

INTEGRATING DIGITAL TECHNOLOGIES AND INNOVATIONS IN HEALTHCARE DELIVERY IN SELECT RURAL COMMUNITIES IN ANAMBRA STATE NIGERIA

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Abstract

The study is on the application of digital technologies and innovations in healthcare delivery in rural communities in Anambra state. The purpose is to examine how health care delivery in rural areas could be made more effective via digital technologies and innovations. Survey design was adopted for the study. A sample of 120 respondents (comprising of doctors, nurses, rural dwellers, and heads of clinics and hospitals in the selected rural communities in the state) was purposively drawn and used for the study. Structured questionnaire was used for data collection. Three experts validated the questionnaire with a test-retest reliability index of 0.82. Mean and standard deviation were used for data analysis. Results indicate that digital technologies can facilitate health care delivery through quicker diagnoses and better treatment options among others. Some hindrances to the application of digital technologies in health care delivery in rural communities include paucity of funds, illiteracy and suspicion among others. It was recommended that government should allocate more funds to procure digital devices for rural health care and also sensitize rural dwellers to disabuse their minds of any reservations they may hold about adopting digital technologies in health care delivery. The study concludes that if digital technologies are applied in rural healthcare there will be a better healthy nation.

Keywords: Computer, Digital Technologies, Healthcare, Innovations, and Rural communities

Introduction

Health care is a fundamental right of every human being irrespective of age, sex, and location. About half of the world's population is resident in rural communities (Jacobs, 2021). People living in the rural areas do experience some challenges accessing health care due to poor access and availability of quality health care system.

Health care delivery system refers to an organization of people, institution and resources to deliver a health care service to meet the health needs of a target population. A healthy nation is a wealthy nation. As a result no country toys with the health of its citizenry. Over the years the federal government has always allocated a huge sum of money annually for the health sector. This is to ensure that all citizens have access to adequate health care services at the primary, secondary and tertiary health care levels. Each level of health care is meant to address different degrees of health challenge. Health care delivery in Nigeria has been basically on face to face manual basis. This mode of health care practice is fraught with many ills which range from loss of lives, increase in death toll due to untimely access to health care services as well as poor health information (Josen, 2018).

In the modern day a lot of innovations have been recorded at every sphere of life. The advent of technology has influenced all aspects of human existence including health care. The application of digital technologies and innovations is no longer news in our society today. Digital technologies refer to the provision and use of electronic technologies and gadgets to generate, process or store information such as websites, smart phones, internet, artificial intelligence among others. Advocates of integration of digital technologies in all human enterprise believe that these tools are better and

faster in accessing information, delivering results at the fastest possible time with precision and accuracy (Engerson, 2020). In the health care system digital technologies are used to help health care delivery through the intersection between technology and health care. According to Bernstein (2022) the application of digital tools to improve health is very necessary due its vast array of benefits. In the words of Dellotte (2019), digital health employs more than just technologies and tools but also views radically interoperable data, artificial intelligence (AI) and open secure platforms as central to the promise of more consumer focused prevention-oriented care.

Health care delivery in the rural areas of Nigeria including Anambra state has not been very satisfactory. In the views of Jacobs (2021), health care delivery in the rural areas is often deficient in human resource, infrastructure and adequate health information. These short falls have led to the death of patients whose lives could have been saved should there be efficient health care services. As a result of the non-use of digital technologies in health care there have been serious problems regarding the health of many rural dwellers. This is the rationale for the present study. The researcher is motivated to take up this study to critically examine how integration of digital technologies in health care delivery in rural areas can help improve the health of rural dwellers in selected communities in Anambra state.

Statement of the Problem

The adequate health of every citizen is one of the basic requirements for a vibrant and productive nation. The more healthy a nation the more productive and meaningful lives they live. Many Nigerian citizens live in the rural areas. A lot of people in the rural area do face numerous challenges in healthcare due to poor access to basic health care services and lack of prompt response to their health needs. These problems are caused by poor or dysfunctional health facilities, inadequate human resource and lack of right health information among others. These challenges have led to the occurrence of avoidable deaths, and other health complications. One of the credits of digital technologies is the speed at which the right information is accessed and health care services provided. Consequently, it is envisaged that if digital technologies and innovations are co-opted in rural health care services, there may be an improvement in the health care system of rural dwellers as well as a reduction in the number of avoidable medical fatalities and other health conditions. Now the problem of this study is to examine how the integration of digital technologies and innovations in health care delivery will influence the health conditions of rural dwellers in Anambra communities.

