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Mobile Communications, physical distance and access to follow-up healthcare service in Lagos Metropolis

Femi Ola Aiyegbajeje[1, CDFPMR], Dickson Dare Ajayi[2, M]

[1]*University of Lagos, Faculty of Social Sciences,* Department of Geography, UNILAG Road, 1, Akoka, Lagos State, 100213, Nigeria; phone: +234 803 551 4427 e-mail: femidavid2002@yahoo.com or faiyegbajeje@unilag.edu.ng *(corresponding author);* [2]*University of Ibadan, Faculty of the Social Sciences,* Department of Geography, 1, UI-Ojoo Road, Ibadan, Oyo State, 200284, Nigeria; phone: +234 805 613 7219, e-mail: ajayidd@yahoo.com

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Abstract. The widespread use of mobile communications has resulted in a new practice in family and social life, with significant implications for physical distance. This is because mobile communication allows users to overcome spatial issues such as distance to healthcare services, shift to person-to-person connectivity, and the blur boundaries between one point and another. The uneven distribution of healthcare facilities and distances among them has compounded the provision of follow-up care services to healthcare seekers. Therefore, this paper examined the relationship between the use of mobile telephone to access follow-up healthcare services and physical distance separating out-patients from healthcare centres. The unified theory of acceptance and use of technology (UTAUT) model provided the framework for the study. Using a systematic random sampling technique, a structured questionnaire focusing on socio-demographic characteristics (gender, age, and income), mobile telephone usage for follow-up healthcare services and its effect on physical distance, was administered on 370 respondents at Lagos University Teaching Hospital (LUTH) Idi-Araba, Lagos. Pearson correlation was used to determine the relationship between the physical distance of patients from the hospital and mobile telephone calls for follow-up healthcare services, and the result revealed a strong positive relationship between them ($r = 0.898$, $p \leq 0.05$). The result indicates that 134 patients used mobile telephone to access follow-up healthcare services. It was also found that physical distance is responsible for 89.8% of mobile telephone calls for follow-up healthcare services. Continuous use of mobile telephone technology to improve the quality of follow-up health care service provision for patient satisfaction is recommended.

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Contents:

1. Background

One of the barriers to healthcare services is the distance between the service location and the household's location (Peters et al., 2008). Penchansky, Thomas (1981) categorized the barriers to healthcare services into five types: accessibility, availability, affordability, acceptability and accommodation. The first two barriers are generally spatial in nature, while the latter three are aspatial. Furthermore, Russel et al., (2013) consider seven dimensions of accessibility barriers including two spatial (availability and geographic accessibility) and five non-spatial (affordability, accommodation, timeliness, acceptability and awareness). Availability in the context of healthcare facilities refers to the number of health care service points which people in need can choose from, while accessibility measures the flow of people between residential and demand areas (healthcare centres). Accessibility to healthcare services may be defined in different ways. Some definitions focus on the number of people actually using healthcare services, others focus on physical distance covered by patients utilizing healthcare centres (Barwell, 1966; Daly, 1975; Okafor, 1984). Also, there are studies focusing on the time needed to reach a healthcare centre and studies using an index to evaluate access to healthcare. One such study was carried out by Kanugantia et al., (2016) using Two-step Floating Catchment Area Method (2SFCA) in Rajasthan.

Accessibility to health-care facilities has thus been regarded as an individual's or a community's ability to obtain health-care services (Aregbeyen, 1992). The World Health Organisation (1997) described high accessibility as spending less than 30 minutes in driving to healthcare centres in developing countries. Hamer (2004) refers to patient's access as the extent to which people, particularly those from disadvantaged groups (older, younger, people with disabilities, low-income, different ethnic groups, etc.) or disadvantaged areas (patients living far and outside the state hosting these facilities), can utilize the health services that they need either by travelling to those services or by bringing services to them. However, this is not the case in Nigeria as various governments had attempted to improve the state of healthcare service delivery in the past decades without considerable interest in the area of physical accessibility or physical distance (Adejuyigbe, 1977; Okafor, 1984; Aregbeyen, 1992; Isola, 2012).

