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REVIEW

The Impact of Telemedicine During the COVID-19 Pandemic in Nigeria: A Review

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Summary

Background: Telemedicine practice is a rapidly evolving aspect of medicine in developed countries, though resource-limited countries like Nigeria are yet to embrace it fully. Moreover, the COVID-19 pandemic has limited patients' visits to hospitals in addition to the social distancing measures deployed by the government. In addition, with the challenges of a limited number of doctors, among other difficulties, it has become important that a radical approach to patient care and treatment should be explored.

Methods: A comprehensive literature review of original articles was done using an internet search. Words such as Telemedicine, COVID-19, Pandemic, Requirements, History, Benefits, and Challenges were searched on Google scholar, EMBASE, PubMed, Medline, Web MD, and Scopus to check for various articles published or any probable link. The references of the relevant articles were searched.

Results: The practice of telemedicine has evolved over the years. Also, the global telemedicine market has grown exponentially and is expected to grow even further in the next five years. Unfortunately, this exciting narrative is not obtainable in developing countries like Nigeria. Indeed, some healthcare providers in Nigeria need to prepare for this new technological advancement, and consequently, they struggle to evolve their practice to adopt this new technology. Furthermore, there is disinterest from most of the end users, particularly the patients.

Conclusion: Modifications must involve telemedicine services with a view of getting ready and well-organized in the event of any future pandemic such as COVID-19, in addition to harnessing the benefits of this service in the future.

Keywords: Challenges, COVID-19 pandemic, Healthcare Industry, Nigeria, Telemedicine, Telehealthcare.

Introduction

Following the COVID-19 pandemic which ravaged cities, countries and every continent of the world, Nigeria's approach to healthcare services witnessed a change. Global healthcare, including Nigeria, is evolving due to COVID-19 preventive strategies such as social distancing. Social containment measures were adopted worldwide, and healthcare systems were reorganized to cope with a growing number of

acutely ill patients. In Nigeria, the first case of COVID-19 was recorded on 27 February 2020. [1] As the number of confirmed cases continued to rise, the Federal Government of Nigeria responded on 30 March 2020 by restricting the movements of persons for two weeks in the country's capital Abuja, as well as in Lagos and Ogun States, perceived to be the epic centres of the disease at that point. Other states of the federation followed and invoked the provisions of the Quarantine Act to restrict the movements of

persons. In addition, these measures were aimed at ramping up efforts in contact tracing, testing and isolation, and case management. [2]

Due to restricted movement, some of these strategies inevitably hindered effective health service delivery to the populace. These measures were expected to lead to increased use of telemedicine services in patient care and service delivery: unfortunately, the integrity of this assertion may be questionable in Nigeria. It is noteworthy that some of the fundamental challenges of healthcare services, such as accessibility, equality, value, and affordability, continued to hinder achieving effective healthcare delivery, especially in developing countries. Furthermore, devices of modern information and communication technologies (ICTs), such as computers, internet facilities, and cell phones, are revolutionizing human interactions. [3] The increasing importance of these technologies in healthcare delivery cannot be overemphasized as they have great potential to address contemporary global health problems, primarily when channelled towards the right direction. This justifies the use of telemedicine, which uses ICTs to overcome geographical barriers and increase access to healthcare services. This is particularly beneficial for rural and underserved communities in developing countries that traditionally lack access to healthcare. [1] Therefore, stakeholders in the healthcare industry have a lot of roles to play in establishing telemedicine as part of a sustainable solution to the challenges of healthcare faced by developing countries.

According to the World Health Organization (WHO), telemedicine is defined as the "Delivering of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for the diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities".[4] While telemedicine is still evolving as a new technology, ICT innovations are being developed to adapt and meet the evolving health needs of society. Furthermore, there is a need to differentiate

telemedicine from telehealth. While telemedicine is limited to delivering health services by doctors, telehealth connotes health services offered by all other health personnel, excluding doctors. [5] In addition, telehealth covers non-clinical events like administrative meetings, continued medical education (CME), and physician training. In other words, it is not a specific service but a collection of methods to improve patient care and education delivery. [3] For telemedicine to achieve its objective, it should be capable of providing medical support. Secondly, it is supposed to surmount geographical barriers, connecting people who are not domiciled in the exact location. Thirdly, it includes the use of ICT; fourthly, its primary objective is the improvement of health outcomes. Therefore, telemedicine can be found to be invaluable in some special situations. These include situations with barriers to treatment, such as during the ongoing COVID-19 pandemic. Other instances include patients who live far away from medical care facilities and those who cannot transport themselves. This justifies the need for this review, which explores the history of telemedicine and highlights its benefits, challenges, and prospects.

