TOWARDS VIRTUALIZATION OF HEALTHCARE SYSTEM IN RIVERS STATE: THE NEEDS, HURDLES AND SOLUTIONS

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Abstract
This work was focused on the needs, hurdles, and the solutions for the virtualization of the healthcare system in Rivers State. High medical transportation costs, transportation risks, shortage of healthcare facilities especially in the rural areas, and convenience in accessing healthcare services, if virtualized, were the necessitating factors (the needs) of virtualization of the healthcare system as discussed. The hurdles discussed were medical infrastructural deficit, face-to-face oriented culture and resistance to change, epileptic power supply, poor network condition, and low digital orientation of both service providers and healthcare consumers. The solutions consisted of more investment in medical infrastructure, reorientation and sensitization via media houses, improvement and alternation of power supply, upgrade by network service providers, and enhancement of hands-on computer education. The work concluded that a healthcare system that adopts virtualization will bring about improvements in the healthcare system. It will reduce medical transportation costs and risks, and substitutes for shortage of healthcare facilities especially in rural areas. The study recommended, amongst other things, that the healthcare sector in Rivers State and the entire nation of Nigeria should encourage employees and management to go virtual in service delivery by setting up and easing access to digital devices and technologies, improving and alternating power supply, and enhancing hands-on computer education.

Keywords: Virtualization, Healthcare System, Virtualization Needs, Virtualization Hurdles, and Virtualization Solutions.

INTRODUCTION

A healthcare system consists of all organizations, people, and actions whose primary intent is to promote, restore, or maintain health (Pallipedia, 2019). It includes efforts to influence determinants of health as well as more direct health-improving activities. This system is therefore more than the pyramid of publicly owned facilities that deliver personal health services. It includes, for example, a mother caring for a sick child at home, private healthcare providers, behavior change programs, vector-control campaigns, health insurance organizations,

and occupational health and safety legislations. It includes inter-sectoral actions by health staff, for example, encouraging a ministry of education to promote female education, a well-known determinant of better health.

This work conceives a healthcare system as one by which healthcare is made available to the population and financed by government, corporate organizations, and individuals. In a larger sense, the elements of a healthcare system include the following: (1) personal healthcare services for individuals and families, available at hospitals, clinics, neighborhood centers, and similar agencies, in physicians' offices, and in the clients' own homes; (2) the public health services of maintaining a healthy environment, such as control of water and food supplies, regulation of drugs and safety intended to protect a given population; (3) teaching and research activities related to the prevention, detection and treatment of diseases; and (4) third party coverage of system services ((i.e health insurance). In every organized society, these elements function for the healthy living of every individual in that population.

Healthcare system virtualization is the process of bringing healthcare services (including self-services) closer to healthcare seekers by enhancing easy and swift communication between them and caregivers via digital technologies that run on phones, tablets, desktops laptops and customized devices. Such a process allows healthcare seekers to easily access their medical records via their personal platforms with a healthcare centre. In this process, healthcare seekers can also lodge their complaint(s) to the hospital via their platforms and the healthcare centre responds in no time. A virtualized healthcare system allows for live chat involving texts, voice and video calls between a healthcare giver and a patient, and health issues can be discussed such that a patient can even be instructed on how to go about a certain self-service (Nasi et al., 2015). The essential things needed to make such system a reality are digital devices and technologies, reliable network services and power supply. With these in place, virtualizing a healthcare system is possible both in urban and rural areas. With such a system in place, issues such as high transportation costs, transportation risks and shortage of healthcare facilities especially in rural areas can be taken care of to a great extent.

Several long term issues such as shifting of data towards the cloud, increased security requirements, new technology requiring new hardware/software, and experienced IT (information technology) professionals in healthcare, are driving healthcare systems to move to virtualized network (West, 2018). By using virtualized networks, healthcare organizations are reducing costs, providing higher levels of patient care, improving security and enhancing network efficiencies. Hospitals, large healthcare systems or clinics can focus on implementing emerging technologies to support better patient outcomes, rather than spending excess cycles managing their physical data centers and networks (Healthcare IT News Australia, 2018).