Globally, one important technology that has now been deployed to tackle the problem of accessibility created by physical distance is the use of Information and Communication Technologies (ICT) for the development of the health sector (Idowu et al., 2003; Akadiri et al., 2009; Beedasy 2010; Ryan et al., (2005); Franklin et al., (2006); Logan et al., (2007). Obviously, there exists a significant correlation between the level of ICT use and the level of performance in the health sector (Odusote, 2010). The perceived importance of ICT to all human endeavours has been shown as a possible way of addressing problems hindering accessibility to healthcare services (Idowu et al., 2003; Odusote, 2010; Oritz, Clancy, 2003). The increase in the use of telecommunication services, which is arguably the most rapidly growing segment in the world environment, has had a positive impact on all human endeavours, especially in the area of facilitating accessibility to

various places. By employing the use of mobile telephone to support the provision of healthcare services, patients may experience a reduction in the frequency of visits in hospitals, and doctors will enjoy the privilege of managing patients in isolated or remote areas (Aiyegbajeje, Ajayi, 2018).

Previous studies have revealed that physical accessibility to healthcare services has been a major challenge to healthcare seekers, especially in developing countries (Adejuyigbe, 1973; 1977; Okafor, 1984; Tanser F. et al., 2006; Claudia et al., 2011; Linard et al., 2012; Luis, Cabral, 2016). This challenge is most prevalent in Nigeria and other African countries, particularly in the area of physical accessibility to healthcare centres, as a result of unequal distribution of healthcare facilities, a low doctor-patient ratio, distance, poor transport systems, poor roads, and traffic congestion (Bour, 2003; Coeytaux et al., 1993; Okoro et al., 2010; Pearson, 2000). However, some studies have suggested that mobile telephone usage is capable of moderating the challenges posed by physical accessibility (Golob, Reagan, 2001; Kitamura et al., 1990; Kwan, Weber, 2003). For instance, the literature on the usefulness of mobile telephones in healthcare domain has focused primarily on improved public health information management systems and information sharing among health workers (Beedasy, 2010; Cox, Scott, 2002; Donner, 2004). These studies examined various ways in which mobile telephones/ICT have helped in disseminating and managing health information, particularly to forestall the problem of case notes getting lost in transit and to shield the contents of case notes from patients. Also, several studies: Waller et al., (2006); Freng et al., (2011); Menon-Johansson et al., (2006); Patrick et al., (2008); Ryan et al., (2005) established that patients' health index were monitored with the use of mobile telephones by sending them short service messages (SMS). Ericsson and the Earth Institute (2010) and Friedman et al., (1996) studied the dynamics of mobile telephone usage in building clinical bridges between patients and available health-care service providers. Other studies have also been conducted on how the mobile telephone serves as an alternative to face-to-face patient care (Amrita et al., 2004; Currell et al., 2010). The results of these studies have indicated the effectiveness of mobile telephone usage in the management of patients.

Furthermore, the literature on the use of mobile telephone in the healthcare domain in Nigeria has also largely focused on identifying the most-used ICT among health workers in Nigeria's tertiary health-care facilities (Idowu et al., 2003). This study examined various ICTs used in selected tertiary hospitals and identified the mobile telephone as the most used technology among health workers. Idowu and Ajayi (2008) examined how patients' case notes (which encompass patients' symptoms, diagnosis, and medication with clinical number) were transmitted within primary healthcare centres in Nigeria using mobile telephone technology. The study noted that the system has the potential to increase medical personnel's productivity, reduce pre-natal and neo-natal mortality rates, improve medical care and minimize the cost of referral since mobile telephone technology is available and some mobile operators offer free text services. Akadiri et al., (2009) found that telecommunication has had a tangible impact on intra-hospital communication among the hospital personnel. However, the study failed to evaluate the tangible impact it may have on patients as regards physical accessibility to healthcare centres. On the use of mobile telephone as a mobile-based alert system for out-patient adherence in Nigeria, Okuboyejo et al., (2012) noted that despite these efforts, none of these studies had attempted to examine the frequency of mobile telephone usage to access healthcare services in Nigeria. However, despite the fact that several studies (Idowu, Ajayi, 2008; Akadiri et al., 2009; Isola, 2012; Aiyegbajeje, Ajayi, 2018) have shown that the mobile telephone has found its way into healthcare service delivery processes in Nigeria, which was coupled with Nigeria's high mobile density at 110.09% in 2017 (NCC, 2018), its effects on physical accessibility to follow-up healthcare services have not been adequately established in the literature. This study therefore aimed at evaluating how physical distances influenced the use of mobile telephone to access follow-up healthcare services in the Lagos metropolis, Nigeria.

