


'Digitising health protection schemes in Ghana': An enquiry into factors associated with the use of a mobile phone-based health insurance contribution payment system among tertiary students

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ABSTRACT: In 2018, Ghana's National Health Insurance Scheme (NHIS) introduced a mobile money payment system for membership renewal and premium payments to enhance enrolment and retention rates. However, the adoption of such innovations depends on various factors, including personal traits and public perceptions. This study aims to explore the determinants of NHIS membership renewal and premium payment via the mobile renewal system. Conducted at Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana, the study used a survey design to gather data from 951 KNUST students. Employing logistic regression analysis, the study identified key factors influencing the use of the NHIS mobile renewal service. The findings revealed that individuals aged 19-21, 25-27 or above 27, without mobile money accounts, and those with no history of online purchases were less likely to adopt the mobile renewal system ($P < .05$). Conversely, those perceiving the system as useful and easy to use were more likely to utilise it for NHIS membership renewal ($P < .05$). In conclusion, policymakers should prioritise system quality, accessibility, perceived ease of use, and usefulness to facilitate the adoption and usage of the NHIS mobile payment system. These findings contribute valuable insights for enhancing the effectiveness of health insurance innovations.

KEYWORDS: National Health Insurance Scheme, mobile money payment system, health protection schemes, students, Ghana

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Background

The delivery of healthcare and the provision of allied health-care interventions via mobile devices, computers, and tablets remains one of the contemporary paradigms in global health-care delivery. The World Health Organization [WHO]¹ defines mobile health (mHealth) as the use of mobile phones and associated technologies in medical care. This has been promoted by the rapid advancement of mobile technologies and applications and continuous growth in coverage of mobile cellular networks.¹ The WHO regards this vital component of electronic health (mHealth) as paramount for making health care accessible to hard-to-reach populations.¹ Hurt et al.² therefore referred to mHealth as a useful tool for achieving Universal Health Care (UHC). Even though the concept of mHealth was largely a phenomenon associated with high-income countries, the past decade has witnessed a tremendous scale-up in low- and middle-income countries [LMICs].² According to the WHO,¹ this is a consequence of global

efforts to promote equity in healthcare accessibility in these regions.

Globally, Africa has one of the poorest healthcare systems.^{2,3} According to Ashiagbor et al.,³ many people still have to travel long distances to access healthcare facilities. In Nigeria and the Central African Republic, Medecins Sans Frontieres [MSF]⁴ and Otu et al.⁵ have noted that the uneven distribution of health facilities has led to reduced health-seeking behaviour among most rural people and the urban poor. Similarly, in the Democratic Republic of Congo, South Africa, Ghana, and Ethiopia, it has been established that health facilities are largely concentrated in urban centres to the neglect of rural dwellers.^{1-3,6} This has led to a colossal reliance on traditional health-care systems and faith-based healing practices.^{7,8} The WHO referred to these systems of health care as ineffective due to their inability to help combat 'simple' or 'less deadly' diseases.¹ Again, direct out-of-pocket payments are among the most important financing mechanisms in many health systems,



adversely affecting equality and leading vulnerable groups to poverty. The situation creates gaps in financial accessibility to healthcare services, thereby resulting in inequity, and deteriorated health outcomes, and, in some instances, avoidable deaths.

Challenges with financing healthcare, the generally poor state, and low capacities of healthcare facilities, coupled with the WHO's aspiration of achieving one doctor per thousand people by 2024, have awakened the interest of regional and national governments towards adopting efficient and pragmatic measures targeted at improving healthcare delivery in sub-Saharan Africa.⁹⁻¹¹ Recent studies have shown that some countries are making tremendous strides in their health sectors. Some of these countries include South Africa,¹² Rwanda,¹³ Ghana¹⁰ and Nigeria.¹¹ One common characteristic of these countries is the attempt to make health care accessible to all citizens through the national health insurance scheme [NHIS]. These efforts signify attempts to undo the healthcare utilisation barriers and financing gaps that hinder access to preventive and curative medical services among vulnerable populations in particular. Health insurance provision through pooled funding is seen as an income redistributive approach that results in improved access to healthcare services among vulnerable groups by balancing the potential to pay for such services.

