influences the relationship between PEOU, PU, MS, APT, RTI and UHC

Research methods and data collection

The study employs a Structural Equation Modeling approach to develop and verify the research model and to illustrate the relationship between the constructs (Figure 1). The survey was created online using www.wjx.cn and the questionnaire link sent to participants via WhatsApp, Facebook, Mails, and WeChat. Also, to help reach out to respondents who for reason(s) of;

- (i) Not being users of any of the questionnaire administration mediums utilized;
- (ii) Not being regular users of the questionnaire administration/dissemination platforms used;
- (iii) Encountering or likely to experience internet network challenges, paper questionnaires were administered in addition to the online surveys.

The study was conducted among actors in the health sector, including Nurses, Medical doctors, Health Administrators and other health support service providers like pharmacists, ambulatory service providers, and laboratory technicians. Therefore, practitioners from across diverse fields of expertise in different health facilities across Ghana were targeted under convenient sampling technique. To avoid bias, participants were not offered any incentive. In this study, a total of 450 questionnaires were distributed. At the end of the survey which targeted fully engaged practitioners in both governments and non-government owned and controlled health facilities, 420 questionnaires were retrieved. After sorting out questionnaires with incomplete responses, 416 useable questionnaires representing 92.4% were used. This is an indication of a high response rate and internal validity for the study. The demographic features of respondents are summarized in Table 1. The survey involved 40 items

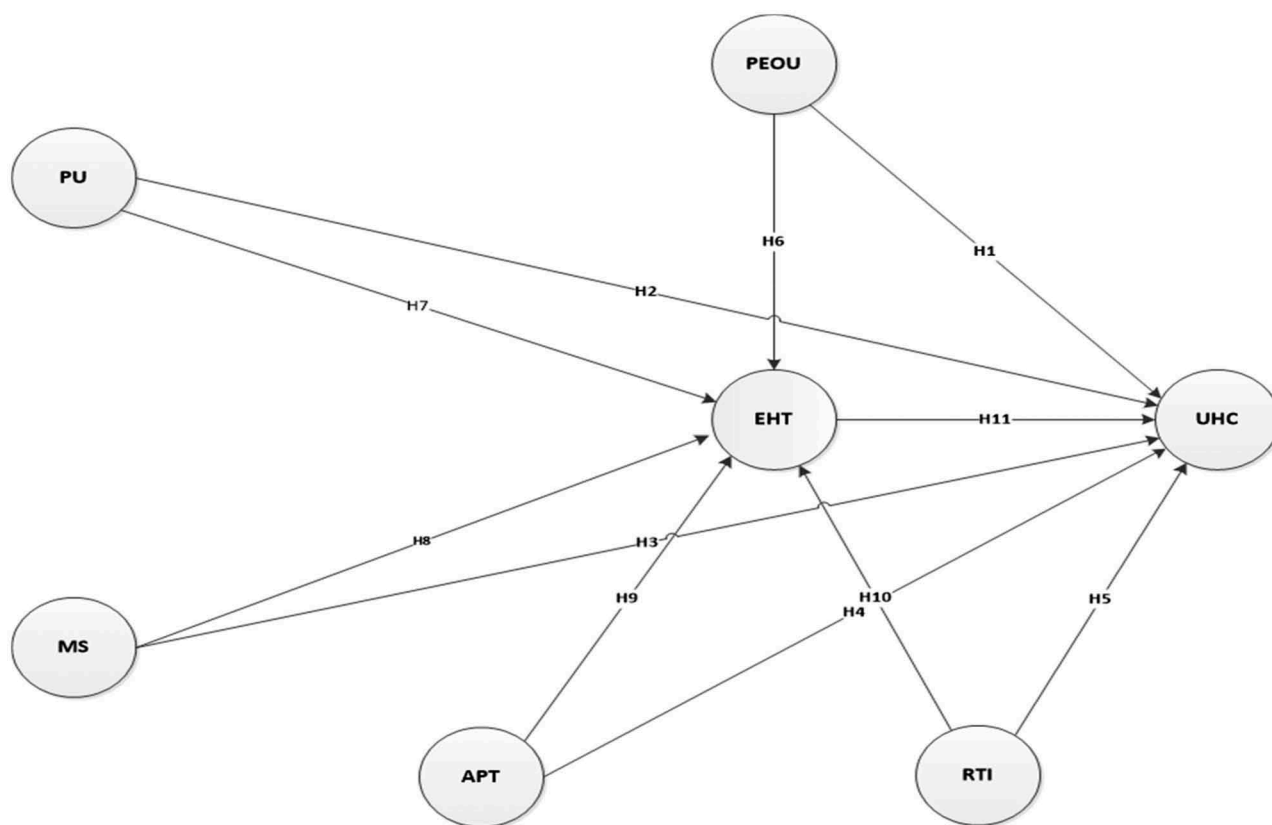


Figure 1. Conceptual Framework.