To this end, the Lagos University Teaching Hospital (LUTH), in the Mushin Local Government Area (LGA) of Lagos State was selected for this study. Lagos provided a setting for the study be-

cause of its population size, the complex nature of movement within the metropolis which is characterized by heavy traffic congestion, and location of several tertiary healthcare facilities such as the Lagos University Teaching Hospital (LUTH), the Lagos State University Teaching Hospital (LASUTH), the National Orthopaedic Hospital, and the National Psychiatric Hospital and numerous privately owned tertiary facilities). Furthermore, LUTH (see Fig. 1) is one of the leading teaching hospitals serving as referral centres to other lower-tier hospitals with varied specialized services in Lagos State and its environs.

The study is an empirical contribution to the growing body of research on the usefulness of mobile telephone in the healthcare domain. Besides re-emphasizing the importance of the mobile telephone to healthcare provision, the study takes an opportunity to showcase the significant positive effect of mobile telephone use on follow-up healthcare provision. Finally, the findings of this research serve as material to improve the quality of follow-up health care service provision for patient satisfaction.

2. Research materials and methods

Primary data were obtained through a survey questionnaire. Using a structured questionnaire, information on the socio-demographic characteristics, mobile telephone usage for follow-up healthcare services and its effect on physical distance were sought from the respondents. The study population comprised adult out-patients registered with LUTH. The questionnaire was divided into four sections. The first section obtained information on sex, age, income, occupation, educational status, religion, and marital status; the second section focused mobile telephone use for access to follow-up healthcare