Following the passage of the National Health Insurance Act (Act 650 of 2003) and Legislative Instrument (LI) 1809, the Government of Ghana [GoG] established the NHIS in 2003.¹⁴ In Ghana, the advent of the NHIS has seen an unprecedented increase in healthcare utilisation in the last two decades.¹⁵⁻¹⁷ Kwarteng et al¹⁸ identified that the introduction of the NHIS led to a partial shift from the well-known and prevalent 'cash-and-carry' system, which made it impossible for poor citizens to seek medical care. The policy protects Ghanaians and lawfully residing non-Ghanaians from financial risk by absolving them of paying for some medical treatments in designated health facilities.¹⁹ The National Health Insurance Act of 2003, Act 650, details the specific ailments and medical treatments that are covered and excluded under the policy.^{14,20} The National Health Insurance Authority [NHIA] set the premium at a minimum of GH¢ 6.00 (\$0.53) and a maximum of GH¢ 42.00 (\$3.73), with a GH¢ 6.00 (\$0.53) processing charge. Enrolment costs for people under 18 years is GH¢ 6.00 (\$0.53), GH¢ 6.00 (\$0.53) for active Social Security and National Insurance Trust (SSNIT) donors, and GH¢ 28.00 (\$2.49) for all other individuals (18-69 years).^{21,22} However, exemptions are offered to vulnerable populations, including the aged (70 years and above), the hard-core poor, expectant mothers, and those with mental illnesses.

In the year 2018, the Ghanaian health sector was further strengthened by the introduction of a mobile phone-based health insurance contribution payment system. This is a complementary system alongside the conventional in-person renewal system that makes it easier for NHIS subscribers to renew their yearly subscriptions using their mobile wallet, a

payment processing service operated under financial regulations and performed from or via a mobile device.^{23,24} The goal of the mobile renewal service was to help address the problem of long waiting hours at designated renewal centres.²⁵ The system has also removed other barriers to membership renewal, including time and travel costs, in addition to delays in the processing of membership cards. The aforesaid goal cannot be delinked from the fertile ground (necessary and sufficient conditions) offered by the high mobile phone usage, high mobile money transactions recorded in Ghana in recent times, and the e-governance strides of the government through its agencies and departments. Under the mobile renewal service, except for pregnant women and the indigent, who are required to visit district offices to renew their subscriptions, all member categories can use the mobile phone-based contribution payment system. According to the Atlantic Federation of African Press Agencies [AFAPA],²⁶ the use of mobile money systems for the renewal of NHIS membership, has witnessed a phenomenal increase in the country. Up to 9.1 million people renewed their memberships in 2019, and more than 5.8 million people (70%) utilised the mobile money wallet renewal system. About 8099074 mobile renewals were reported between January 2019 and May 2020.²⁶ The proportion of mobile renewals to total renewals increased between June 2019 and April 2020 (67.4% in June 2019 to 82.3% in April 2020). Hence, the scheme has been adjudged as a potential pathway for making health care accessible to all Ghanaians.^{23,24,26-28}

Several studies have been conducted among the general Ghanaian population to establish the determinants of NHIS membership renewal via the mobile phone-based health insurance contribution payment system in both rural and urban Ghana. Factors such as age, informal sector employment, urban residence, religion, proximity to health facilities, income, level of education, and underlying health conditions have been identified as major predictors.^{9,10,18,25,29} However, most of these studies were conducted within health institutions/facilities that were largely patronised by older adults. The existing literature has reported low information technology usage among older populations.^{30,31} People with low information technology skills often dominate this population, hindering their effective harnessing and utilisation of modern, sophisticated mobile phones and associated devices for healthcare accessibility. As far as this study is concerned, no such study has been conducted in higher educational institutions – with a youthful population.³²⁻³⁴ This study, therefore, sought to explore the predictors of mobile wallet systems' usage for the renewal of NHIS membership among tertiary students at the Kwame Nkrumah University of Science and Technology [KNUST], Kumasi, Ghana. In Ghana, NHIS membership has become a primary requirement for students seeking tertiary education.^{9,27} However, renewal of membership is not monitored among students, even though, frequent communications on the importance of enrolling and renewing membership are usually made. This makes the targeted

population ideal for the study. Drawing on the Technology Adoption Model [TAM], an information systems theory that models how users come to accept and use a technology³⁵ and the Theory of Reasoned Action [TRA], which explains the relationship between attitudes and behaviours within human action,³⁶ the study examined the adoption of mobile renewal service for NHIS membership renewal among tertiary students at KNUST. The study answered the question: What are the demographic and socioeconomic factors, mobile money usage, and online purchasing behaviour, in addition to technology-related factors that predict the usage of mobile technology system for the renewal of NHIS membership?