History of Telemedicine

Telemedicine could be traced back to 1879 when the first revelation of healthcare coming to the home was made in an article published in the Lancet journal. In that article, scientists observed that unwanted visits to physicians' offices could be scaled down with the invention of the then-new telephone. [6] Again in 1925, a magazine named Science and Innovation published a report depicting a physician using radio to offer consultation.[4] Interestingly, this article envisaged a day when a physician could carry out clinical reviews over a long distance with a video device. [6] It is noteworthy that in the early nineteenth century, doctors were documented to offer consultations to ship-based clinics with the aid of radios.

It is worthwhile to mention the efforts of Alexander Graham Bell towards telecommunication development in what is documented as the first telephone call in 1876. [6] Similarly, this evolution continued until 1925 when a radio and publishing

entrepreneur, Hugo Gernsback, suggested that physicians will in future deploy the use of radio and television to reach their patients.^[6] He further developed the "teledactyl", a device that doctors can use in seeing their patients and using robotic arms to touch them. Even though this has not come to pass, his theories of telemedicine are now in use.

Furthermore, radiological images of innovations by scientists during the Second World War were sent with telephone lines to distances of more than 24 miles in Pennsylvania.^[7] Similarly, reports of neurological examinations were sent through cable wires by the University of Nebraska in the 1950s, in what appears to be one of the early expeditions into telemedicine by an academic institution.^[7] At about this same period, a Canadian physician from Montreal invented a teleradiology device which he used in sending radiographic images to various hospitals through a coaxial cable.^[8] About a decade later, physicians working at a hospital in Boston reported a "comprehensive system for telediagnosis" called telediagnosis.^[8] Mention must be made of efforts by Nebraska Psychiatric Institute in collaboration with Norfolk State Hospital to connect through a close circuit television, with the sole aim of working together.^[9] The National Air Space Agency (NASA) collaborated with the Nebraska Psychological Institute to expand telemedicine use in healthcare services towards the end of the 1970s.^[10] Subsequently, NASA became a key leader and driver of telemedicine research in the 1980s, exemplified by their rural targeted health projects and their efforts at investigating the modality of astronauts receiving medical attention from thousands of kilometres away from space.^[10] The advent of ICT in the 90s dramatically impacted telemedicine practice owing to the renewed interest of governments and health institutions towards it; besides, more funds are channelled towards telemedicine to improve its applicability and geographical reach.^[3]

Telemedicine Today

In 2020, telemedicine became a 45 billion US dollar industry and is now a crucial aspect of modern

healthcare delivery.^[11] The history of telemedicine shows that the practice of Medicine has come so far from where it used to be, even though a lot more still needs to be done. The telemedicine market is growing worldwide and is expected to reach 176 billion US dollars by 2026.^[11] The telehealthcare market is predicted to hit over 5.49 billion dollars in the Middle East and Africa by 2024.^[11] Similarly, access to essential telemedicine devices like mobile phones and computers has increased.^[12] Also, individuals in rural and busy urban areas can easily connect with a provider. Moreover, home-use medical devices allow caregivers to monitor vital signs and blood glucose levels.^[12] Furthermore, physicians can gather essential medical information and diagnose without patients' physical presence in a doctor's office. During the COVID-19 pandemic, telemedicine has the potential to significantly improve access to quality, affordable care for patients while maintaining physical distancing for the safety of both patients and healthcare providers. Apart from virtual clinics, text messages, email, mobile phone applications, and data from wearable devices can be used for information exchange between patients and healthcare givers.^[12]

Telemedicine in Nigeria

Nigeria is the most populous black country on earth, with a population of over 200 million people.^[11] The government is saddled with a vast dichotomy between the high class, which constitutes a minute percentage of its population and the disadvantaged group, which makes up a significant percentage of the people. The implication of this disparity is evidenced in the worsening poverty level and lack of access to essential healthcare services, especially in rural areas. It is even more interesting to note that Nigeria overtook India as the country with the largest extremely poor population in early 2018, with about 87 million people in extreme poverty, compared with India's 73 million.^[14] Furthermore, extreme poverty in Nigeria is growing by six people every minute.^[14] The latest data from the World Health Organization (WHO) reveals that Nigeria's physician-to-patient ratio is four doctors per 10,000 patients, and patients often wait hours to be seen.^[15] In the US, the ratio is

26 doctors per 10,000 people and 28 per 10,000 in the UK. [16] In the populated hospital waiting rooms, patients must stay for hours to be attended to due to insufficient healthcare workers.