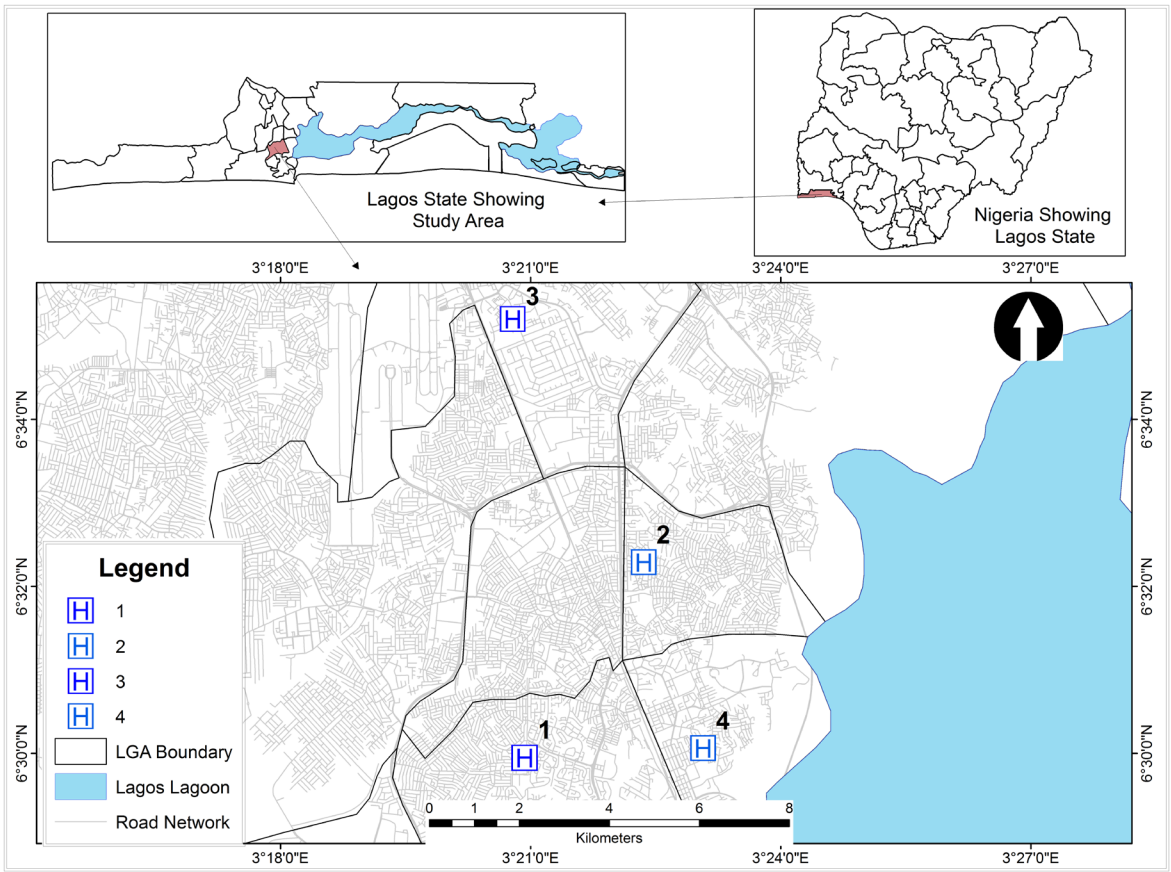

Fig. 1. Location of the Lagos University Teaching Hospital (LUTH) within Lagos Metropolis. H1 = LUTH (study Area); H2 = LASUTH; H3 = National Orthopaedic Hospital; H4 = National Psychiatric Hospital

Source: Geographic Information System (GIS) Laboratory, University of Lagos (2018)

services such as mobile telephone ownership, mobile telephone usage to access follow-up care, and proximity to LUTH; the last section consisted of questions about the effect of mobile telephone use on physical distance, particularly the positive effect on distance. The Unified Theory of Acceptance and Use of Technology (UTAUT) model as propounded by Venkatesh et al., (2003) looks at four major dimensions that contribute to mobile telephone usage: performance expectance, effort expectance, social influence and facilitating conditions in the environment. The explanation provided on the fourth dimension of the UTAUT model (facilitating conditions in the environment) provided the framework for the study.

The operational variables are listed in Table 1. The *determining factor* represents the questions posed to the respondents. The *operational variable* explains the collated results of answers obtained from the respondents, while the *response category* describes the format of capturing the responses. Some responses are captured in 'yes' and 'no' format and Likert format. The Likert format used 'Agreed', which is denoted as 'A', 'Undecided' is denoted as 'U' and 'Disagreed' is denoted as 'D'. 'Agreed' suggests that the respondent aligned with the position of the statement, 'undecided' implies that the respondent had no knowledge to the statement stated while 'disagreed' suggests the respondent did not align with the position of the statement.

A total of 400 copies of the questionnaire were administered in twelve clinics within LUTH. At the end of the sampling exercise, 370 questionnaire forms out of 400 were successfully filled in and returned representing a response rate of 92.5%. The systematic random sampling technique was adopted in the distribution of the questionnaire. Questionnaires were administered in one clinic a day. Out-Patients were selected for the purpose of this study in eleven (11) clinics in LUTH, i.e. Medical out-patient (MOP) II; Surgical out-patient (SOP); Oral maxillofacial (dentistry); Medical out-patient department (MOP) I/ Haematology and blood transfusion; Ear, nose and throat (ENT); Accident and Emergency; Obstetrics and Gynaecology; Ophthalmology; Paediatrics out-patient; Surgical out-patient (SOP) II / general surgery and Orthopaedic/trauma. Copies of the questionnaire were distributed to each out-pa-

Table 1. Operationalization of mobile telephone usage

Determining factor	Operational Variable	Response Category
Do you own a mobile phone	Percentage of respondents who own a mobile phone	Yes/No
Have you ever called your doctor to access follow-up healthcare services	Percentage of respondents that indicated calling their doctor to access follow-up healthcare services	Yes/No
How far do you live from the Hospital	Percentage of respondents who live over 5km away	Distance in Km
Mobile telephone usage has increased my level of healthcare service utilization	Percentage of respondents who indicated a positive effect of mobile telephone usage on access to healthcare service	A, U, D
Mobile telephone usage has increased my access to follow-up care services	Percentage of respondents who indicated positive effect of mobile telephone usage on access to follow-up care services	A, U, D
Because of my mobile telephone, distance cannot discourage me accessing follow-up care services	Percentage of respondents who indicated a that physical distance is no longer a barrier to accessing follow-up care services	A, U, D
How many times a week do you call your doctors?	Average frequency of calls by patients in a week	(a) Once a week, (b) twice a week (c) three times a week (d) four times a week (e) more than four times a week

Note: A = Agreed; U = Undecided; D = Disagreed
Source: *Authors' analysis*

tient at a regular interval of three out-patients in a row. In each clinic, out-patients of at least 18 years of age were given the questionnaire to fill in. Informed consent was received from respondents before questionnaire administration. The surveyed patients lived in various parts of Lagos and outside the Lagos metropolis.