Profile of the Study Setting

KNUST is a public university located in Kumasi in the Ashanti Region of Ghana. The University focuses on science and technology. The university has 6 colleges that are made up of faculties, within which departments are situated. With an over 70,000 student population, KNUST is committed to the professional development of Ghana and Africa's labour force. As a science and technology centre committed to developing innovative minds to propel the technological advancement of the country and the continent at large, it is important to understand the adoption of technological advancements within this student population.

Methods

Study design

We employed the survey research design, a specific form of research design where a predetermined set of questions are given to participants, as the main technique of data collection.³⁷⁻⁴⁰ Surveys are techniques that researchers employ to better understand individual or group perspectives on a certain subject or issue of interest,^{37,40} in this instance, the prevalence and predictors of mobile system use for the renewal of NHIS membership among tertiary students at KNUST. We employed the quantitative survey design, which is frequently used in large-scale research and depends heavily on closed questions to collect data. This ensured the operationalisation of a statistical analytical framework to develop a broad overview of mobile phone-based health insurance contribution payment use among tertiary students in Ghana. Again, the design allowed the researchers to collect data from a large number of participants efficiently and analyse the results to draw conclusions and make inferences about the target population.

Study population

Undergraduate and postgraduate students of KNUST, Kumasi, constituted the participants of this study. The choice of undergraduate and postgraduate students of KNUST, Kumasi as participants in this study was based on several factors. Firstly, these

students are easily accessible and available within the research environment, making them convenient for recruitment. Secondly, as students of an academic institution, they possess a certain level of educational background and knowledge that may be relevant to the study's objectives. Lastly, by involving students from KNUST, the study could potentially provide insights into the experiences and perspectives of this specific group in relation to the research topic.

Sample size and sampling technique

The sampling methodology involved a 4-stage cluster sampling approach. Firstly, of the 6 colleges in the University, the College of Humanities and Social Sciences [CoHSS] was selected through a simple random approach. Secondly, between the Faculty of Social Sciences [FoSS], Faculty of Law and KNUST School of Business [KSB] (the 3 faculties that make up CoHSS), the Faculty of Social Sciences was selected using a simple random approach. Thirdly, furnished with the reference numbers of students in the departments within FoSS, the sample size was estimated using Miller and Brewer's⁴¹ formula $n = \frac{N}{1 + N(\alpha)^2}$ where n (sample size, 1500), N (sample frame; 7700) and α (margin of error; 0.05). To increase the sample size, the 380 obtained from the equation was multiplied by 3. Of the 1141, a total of 951 responses were obtained, indicating an 83.3% response rate. Finally, we employed the systematic sampling technique to select the participants at $K=5$. Thus, our sample was made up of every fifth member on the list after randomly selecting a starting point.

Data collection procedure

The study's data were collected by 15 well-trained research assistants selected based on their proficiency in social surveys. The research assistants located the participants based on their reference numbers and programme of study. They interacted with the selected participants, and those who consented and signed a consent form to indicate their willingness to participate in the survey were reached through email. Data were collected electronically using Google Forms. The forms were emailed to participants. The participants completed the forms and submitted them to our database. Before the data was collected, the data collection tool was pre-tested and all the necessary corrections and changes were made. The data collection tool, designed in a close-ended format was used to collect information on the socio-demographic characteristics, knowledge of the mobile phone-based health insurance contribution payment system, perceptions about the mobile phone-based health insurance contribution payment system for NHIS membership renewal, and attitudes towards the mobile money payment system. The data was gathered between April 20, 2021, and May 20, 2021.

Outcome and predictor variables

In this study, the outcome variable is the use of a mobile phone-based health insurance contribution payment system for NHIS membership renewal, comprising 2 categories (1 = utilisation of the mobile phone-based health insurance contribution payment system, 2 = no utilisation of the mobile phone-based health insurance contribution payment system). The variable was measured within a timeframe of 6 months before the data collection. This was done to limit recall bias, since longer recall periods in micro-level studies that seek to establish an association between variables increase bias, while a shorter recall period limits recall bias.⁴² The predictor variables were gender (1 = male, 2 = female), age in years (1 = 19-21 years, 2 = 22-24 years, 3 = 25-27 years, 4 = more than 27 years), religion (1 = Christianity, 2 = Islam, 3 = African Traditional Religion) level of education (1 = first-year students, 2 = second-year students, 3 = third-year students, 4 = fourth-year students, 5 = postgraduate students), mobile money ownership (1 = has registered as a mobile money subscriber, 2 = has not registered as a mobile money subscriber), and online purchasing behaviour (1 = has ever made an online purchase, 2 = has never made an online purchase), in addition to NHIS enrolment duration (1 = below 5 years, 2 = between 5 and 10 years, 3 = between 11 and 15 years, 4 = more than 15 years). Other predictor variables include the perceived usefulness of the mobile phone-based health insurance contribution payment system and perceived ease of use of the mobile phone-based health insurance contribution payment system (both independent variables were measured on a Likert scale with anchors ranging from 1 which corresponds to strongly disagree to 4 which corresponds to strongly agree).