The healthcare system in Rivers State and Nigeria at large can go virtual, as this will provide more efficient access to shared records, better security and easy transition to mobile devices. Such a system must have a Hospital Information System (HIS), an interactive system which contains a comprehensive, detailed and frequently updated information of the services, patients, and healthcare practitioners in the healthcare centre of use. Healthcare virtualization could be the key to working through some of the hang-ups that can prevent effective and efficient information sharing between health systems, hospitals and large physician practices by eliminating the need to physically meet in order to exchange health data or request any documents within a care setting (National Academy of Science, 1997). Healthcare is one of the industries that can stand to benefit the most from virtualization, especially virtualization in its mobile form. Since electronic health records (EHR) need to

be shared between different doctors, specialists and facilities, it is more important than ever for that information to be just as easily accessible as it is secure (Luxon, 2017). This is very needful, especially in a time as this where there is high medical transportation costs, transportation risks, and shortage of healthcare facilities especially in rural areas. These problems associated with a non-virtualized health system necessitated this study with a view to finding the solutions; and the details of which have been schematically presented in Figure 1.

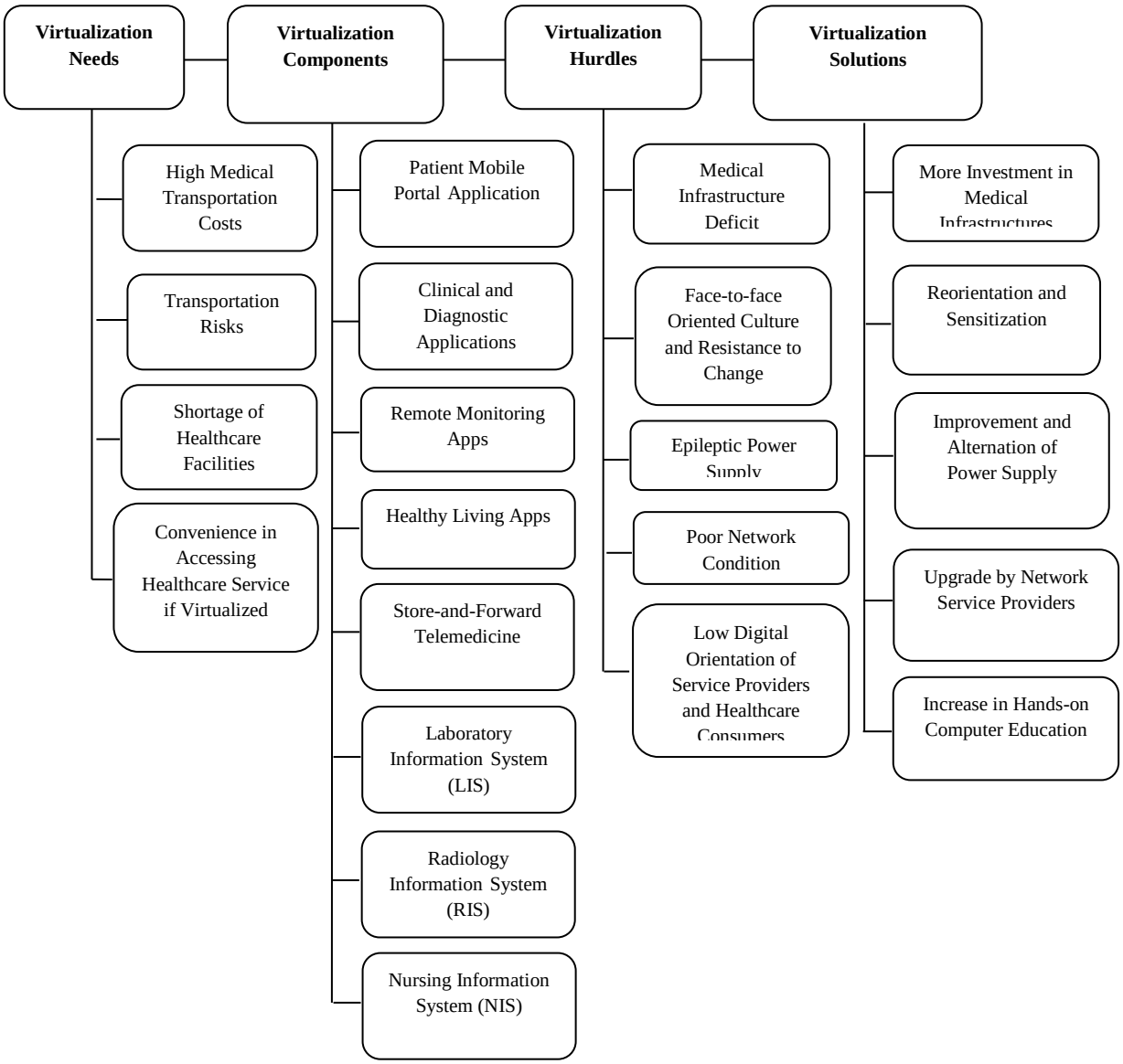

Figure 1: Elements in Virtualization of Healthcare System in Rivers State.
Source: *Authors (2020)*