Research Questions

The following research questions were raised and answered in the course of the study.

1. What are the various digital technologies and tools that could be integrated into rural health care delivery in communities in Anambra state?
2. What are the expected benefits of integrating digital technologies and innovations in rural health care delivery in communities in Anambra state?
3. What factors pose threats to effective integration of digital technologies and innovations in rural health care delivery in communities in Anambra state?
4. In which way is the integration of digital technologies and innovations in rural health care delivery made more effective in Anambra state?

Literature Review

Meaning of Digital Technologies (DTs)

Digital technologies (DTs) refer to technologies such as online resources, learning management systems, programmes and applications and tools (like laptops, tablets, and online devices) which are used in data gathering and management and for research {Institute of Health and Technology (IHT), 2018}. According to Leene (2018) they refer to digital tools, systems, devices, and resources that generate , store, or process data such as social media, online games, multimedia and mobile phones; They can equally be seen as technologies that represent texts in a digitized form. Based on the foregoing definitions one can define digital technologies as all kinds of tools applications, and media that read, record, edit, and distribute analog forms such as texts sounds and images which have been

converted to digital codes. These tools can generate, store and process data. The aim of all digital technologies is to create and practicalise digital or computerized devices, methods and systems. The importance of digital technologies in our today's modern world cannot be undermined.

According to Acsen (2021) digital technologies are useful in business, communication and for researches. Their use facilitates information sourcing, generation, organization and dissemination in a most efficient and fastest way possible. Digital technologies are also referred to as digital media. They help people connect with each other in new and different ways, allowing users to manage social connections across distances and time. They are simple to back up and communicate with others. They also allow for easier editing and modification and are less expensive.

Health Care Delivery

Health care delivery (HCD) is a term used to denote the services provided by nurses, doctors and other medical and health personnel to ensure the health needs of citizens are met. The major role of the health care delivery system is to provide for services to be delivered to people in order to contribute to their health. These services are delivered in defined settings such as homes, educational institutions, work place, public places, hospitals and communities and clinics. According to Pallipedia (2018) a health care system consists of all organizations, people, and actions whose primary intent is to promote, restore, or maintain health. This includes the efforts to influence determinants of health as well as more direct health inspiring activities. From the premises above the main role of the health care services is to meet the health needs of target population.

The importance of good health care delivery will well be seen when one considers the fact that people demand health because of its role in facilitating and providing happiness. A healthy person is a wealthy person. Health can affect one's job productivity through absenteeism. Low productivity due to health challenges is one of the factors that destroy a nation, hence investment in improving and managing health offers opportunities to reduce losses in work places.

In addition, Peterson (2012) stated that high quality health care helps prevent diseases and improve the quality of life. Good health is central to human existence and well-being which has positive effect on prosperity and economic progress of both individuals and the nation at large. The Scientific World Group (2019) averred that health has an important role in feeling happy because a lot of people who suffer from diseases are able to fight the ailments hence they are able to achieve physical fitness and feel better. In summary, health care delivery is central to the existence and well-being of all and sundry.

Challenges of Health Care Delivery in Rural Area

The level of advancement of any nation is to a great extent determined by the level of the effectiveness of her health care system. Many residents in the rural area are affected badly due to poor level of health care. Miahz (2020) stated that health care delivery of urban centres grows at a geometric rate while the rural area is second to non-existent. A lot of persons in the rural areas do not have access to good health care services; many others do not receive the needed health attention as at when due leading to health complications and in some cases loss of lives.

Some of the reasons for the poor access to health in the rural areas according to Rehzie (2020) is lack of access to health care information. Information is critical to survival. One is bound to be deformed if ill or uninformed. This lack of basic health information is traceable to poor internet services and connectivity or outright lack of same.

Another reason for poor health care delivery in the rural area is inadequate health human resources. Many health workers are seen scrambling for space in the urban areas and cities due probably to high remuneration and better conditions of service as well as better equipment and high patronage. These advantages make the rural areas to be deserted by health workers (Njebo, 2019). The after math is high rural-urban migration of health workers making the rural areas to suffer in health care services. In the opinion of Emeboluwa (2013) rural area health care delivery is poor due to some superstitious beliefs

(myths) being held by rural dwellers. Some rural locals do not believe in modern health or medicine; they attribute sicknesses to one demi-god or evil spirits and as such seek other means of relief. These belief systems debar them from accessing health care services even when such are provided. That is why Odenigbo (2020) called for health awareness campaign especially for rural dwellers to enlighten them about the importance of accessing health and to help them disabuse their minds of any myths they may have been holding unto about modern health care.