Data processing and analysis

In this study, both descriptive and inferential analytical techniques embedded in Statistical Package for the Social Sciences [SPSS] software version 20 were employed. Percentages and frequencies were employed to describe the demographic and socio-economic characteristics of the participants. Inferential statistics such as multivariable logistic regressions were used to estimate the association between demographic and socio-economic characteristics, mobile money subscription, online purchasing behaviour, and perceptions about the mobile phone-based health insurance contribution payment system. The binary logistic analysis examined the association between the outcome and predictor variables. SPSS was used to perform the analysis, and the logistic regression analysis is presented as odds ratios. We developed two separate models to explain factors associated with the use of the mobile phone-based health insurance contribution payment system, for NHIS membership renewal. The first model included only demographic and socioeconomic characteristics, mobile money subscriptions, and online purchasing behaviour, in addition to NHIS enrolment duration. The second model covered

perceptions about the mobile phone-based health insurance contribution payment system, plus all variables in Model 1. The significance of the test was set at a *P*-value of .05 or less.

Results

Background information of the participants

The background information of the participants is presented in Table 1. From the results, the majority of the students were males (60.5%), between the ages of 19 and 21 years (41.5%), belonged to the Akan ethnic group (56.8%), professed the Christian faith (80.7%), were in level 100 or the first year of their undergraduate study (50.1%), and had registered for mobile money (93.6%). Additionally, we found that 35.2% of the participants had ever made an online purchase, 41.5% had enrolled in the scheme for more than 15 years, and 4% had complementary health insurance.

Prevalence, patterns and perceptions of the mobile money payment system

From the results in Table 2 below, 57.3% were knowledgeable in the mobile money payment system for the renewal of NHIS membership, and 51.4% had ever used the mobile money system for NHIS membership renewal. Furthermore, 53.3% believe it is effective, 54.3% strongly believe it is a good initiative for digital governance, 51.4% strongly agree that it is convenient, 43.6% agreed that the system is easy to use, 63.6% agreed that it eliminates transportation costs to renewal centres and offices, and 67.3% believe the system saves time spent in renewing membership. Further, significantly marked differences were found within gender and the prevalence, patterns, and perceptions of mobile money system usage for the NHIS membership renewal among the students.

Predictors of mobile money system's usage for NHIS membership renewal

Sequential logistic regression analysis was conducted to determine the variables that correlate to the mobile money system usage for NHIS membership renewal among the students. The results of the analysis are presented in Table 3. The bold entries in Table 3 represent the statistically significant results. In model 1, the background information of the students was used as an independent variable to predict the usage of the mobile money system for NHIS membership renewal. The results show that males (AOR: 2.092, CI: 1.028-3.044, *P* = .022), those aged between 19 and 21 (AOR: 2.368, CI: 1.033-1.042, *P* = .006), and those aged between 25 and 27 (AOR: 3.006, CI: 2.026-4.041, *P* = .007), were significantly more likely to report the usage of the mobile money system for NHIS membership renewal, while those without mobile money accounts (AOR: 0.348, CI: 0.021-0.044, *P* = .027), and those who never made an online purchase (AOR: 0.829, CI: 0.003-0.039, *P* = .043), were significantly less likely to report the usage of the mobile money system for NHIS membership renewal.

Table 1. Background information about the participants.