The use of telemedicine in Nigeria dated to 2007, when the National Space Research and Development Agency and the Federal Ministry of Health inaugurated their first project in six Federal Medical Centres and two teaching hospitals across the country. [17] However, despite all its apparent benefits and potential, most Nigerians either do not take advantage of telemedicine or do not know about it. Since the coronavirus pandemic hit Nigeria in March 2020, hospitals have been limiting in-patient visits to protect their doctors from exposure to the virus. This is due to the temporary closure of a few hospitals after doctors tested positive for COVID-19. While this measure might be justifiable from a prevention standpoint, it leaves many people without access to their desired healthcare services. This inexorably justifies the use of telemedicine. Unfortunately, the adoption of telemedicine is still abysmally low in Nigeria despite the current global coronavirus pandemic, even though this has contributed to increasing the depth of its usage in some climes. [18] Despite all the challenges and setbacks, it is reassuring that some healthcare institutions in Nigeria have blazed the trail in establishing telemedicine facilities. [18]

Types of Telemedicine

Telemedicine can be broadly categorized into three types. [18] Interactive Medicine (also known as real-time telemedicine) enables patients and physicians to communicate in real-time using various interactive devices like telestethoscope (eStethoscope), teleophthalmoscope (eOphthalmoscope) and teleotoscope (eOtoscope). The second type is 'Store and Forward', which permits providers to share patient information with a practitioner in another location. For example, radiological studies, laboratory results and biomonitoring information may be sent to a physician at a convenient time for an offline assessment. Sometimes, the digital images could be taken using a digital camera ('stored') and

sent ('forwarded') to another location.[19] The advantage is that it only requires the parties to be present simultaneously. The third type is remote monitoring, also known as self-monitoring or testing. This allows healthcare providers to monitor a patient remotely with technological devices. It is mainly used for managing chronic diseases or specific conditions such as cardiac disease, diabetes mellitus, or asthma.[19]

Technological Requirements in Telemedicine

A broadband internet connection is an essential requirement in telemedicine practice.[20] It is crucial to understand that the amount and rate of the internet connection will determine video quality and the amount and speed of data transfer. However, in an ideal setting, a primary business broadband connection should be adequate at about 50-100 Megabits/sec (Mbps). [20] Another critical requirement is a video platform or a smartphone. [20] Typically, a direct-to-consumer system in which the patient uses the home computer or app-enabled smartphone to interact with the doctor is the most basic system needed. Such plans are offered through a third-party vendor. The second video option is a connection between two secure locations or computers. In this latter scenery, the provider controls both ends of the interface and will use an already set-up computer to interact with the patient. This is a costlier solution and will require the patient to go to the remote computer site, usually at a remote health facility.

Another vital requirement is a qualified computer scientist or technical support. This is because they are essential for any program to run well. [20] Moreover, support can be virtual or in person, depending on resources, although access to the doctor is critical. The support staff will guarantee stable and secure internet connectivity. More importantly, they should be available to help with technical and hardware problems which may occur during a clinic day to avoid disruptions to patient care. Another requirement is a recording device which is usually part of the video conferencing package.[20] Lastly,

there may be a need for peripheral and video assist devices, although it is optional at the start of the program. Examples of peripherals include video otoscopes for otolaryngology examination. These electronic stethoscopes can be used in cardiovascular assessment just as high-definition video cameras allow for the visualization of rash or skin lesions (dermoscopy).^[20] In summary, a telemedicine cart should have a computer with adequate access, video equipment, a power supply (battery to permit mobility) and peripherals with storage capacity. A typical mobile unit will enable telemedicine services to move about within a health facility so that multiple patient rooms are used. The expenditure differs widely depending on the equipment and capacity.