PU = Perceived Usefulness; PEOU = Perceived-Ease-of-Use; MS = Management Support; APT = Adequate practitioner training; RTI = Relevant technology Infrastructure; EHT = Electronic Health Technology; UHC = Universal Health Coverage.

Table 1. Descriptive information of samples demographic characteristics.

Measures	Frequency	Percentage
Gender		
Male	172	41.3
Female	244	58.7
Age		
>30	76	18.3
30-39	148	35.6
40-49	124	29.8
50-59	56	13.5
60+	12	2.9
Educational Level		
Certificate	28	6.7
Diploma	120	28.8
Bachelors	124	29.8
Master	84	20.2
PhD	56	13.5
Others	4	1.0
Years of Service		
>5	100	24.0
5-10	220	52.9
11-15	96	23.1
15+	0	0
Area of Expertise		
Medical Doctor	92	22.1
Nurse	180	43.3
Health Administrator	64	15.4
Others	80	19.2

disseminated over chosen constructs adapted from previously tried, tested and validated questionnaires. The researchers made few changes in the language of the questions to reflect the measurements of the constructs. The items for Perceived-Ease-of-Use (PEOU) were adapted from prior studies, who have already established their reliability and validity (Davis, 1989; Morton, 2008; Rauniar, Rawski, Yang, & Johnson, 2014; Sanch, Cortijo, & Javed, 2014; Sarwar et al., 2019). Perceived Usefulness was also adapted from (Davis, 1989; Morton, 2008; Rauniar et al., 2014; Sanch et al., 2014; Sarwar et al., 2019). Management Support was adapted from (Aldosari, 2004; Dansky, Gamm, Vasey, & Barsukiewicz, 1999; Morton, 2008). Similarly, Adequate Practitioner Training was adapted from Morton (2008) while Relevant Technology Infrastructure was also adapted from Bultum (2014). Constructs for measuring Electronic Health were adapted from prior studies by Morton (2008). Finally, the items used for Universal Health Coverage were adapted from (WHO, 2017).

A 5-point Likert scale ranging from Strongly Disagree to Agree Strongly was used to measure the responses. Specific changes were made in sentence structure of questions according to the current study. To help develop an understanding of the study, a brief was held for respondents about the study purpose. In compliance with research ethics, respondents were assured of the confidentiality of all information provided. They were also guaranteed that data collected will be used only for academic purpose.

Data analysis and results

Based on the proposed theoretical framework and hypotheses, Structural Equation Modeling technique along with PLS-SEM data analysis software version 3.0 was used for data analysis and establishing the model. In analyzing the data, measurement models were initially verified to confirm the validity and reliability of the study constructs. Subsequently, the structural model was assessed by using hypotheses testing. The proximate reason for the use of SEM is to use an observed variable to measure an unobserved variable. In analyzing the data, the measurement models were verified to confirm the validity and reliability of the constructs using SPSS v.23. And finally, structural modeling was used to measure the mediating effect of electronic health. Discriminant validity analysis was conducted to assess the degree of correlation among the latent variables. The results of the discriminant validity analysis indicate that the indices according to benchmark $> .7$ validate the proposed model. From Table 2, the highlighted diagonal line is an indication of the relationship of the latent variables which is also the square root of their respective average variance extract (AVE) captured in the outer loadings in Table 3. Also, composite reliability (CR) analysis was conducted to confirm the reliability and validity of relationships between latent variables in the study of health innovation adoption and utilization. In the analysis, all composite reliability scores of our variables were found to be above .7 showing sufficient statistical significance of proposed constructs (Fornell & Larcker, 1981; Hair, Anderson, Tatham, & Black, 1998; Wu, 2010). As indicated in Tables 2 and 3, R square recordings show weak construct

Table 3. Analysis of variable loadings.

Constructs	OL	VIF	Q ²	R ²	AVE	rho A
APT1	0.909	2.246	0.001		0.703	0.825
APT2	0.867	2.672				
APT3	0.712	2.294				
APT4	0.853	2.087				
EHT1	0.916	2.697			0.732	0.997
EHT2	0.920	2.753				
EHT3	0.782	2.351				
EHT4	0.796	2.382				
MS1	0.773	2.258	0.028	0.053	0.617	0.905
MS2	0.762	2.174				
MS3	0.820	2.296				
MS4	0.838	2.441				
MS5	0.818	2.357				
MS6	0.752	2.111				
MS7	0.727	2.000				
PEOU1 <-	0.844	2.454	0.002	0.004	0.71	0.902
PEOU2 <-	0.866	2.891				
PEOU3 <-	0.829	2.496				
PEOU4 <-	0.841	2.447				
PEOU5 <-	0.833	2.216				
PU1	0.760	2.507	0.008	0.018	0.657	0.941
PU2	0.821	2.423				
PU3	0.851	3.579				
PU4	0.759	2.658				
PU5	0.859	2.882				
PU6	0.854	2.310				
PU7	0.761	2.036				
RTI1	0.898	6.145	0.008	0.014	0.694	0.87
RTI2	0.910	6.424				
RTI3	0.681	1.389				
RTI4	0.824	1.738				
UHC1	0.788	1.861	0.044	0.085	0.659	0.89
UHC2	0.767	1.948				
UHC3	0.856	2.422				
UHC4	0.851	2.521				
UHC5	0.794	1.642				

OL = Outer loadings, VIF = Variance Inflation Factor, Q² = Collinearity redundancy, R² = Explanatory power, AVE = Average variance extract, rho_A = Unidimensionality of Reliability.

power. (APT = 0, MS = 0.053, PEOU = 0.004, PU = 0.018, RTI = 0.014, UHC = 0.085). The measurements are against the benchmark which indicates that, values between .19-.33 (weak) .33-.57 (Moderate) and $>.67$ strong (Hair, Black, Babin, & Anderson, 2010).