Empirical Review

Asogwa (2019) studied newspaper framing of Lassa fever and health behaviour of residents of Ebonyi State, Nigeria. The researcher adopted mixed methods survey and content analysis. Four newspapers were studied by the researcher: *ThePunch*, *Vanguard*, *The Guardian* and *This day* newspapers and 384 respondents took part in the study. The result showed that the newspapers mostly used gain frames in their framing of Lassa fever and such stories influenced the health behaviour in the area of avoiding contacts with rodents, keeping food away from rodents as well as keeping their environment clean. The researcher recommended that further studies should be expanded to cover more areas to give room for comparison

Sabur , Gerhard and Kurt and Schmailz (2019) carried out a study in acceptance of digital technologies in medicine among patients and healthy users. Survey research method was applied. Their study aimed to identify the spread of and experience with new digital technologies in the medical sector in Germany. Results showed that the average age of the respondents was 59.7 years, with a standard deviation of 16 years. Digital health care apps were generally accepted, but differences were observed among age groups and genders of the respondents. Men were more likely to accept digital technologies, while women preferred coaching and consultation apps. Analysis of the user typology revealed that most users were patients followed by patients with acute conditions and healthy users. The majority (68%) discovered coaching or medication apps themselves on the internet, while more than half of the users faced initial difficulties operating such apps. The authors concluded that the acceptance of digital technologies in the German health care sector varies depending on age and gender. The broad acceptance of medical digital apps could potentially improve individualized health care solutions and warrants governance.

Morris (2022) studied the role of digital health technology in rural cancer care delivery: A systematic review. The study was motivated by the fact that rural residents face higher cancer incidence rates and mortality rates, disparities that could be mitigated with health technology interventions, yet a digital divide is also apparent. Hence the study systematically and critically examines existing literature to understand how digital technologies have been used to support rural oncology care. The PubMed, CINAHL Complete, PsycINFO, and Embase were searched using Medical Subject Headings terms and keywords.

The mixed methods appraisal tool was used to assess methodological quality. Findings show that digital health has been less extensively utilized in rural oncology compared with the general cancer population and other chronic diseases. The study identified 54 studies that used technology in rural cancer care delivery, a comparatively small number, representing a significant gap in the literature. Studies were classified into 4 categories: Telemedicine (n = 32), phone calls (n = 11), Internet (n = 9), and mobile phone (n = 2). The researcher recommended that there is need for further implementation and expansion of telemedicine. The author suggested further that social and behavioral determinants of health and access to technology must be considered.

NkqubelaHerselman and Conradie (2010) studied ICT applications as e-health solutions in rural healthcare in the Eastern Cape Province of South Africa. The study was necessitated by the fact that Information and Communication Technology (ICT) solutions (e.g. e-health, telemedicine, e-education) are often viewed as vehicles to bridge the digital divide between rural and urban healthcare centres and to resolve shortcomings in the rural health sector. Consequently, the study focused on factors perceived to influence the uptake and use of ICTs as e-health solutions in selected rural Eastern Cape healthcare centres, and on structural variables relating to these facilities and processes.

Attention was also given to two psychological variables that may underlie an individual's acceptance and use of ICTs: usefulness and ease of use. The study discovered that a majority of participating staff perceived their level of ICT-related skills to be a problem that could hamper application of e-health solutions. Also all staff believed that lack of information (i.e. lack of relevant content for ICT applications) was a barrier to e-health solutions. The study recommended that special attention be given to improving basic infrastructure: hardware, appropriate software and telecommunications skills and knowledge development, ICT skills training programs and policies for technology maintenance and support be introduced/upgraded.

Theoretical Framework

Technological Determinism theory

This paper finds expression on technological determinism theory propounded by McLuhan (1962), who Baran and Davies (2012, p. 273) quoted as stating that "changes in communication technology inevitably produce profound changes in both culture and social order." Technological Determinism theory was propounded by Marshal McLuhan in 1962. The theory states that man's feelings, actions and thoughts are shaped by evolving technologies. In the thinking of the founding father of the theory, the "medium (technology) is the message" because human beings act, learn, feel and think the way they do due to the messages they receive through the current technologies (McLuhan, 1965). Technological determinism theory ascribes absolute power of influence to the technology that propels the mass media. The theory holds that the media not only alter their environment but the very message they convey.

This is because the media bring about new perpetual habits and their technologies create new environments (Edegoh and Samson, 2014). The theory asserts that technology decisively shapes how human beings think, feel and act and how societies organise themselves and operate.