Benefits of Telemedicine

The benefits of telemedicine are enormous irrespective of who the beneficiaries include doctors, hospitals/ health institutions, and patients. This diverse impact explains the reason for its consistent growth over the years.

Benefits to Doctors

For the doctor, one of the essential benefits of telemedicine is that he no longer feels overwhelmed by long queues or overcrowding due to an uncontrolled, disorganized approach to hospital visits by patients.^[21] Secondly, there is a reduction in the risk of transmission of infectious diseases from patients and other hospital staff who may be asymptomatic carriers.^[22] There is also an efficient use of time and resources since patients can schedule consultations ahead of time.^[22] Furthermore, doctors become globally visible, offering care to patients beyond their local environment.^[22] Doctors also have a high chance of adapting to the new patient care model, which reduces risk without compromising quality and can earn an additional income while providing private consultations after regular hospital care. Similarly, there is respect for doctors' time to eliminate unsolicited, unrecognized and unappreciated phone consultations, which make doctors feel used.^[22] Telemedicine practice is an opportunity to contribute to public education

because health blogs enjoy a significant readership by the public. Therefore, doctors could provide authentic information on an area of interest to many people.^[23] Also, doctors become easily more accessible to patients, and this will prevent self-medication, quackery, poor health-seeking behaviour, and delay in visiting the hospital.^[22] Lastly, doctors become a contributory voice in society as it gives them a platform to contribute to the health technology revolution by providing feedback and innovative ideas.^[23]

Benefits to patients

Telemedicine allows doctors to monitor their patients from the comfort of their homes. It can help reassure patients and keep them safe at home while ensuring that only persons who need to visit the hospital, do so. Moreover, it allows patients to spend considerably less money than they would on traditional, in-person visits to the hospital.^[24] It also helps healthcare providers reduce the expenses of caring for patients. Furthermore, it is faster, more convenient, and more comfortable since patients can speak with a doctor online soon after noticing unusual symptoms, sometimes even within seconds.^[24] Besides, it allows the patient to connect with doctors from the comfort of a home or office, eliminating the pressure associated with visiting the doctor's office. Furthermore, it reduces risk since the patient does not have to be in a hospital waiting room or in the physical presence of a doctor. The risk of exposure to infectious diseases by touching surfaces or items like furniture and books is also reduced.^[22] Telemedicine also eliminates the risk of physical contact with other sick patients or healthcare workers.^[22] In addition, virtual care significantly reduces travel time for individuals in areas where they do not have certain specialists close by. It helps individuals who do not have convenient transportation or mobility problems access healthcare professionals they otherwise would not have been able to reach.^[24]

Benefits to the hospital

The benefit of telemedicine to the hospital community needs to be highlighted. Firstly, there is an increase in the volume of use due to improved efficiency and the range of services provided, leading to higher internally generated revenue.^[25] Secondly,

hospitals, through analytics, can make better decisions around planning for the population beyond individual health. [25] Furthermore, it provides a veritable opportunity for the hospital to provide health services beyond the local environment, thereby removing geographical barriers to patient care. [25] It also leads to decreased transmission of infectious diseases within the hospital environment since patients are seen remotely without any physical contact. [26] In addition, it serves as an additional revenue source for the hospital by expanding the clientele base while simultaneously reducing overhead expenses by reducing the number of staff required to take care of the increasing number of clients. [26] To a large extent, telemedicine improves patient satisfaction since they can consult from the confines of their homes without travelling long distances to see their doctor.[26]

Challenges of Telemedicine

Despite the apparent benefits of telemedicine, there are fundamental challenges against its effectiveness, especially in resource-poor settings like Nigeria, despite the COVID-19 pandemic, which should have provided an opportunity to scale up its usage. [27] A significant challenge is that several healthcare providers in Nigeria need to prepare for this new technological advancement. Thus, they need help to adopt this new technology for healthcare services into their existing practices.[27] Furthermore, there needs to be more interest from the majority of the end users, which are the patients, even though some tech-savvy patients have embraced this new technology.[27] This apathy could be a lack of education and awareness and concerns about this new technology. Poor technological infrastructure is one of Nigeria's biggest challenges in telemedicine practice. Some of these challenges range from poor internet network connectivity to the unavailability of telemedicine support devices and finding the right platform to use. [27] Even when available, the cost of installation and maintenance could be a considerable burden.