Discriminant validity analysis

Model analysis

In the reliability test, Cronbach alpha values were found to be more than .7, indicating a reasonable scale of reliability. Table 2 and Figure 2 capture the results. Path coefficient of the various constructs in

Table 2. Fornell-Larcker criterion of discriminant validity.

CONSTRUCTS	APT	EHT	MS	PEOU	PU	RTI	UHC	CR	R Square	Cronbach Alpha
APT	0.839							0.904	0	0.883
EHT	0.007	0.856						0.916		0.888
MS	0.108	0.230	0.785					0.918	0.053	0.896
PEOU	0.061	0.061	0.161	0.843				0.925	0.004	0.898
PU	-0.012	0.133	0.088	0.175	0.810			0.930	0.018	0.916
RTI	0.119	0.120	0.123	0.094	0.050	0.833		0.900	0.014	0.849
UHC	0.101	0.061	0.090	0.253	0.042	0.140	0.812	0.906	0.085	0.872

APT = Adequate practitioner training, EH-Electronic Health, MS = Management Support, PEOU = Perceived-Ease-of-Use, RTI = Relevant technology Infrastructure, UHC-Universal Health Coverage, CR-Composite Reliability.

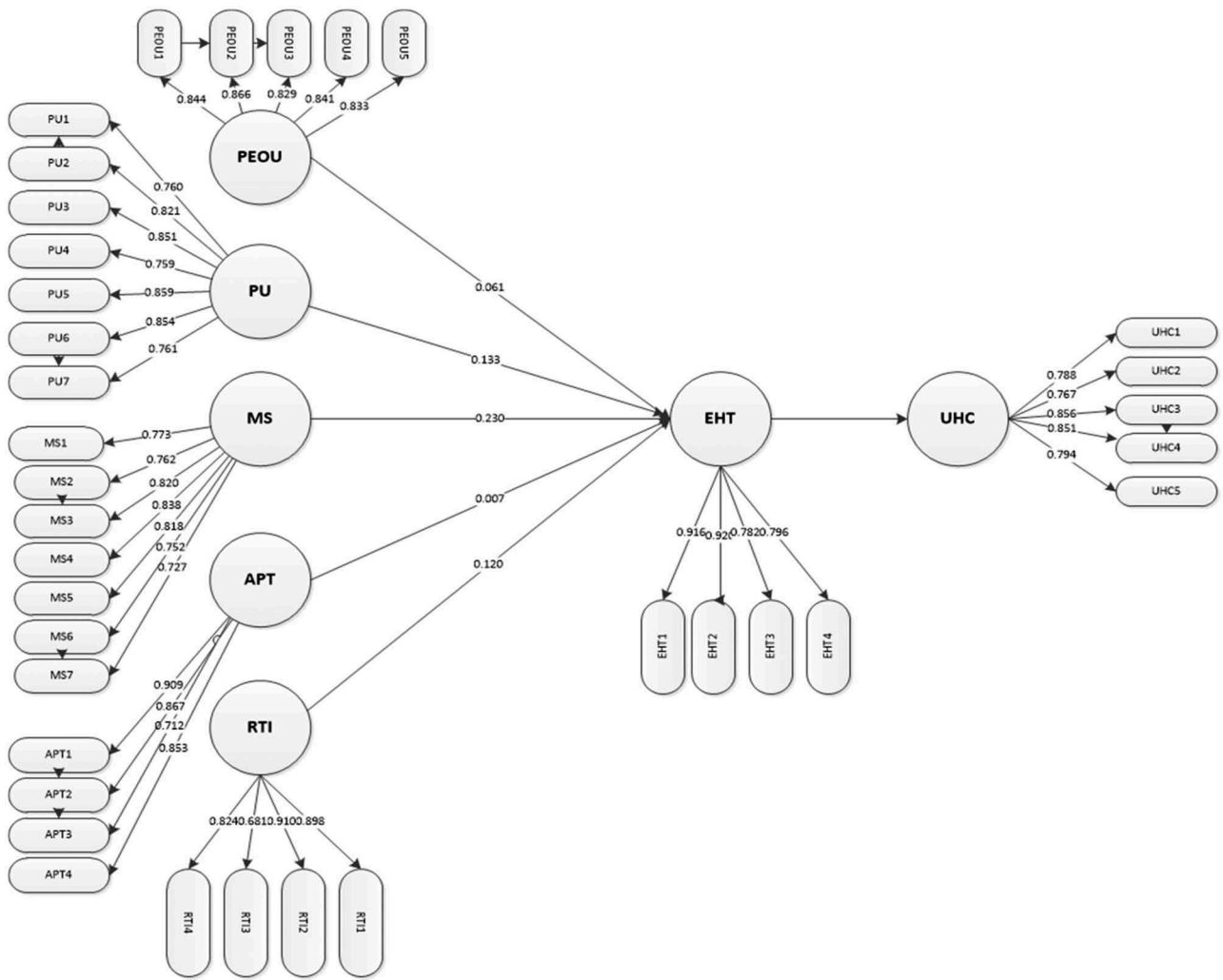


Figure 2. Measurements and Structural Model Equation.

PU = Perceived Usefulness; PEOU = Perceived-Ease-of-Use; MS = Management Support; APT = Adequate practitioner training; RTI = Relevant technology Infrastructure; EHT = Electronic Health Technology; UHC = Universal Health Coverage.

Table 4, alongside their respective hypotheses, indicates the significance of inferences. The external loadings, on the other hand, recorded significant loadings which were all above the threshold of .7.

(Fornell & Larcker, 1981; Hair et al., 2010) as shown in Table 3.

Next, partial least square (PLS) analysis was conducted to ascertain values of Variance Inflation Factor

Table 4. Results of hypotheses testing.

HYP	Original Sample (O)	Sample Mean (M)	Standard Deviation	t	Effects			inference
					f ²	Indirect(β)	p < value	
H1PEOU->UHC	0.234	0.236	0.081	2.882**	0.057	0.234	0.004	Supported
H2PU-> UHC	-0.01	-0.008	0.062	0.156	0	-0.01	0.876	Unsupported
H3MS-> UHC	0.026	0.035	0.049	0.538	0.001	0.026	0.591	Unsupported
H4APT->UHC	0.072	0.055	0.095	0.757*	0.005	0.072	0.449	Unsupported
H5RTI->UHC	0.103	0.107	0.058	1.766**	0.011	0.103	0.078	Supported
H6PEOU->EHT	0.061	0.068	0.053	1.159**	0.004	0.061	0.247	Supported
H7PU->EHT	0.133	0.153	0.066	2.024***	0.018	0.133	0.044	Supported
H8MS->EHT	0.23	0.239	0.068	3.362***	0.056	0.230	0.001	Supported
H9APT->EHT	0.007	0.004	0.071	0.092	0	0.007	0.927	Unsupported
H10 RTI->EHT	0.12	0.125	0.06	1.995***	0.015	0.12	0.047	Supported
H11EHT->UHC	0.029	0.026	0.036	0.796*	0.001	0.029	0.427	Supported