VARIABLE	CATEGORIES	COUNT (951)	PERCENTAGE (%)	
Gender of the participants	Female	376	39.5	
	Male	575	60.5	
Age of the participant	Below 19 years	260	27.3	
	19-21 years	395	41.5	
	22-24 years	140	14.7	
	25-27 years	88	9.3	
	Above 27 years	68	7.2	
Ethnic group to which the participants belong	Akan	540	56.8	
	Ewe	180	18.9	
	Mole-Dagbon	31	3.3	
	Ga-Dangme	100	10.5	
	Gurma	28	2.9	
	Grusi	62	6.5	
	Mande	4	0.4	
Religious faith professed by the participants	Guan	6	0.6	
	Christianity	767	80.7	
	Islam	180	18.9	
	African Traditional Religion	4	0.4	
	The educational level of the participants	Level 100	476	50.1
		Level 200	320	33.6
		Level 300	80	8.4
Level 400		50	5.3	
Post-first degree		25	2.6	
Have mobile money account	Yes	890	93.6	
Ever made an online purchase?	Yes	335	35.2	
NHIS enrolment duration	Below 5 years	140	14.7	
	5-10 years	260	27.3	
	11-15 years	156	16.5	
	More than 15 years	395	41.5	
Covered by supplementary health insurance	Yes	38	4.0	

In the full model (model 2), participants aged between 19 and 21 years (AOR: 0.401, CI: 0.020-0.049, $P=.001$), those aged between 25 and 27 years (AOR: 0.663, CI: 0.023-0.045, $P=.008$), aged more than 27 years (AOR: 0.561, CI: 0.009-0.042, $P=.004$), those without mobile money accounts (AOR: 0.662, CI: 0.014-0.033, $P=.047$), and those who never made an online purchase (AOR: 0.077, CI: 0.007-0.050, $P=.003$),

were significantly less likely to report the usage of the mobile money system for NHIS membership renewal. Furthermore, those who perceive the system as useful (AOR: 3.745, CI: 2.014-4.049, $P=.034$), and those who perceive it as very easy to use (AOR: 4.235, CI: 1.011-4.039, $P=.001$), were significantly more likely to report the usage of the mobile money system for NHIS membership renewal.

Table 2. Prevalence, patterns and perceptions of the mobile money payment system.

VARIABLE	CATEGORY	MALE(N=575)	FEMALE(N=376)	TOTAL=951	P-VALUE
		N (%)	N (%)	N (%)	
Knowledge of mobile money system to renew membership	Yes	400 (69.6)	145 (38.6)	545 (57.3)	.001*
Used the mobile money system to renew membership	Yes	362 (63.0)	127 (33.8)	489 (51.4)	<.000*
The NHIS mobile money renewal system is an effective way of membership renewal	Agree	351 (61.0)	156 (41.5)	507 (53.3)	<.023*
The NHIS mobile money renewal system is a good initiative	Agree	354 (61.6)	162 (43.1)	516 (54.3)	.007*
The mobile money renewal system is a convenient method for NHIS membership	Agree	377 (65.6)	112 (29.8)	489 (51.4)	<.000*
Usage of the mobile money renewal system is easy	Agree	310 (53.9)	105 (27.9)	415 (43.6)	.038*
Reduces transportation cost	Agree	400 (69.6)	205 (54.5)	605 (63.6)	.020*
Saves you from long queues at NHIS offices	Agree	385 (67.0)	255 (67.8)	640 (67.3)	.003*

*The Chi-square statistic is significant at the 0.05 level.

Table 3. Predictors of mobile money system's usage for NHIS membership renewal.

VARIABLES	MODEL 1				FULL MODEL			
	EXP(B)	95% C.I. FOR EXP(B)		P-VALUE	EXP(B)	95% C.I. FOR EXP(B)		P-VALUE
		LOWER	UPPER			LOWER	UPPER	
<i>Background characteristics</i>								
Gender ^a								
Males	2.092*	1.028	3.044	.022	0.788	0.597	1.039	.843
Age (years) ^b								
19-21	2.368*	1.033	2.042	.006	0.401*	0.020	0.049	.001
22-24	1.653	0.879	3.108	.674	0.848	0.523	1.374	.863
25-27	3.006*	2.026	4.041	.007	0.663*	0.023	0.045	.008
Above 27	1.433	0.700	2.936	.078	0.561*	0.009	0.042	.004
Religion ^c								
Islam	0.076	0.097	1.022	.562	0.631	0.010	0.041	.660
Traditional African Religion	0.172	0.289	0.982	.977	5.734	0.029	0.366	.927
Educational level ^d								
Level 200	0.795	0.337	1.876	.053	0.647	0.428	0.977	.836
Level 300	0.667	0.286	1.559	.558	1.084	0.566	2.077	.812
Level 400	0.798	0.283	2.248	.689	1.928	0.907	4.099	.589
Post first degree	1.606	0.543	4.752	.676	2.187	0.848	5.645	.743
Registered for mobile money ^e	0.348*	0.021	0.044	.027	0.662*	0.014	0.033	.047
Online purchasing behaviour ^f	0.829*	0.003	0.039	.043	0.077*	0.007	0.050	.003