From the submissions, the relevance of this theory to this paper stems from the point that technological inventions such as like laptops, tablets, and online devices which are used in data gathering and management could be applied or integrated in health care delivery in rural areas in Anambra State. In other words, integration of digital technologies in health care delivery in rural areas can help improve the health of rural dwellers in selected communities in Anambra state.

Methodology

The study was a descriptive survey. It was conducted in selected rural communities in Anambra state. The population consisted of all doctors, nurses, rural dwellers, and heads of clinics and hospitals in the selected rural communities in the state. A purposive sample of 120 respondents was drawn. Data were elicited by means of a researcher made-structured questionnaire tagged Digital Technologies and Rural Health Care Delivery Questionnaire (DITERUHCDQ). Three experts validated the questionnaire with a test-retest reliability index of 0.82. The direct delivery or personal contact method was adopted in the collection of data. Data collection lasted for 5 working days. The author used frequency tables and simple percentage for data analysis. The bench mark percentage was 50% and decisions were made based on the 50% criterion. Factors whose percentage response was below 50% were discarded while those above 50% were accepted.

Data Presentation and Analysis

Research Question One: What are the digital technologies that could be used to enhance rural health care services in communities in Anambra state?

Table 1: Digital Technologies that could be Integrated in Rural Health Care Delivery in Anambra Communities

S/NO	Statement	Agreed		Disagreed	
		Freq	%	Freq	%
1.	Electronic health records(EHR)	96	80.0	24	20.0
2.	Electronic Medical results transmitter(EMRT)	89	74.2	31	25.8
3.	Confidential Electronic Patient Portal	90	75.0	30	25.0
4.	Electronic Drugs Prescriber	84	70.0	36	30.0
5.	Mobile devices and Tablets	80	66.7	40	33.3
6.	Internet Connectivity	100	83.3	20	16.7
7.	Electronic Lab result Interpreter	105	87.5	15	12.5

Table 1 shows some digital technologies which can be integrated in rural health care delivery. They include Electronic lab result interpreter (87.5%), EHR (80%), internet connectivity (83.3%) and the least observed digital technology in Table 1 is mobile devices and tablets with only 66.7% affirmative response.

Research Question Two: What are the expected benefits of application of digital technologies in health care delivery in Rural Communities in Anambra State?

Table 2: Expected Benefits of Integration of Digital Technologies in Rural Health Care Delivery in Communities in Anambra State

S/NO	Statement	Agreed		Disagreed	
		Freq	%	Freq	%
1.	Improved self-care for minor ailments	112	93.3	08	6.7
2.	Improved self-management of long term health condition	110	91.7	10	8.3
3.	Improved and faster access to health care services	93	77.5	27	22.5
4.	More appropriate delivery of health services	114	95.0	06	5.0
5.	Cost effective means of accessing health care	108	87.5	12	12.5
6.	Better patients' adherence to medication and treatment	102	85.0	18	15.0

Evidences in Table 2 show the benefits that are associated with integrating digital technologies in rural health care delivery. Notable among them are more appropriate delivery of health services (95%), improved self care for minor ailments (93.3%), and improved self management of long term health conditions (91.7%). The least observed benefit is improved and faster access to health care services (77.5%)

Research Question Three: What are the challenges of effective integration of digital technologies in health care delivery in rural communities in Anambra state?

Table 3: Challenges of Effective Integration of Digital Technologies in Rural Health Care Delivery in Communities in Anambra State

S/NO	Statement	Agreed		Disagreed	
		Freq	%	Freq	%
1.	Adherence to superstitions/ myths about technology	118	98.3	02	1.7
2.	Poor health awareness by rural dwellers	115	95.8	05	4.2
3.	Poor sustainability	83	69.2	37	30.8
4.	Lack of Digital health Experts	109	90.8	11	9.2
5.	Poor maintenance of Digital Health tools	94	78.3	26	21.7
6.	Poor or no internet connectivity	103	85.8	17	14.2

Results presented in Table 3 reveal that adherence to superstitious beliefs / myths about technology (98.3%) is the lead challenge hindering effective integration of digital technology in rural health care

in Anambra communities. Other factors include poor health awareness by rural dwellers (95.8%), lack of digital health experts (90.8%) and poor or no internet connectivity (85.8%).

Research Question Four: How can the integration of digital technologies in rural health care in communities in Anambra State be made more effective?