The average number of mobile telephone calls of patients to doctors was calculated based on the number of times a patient called their doctors on a daily basis for a period of one month. Physical distance was calculated using the radius of out-patient's location from the hospital (LUTH). This was categorized into three classes (near, far and very far). Out-patients residing within 5km radius fell under the 'near' category and were assigned '1', while those between 6km and 10km were categorized as 'far', denoted as '2', and those in the bracket of 11km away and above were classified as 'very far' '3'. Follow-up healthcare services were measured based on out-patient's responses; 'Agreed' were classified as '2', while 'undecided' and 'disagreed', were classified as '1'. The Pearson Product Moment Correlation technique was used to determine the relationship between mobile telephone usage to utilize follow-up healthcare services (Y) and physical distance (X) of out-patients from LUTH. The model is given as ($Y = b_0 + b_1 X$) Where; Y = mobile telephone usage for follow-up healthcare service; b_0 = Y-intercept; bı = regression coefficient and X_1 = physical distance. Subsequently, the PPMC coefficient ascertained a significant positive relationship between mobile telephone usage to utilize follow-up healthcare services and physical distance of out-patients. The statistical analysis was conducted using SPSS version 20.0, while maps highlighting various distances were produced with the help of the ArcGIS 10.3 software.

3. Research results

3.1. Demographic profile of respondents

The characteristics of the study sample are presented in Table 2. With a high mobile telephone ownership (99.2%), the study sample mostly consisted of women (56.7%), people within the 18–27 and 28-37 age groups (35.7% and 28.4%, respectively). In addition, the respondents, to a large extent, had tertiary-level education (43.5%) and were workers (40.3%). However, only a few (36.2%) used mobile telephones to access healthcare.

3.2. Distance covered by patients to the hospital

Healthcare facilities were unevenly distributed in Lagos metropolis, which coupled with other geographical problems, such as distance and traffic congestion (in the case of urban centres), patients covered varied distances across the Lagos metropolis as shown in Fig. 2. This revealed that more than a half of the sampled patients lived far away from LUTH. About 104 (44.4%) patients resided outside the Lagos metropolis resulting to the increase in the volumes of mobile telephone usage among patients.

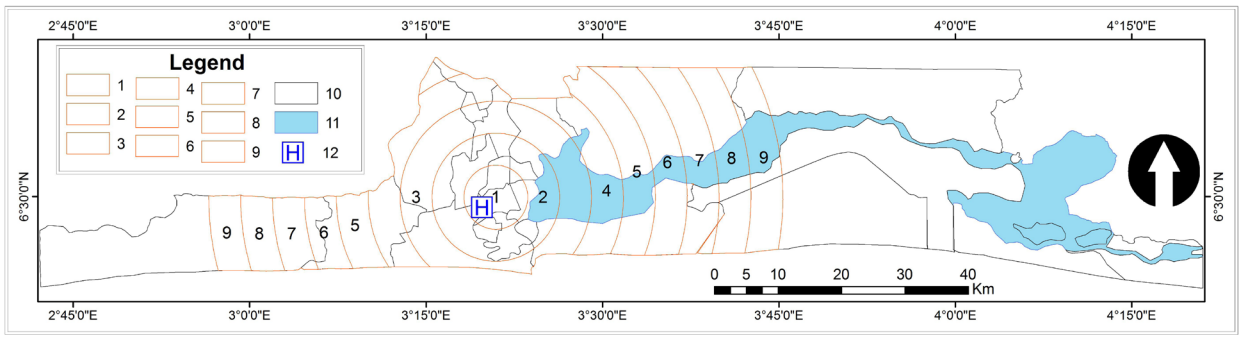

Fig. 2. Map of Lagos State showing distance covered by patients to reach LUTH. Explanation: 1 = 0-5km; 2 = 6-10km; 3= 11-15km; 4=16-20km; 5=21-25km; 6=26-30km; 7=31-35km; 8=36-40km; 9= Over 40km; 10= Local Government Area (LGA) Boundary; 11=Lagoon (Water body); 12 = Lagos University Teaching Hospital (LUTH) [Study Area].
Source: Authors' analysis

