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ORIGINAL RESEARCH

Digital and Home Healthcare Survey among Nigerians: Assessing Awareness, Preferences, and Willingness to Pay for an Integrated Healthcare Ecosystem to achieve Universal Health Coverage

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Abstract

Introduction: The COVID-19 pandemic highlighted the need for evolving an integrated healthcare ecosystem that will connect patients to digital and home healthcare to achieve universal health coverage. The survey aims to assess perceptions and preferences about digital and home healthcare services and develop an integrated healthcare ecosystem.

Methods: A survey of 254 Nigerians was conducted to assess their awareness, preferences, and willingness to pay for digital and home healthcare services using electronic questionnaires, and the data were analysed using SPSS 16.0.

Results: Males constituted 70.9%, and 61.4% were aged ≤ 35 years. Two-third were clients, and a third were healthcare providers. Although about 71% patronized public hospitals, there was poor satisfaction (31.7%) than those attending private hospitals that were more satisfied. The male gender, private hospital utilization, and age of ≤ 35 years were associated with the satisfaction with OR 1.19 (95% CI 0.69-2.05), OR 1.22 (95% CI 0.73-2.04), and OR 2.41 (95% CI 1.38-4.20) respectively. Thirty minutes was the acceptable delay in receiving care by most respondents. Only 39.4% were aware of digital health, and 52.8% were aware of home healthcare. Male gender was associated with DH awareness, while being a healthcare provider was associated with both DH and home healthcare awareness. The respondents' median amount was willing to pay for DH and HH respondents is \$1.64 - \$6.56 and \$3.28 – \$6.56, respectively.

Conclusion: In response to the survey result, we designed an integrated hospital, digital, and home healthcare project named eDokta, to leapfrog the attainment of universal health coverage in Nigeria.

Keywords: Digital health, home healthcare, universal health coverage, healthcare ecosystem



Introduction

Nigeria is the most populous country in Africa and is poised to become the third most populous in the world by 2050 (1). Poverty, inequality, and poor access to health have kept the citizens' life expectancy low. The Nigerian healthcare system is bedeviled with a lack of human resources, infrastructural and system challenges, which threaten the attainment of universal health coverage (UHC). To ameliorate that, Nigeria developed a national health Information Communication Technology (ICT) strategic framework 2015-2020 with the vision: "By 2020 Health ICT will help enable and deliver universal health coverage in Nigeria" (2). This strategic framework provides for the identification, prioritization, and application of appropriate ICTs that can strengthen the national health system. Poor implementation of the framework led to poor results by 2020. One of the most essential strategies for improving the provision of quality health care to attain UHC in resource-constrained settings is the effective utilization of digital health (DH). Digital health is defined as a system that connects and empowers people and populations to manage health and wellness, augmented by accessible and supportive provider teams working within flexible, integrated and interoperable, and digitally-enabled care environments that strategically leverage digital tools, technologies, and services to transform care delivery (3). It is also defined as the application of ICT to advance health services delivery." The term DH is also used interchangeably with eHealth. The World Health Assembly (WHA) recognized the role of DH in healthcare delivery in resolution WHA

58.28 (2005): "eHealth is the cost-effective and secure use of ICT in support of health and health-related fields including healthcare services, health surveillance, health literature, and health education, knowledge and research. mHealth is a subset of eHealth and involves providing health services and information via mobile technologies such as mobile phones, tablet computers, and personal digital assistants. DH is a tool for the achievement of Goal 3 of the Sustainable Development Goals by 2030, which is to "Ensure healthy lives and promote well-being for all at all ages," particularly its article 8 to "Achieve universal health coverage (UHC)" in ensuring people access quality healthcare without falling into financial catastrophes (4,5). The role of DH cut across healthcare financing, health service delivery, human resources training, health system support, and health information system. Despite these potentials, DH implementation has taken a slow course, especially in many African countries. Some of the challenges hampering its scale-up in many developing countries are issues bordering on usability, technology integration and interoperability, data security, and privacy, reliability, network access, affordability, acceptability, illiteracy, funding, trained human capacity, policy, and regulation (6,7). The application of DH in Africa has gained momentum over the past decade, essentially due to the digital revolution brought about by the increasing penetration of mobile technology and internet use, which stood at 80.8% and 25.1% as of 2018. This is further enhanced by the proliferation of affordable smartphones, particularly from China (5). These factors have afforded a great opportunity, which could improve the