VIRTUALIZATION NEEDS OF HEALTHCARE SYSTEM IN RIVERS STATE

The need for virtualization of the healthcare system in Rivers State as stated previously relates to high medical transportation costs, transportation risks, shortage of healthcare facilities especially in rural areas, and convenience in accessing healthcare if virtualized.

High Medical Transportation Costs: Medical transportation is the conveyance of a patient from home or one healthcare centre to another through highly trained drivers in company of emergency medical technicians and paramedics that provide medical services that may be needed to ensure safe arrival. Medical transportation enables patients to reach their destination quickly and efficiently. There are emergency and non-emergency medical transportation (Luxon, 2017). The emergency medical transportation includes basic life support ambulance (for patients who need medical assistance while in transit, and are provided bandages, EpiPens, cardiac monitoring, splints, oxygen tanks, and other medical supplies on board at all times) and advanced life support ambulance (one in which paramedics administer shots, medication, monitor vitals, and stabilize the patient for transport to an emergency room or trauma unit). Non-emergency medical transportation is a professional service to transport individual(s) with a health condition or injury that does not pose an immediate threat. Non-emergency medical transportation includes wheelchair transportation (for patients who are confined to a wheelchair or who cannot walk on their own), courier medical transport (used to transport human blood, organs and other biological matter to and from hospitals and research facilities), stretcher medical transportation (specifically for patients who suffer from back conditions or who cannot sit upright), and flight escort services (for patients who are well enough to travel by air but require medical supervision because they cannot converse or sit upright).

All of these services are not done for free. As a matter of fact, they are expensive and a whole lot of the population in Rivers State cannot conveniently pay for these; considering the economic situation, especially this one occasioned by the deadly corona virus pandemic. It therefore becomes a necessity that medical services in Rivers State are virtualized. This will reduce frequent transportation of patients, since the patient can easily report the situation to their physician or medical centre and medical advice given. If patients can stay in their homes, run test(s) that can be reported to their doctor just-in-time and advice given, there would not be need to transport such patients to the hospital anymore on that issue at that moment. Same applies to patients who notice complication(s) or other issues and report to the doctors assigned to them. Such patients get attended to on time. A virtualized healthcare system permits that patients have their individual online portals with the medical centre they are registered with, and this can be accessed by both parties (healthcare centre and patient) (James, 2016). With this on ground, patients can easily view their medical history and all activities going on their pages from which they can retrieve information, communicate and get feedback from their medical.

Transportation Risks: Another issue that necessitates virtualization of the healthcare system in Rivers State is transportation risks. The security nature in the State, as it is also across the country, makes it very risky for anyone to constantly move from one place to another. People get kidnapped, robbed, killed, raped, etc. Some of the means used in transporting the patients are not also in good working condition fit for patients' transportation (Onyeme et al., 2019). All of these and more pose risks for the patients. As such, it will be good news for the healthcare system in Rivers State to be virtualized so that patients will not need to travel unnecessarily.

Shortage of Healthcare Facilities: Most of the healthcare centres in the rural areas in

Rivers State lack essential facilities for their service delivery. The labs are not well equipped, wheelchair and stretchers are insufficient, rooms and bed spaces are inadequate, patients suffer discomfort due to lack of things like TVs, fans, air conditioners, wifi, power, etc.; all these make patients to seek medical attention in urban areas (Onyeme et al., 2019). This shortage of healthcare facilities is a major situation that causes patients to move to urban locations for healthcare services; even though facilities in the urban centres also suffer similar problems to some extent. This is not healthy as it makes the patient spend more on transportation fare and medical bills. A patient in this situation is also exposed to transportation risks, and therefore, a virtualized healthcare system is needed in Rivers State for all medical centres.