PEOU = Perceived-Ease-of-Use; PU = Perceived Usefulness; MS = Management Support; APT = Adequate Practitioner Training; RTI = Relevant Technology Infrastructure EH = Electronic Health; UHC = Universal Health Coverage; β = path coefficient, t = significance, f² = effect size, p value *t is sign at p > .05, **t is sign at p > .01 and ***t is sign at p > .001.

(VIF) between the latent variables. From the results obtained, the values were sufficiently consistent with the standard measurement of .5 (Hair et al., 2010). Regarding external measurement loadings, which measures the relationships between the unobserved construct and errors, the values obtained were reliable and proved consistent with Dillon-Goldstein's rho which also measures Unidimensionality of the reliability which is better in principle than Cronbach alpha (Chin, 1998). From Table 3, it is clear that the values obtained were all beyond the minimum threshold of .7 (Hair et al., 2010).

Hypotheses testing and effects

After signifying the validity of the measurement model, proposed hypotheses were tested. Figure 3 indicates path analysis results using PLSmarts software v.3.0. The results found H1; PEOU \rightarrow UHC ($\beta = 0.234$, $SD = 0.081$, $f^2 = 0.057$, $t^2 = 2.882$, $p > .004$) as supported and confirmed that perceived-ease-of-use of e-health technology has a significant relationship which could be mediated by electronic health technology adoption and utilization. Under H2; PU \rightarrow UHC ($\beta = 0.01$, $SD = 0.062$, $f^2 = 0.000$, $t^2 = 1.156$, $p > .876$), the study results revealed no significant relationship between perceived usefulness of ehealth technology adoption and utilization as a predictor of universal health coverage achievement. Also, under hypothesis 3; MS \rightarrow UHC ($\beta = 0.026$, $SD = 0.049$, $f^2 = 0.001$, $t^2 = 0.538$, $p > .591$), results revealed no significant relationship. As such, the hypotheses were unsupported. Moreover, H4; APT \rightarrow UHC

recorded ($\beta = 0.072$, $SD = 0.095$, $f^2 = 0.005$, $t^2 = 0.757$, $p > .449$) and showed an insignificant relationship. As such, the hypothesis was unsupported. The findings further recorded under H5 that RTI \rightarrow UHC ($\beta = 0.103$, $SD = 0.058$, $f^2 = 0.011$, $t^2 = 1.766$, $p > .078$). This supported the hypotheses. Besides, H6; PEOU \rightarrow EHT recorded ($\beta = 0.061$, $SD = 0.053$, $f^2 = 0.004$, $t^2 = 1.159$, $P > .249$).