smooth launching of various DH platforms, but there is a need to understand enablers for their effective utilization. A feasibility survey was conducted to develop a sustainable DH platform that will facilitate the attainment of SDGs. The objectives of the study are to assess the respondents' perceptions about conventional hospital-based care; set awareness and preferences of DH and home healthcare; determine the willingness to pay for DH and HH services; and then develop an integrated healthcare ecosystem that will incorporate hospital-based, digital and home healthcare services to achieve UHC.

Methods

An online survey to assess the awareness, preferences, and willingness to pay for Nigerians' DH and home healthcare services was conducted in December 2019 electronically using google forms. (8) The data was automatically received, and a Microsoft Excel spreadsheet version of the data was gener-

ated. The data was then transferred and analysed using Statistical Product and Service Solutions (SPSS) 16.0. Basic information, perceptions, and awareness of hospital based, digital, and home healthcare and their association to age, sex, status, and hospital being utilized was analyzed.

Results

Two hundred and fifty-four (254) respondents electronically filled the online questionnaire representing a response rate of 84.7%. The respondents include those living in all 36 states and the capital of Nigeria. However, 69.7% were living in Kano state. Males constituted 70.9%, while 61.4% and 38.6% were aged ≤ 35 years and >35 years, respectively. The respondents include civil servants (40.2%), medical doctors (31.5%), traders/businesspersons (8.3%) and 11.4% were unemployed. Others include other health workers, bankers, engineers, and software developers. Healthcare providers constituted 36.2%, while clients were 63.8%. (Table 1)

Table 1: Respondents' baseline characteristics

Over-all Percentage % (N=254)		
Age (years)		
	≤ 35	61.4(156)
	>35	38.6(98)
Sex		
	Female	29.1(74)
	Male	70.9(180)
Status		
	Clients	63.8(162)
	Providers	36.2(92)
Hospital being utilised		
	Private	28.7(73)



Type of phone used	Public	71.3(181)
	iOS	8.3(21)
	Others	0.8(2)

Public hospitals were the most utilized by 71.3% of the respondents. The level of satisfaction is better with the private hospitals as 60.3% of the respondents were satisfied in contrast to only 31.7% who were satisfied with the public hospitals. Younger age ≤ 35 years, male gender, and private hospital patronage were associated with reasonable satisfaction with OR 1.22 (95% CI 0.73-2.04), OR 1.19 (95% CI 0.69-2.05), and OR 2.41 (95% CI 1.38-4.20) respectively. Only a quarter of the respondents considered lack of trained staff, while delay in receiving care and poor staff attitude featured prominently by 74% and 63% of the respondents. Lack of feedback from hospitals and health workers and lack of quality branded drugs are reasons for dissatisfaction by nearly a third of the respondents. Thirty minutes was the acceptable delay in receiving care when sought for by 80% of the respondents. The DH awareness of the respondents was relatively low (39.4%) and male gender and being a healthcare provider associated with the

awareness OR 1.40 (95% CI 0.80-2.47) and OR 1.40 (95% CI 0.83-2.36) (Table 2). Virtual booking for medical consultation, health education, and remote patient monitoring was the commonest DH services needed (Figure 1). Nearly two-thirds of the respondents preferred online DH services over mobile DH services, and 90.9% use Android phones, while 8.3% use iOS phones. More than half (52.8%) of the respondents were aware of home healthcare services which were significantly associated with respondents' status as healthcare providers, OR 3.25 (95% CI 1.90-5.60) (Table 3). Approximately three-quarters (74.8%) of respondents believe it was operational, and 93.3% were willing to utilize the services. The Home Healthcare (HH) services needed include home consultation (81.3%), home delivery of purchased drugs (66.3%), and simple investigations (64.7%). Other services include sample collection and delivery of results and nursing care.