Convenience in Accessing Healthcare Services if Virtualized: Accessing a virtualized healthcare service is convenient for the healthcare givers and the patients. This is so because patients can stay at the comfort of their homes and offices without panic to interact with their healthcare centres or doctors as the case may be via digital technologies as made available by the healthcare centre. A virtualized healthcare system allows for collaboration between healthcare workers and patients, data storage, costs saving, security, which are all advantages, and they ensure convenience on both ends of the healthcare service delivery (Mohammed, 2018). There is convenience in accessing healthcare service if virtualized, since speed of service delivery is ensured as a result of swift medical attention. It is quicker to get to interact with your healthcare giver on chat, voice and video call, enabled by the customized digital technology which may even lead to you carrying out a self service and report just-in-time to him/her. This is much faster and convenient than going to the hospital, where the doctor may not even be disposed for your visitation (Balidwin et al., 2017). We therefore need a virtualized healthcare system in Rivers State.

COMPONENTS OF VIRTUAL A HEALTHCARE SYSTEM

There are lots of applications/software that are used in a virtualized healthcare system. For the sake of this work, some components (applications/software) from Mohammed (2018) and Ventola (2014) works have been envisioned to help make a virtual healthcare system a reality in Rivers State.

Patient Mobile Portal Application: A patient mobile portal application is an electronic portal that enables patients have access to medical services via electronic devices (e.g. smartphones, tablets, laptops, desktop PCs, and some customized devices) by connecting with their doctors and healthcare centres (Stephen, 2018). With a patient mobile portal application, patients can stay connected, administrative duties can be reduced, there will be no need to repeat information, patients can be educated on how to effectively and efficiently manage their health, and payment and billing statements can be easily accessed. With such an app as this in place, healthcare seekers across Rivers State can easily access medical services via their electronic devices or other customized devices as the case may be.

Clinical and Diagnostic Applications: These apps allow practitioners to gather, evaluate, and share data about their patients (Kumar, 2018). They may include the ability to access electronic health records (EHRs) on the go, view lab results, or perform digital imaging. Built-in symptom checkers help providers and patients diagnose illnesses and injuries quickly. Such applications even allow for hassle-free patient scheduling. Doctors and other healthcare practitioners across Rivers State can make use of these applications to access and monitor patients, from which they can gather, evaluate, and share data about their patients. This would help birth a virtual healthcare system in Rivers State.

Remote Monitoring Apps: Remote monitoring apps allow patients to remain at

home while still under the (virtual) care of their physician (Balidwin et al, 2017). Not every condition needs to be managed in a clinical setting. Practitioners can keep track of their patient's heart rate, oxygen level, blood glucose readings, blood pressure, and other pertinent healthcare information without the need for office visits. Remote monitoring apps, being applications that ensure patients get medical attention virtually from their healthcare providers, also apply to mobile health providers. Mobile health apps may include electronic visit verification (EVV) that logs who provided which services to whom, plus when and where it was delivered. This type of compliance information will be required of many providers in the coming years.

Healthy Living Apps: These applications are designed with patient engagement in mind. Healthy living apps, being virtual healthcare applications, track health metrics such as diet, exercise, heart rate, and sleep (John, 2016). Pregnant women can even use apps about fetal development. Patients with diabetes or heart disease may benefit from apps that offer a diet plan tailored to their specific circumstances.

Store-and-Forward Telemedicine: Store-and-forward telemedicine is also called "asynchronous telemedicine." It is a method by which healthcare providers share patient medical information like lab reports, imaging studies, videos, and other records with a physician, radiologist, or specialist at another location (i.e virtually) (Ventola, 2014). It is unlike email, but it is done using a solution that has built-in, sophisticated security features to ensure patient confidentiality. Store-and-forward telemedicine is an efficient way for patients, primary care providers, and specialists to collaborate because they can all review the information when it is convenient for them. The approach gives patients access to a care team that can be comprised of providers in different locations, even across long distances and in different time zones. Store-and-forward is particularly popular for diagnoses and treatment with certain specialties including dermatology, ophthalmology, and radiology.