From the inference, the hypothesis is significant to the study of health innovation technology adoption and utilization studies. It was also revealed that H7; PU \rightarrow EH recorded ($\beta = 0.133$, $SD = 0.066$, $f^2 = 0.018$, $t^2 = 2.024$, $p > .044$). This shows a significant positive relationship. Per the analysis of results obtained, H9; APT \rightarrow EH ($\beta = 0.007$, $SD = 0.071$, $f^2 = 0.000$, $t^2 = 0.092$, $p > .927$) was unsupported. The results of H10; RTI \rightarrow EHT ($\beta = 0.120$, $SD = 0.060$, $f^2 = 0.015$, $t^2 = 1.995$, $p > .047$) indicated that the existence of relevant technology infrastructure is a sufficient predictor of practitioners' intention to adopt and utilize ehealth technology innovation. This confirmed the proposition. Finally, as captured in H11; EH \rightarrow UHC ($\beta = 0.029$, $SD = 0.036$, $f^2 = 0.001$, $t^2 = 0.796$, $p > .427$), a weak, yet significant relationship was recorded. This supported the hypotheses. Results indicate that all proposed hypotheses supported but H2, H3, H4 and H9.

Mediating effect of electronic health

Integral to the objectives of this study, how electronic health as a mediating variable can influence the

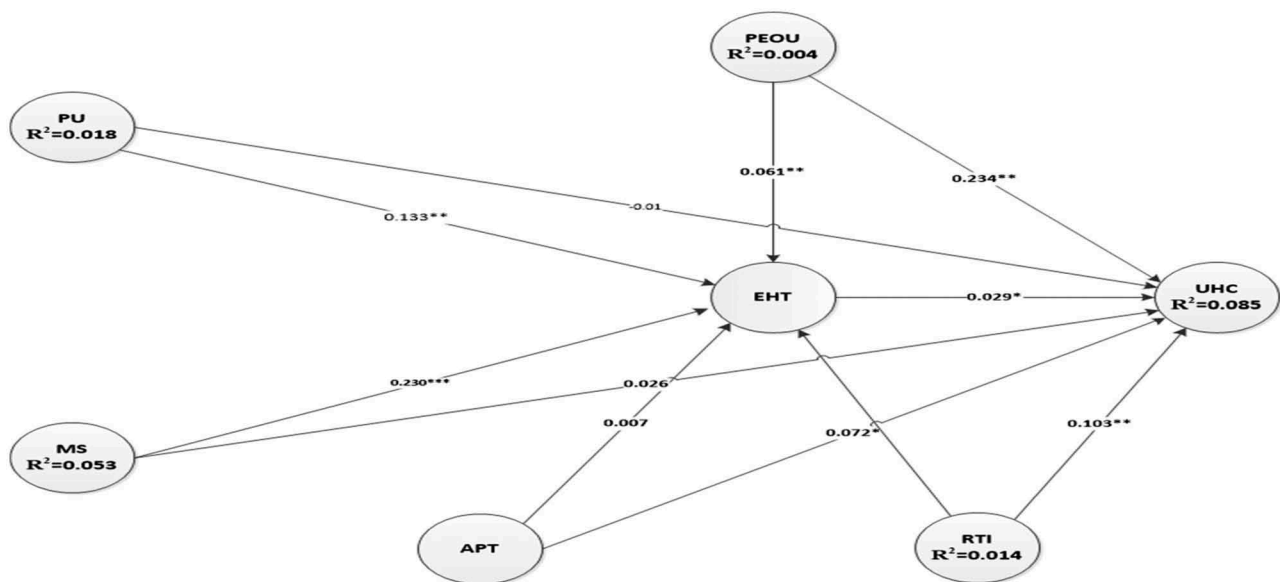


Figure 3. Structural Equation Modeling with Results of Significance.

PU = Perceived Usefulness; PEOU = Perceived-Ease-of-Use; MS = Management Support; APT = Adequate practitioner training; RTI = Relevant technology Infrastructure; EHT = Electronic Health Technology; UHC = Universal Health Coverage.

relationship between the independent variables; thus, PEOU, PU, MS, APT, RTI and the dependent variable; thus, UHC is investigated. With particular emphasis on the path coefficient showing the relationship between the mediator and dependent variable, as shown in Figure 3, EH \rightarrow UHC recorded ($\beta = 0.029$, $SD = 0.036$, $f^2 = 0.001$, $t^2 = 0.796$, $p > .427$) which shows a positive relationship as well as the predictive power of the mediator to influence the dependent variable. To the best of the researchers' knowledge, there is a literature deficit relative to universal health coverage owing to the newness of the global goal. And this constitutes part of the reason why they will make seminal contributions to health technology-based studies while breaking grounds for further future research.