(Continued)

Table 3. (Continued)

VARIABLES	MODEL 1			FULL MODEL				
	EXP(B)	95% C.I. FOR EXP(B)		P-VALUE	EXP(B)	95% C.I. FOR EXP(B)		P-VALUE
		LOWER	UPPER			LOWER	UPPER	
NHIS enrolment duration ^g								
5-10 years	2.672	0.025	1.001	.783	0.975	0.056	1.062	.986
11-15 years	1.062	0.067	0.771	.654	1.671	0.023	0.098	.784
More than 15 years	1.063	0.067	1.062	.984	2.762	0.663	1.144	.778
<i>Perception of the system</i>								
Perceived usefulness ^h								
Agree					3.745*	2.014	4.049	.034
Perceived ease of use ⁱ								
Agree					4.235*	1.011	4.039	.001
Model fitting information -2Log Likelihood	1673.046				1273.463			
Hosmer-Lemeshow χ^2 (significance)	9.782(0.341)				19.306 (0.347)			
Nagelkerke R^2	0.245				0.318			

*P-value of .05 or less.

^aFemale is the reference category for the gender variable.

^bBelow 19 years (16-18) is the reference category for the age variable.

^cChristianity is the reference category for the religion variable.

^dLevel 100 is the reference category for the education variable.

^eNo is the reference category for the mobile money variable.

^fNo is the reference category for the online purchase variable.

^gBelow 5 years is the reference category for the NHIS enrolment duration variable.

^hDisagree is the reference category for perceived usefulness.

ⁱDisagree is the reference category for perceived ease of use.

Discussion

The objective of the study was to investigate the determinants of renewing membership and paying the NHIS premium through the mobile money payment system, with students of KNUST being the population of the study. We found that more than half of the students (51.4% of the 951 students) have used the mobile money system for the renewal of their NHIS membership. This was occasioned by high knowledge of the system and positive perceptions ranging from its effectiveness as a digital governance mechanism, its convenience, ease of use, cost and time-saving potential. Our finding corroborates several other studies^{23,24,43-45} where comfort, convenience, reduction in renewal time and absence of transportation costs, hitherto, whose presence constituted barriers to renewing the NHIS membership were established. As indicated by Addae-Nketiah²³ the elimination of travel costs directly translates into monetary savings for those involved. This suggests that following the implementation of the mobile renewal service, NHIS members can now conveniently renew their NHIS subscription from the comfort of their home via mobile renewal service, without incurring travel costs which directly translates into

monetary savings that support the predictions in the NHIA policy guide on the mobile renewal service.⁴⁶

The challenges brought by the 'Cash and Carry' payment system, which demands that patients pay cash before receiving medical treatment, and the ensuing discrepancies in financial access to healthcare led to the creation of the NHIS. Evidence suggests that several reasons, including network issues at renewal centres and transportation costs to these centres have recently made it more difficult to renew NHIS membership. The NHIA implemented mobile membership renewal via a mobile money payment system in response to some of these issues so that NHIS members will not incur extra renewal expenses and delays at NHIS offices. This is to enhance membership renewal and retention, as well as Ghana's overall healthcare system through the provision of a financial buffer to subscribers. The implementation of the NHIA's mobile renewal system is not spared of difficulties. Network problems, card activation challenges, double renewal, drawn-out process steps, and a lack of information technology [IT] expertise on the part of some NHIS clients are cited in the NHIA report.^{23,24} Our analysis, however, showed a highly positive perception of the

system among the participants. The NHIA and its allied partners must ride on these positives and improve on their education and awareness creation to achieve higher sentiment and attitude towards the system.

From the logistic regression estimates in Table 3, variables including the participant's age, mobile money registration, and online purchasing behaviour were significant predictors of mobile phone-based health insurance contribution payment use. Furthermore, participants with positive perceptions about the system's usefulness and ease of use were significantly more likely to report the usage of the mobile money payment system for NHIS membership renewal. The predictive potential of age in our study was not expected since the population was made up of youths who spend more time on their phones^{30,31,47-49} and make a lot of online purchases.^{50,51} Our stance is premised on the expectation of some uniformity within the various age categories. The differentiated effects of age on the usage of the mobile payment money platform for the renewal of NHIS subscription among the participants imply that although youths are known to make a lot of online purchases, there are marked or significant variations regarding this behaviour among them. It presupposes that youths must be perceived as differentiated groups and not lumped together into a homogenous entity.