Laboratory Information System (LIS): Laboratory information system is an integrated and comprehensive software used for the collection, storage, and retrieval of data from clinical laboratories (Mohammed, 2018). It automates the flow of all information related to a total testing process (Lukic, 2017). In the last few decades, medical laboratories have experienced dramatic transformation due to automation and development of information technology. Electronic request enhances the quality of communication between laboratory and clinicians. Moreover, LIS performs automated printing of receipts and bills for analysis which patients pay at admission desk. Printing of patient's informed consent for venipuncture is also automated (Lima-Oliveira et al., 2015). By entering patient's information and test orders in LIS, it generates electronic invoice for health insurance organization, without any further need for additional actions of admission personnel. Complete electronic register of patients is printed at the end of the day so that personnel are not required to manually write paper register. Having an automated system such as a LIS is what a difficult time as we have it today (Covid-19 pandemic) calls for; patients' information can be collected, stored, and retrieved efficiently and with ease. Such information can even be related to patients virtually.

Radiology Information System (RIS): A *radiology information system* (RIS) as a component of a virtualized healthcare system is a networked software *system* for managing medical imagery and associated data (Rouse, 2017). This is another class of automated healthcare software that can be utilized in healthcare centres to swiftly run patients' radiology data, which is what should really be obtainable in a virtualized healthcare system. A RIS is especially useful for tracking *radiology* imaging orders and billing *information*, and is often used in conjunction with Picture Archiving and

Communication System (PACS) and Vendor Neutral Archives (VNAs) to manage image archives, record-keeping and billing. A RIS is a computer system designed to support operational workflow and business analysis within a radiology department. A RIS is also a repository of patient data and reports, and contributes to the electronic patient record. As RIS has evolved, its applications have widened to include other departments and imaging specialties such as nuclear medicine, radiotherapy, endoscopy and so on. Where a RIS supports these additional specialties, it may be more accurately described as an Imaging Information System (IIS). A RIS supports a wide range of functional requirements which overlap with functionality provided by other hospital information systems and PACS (for example, appointment scheduling, work lists and digital dictation). In an integrated solution, it is acceptable for other systems to provide this functionality provided the overall operational workflow and business analysis requirements are satisfied by the integrated solution.

Nursing Information System (NIS): Nursing information includes data collected by nurses, data used by nurses, data about nursing activity, and data about the nursing resource (Toromanovic & Masic, 2010). Nursing information system is an automated healthcare system software that allows for a wide scope of health data, capturing and processing health and health-related data of broad diversity, scope and level of detail (Toromanovic & Masic, 2010). According to Mamta (2014), nursing Information Systems (NIS) are computer systems that manage clinical data from a variety of healthcare environments. These systems are made available in a timely and orderly fashion to aid nurses in providing and improving patient care. And in the day to day nursing practice, a Nursing Information System can be applied to model the processing of data, information, and knowledge within a computer system. It processes the nursing data to information and thereafter to nursing knowledge. For nurses' aid and delivery of patient care, nursing information systems provide certain features such as patient charting, staff scheduling, clinical data integration, decision support, etc.

VIRTUALIZATION HURDLES OF HEALTHCARE SYSTEM IN RIVERS STATE

All of the healthcare components discussed above, if adopted in the healthcare system in Rivers State, would help bring to reality a virtualized healthcare system where patients can remotely access healthcare and issues such as high medical transportation costs, transportation risks, shortage of healthcare facilities, and certain inconveniences can be warded off to a great extent. It would also create an avenue for patient-doctor(s) and patient-healthcare centre collaboration, as well as ease of healthcare access, since there is assurance of convenience in accessing a virtualized healthcare system. Systems such as LIS, RIS and NIS can at times get their data virtually and relate the information same way to the patients and healthcare givers. However, there are hurdles to virtualized healthcare system in Rivers State. These are examined in this section of this paper.

Medical Infrastructure Deficit: Medical infrastructure is a key pillar supporting the fundamental aim of promoting improved standards of care and wellbeing for all patients, together with a good experience of the healthcare system. Infrastructure must integrate the hospital, as the centre for acute and inpatient care, into the broader health care system, and should facilitate the seven domains of health quality – patient experience, effectiveness, efficiency, timeliness, safety, equity and sustainability (Buckler et al., 2016). To Luxon (2017), medical infrastructure refers to the built environment and supporting elements such as equipment, access, information technology (IT), systems and processes, and sustainability initiatives and staff. On the whole, these interwoven facets should enable patients to move seamlessly, with their privacy and dignity maintained at all times, from initial referral through local hospitals to specialist tertiary centres and discharge to

appropriate care, whatever the age or social circumstances of the patient. Indeed, the elements that make up a healthcare infrastructure (built environment, equipment, access, information technology (IT), systems and processes, sustainability initiatives and staff) must be available in good condition and accessible by patients and caregivers for effective and efficient healthcare delivery (Department of Health, 2015). Here in Rivers State, the reverse is the case. There is obvious deficit of the elements, especially in the rural areas. The environment is nothing to write home about; patients and healthcare givers suffer shortage of equipments; there is little access to mental health support, healthcare facilities, and all relevant hospital information. The utilization of information technology (IT) is still in the infant stage, and the level of governance and staff structure are substandard.