Figure 2 indicates the mediating critical factor and path coefficient values regarding the interaction effect of independent and dependent variables. Results revealed EHT to be mediating the relationship between the independent and dependent variables as shown in Table 3, Figure 1.

Discussion and conclusion

Our findings indicate that perceived ease of use of electronic health technology, as captured in the results, have a significant effect in relations to driving universal health coverage. This implies that users' comfort and convenience in the adoption and utilization of a particular health technology, to a greater extent, serves as a determining factor for practitioners. Therefore, in pursuit of universal health coverage goals, it is important that factors of convenience are integrated into the innovation design framework to enhance widespread usage. With regards to prior studies on how ease of use could impact on UHC drive, to the best of the researcher's knowledge, there is a dearth of literature on this subject matter. This however said (Morton, 2008; Sarwar et al., 2019) in a study confirm the positive effect of perceived ease of use on the adoption of a technology.

Regarding H2, the study findings indicate that perceived usefulness of adoption and utilization of an innovation by a user or users has an insignificant correlation with driving UHC goals. This was inconsistent with the proposed hypothesis. However, in the assumptions of the authors, this could be ascribed to the complex nature of the UHC goal drive using technology. Under this circumstance, the study concludes that the UHC policy goal requires more than technology to be driven (Adams et al., 2013). The insignificant effect of health innovation adoption and utilization on universal health-care drive could also be attributed to

practitioners' non-conversance with health innovation adoption and perhaps the newness of the goal of universal health coverage. This inconsistency could further be attributed to the complexity of the institutionalized health structure which has different actors with diverse attitudes and behaviors towards work. Part of the ways to forge a much stronger consensus towards driving the achievement of UHC goal by 2030 calls for a much broader stakeholder engagement on the subject matter.

Similarly, there was an insignificant relationship between management support of electronic health technology as a predictor of driving the achievement of UHC goals. This result is not supportive of hypothesis 3. This results in dissonance with (Aldosari, 2004; Dansky et al., 1999; Morton & Wiedenbeck, 2009; Poon et al., 2004) who confirmed management support of innovation usage as a predictor of health technology adoption. Therefore, it becomes apparent that management-led initiative is less likely to yield results. In the views of the researchers, adoption and utilization of innovation to driving UHC goals rest more on individual practitioners. In this regard, the adoption endeavor may have to be pushed and pursued in a manner transiting from the individual practitioners' level and then to a larger level to involve management. Thus, from micro to macro level. The insignificant effect of management support on universal health coverage should be a wakeup call for health establishments to engage professional health administrators with the requisite qualification and understanding of the health sector. Engaging human resources with the requisite knowledge and skills would help practitioners appreciate the goals and pursue them more rigorously and vigorously.

Furthermore, hypothesis four was also unsupported. The study results revealed an insignificant relationship between adequate practitioner training on electronic health technology adoption and utilization and UHC goal drive. This could be interpreted to mean that training offered to practitioners has or could have little or no significance on technology adoption. While training on electronic health innovation appears to be important to ensure not only adoption and utilization but also to propelling UHC goals, it does however appear not to have an overall impact. The varying attitudes of practitioners towards purposefully driving innovation are confirmed by Teach and Shortliffe (1981). In the views of the researchers, the insignificance could be attributed to insufficient motivation to use technology and anxiety brought about by technology use (Morton, 2008). Practitioners' familiarity with the conventional health-care process in Ghana which does not involve much utilization of technology in

dispensing service is also likely to be a reason for the low premium, priority and significance placed on training as a conduit to equip practitioners with the requisite skills in the use of technology to drive UHC goals.

Despite the negative relationships recorded, our study revealed a significant correlation between the existence of a relevant technology infrastructure as an adoption stimulus to drive UHC. This supported the hypotheses and indicated that relevant technology infrastructure for e-health technology has an effect on universal health coverage. Prior studies like (Bultum, 2014) confirm how the existence of a relevant technology infrastructure can influence technology adoption, utilization and service delivery. This is a confirmation of hypotheses 5.

Besides, the results of analysis further revealed that perceived ease of use recorded a positive relationship with electronic health innovation adoption and utilization. From the confirmed inference 6, the hypothesis is supported. This is consistent with (Amadu et al., 2018; Davis, 1989; Sarwar et al., 2019). In confirmation of H7, it was revealed that users' perceived usefulness of electronic health innovation technology has a significant correlation with adoption. The study indicated a strong correlation between the two variables. This is consistent with seminal information system-based studies such as Chau & Hu (2002); Chismar & Wiley-Patton (2003). Aldosari (2004) and Seligman (2001) also corroborate the significance of perceived usefulness to innovation adoption. This finding is an indication of how perceptions of user unfriendliness or otherwise could influence practitioner's intention or decision to adopt technology.