Figure 1: Preferred digital health services by the respondents

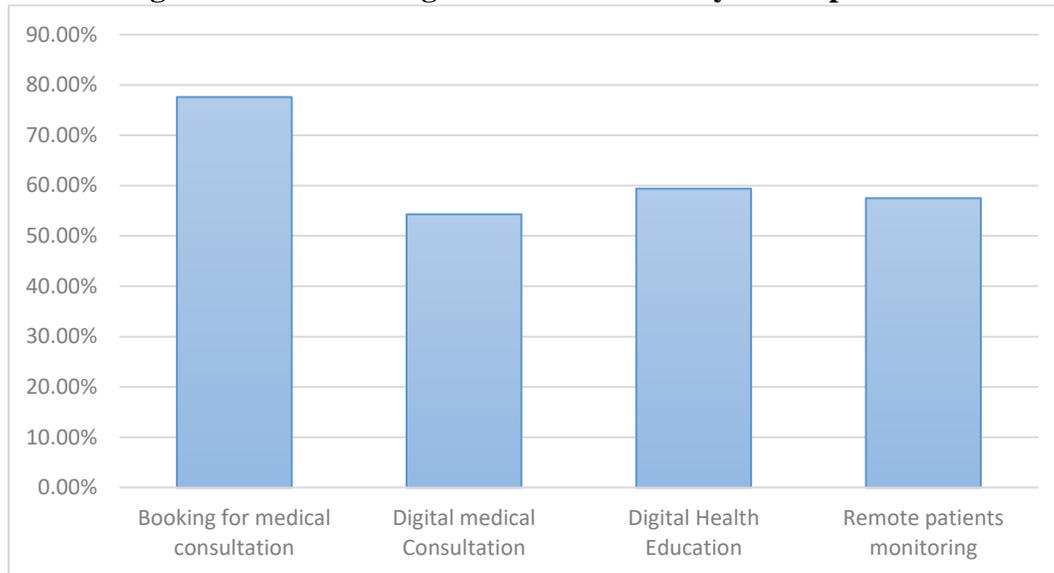


Table 2: Awareness of digital health and home healthcare

	Digital health				Home healthcare			
	Awar e n=10 0	Una- ware n=154	OR (95% CI)	p-value	Awar e n=13 4	Una- ware n=120	OR (95% CI)	p- val ue
Age (years)								
≤35	57	99	0.74 (0.44-1.23)	0.291	78	78	0.75 (0.45-1.25)	0.3 02
>35	43	55			56	42		
Sex								
Male	75	105	1.40 (0.80-2.47)	0.261	94	86	0.93 (0.54-1.60)	0.8 90
Female	25	49			40	34		
Status								
Provider	41	51	1.40 (0.80-2.47)	0.230	65	27	3.25 (1.90-5.60)	0.0 00
Client	59	103			69	93		
Hospital patronized								
Private	25	48	0.74 (0.42-1.30)	0.322	26	47	0.37 (0.21-0.66)	0.0 01
Public	75	106			108	73		



There is a remarkable willingness to pay for the DH and HH services. The median amounts the respondents were willing to pay for the digital booking for consultation, digital booking and physical consultation, digital booking and virtual consultation, and digital health education were \$3.28 (\$4.92), \$6.56 (\$6.56), \$6.56 (\$13.12) and \$1.64 (\$5.90) re-

spectively. The median amounts (and interquartile range) the respondents were willing to pay for a home consultation, simple investigations, sample collection/results delivery, nursing care, and pharmaceuticals delivery were \$6.56 (\$13.12), \$3.28 (\$4.92), \$3.28 (\$4.92), \$6.56 (\$6.56) and \$4.92 (\$6.56) respectively. (Table 3).