Face-to-Face Oriented Culture and Resistance to Change: In this part of the world, so many believe that they have to see the doctor or anyone in charge on a face-to-face interaction before their health issues can be taken care of sustainably. They do not believe that they can lodge their complaint(s) on their portal with the healthcare centre and they get their issue(s) cleared on time. They do not also believe that they can interact with the doctor or anyone in charge via a digital device that allows for chat, voice or video call and they also get all or part of their problems solved. There is always this strong feeling in them that when they meet with the doctor in person, then their health challenge gets better solved than the other way round.

Epileptic Power Supply: Power supply poses another hurdle to virtualization of healthcare system in Rivers State. According to Allen (2017), the issue of inadequate power supply in the healthcare system has been the reason for some deaths and complications recorded. The digital gadgets and technologies that are used to virtualize a healthcare system all need good power supply to be feasible. We have situations where the public power supply is in a sorry-state and the centre-owned power generating facility is also in a critical situation. Twenty hours public power supply is not a reality in any part of Rivers State. Only few private healthcare centres can boast of twenty to twenty-four hours power supply. A study on challenges faced doing business in Nigeria indicates the biggest obstacle is the lack of electricity (Cervigni et al., 2013). Today, Nigeria scarcely generates less than 5000MW of electricity (NERC, 2016), not good enough to efficiently and effectively power one of its 36 states. The absence of reliable energy supply has also left the rural population socially backward, since electricity is required for the basic developmental of services such as clean piped-water, health care, telecommunications, and quality education. Poor access to electricity have played a great part in a declining manufacturing sector due to reduced competitiveness, translated into youth unemployment estimated at about 60 percent (Pollet et al., 2016). This situation will definitely hinder the achievement of virtualization in Rivers State healthcare system, because a steady power supply is needed for all healthcare systems and homes in Rivers State for this to happen.

Poor Network Condition: To successfully virtualize a healthcare system, good network condition from network providers such as Glo, MTN, 9mobile, Airtel, Spectranet, Smile, etc. is needed to get all necessary gadgets and technologies connected. The network situation in this part of the country, especially in the rural areas, is poor for most of the network providers. Chats, voice and video calls are not without hitches each time they are carried out here. They are most annoying when it comes to making video calls (being what is needed much often in a virtual healthcare system) with apps such as Skype, Zoom, WhatsApp, Facebook Messenger, etc. This is attributed to poor network condition in Rivers State and the entire Nigeria.

Low Digital Orientation of Service Providers and Healthcare Consumers: Another hurdle to virtualization of the healthcare system in Rivers State is that healthcare service providers and its consumers are poorly oriented when it comes to digital life. A lot of them do not have access to smart phones and other digital facilities. How can a person be digitally oriented when he/she does not have access to the facilities and technologies that are used for digitalization? A good number of those who have access to these facilities and technologies do not know how to effectively and efficiently utilize them; their level of digital literacy is low. To a great extent, this would hinder digital communication on both sides, which is a hindrance to virtualization of the healthcare system in Rivers State.

VIRTUALIZATION SOLUTIONS

In order to address the aforementioned hurdles to the virtualization of the healthcare system in Rivers State, and to respond to the need for virtualization, the researchers have charted out the way forward in terms of appropriate solutions.

More Investment in Medical Infrastructure: Public/private partnerships are highly needed in the healthcare industry in Rivers State, with the government often providing land for the project as well as security for investments. Patrick (2018) said that Nigeria suffers a heavy burden of infectious diseases, particularly malaria, and experiences frequent outbreaks of water-borne diseases such as cholera which, in some instances, requires hospitalization. He additionally asserted that Nigeria has been witnessing an increase in the incidence of non-communicable diseases, which often lead to hospitalization if the condition is not well-managed.