Furthermore, results under hypotheses 8 revealed a significant relationship between Management Support and electronic health technology adoption intention. Management support which refers to practitioners' expectation and perceptions of management's ability to provide adequate resources to enhance electronic health innovation adoption and utilization (Anderson & Aydin, 1997; Lorenzi & Riley, 2000) and providing moral and financial support, training programs, and clinical and technical support (Simon et al., 2007) is confirmed as a predictor of health practitioners' adoption and utilization intention of innovation. This is confirmed by (Aldosari, 2004; Morton & Wiedenbeck, 2009; Poon et al., 2004; Wu & Lee, 2005). The study results indicate the need for instituting a strong management that can provide the resources necessary to enhance adoption and utilization.

Analysis of data revealed that adequate practitioner training, as captured under hypothesis 9 revealed a negative relationship with user adoption and utilization of electronic health technology. Against this backdrop, it is obvious that adequate practitioner training is not sufficient and enough predictor of physicians' adoption of

electronic health technology. While training seems to be very important to practitioner's technology adoption, it appears to have no impact on adoption. This finding is consistent with (Dillon & Morris, 1996; Hurley, 1992; Karsh, 2004; Morton & Wiedenbeck, 2009).

As confirmed in prior studies by Grimson, Grimson, and Hasselbring (2000), the results of H10 indicated that the existence of relevant technology infrastructure is a sufficient determinant of practitioners' intention to adopt and utilize ehealth technology innovation. Fundamentally, technology infrastructure comprises the existence of technology-driven communication devices like computers, which are essential to impelling health technology innovation adoption and utilization by practitioners and consumers alike. The pertinence of this infrastructure lies in its strength to provide connectivity as a basis for enhancing and improving health service delivery while overcoming its inherent system-related challenges (Detmer, 2003).

More specifically, a relevant technology infrastructure constitutes the foundation on which sound clinical and clerical decision-making efforts of practitioners subsist. This comes with series of support for applications while integrating the systems' applications to solicit for accurate and complete data. Relevant Technology Infrastructure (RTI) according to the findings of this study has a significant predictor relationship with electronic health innovation. By inference, it appears that the existence of a relevant technology infrastructure can influence electronic health technology innovation adoption and utilization by health practitioners. The significant correlation between technology infrastructure and health innovation technology adoption is confirmed by (Grimson et al., 2000).

Finally, as captured in H11, electronic health innovation as a mediator between the independent and dependent variables recorded a coefficient = 0.029*, indicating a significant mediating effect. Even though the significance is weak, other research studies (Fabrizi, Guarini, & Meliciani, 2018) confirm the significance of the results. Hence, the hypothesis is significantly supported.

From the discourse, it could be deduced that technology can be an excellent tool and driver of health service delivery, while helping to break geographical barriers, ensuring equity, promoting efficiency and quality in healthcare delivery and building a sustainable and resilient healthcare system to help promote the larger goal of universal health coverage. In this regard, the attitude of practitioners, who constitute the nucleus of the health system, and as such drivers of the UHC policy vehicle become central in this effort as the nuances in practitioners' attitude relative to technology adoption and utilization is essential. For this reason,

practitioners need to be committed and motivated to realize the goal, while improving professional capacity through education and training. From the results of the various hypotheses indicated and explained above, as captured in Table 4, except for H2, H3, H4 and H9, all hypotheses indicated a significant relationship.

Summarily, this study concludes that technology has permeated diverse facets of our social life. This is amply evidenced in its enormous development, subsequent deployment and utilisation in institutions and sectors including the health sector. The integration of technology is substantial and has proven to be very beneficial in health service delivery as it aids practitioners in discharging their duties effectively and efficiently. In spite of this, the adoption of technology and its utilisation as evidenced in prior studies, and more precisely in this study, appear to be influenced by a concatenation of factors. As such, technology adoption attitudes could be varying and chiefly informed and influenced by different elements. The current study specifies that PEOU, PU, MS, APT and RTI are key positive factors to influencing technology adoption and utilization by practitioners. The analysis further revealed that electronic technology innovation adoption, which within the purview of the topic under investigation – ehealth and its potential impact to driving Universal Health Coverage status appeared significantly supported as hypothesized. In the world of information technology, given the urgency of health matters, and the unbridled global commitment to asserting equity and quality in health-care delivery, building a responsive, sustainable and resilient health-care system in promoting sector effectiveness and efficiency, having a deeper insight into the complexities and intricacies underpinning technology adoption and utilisation behavior of users is crucial for technology adoption and utilisation in the overall global stride to achieving universal health coverage.

Future implications and limitations

Health sector practitioners can use electronic health technology innovation to promote efficiency, effectiveness and overall, improve health sector performance to the benefit of not only patients but also practitioners as well. Practitioners can develop high creativity among themselves by promoting innovation which is likely to help global health care and delivery. The results of this study can support individual and institutional stakeholders to gain a better understanding of factors (direct and indirect, explicit and implicit) that is likely to inform adoption and utilization of electronic health technology by health practitioners in the global effort to advancing and achieving universal health coverage. Also, stakeholders can use the study findings to develop systems

that accommodate the different specialties, users' technology efficacy levels and needs.