Table 2. Socio-economic and demographic profiles of respondents (patients)

	Item	LUTH
Mobile telephone ownership among patients	Yes	367 (99.2%)
	No	3 (0.8%)
	Total	**370(100%)**
Patient's use of mobile telephones to access healthcare services	Yes	134 (36.2%)
	No	236 (63.8%)
	Total	**370 (100%)**
Sex distribution	Male	160 (43.2%)
	Female	210 (56.7%)
	Total	**370(100%)**
Age	18-27 years	132 (35.7%)
	28-37 years	105 (28.4%)
	48-57 years	81 (21.9%)
	58-67 years	20 (5.4%)
	68-77 years	10 (2.7%)
	Above 77 years	22 (5.9%)
	Total	**370(100%)**
Occupation	Workers	149 (40.3%)
	Artisans	55 (14.9%)
	Students	73 (19.7%)
	Professionals	29 (7.8%)
	Unemployed	50 (13.5%)
	Pensioners	14 (3.8%)
	Total	**370(100%)**
Educational status	No formal education	35 (9.5%)
	FSLC	29 (7.8%)
	SSCE	36 (9.7%)
	OND/NCE	84 (22.7%)
	HND/Bachelor	161 (43.5%)
	Master's degree	25 (6.8%)
	PhD	0 (0%)
	Total	**370(100%)**
Income	<₦50,000	281(75.9%)
	₦51,000 - ₦100,000	41 (11.1%)
	>₦101,000	48 (12.9%)
	Total	**370 (100%)**

Source: Authors' analysis.

3.3. Patients' mobile telephone usage across various distances

The frequency of mobile telephone usage for follow-up care services across varied distances depends, *inter alia,* on distance from the hospital, heavy traffic congestion, long waiting-time at the clinic (Akadiri et al., 2009; Aiyegbajeje, 2016). Therefore, in order to overcome these problems, patients resolved to make use of their mobile telephone to connect with their doctors instead of face-to-face interaction as opined by Amrita et al., 2004;

Currell et al., 2010; Aiyegbajeje, Ajayi, 2016. Figure 3 indicates a gradual increase in the frequency of mobile telephone calls by patients with increasing distance from the hospital.

As indicated in Table 3, there was a strong positive significant relationship between patients' mobile telephone usage and patients' distance from hospital ($r = 0.898$, $p<0.05$). The strong positive relationship indicates that as patients' distance from the hospital increases, the frequency of mobile telephone usage grows (see Fig. 2). The result shows that the variation in patients' distance from the hospital is responsible for 0.898 (89.8%) of mobile telephone usage. The result implies that physical distance is responsible for 89.8% of mobile telephone calls for follow-up healthcare service. This shows that patients residing far away from the hospital engage in more frequent use of mobile telephones than their counterparts living around the hospital (see Fig. 3). telephone usage among patients could also constitute another major health risk.

The strong positive significant relationship between patients' mobile telephone usage and patients' distance from hospital points out the fact that generally speaking, the farther the location of patients, the more mobile telephone calls are put across to hospitals for follow-up healthcare services. Thus, the physical distance separating the patients from the hospital generally stimulates relatively frequent mobile telephone calls. This view is confirmed by a preliminary correlation analysis, based on the study's data set, which shows a strong and positive relationship between mobile telephone usage for follow-up healthcare service and physical distance of patients from the hospital ($r = 0.898$, $p<0.05$). Moreover, the theory regarding the distance decay is based on real distance analysis (people living far away travel less frequent to access to healthcare services and, there-

4. Discussion

The main thrust of the paper was to determine the relationship between patients' mobile telephone usage for follow-up healthcare services and their distance from hospital. An average of 550 mobile telephone calls were made by 134 patients across varied distances from the hospital within a month and this is despite the low-income status of the majority of the patients. There are disparities in the use of mobile telephones in accessing follow-up healthcare services among patients due to their distance from the hospital. Patients located 30km away and above recorded very high mobile telephone usage of 61.3% of mobile telephone calls coming from this distance bracket to the hospital. This may imply that patients located far away from the hospital may be facing serious issues pertaining to traffic congestion, poor road condition leading to very long hours spent on travel (travel-time) and high transport costs which constitute the physical distance between patients and hospital. This therefore encourages the use of mobile telephones among patients (Aiyegbajeje, 2016). Public policy should focus on addressing the challenges posed by physical distance. This is pivotal as an increase in mobile