Table 3: Willingness to pay for digital and home healthcare services in USD

Digital Health Services	Booking	Booking and physical consultation	Booking and remote consultation	Health education	
Median (Interquartile range) \$	3.28 (4.92)	6.56 (6.56)	6.56 (13.12)	1.64 (5.90)	
Mean (SD)/\$	5.75 (±7.12)	8.98 (±9.06)	8.62 (±8.82)	5.60 (±21.90)	
Home health services	Consulta-tion	Basic Investi-gations	Sample taking and results deliv-ery	Nursing care	Pharmaceuti-cals delivery
Median (Interquartile range) \$	6.56 (13.12)	3.28 (4.92)	3.28 (4.92)	6.56 (6.56)	4.92 (6.56)
Mean (SD)/\$	9.58 (±9.83)	6.76 (±32.05)	5.61 (±5.14)	8.64 (±12.03)	7.58 (±10.60)

Those younger than ≤ 35 years were more to pay a higher amount for digital booking, digital booking and physical consultation and health education with OR:1.39, OR:1.05, and OR:1.38, respectively. At the same time, those patronizing private hospitals were more willing to pay for the digital booking and health education. Females and those patronizing private hospitals were more willing to

pay higher for all types of home healthcare services. At the same time, those older than 35 years were more willing to pay higher amounts for a home consultation, sample collection and results of delivery, nursing care, and pharmaceutical products. Compared with the clients' willingness to pay for the services, healthcare providers were more willing to pay higher for all digital and home healthcare



services. (Table 4). The healthcare providers' willingness to pay higher was more when the services involve consultation such as digital booking and physical consultation, digital

booking and remote consultation and home consultation with OR 2.31 (95% CI 1.36-3.91), OR 2.21 (95% CI 1.30-3.78) and OR 2.29 (95% CI 1.36-3.89) respectively.

Table 4: Respondents willingness to pay higher than medium (WTPH) and willingness to pay the medium and lower (WTPL) between healthcare providers and clients

Digital health services										
	Booking		Booking and physical consultation		Booking and remote consultation		Health education			
	WTPH (WTPL)	OR (95% CI)	WTPH (WTPL)	OR (95% CI)	WTPH (WTPL)	OR (95% CI)	WTPH (WTPL)	OR (95% CI)	OR (95% CI)	
Pro-vid-ers	39(53)	1.51 (0.89-2.57)	46(46)	2.31 (1.36-3.91)	43(49)	2.21 (1.30-3.78)	43(49)	1.07 (0.64-1.79)		
Cli-ents	53(109)	1.00	49(113)	1.00	46(116)	1.00	73(89)	1.00		
Home healthcare services										
	Consultation		Basic Investiga-tions		Sample taking and results delivery		Nursing care		Pharmaceuticals delivery	
	WTPH (WTPL)	OR (95% CI)	WTPH (WTPL)	OR (95% CI)	WTPH (WTPL)	OR (95% CI)	WTPH (WTPL)	OR (95% CI)	WTPH (WTPL)	OR (95% CI)
Pro-vid-ers	54(38)	2.29 (1.36-3.89)	46(46)	1.95 (1.15-3.28)	54(38)	1.49 (0.89-2.50)	41(51)	1.44 (0.86-2.43)	52(40)	1.12 (0.67-1.88)
Cli-ents	62(100)	1.00	55(107)	1.00	79(83)	1.00	58(104)	1.00	87(75)	1.00

Discussion

The Nigerian healthcare industry is pluralistically shared by the public and private sectors. Although the public sector owns about 66% of the health facilities in Nigeria, the private sector accounts for 70-75% of the total health expenditure (9). The public healthcare system is organized into primary comprising of primary healthcare services at the rural and

community level, secondary consisting of general and specialist hospitals, and tertiary healthcare having the teaching hospitals and specialized medical centers. The private hospitals and clinics contribute significantly to Nigeria's healthcare delivery all over the country (10). The healthcare budget is abysmally low as only 3.6% of Nigeria's GDP was