Finally, this study has certain limitations. First, this research is purely quantitative; the data for this study were collected through survey questionnaires. Also, with regards to this study, medical practitioners from across the various fields of expertise in both government and private health facilities in Ghana were interviewed. Participants extracted from both rural and urban, small, medium and large health facilities were considered for data collection. On this score, future research could be also be conducted by focusing on specific expertise in a specific government or private health facility. The study also recommends that future research focus on health practitioners and facilities in different geographic locations. Undertaking this research will help to investigate variations in factors such as practitioners' field of practice, facility type and resourcefulness, size and geographical location and their relationship with technology adoption and utilization. This is another research to be commissioned. Follow-up studies with focus groups, user interviews, or observations would also help provide a more detailed understanding of factors influencing practitioners' innovation adoption and needs. Future research should also be undertaken using qualitative research method. Furthermore, the study also recommends future studies to among other things, focus on factors affecting electronic health technology adoption by patients across different social spheres. Lastly, the research suggests future studies to further concentrate on exploring how technology could effectively and efficiently be harnessed and sufficiently deployed to help in expeditiously pushing the agenda of universal health coverage.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

All procedures performed in this study are in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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Appendix 1.

A brief overview of the study

The purpose of this study seeks to investigate technology integration in healthcare delivery in Ghana and assess its potency in not only driving the health sector but also helping to achieve universal health coverage (UHC) through the mediating role of electronic health technology (ehealth). Health technology integration (ehealth) within the precincts of this study is defined as the deployment of Information and Communication Technology (ICT) into the health service and providing infrastructure for improving health and healthcare of people. This may encompass the use of online information systems by health-care professionals and hospital services, mobile health telemedicine services and other technology-driven healthcare support services. By universal health coverage, we infer to the principle whereby healthcare delivery and the building of related infrastructure are centered on equity, quality, responsiveness, efficiency and resilience whiles breaking all divide gaps. Please provide your honest response as per the scale.

Constructs and measurement items:

Perceived-Ease-of-Use (Davis, 1989; Morton, 2008; Rauniar et al., 2014; Sanch et al., 2014; Sarwar et al., 2019).

PEOU 1 My interaction with electronic health will be clear and understandable - "User-Friendly."

PEOU 2 Learning to use electronic health technology will be easy for me.

PEOU 3 I expect to become skilled in using electronic health technology.

PEOU 4 I expect electronic health technology to be accessible for health practitioners to use.

PEOU 5 Electronic health is flexible to interact with it.

Perceived Usefulness (Binesh, 2018; Davis, 1989; Morton, 2008; Rauniar et al., 2014; Sanch et al., 2014)

PU 1 Using electronic health will improve the quality of work and services provided to patients.

PU 2 Using electronic health will give me greater control over my work.

PU 3 Using electronic health will allow me to work quickly and increase productivity.

PU 4 Using electronic health will allow me to accomplish more task and improve learning performance.

PU 5 Using electronic health will enhance effectiveness in my job.

PU 6 Using electronic health technology will make my job easier to perform.

PU 7 Electronic health will be a useful tool for practicing my profession.

Management Support (Aldosari, 2004; Dansky et al., 1999; Morton, 2008).

MS 1 Electronic health is vital to top management.

MS 2 Electronic health will be introduced to me forcefully by management.

MS 3 Management will support by providing the needed resources during implementation of electronic health technology.

MS 4 Management will involve me in the implementation of electronic health technology.

MS 5 Management will provide me the required training needed to use electronic health technology effectively.

MS 6 I will have easy access to resources to help me understand and use electronic health.

MS 7 Management expects me to use electronic health technology innovation.

Adequate Practitioner Training (Morton, 2008)

APT 1. The training I will receive on the electronic health will be sufficient.

APT 2 I will accept the training that I need to be able to understand and use electronic health technology.

APT 3 The electronic health training will be more useful to my work.

APT 4 The electronic health training will make it easier for me to use health technology.

Relevant Technology Infrastructure (Bultum, 2014)

RTI 1 Poor internet connection is not good enough to support electronic health.

RTI 2 ICT infrastructure availability will help electronic health technology.

RTI 3 Electronic health technology may not perform well because of technology network challenges.

RTI 4 Electronic health technology infrastructure is too expensive to be provided.

Electronic Health (Morton, 2008)

EH 1 I prefer use of personal computer (laptop or handheld) device in my work.

EH 2 The frequency of use or familiarity with electronic health is an essential component of its usage.

EH 3 I.C.T training or experience is a good determinant in e-health technology adoption.

EH 4 I.C.T knowledge will enhance technology use in my work.

Universal Health Coverage (World Health Organization, 2017)

UHC 1 Electronic health Technology integration will promote and ensure equity in healthcare.

UHC 2 The integration of electronic health care will enhance quality in healthcare delivery.

UHC 3 Electronic health technology will help in building responsive health system.

UHC 4 Electronic health technology integration will promote efficiency in healthcare.

UHC 5 Electronic health technology integration will help build a sustainable and resilient healthcare system.