Besides, a weak internet connection can make it difficult to offer quality care to patients. Another critical challenge is a law regulating telemedicine practice.[5] In Nigeria, there are no specific laws regulating telemedicine practice at present. Even though several interrelated laws are relevant to some issues, they need to cover telemedicine practice sufficiently. Some aspects of telemedicine that require a legal framework include clinical liability, indemnity of healthcare providers, and credentialing of practitioners and providers. The objective is to guarantee patient safety and incorporate technical and ethical training on telemedicine during doctors' training.[27] Consequently, to realize a telemedicine practice in Nigeria which is based on international best practices, a suitable legal framework must be provided by the appropriate agencies; this is critical since telemedicine includes general legal matters like data protection, informed consent, privacy, medical negligence, contracts, medical ethics; and more specifically, medico-legal and ethical concerns like e-advising, e-consultation, e-prescribing, e-dispensing and e-consent.[27]

Another challenge is the need for a healthcare policy that can integrate telemedicine into the national healthcare policy framework, just like the National Health Insurance Scheme intends to achieve universal health coverage. [27] Data theft and conformity with privacy law are often encountered challenges as hackers and other criminals may be able to access a patient's medical data, especially if the patient accesses telemedicine on a public network or via an unencrypted channel.[27] The inability to examine patients and rely on patient self-reports during consultation can be a challenge because if the patient leaves out an important symptom that might have been noticeable during in-person care, this can negatively affect treatment. Doctors are also worried about perceived malpractices during consultations. Furthermore, while advances in Medicine have made it more efficient to use technology, there are times when system outages occur, which is certainly not suitable for telemedicine practice. There is also the potential for error as technology can only sometimes capture what the human touch can. Healthcare systems that adopt telemedicine solutions can attest that it requires a lot of time and money. Therefore,

implementing a new technique requires training, but sometimes, staff needs help to welcome this change. [26] Although it is expensive initially, healthcare systems should see a positive return on investment over time due to more patients and fewer staff. Delays in paying participating hospitals or clinics might limit their efficiency as many of these healthcare providers may be based overseas. Finally, patients should have the right to change their service providers where they are not satisfied with the quality of service rendered, just as it is obtainable with the health maintenance organizations (HMOs) under the health insurance scheme.

Future of Telemedicine

Notwithstanding the challenges bedevilling telemedicine practice, especially in a developing country like Nigeria, it is undeniable that the future of telemedicine is promising, judging by its futuristic capability. A good example is the online medical centres being developed: this consist of a 24-hour online collaborative platform for patients, providers, and staff. [29] It may look like an assemblage of remote doctors managing hospitalized patients. The benefit it confers on telemedicine practice is that doctors can treat and diagnose more patients in less time with the assistance of digital monitoring devices and video conferencing. Besides, the future could include international partnerships as technology becomes more robust. Moreover, some countries offer medical advances not currently available in Nigeria, but telemedicine would bridge the knowledge gap. [30,31] Today, sharing electronic medical record (EMR) information with a health system that uses another EMR platform is still challenging. The future will likely include enhanced sharing capabilities that will allow for patients' care no matter where they are. The concept of augmented or virtual reality mirrors is still a dream in this part of the world. Augmented reality (AR) is an experience where designers enhance parts of users' physical world with computer-generated input. [30,31] Virtual reality immerses the user in an entirely artificial computer-simulated environment. The system will combine augmented reality and adaptive image transformation for diagnostics and patient monitoring. With better imaging provided by

AR mirrors, providers can better diagnose eye problems, skin problems, and even breast cancer.

Conclusion

The gains of telemedicine can only be fully harnessed when medical practitioners, patients and health facilities become knowledgeable and are willing to utilize it. With the extreme shortage of doctors and other healthcare providers compared with the alarmingly increasing population, rapidly evolving technology, and the burden of the COVID-19 pandemic, telemedicine practice has come to stay in Nigeria. Considering the advantage it confers, especially regarding social distancing and reduced use of emergency rooms, concerted efforts should be made to explore the other benefits of telemedicine, especially in the post-pandemic era. However, the inherent challenges, such as poor availability and insufficient coverage, should be addressed. The government and private investors also have a role in ensuring that all adopt telemedicine, and this will completely revolutionize patients' and health workers' perspectives towards telemedicine. It is essential to note that telemedicine comes with a price, although its benefits surpass any accrued cost.

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