spent on health, which translates to \$14.6 billion in 2016. There is a considerable healthcare infrastructural gap and a massive brain drain of healthcare workers (11). It is estimated that about 3,000 new medical doctors are registered in Nigeria annually. Currently, nearly 2,000 doctors migrate from Nigeria to other countries yearly, leaving a net of 1000 doctors and further widening doctors' deficit to about 260,000. Nigerians spend an average of \$1 billion on medical tourism annually abroad. Nigeria has five hospital beds per 10,000 population (9,12). Public hospitals' patronage remains high, with 71% of the respondents despite its poor satisfaction level (32%) when compared to private hospitals likely due to affordability factors. There is a higher satisfaction level (60%) among those who patronize private hospitals. There is evident worsening satisfaction of hospital services over the years compared to Kano reports a decade ago by Iliyasu et al. when the satisfaction level was 83% (13). The satisfaction level is lower than reports from different parts of Nigeria and Ethiopia (14–19). This could be attributable to infrastructural and personnel deficits despite an increasing population, bureaucracy, and ongoing disruption of healthcare services due to industrial actions by health workers. Based on the perceived reasons for dissatisfaction, any intervention that will shorten the duration to receiving care within the first 30 minutes, teach an empathic and memorable staff attitude, provide access to quality drugs and ensure appropriate feedback will significantly improve clients' satisfaction. There is a need to enhance the satisfaction level, especially to the older respondents and females. The differential satisfaction between the public and

private hospitals calls for studying and emulating the delivery of services in private hospitals so that the public hospitals could equally improve the satisfaction. Digital health and home healthcare have the potential of filling these gaps. Digital technology can facilitate healthcare delivery at different levels (system, center, professional and patient levels). Supply chain management and an integrated platform for booking and payment can be facilitated at the system level. At the same time, the availability of remote patient monitoring and remote diagnostics can be improved at the center level. Similarly, education/training and data collection and reporting will be relevant at an individual professional level. At the same time, health and wellness information and medical advice will affect patients' levels (20). The World Health Organization (WHO) classified DH interventions into interventions for clients, interventions for healthcare providers, interventions for a health system or resources management, and interventions for data services (21). DH improves access to health, quality of care and reduces healthcare costs through many applications that can contribute to sustainable development goals. These applications include electronic health records (EHR), telemedicine/telehealth, mHealth, eLearning, the connection of medical devices via the Internet of Things (IoT), and personal health using wearable devices (20,22,23). There is an unprecedented rise in Teledensity, internet penetration, and social media usage globally, but more phenomenal in Africa. There are 1.049 billion mobile users, 473 million internet users, and 216 million active social media users, representing 80%, 36%, and 17% pene-



tration in Africa (24). The available DH services in Africa include mHealth, Social media, Telemedicine/Telehealth, eLearning, EHR, and big data analytics in order of preference (4,5). Nigeria is strategically located to benefit from the digital economy. It accounts for about 47% of the West African population, and a half (about 100 million) of its population is under 30 years and is leading the continent in the economy (25). The country is also experiencing this trend of increasing mobile, Internet, and social media penetration. According to the Nigerian Communications Commission (NCC), the number of mobile phone subscriptions in Nigeria was 176, 897, 879 (92.7% Teledensity), while internet subscriptions were 122, 975, 740 (56% penetration) as of August 2019 (26). The number of smartphone users in Nigeria is estimated to be 36 million (18.37% penetration). This could be attributed to an influx of low-priced smartphones (the average cost of smartphones decreased from \$216 in 2014 to \$95 in 2018). There are 24 million (12% penetration) social media users, and in 2018, 44% and 4% of mobile users use 3G and 4G technology, respectively, and the number keeps increasing (26,27). Despite these potentials, Nigeria was ranked 143rd among 176 countries on the ICT development index (IDD) in 2017. It did not feature among the top 16 countries on the eHealth priority ranking of Sub-Saharan African countries and is ranked 15th among the top 17 countries on the eHealth regulating readiness index. This is due to barriers such as infrastructure and device access challenges, funding, human resources capacity, and policies and government leadership (28,29). To establish sustainable digital health and other digital services,