Table 4: Ways of Making Integration of Digital Technologies in Rural Health Care Delivery more Effective in Communities in Anambra State

S/NO	Statement	Agreed		Disagreed	
		Freq	%	Freq	%
1.	Education of rural dwellers about the importance of embracing modern health care facilities	146	91.3	04	8.7
2.	Provision of necessary digital health tools to rural Health care centres	120	80.0	30	20.0
3.	Training and employment of digital tech experts to monitor the utilization of the digital health tools	105	70.0	45	30.0
4.	Improvement of the working conditions of health personnel in the rural areas	135	90.0	15	10.0
5.	Provision of internet connectivity in rural areas to enhance digital communication and data transfer	125	83.3	25	16.7
6.	Improvement in the communication and transportation system in the rural areas.	110	73.3	40	26.7

Data in Table 4 reveal the ways we can make integration of digital technologies and innovations in rural health care delivery more effective. Table 4 shows that the popular opinions are education of rural dwellers on the importance of embracing modern health care facilities (91.3%), improvement in the working conditions of health workers in the rural areas (90.0%) and provision of internet connectivity in rural areas to enhance digital communication and data transfer (83.3%) among others.

Discussion of Findings

The study was on the integration of digital technologies and innovations in health care delivery in rural areas in Anambra communities with the aim of seeking out the challenges and referring solutions. The analysis of the research questions revealed that there are some digital health tools that could be integrated in rural health care delivery. Some of them include EHR, electronic lab results interpreter among others. This finding agree with Sabur, Gerhard and Kurt and Schmailz (2019) who noted that digital health tools are better off than the non-digital tools. Continuing the authors averred that electronic devises are faster and more cost effective in dispensing health services. For example the electronic lab result interpreter provides a lucid and clear explanation of the diagnosis which some doctors cannot do. This challenge has led to wrong drug prescription and treatment of some patients.

In the same vein it was gathered that there abound many benefits that are derivable from integrating digital technologies in rural health care delivery. Some of the benefits include improved and faster access to health care and more appropriate delivery of health care services among others. These findings are not surprising because NkqubelaHerselman and Conradie (2010) discovered via their study that the use of ICT facilities in dispensing health care in rural areas was more profitable, less expensive, less cumbersome and more effective as many emergency cases were successfully handles with great success. On the factors hindering effective integration of digital technologies and innovations in rural health care delivery, adherence to myths and poor internet connectivity were found to be the leads. These results are consonant with Miahz (2020) who noted that digital techs cannot operate effectively in the absence of a good network or internet connectivity. The reason is to allow for free unhindered flow of ideas, transfer of files and digital data from one medium to another. Electronic information about the patients and their health need to be transmitted to the right doctors

for referrals and for treatment via digital platforms, hence without good internet connectivity, it will be practically impossible to do such.

Also, the study made a move to figure out how to make integration of digital technology in rural healthcare more effective. It was suggested that there is need to educate rural dwellers about the importance of embracing modern technology in accessing health care. This is very necessary because a lot of rural dwellers are still bent on holding to their erroneous archaic superstitious beliefs that debar them from accessing health care services even where available,. They attribute some ailments to the activities of some demonic beings which must be addressed using diabolical means rather than seeking medical attention. These superstitious beliefs have led to death of some rural dwellers or serious health complications.

Conclusion

The study was on the integration of digital technologies and innovations in rural health care delivery in communities in Anambra state. The essence was to identify the benefits, x-ray challenges and proffer solutions for better options. It was gathered that integrating digital technologies and innovations in rural health care has some benefits which include better treatment options and improved services. However there are factors that militate against its effective integration which include poor internet connectivity and adherence of rural dwellers to superstitions among others. In order to make the integration of digital technologies in rural health care more effective, it was gathered that training and employment of digital health experts and provision of internet connectivity are necessary among other options. Based on the findings from the study it was concluded that if digital technologies and innovations are integrated into rural health care delivery in Anambra communities, there would be a better health condition for rural dwellers.

Recommendations

Consequent upon the results from the study, the following are recommended:

1. It was seen that there are so many digital technology tools that can be integrated to help rural health care delivery therefore it important that the government make a move towards providing same to boost the health care services provided at the rural areas in the state.
2. The study discovered that the integration of digital technologies into rural health care delivery has some sterling benefits hence it is important rural dwellers be sensitized by the state ministry of health so that they can embrace modern health facilities provided in their areas for better health.
3. Some of the threats to effective integration of digital technology in rural health care delivery include poor internet connectivity among others, therefore it advisable that the Anambra state government does her best to provide good internet connections in the rural areas.
4. Anambra State government should support and encourage the use of digital technology tools in the rural areas.

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