A wide range of financial services that may be accessed using a mobile phone is referred to as 'mobile money'.⁵² The majority of mobile money services are airtime purchases, bill payments, and remittances. Mobile money looks to have the ability to fundamentally alter how retail finance is managed in developing nations since it serves both network infrastructure and a platform for financial services innovation.⁵³ Mobile money allows financial service providers to serve customers at a lower cost per transaction and with less investment in physical infrastructure by providing a cheap option to outsource cash handling and deposit and withdrawal procedures. Mobile money encourages the increased usage of electronic payments made with mobile devices.⁵³ Consumers may send money to each other quickly and simply through online peer-to-peer money transfers on mobile money without having to deal with the time-consuming procedure of writing and mailing a cheque or sending real currency.⁵² Our finding that respondents without mobile money accounts were less likely to renew their NHIS subscription through the mobile renewal service supports prior research demonstrating that mobile money payment systems by mobile telephony companies have contributed to the steady growth in online shopping amid the new generation of consumers who seek out richer experiences.³³ In light of the finding, policies that promote mobile money services uptake must be promoted.

The youth are noted to make a lot of online purchases.^{50,51} The study has shown that there is high patronage of the option for NHIS membership renewal by mobile phone, aided by the mobile money payment platform: an online purchasing platform. The decision to make an online purchase is partly

influenced by trust and online purchasing history; making individuals who trust online purchasing systems and had made an online purchase in the past more likely to do so in the future. As such, the predictive attribute of past online purchases in the usage of the mobile money payment platform for the renewal of NHIS membership is not a surprise. For participants with expired NHIS subscriptions, the tendency of using the mobile renewal service before the study was low since most of them have not renewed their membership or subscriptions in 3 or 4 years preceding the study, even before the mobile money payment platform for NHIS renewal was launched.

Perception of the innovation's usefulness has a direct and substantial relationship to the use of the mobile renewal service. The outcome demonstrates that NHIS subscribers' use of the mobile renewal service is significantly influenced by their perceived usefulness of the innovation. The result supports the TAM hypothesis that perceived usefulness serves as a primary motivator of usage intentions of innovation.^{23,54-57} The TRA asserts that people's ideas affect their attitudes, which in turn affect their behavioural intentions.^{58,59} Perceived utility and perceived simplicity of usage are both beliefs. They will therefore influence the user's objectives. Communicating the utility and the usefulness of the NHIS mobile renewal service over the traditional method of membership renewal which involves queuing at the office of the NHIA and is deemed inefficient is imperative towards achieving higher utilisation rates of the system, beyond the 56.4% reported in this study and the 82.3% of all renewals in April 2020 by AFAPA.²⁶

The perception of ease of use and the use of mobile renewal services were strongly correlated. The outcome demonstrates that NHIS subscribers' perceived ease of use of the mobile renewal service platform has a significant impact on their use of the service. One of the 2 TAM components used to predict NHIS subscribers' use of mobile renewal services is perceived ease of use.⁶⁰ According to proponents of the TAM, people who desire to use information systems [IS] can adopt them, and the perception of their utility and usability can aid in predicting this intention. Numerous attestations in the current literature on mobile health support the largely favourable impact of perceived ease of use on subscribers' intentions to use the mobile renewal service.^{23,54,55,61,62} The implication is that when developing such innovative means of making payments for services, the focus should be on how easily the target population can use it, taking into account the differential technological complexities of the population. As such, technologies should be developed with a consumer-centric focus, where complexity is at its barest minimum and ease of use is at the maximum.

To enhance participation in the mobile money payment system for NHIS membership renewal among KNUST students, we recommend a proactive approach. The NHIA must undertake periodic and dynamic awareness and education campaigns, emphasising the efficiency and time-saving benefits of the

mobile renewal service through vibrant posters, engaging digital screens, and collaboration with student organisations. The NHIA must organise informative workshops and hands-on training sessions to address concerns and ensure a smooth onboarding process. They must also encourage current users to share positive experiences and implement referral programmes with incentives for new users. Collaborate with mobile money service providers and local businesses to provide exclusive benefits and promotions. Furthermore, the NHIA and the mobile money service providers should actively address security and privacy concerns by offering real-time support. NHIA and the school authorities could team up to seamlessly integrate the mobile renewal service into student life, making it a routine part of activities. Finally, all these must be done with a commitment to continuous improvement based on user feedback, aiming to create a compelling case for widespread adoption.