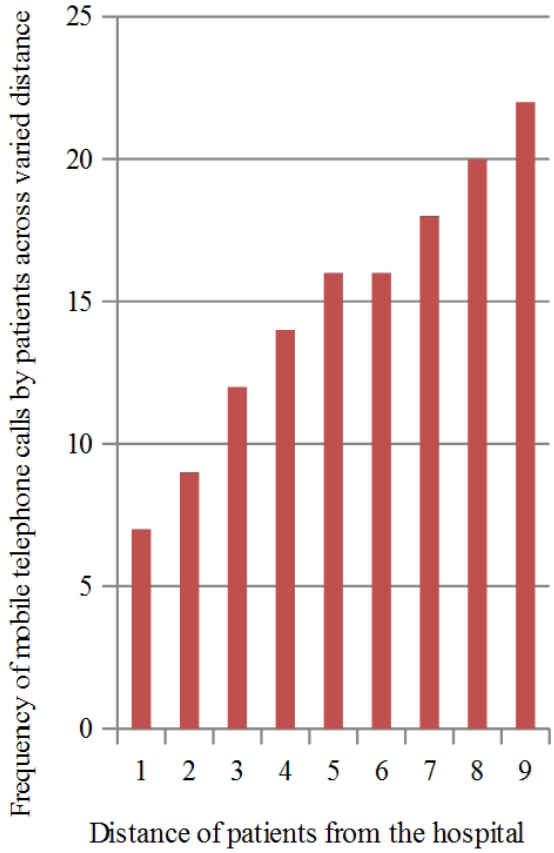

Fig. 3. Patients' mobile telephone calls across various distances: 1= 0-5km; 2= 6-10km; 3= 11-15km; 4= 16-20km; 5= 21-25km; 6=26-30km; 7=31-35km; 8= 36-40km; 9= Over 40km

Source: Authors' analysis

Table 3. Mobile telephone usage and distance of patients from hospital

	Mean	N	Df	Pearson r	Sig
Number of distance-induced calls in a month for follow-up healthcare services	0.995	134	132	0.898**	<0.05
Distance of Patient	1.215				

**Correlation is significant at 0.05 Level (2-tailed).
Source: Authors' analysis

fore, may have higher rate of illnesses). Also, Stock (1988); Bour (2003); Arcury et al., (2005); Fishman et al., (2018) emphasized the issue of distance in the utilization of healthcare services. However, mobile communication has been found to be helpful in overcoming the issue (as stated in the results).

The proliferation of mobile telephones in Nigeria has reached its peak. According to Okonji (2017), Nigeria's mobile teledensity has hit 110.09% as at February 2017. The acceptance of this technology has altered, either positively or negatively, nearly every human activity especially in urban areas. Consequently, urban residents generally resort to frequent use of mobile telephones as against travelling within the city largely because of the chaotic traffic congestion experienced in Nigerian cities, and particularly in the Lagos metropolis.

5. Conclusion

Mobile telephone usage in the healthcare domain has become an acceptable practice globally (Brinkell et al., 2014; Aiyegbajeje, Ajayi, 2018). Physical distance and several other geographical problems have made accessibility to healthcare services a herculean task, but the advent and proliferation of mobile technology has brought some sort of relieve to this menace. This study brings to the fore the importance of mobile telephone usage in addressing the problem of physical distance separating two points of activity. Thus, the study suggests that government and health agencies should further encourage the use of mobile telephone technology to improve the quality of follow-up health care service provision for patient satisfaction. This can be achieved through policy re-engineering and enlightenment campaign to legitimize the use of the mobile telephone as one of the healthcare delivery tools. Secondly, a proper way of monitoring this idea should be carefully designed so as to check any form of abuse between the two parties involved, i.e. healthcare service providers and healthcare seekers.

The paper has contributed to the body of knowledge on the relationship between mobile communications, physical distance and healthcare service provision by highlighting how mobile communications can aid healthcare service provision over long distances. It is therefore recommended that mobile telephone usage be encouraged among healthcare professionals. Also, additional healthcare should be provided to cater for people residing in other parts of the metropolis. However, the study hopes that the recommendations are implemented so as to support the dwindling numbers of healthcare service providers due to brain-drain.

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