there is a need to build critical digital pillars such as digital infrastructure, digital platforms, digital financial services, digital entrepreneurship, and digital skills and literacy (25). Covid-19 has brought the role of telehealth during the pandemic and beyond all over the world to the fore. McKinsey conducted Covid-19 consumer surveys in April and May 2020, which showed an apparent increase in the adoption of telehealth services in the USA. Telehealth usage was 11% in 2019, which increased, and 76% were interested in using telehealth with a 50-175 times increase in the number of telehealth visits and 80 new telehealth services approved by the centers of Medicare and Medicaid. Pre-Covid-19, the total annual revenue of Telehealth players was estimated at \$3 billion and postulated that up to \$250 billion of current US healthcare spending could be virtualized (30,31). The DH awareness of the respondents was low (39.4%), even though this level of awareness could have improved after the Covid-19 pandemic when some DH services were used to provide virtual medical care. The result calls for creating more awareness amongst females and clients. Access to booking for consultation is a challenge, especially for rural dwellers. A window for remote booking for a medical consultation is needed, as indicated by the respondents, in addition to virtual medical consultation, health education, and remote patient monitoring. The preference for online over mobile DH services point to an interesting scenario despite mobile technology penetration being better than internet penetration. This and the preponderance of Android phones should guide any DH platforms in software development and technology deployment. Currently, most



home healthcare services are offered at the individual and informal level, and there is a need to coordinate the services to ensure quality, reliability, and interoperability with other DH services. Home antenatal care, immunizations, management of chronic diseases including HIV-AIDS are low-hanging fruits to consider for HHS. There is a need for a massive HHS awareness campaign targeted at clients and those patronizing private hospitals. Our findings show that there is a notable willingness to pay for the DH and HHS. Although the amount the respondents were willing to pay for both services in this study seems low, it is significant when related to the prevailing minimum wage of \$50 per month. It might increase after experiencing their value and advantages. The potential early adopters of DH with the willingness to pay higher will be the healthcare providers, younger clients, and those patronizing private hospitals and should be the first marketing targets. Gradual engagement of older respondents and public health users will expand the DH market base. Females will likely adopt HHS early, especially since they attend hospitals more frequently to seek care for themselves or their children and hence face the challenges more. Healthcare providers' willingness to pay higher for the digital and healthcare services could likely be due to their exposure to healthcare delivery and challenges, bias because they were potential beneficiaries for the payment, and possible higher disposable income than the clients. In response to the above data, a team (comprising two medical specialists, a biochemist, three IT experts, and a financial expert) developed an integrated (hospital-based, digi-

tal, and home healthcare) healthcare ecosystem and named it eDokta. It was designed to provide hospital-based care, telemedical care, home healthcare, diagnostic and pharmaceutical services, remote patient monitoring, health education, medical education, and universal medical identity services. It is aimed at removing barriers to accessing healthcare by providing virtual access to healthcare providers using mobile and internet technology for personalized, seamless, and quality care by patients and expand the providers' customer base and returns. The critical disruptions are the local content via the inclusion of local languages and the one-stop health solution nature of our services. It has a potential for facilitating DH innovations such as drones (for delivery of medical supplies to difficult terrains), big data (for managed care, disease prediction, and more accurate treatment), Artificial intelligence-AI (for workflow management, precision in diagnosis and treatment aid) and IoT (for remote patients monitoring). Some of our key partners include specialists, hospitals, diagnostic centers, pharmaceutical shops, mobile telecommunication companies, Governments, and Non-governmental agencies. The telemedicine software is developed, and more than 1,000 patients benefit from free consultation during the Covid-19 lockdown. The entire eDokta project will be launched in May 2021.

Conclusion

The digital and home healthcare ecosystem is a new frontier for healthcare globally and is gradually being applied in Africa especially following the Covid-19 pandemic.



The growing dissatisfaction with the current hospital-based healthcare system, the massive health workers' brain drain, and the unequal distribution of health personnel and infrastructure threaten the attainment of Universal Health Coverage in Nigeria and thus pave the way for introducing DH and home healthcare services. Our attempt at translating DH and home healthcare survey to real life (eDokta) is on the verge of debuting, gal-

vanizing the triple helix collaboration between government, research institutes, and industry to develop a sustainable healthcare ecosystem by utilizing digital technology to leapfrog the attainment of UHC in Africa.

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