Strengths and Weaknesses

The current study examined the determinants of the patronage of the mobile option for NHIS subscription renewal among university students in Ghana. The results showed that the main determinants are age, mobile money registration, online purchasing behaviour, the status of NHIS membership, ease of use and perceived usefulness of the mobile money payment system. Being the first study that examined the predictors of the mobile phone-based health insurance contribution payment usage among a unique group on diverse fronts (youths, university students with high mobile phone usage and a high predisposition to making online purchases), our study has made a tremendous contribution to the literature on technology adoption and e-governance. The restricted study area is the main limitation of the study. Future studies could include other universities in other regions of Ghana to make the data more representative of the nation. However, the current study starts a crucial line of inquiry that is required to guarantee the efficacy of the novel intervention. Again, timing is very important for insurance renewal. Renewal periods that coincide with the payment of salaries potentially have a larger positive effect on renewal. Almost all of the participants are currently not working but depends on stipends from their parents or guardians. While we acknowledge that these stipends could be likened to salaries, their irregularity and non-fixed payment periods made it difficult to include this variable in the analysis. This should be considered in future studies. Finally, we did not include information on whether the participants made payments themselves or relied on a third party, be their parents, siblings or colleagues. This information is also crucial for policy purposes. This should also be considered in future studies.

Conclusion

The study assessed the predictors of the mobile money system's use for the renewal of NHIS membership among tertiary students. Multivariable logistic regression analysis was conducted

to determine the variables that correlate to the mobile money system usage for NHIS membership renewal among the students. The results revealed that age, past online purchases, perceived ease of use and usefulness of the mobile renewal system were the significant predictors. There is a need for intensive education and information sharing about the effectiveness and importance of using the mobile renewal system as a mode for NHIS membership renewal against the traditional, in-person approach. Knowledge about the mobile renewal system will be very useful for the adoption of the innovation for NHIS subscription renewal among students in Ghana. Based on the findings, the study makes 3 recommendations to ensure the success of the intervention. The establishment of the TAM components (perceived utility and ease of use) in subscriber usage patterns provides a strong foundation for theoretical and policy ramifications. The notable qualities of the mobile renewal service (usefulness and ease of use) established in the current study should indicate general subscriber acceptance. Additionally, education and communication of the systems' utility should assume a differentiated approach along age, online purchasers and mobile money users. It is also recommended that emphasis be placed on the role of insurance coverage as a risk-sharing approach in healthcare financing and healthcare accessibility and utilisation discourses.

Abbreviations

AOR: Adjusted Odd Ratio
 AFAPA: Atlantic Federation of African Press Agencies
 CoHSS: College of Humanities and Social Sciences
 CI: Confidence Interval
 FoSS: Faculty of Social Sciences
 GoG: Government of Ghana
 IT: Information Technology
 KNUST: Kwame Nkrumah University of Science and Technology, Kumasi
 KSB: KNUST School of Business
 LI: Legislative Instrument
 LMICs: Low-Middle-Income Countries
 mHealth: Mobile Health
 NHIA: National Health Insurance Authority
 NHIS: National Health Insurance Scheme
 MSF: Medecins Sans Frontieres
 SPSS: Statistical Package for the Social Sciences
 TAM: Technology Adoption Model
 TRA: Theory of Reasoned Action
 WHO: World Health Organization

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Authors' Contributions

AKM contributed to the conception and design, acquisition and analysis of data, and manuscript drafting. DK and MA

contributed to drafting the introduction. SUN, EO and TQ developed the methodology. JC and MAA proofread and cross-checked the references. All the authors proofread and recommended the manuscript for publication.

Ethics Approval and Consent to Participate

All methods were carried out per relevant guidelines and regulations. The Ghana Health Service Ethics Review Committee exempted the ethical approval due to the nature of this general qualitative study involving voluntary participants according to the Standard Operating Procedures 2015. All participants provided written informed consent before participating in the research activities. Written informed consent was obtained from the participants. Participants also agreed on the publication of the study results. As the dignity, safety and well-being of the interviewees were a matter of primary concern to the researchers, participation in the study was strictly voluntary, and no identifying or sensitive information was recorded.

Consent for Publication

Not applicable.

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Availability of Data and Materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

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