This increase in incidence of chronic and infectious diseases sets up an immense pressure to diagnose and treat these faster and in a cost-effective manner. But the challenge, especially here in Rivers State is dearth of healthcare infrastructure. The government of Rivers State should therefore create an enabling environment for both public and private investment in the healthcare system providing infrastructure fit for virtualization. This will help increase the amount of medical infrastructure across the state, which will increase access to healthcare as well as the chances for its virtualization in Rivers State.

Reorientation and Sensitization via Media Houses: Media houses such as print media houses, radio and TV stations in Rivers State should assume responsibility of orienting, reorienting, and sensitizing everyone on the need for virtualization of healthcare in Rivers State, as well as the abolishment of face-to-face oriented culture. As part of social responsibility, individuals and corporate organizations in Rivers State should approach the media and pay for such services that will be of general benefit. Media houses should as well do the same as part of their social responsibilities. By so doing, the issue of face-to-face oriented culture and low digital literacy will be taken care of to a great extent. It is important to note that this can also be achieved through other means aside media houses; especially the new media, social media.

Improvement and Alternation of Power Supply: In Nigeria, for many years, businesses irrespective of size, location, export orientation, and ownership have faced a tough situation because of power outages (Iarossi & Clarke, 2011). The power supply through the Power Holding Company of Nigeria (formerly, National Electric Power Authority) has proven to be very unreliable. All firms in Nigeria and especially Rivers State experience power outages and 85 percent own power generating sets (Saifuddin et al., 2016). The inadequacy of electricity supply is a fact of life in Nigeria. This makes many Nigeria-based industries and manufacturing sectors uncompetitive, and drags down annual GDP growth. For instance, according to Todd and Gleave (2014), a major cell phone provider, MTN Nigeria operates 6,000 generators across the country. Not only do generators cost a fortune

upfront but monthly fuel expenditures are very high. MTN spends more than $5.5 million US Dollars monthly on diesel to generate power for 19 hours daily (Todd & Gleave, 2014). The Nigerian Government through its Power Holding Companies (PHCs) should diversify their power supply through appropriate infrastructure development and the utilization of the abundant renewable energy resources present which will not only stabilize the electricity supply but also improve the energy security. It also becomes imperative for most industrial or commercial establishments or even individual consumers to acquire diesel standby power generating plants. Healthcare centres in Rivers State should accept this power supply reality in the country and therefore make alternative provisions in order to constantly have access to power supply for the smooth running of healthcare services.

Upgrade by Network Service Providers: The poor network situation in Nigeria entirely has called for upgrade by these network providers, such as MTN, Airtel, Glo 9mobile, Spectranet, Smile, etc. They should mount more of their masts across the State in both urban and rural environments in order to increase their network coverage. This will enhance communication via texts, chat, voice and video calls using diverse digital platforms, and so on for patient-doctor communication. This also means that the hurdle of poor network condition will be eradicated.

Enhancement of Hands-on Computer Education: Hands-on computer education is the process of obtaining computer literacy supported with trainees having access to the needed computer devices and technologies in the process. Simply put, hands-on computer education is computer training by doing. Healthcare centres across Rivers State and the entire Nigeria nation should invest on hands-on computer education of their employees and managers. Individuals should as well do same for their personal digital upgrade. With this in place, the issue of low digital orientation of both healthcare service providers and consumers will be a thing of the past. This will also pave way for smooth and effective communication between healthcare service providers and seekers across board.

THEORETICAL FRAMEWORK

This work is anchored on two theories, which are Diffusion of Innovation Theory and Socio-Technical Theory.

Diffusion of Innovation Theory: This theory by Rogers' (1962: Odu, 2017) postulates that individuals and social systems will adopt new technologies and innovative ideas at different points and subsequent outcomes from the system get determined by the point an innovation is accepted into a system. The assumptions of the theory are as follows:

i) There will always be a disparity in the level and time at which individuals within a given social system adopt new ideas, techniques, and technology.

ii) Individuals and arms of institutions that adopt innovations early will naturally outperform late adopters and the laggards.

The implication of this theory is that as healthcare systems across Rivers State and the entire nation make effort to delve into virtualization, there will be disparity on how and when healthcare service providers and consumers accept this new lifestyle. Hurdles such as medical infrastructural deficit, face-to-face oriented culture and resistance to change, epileptic power supply, poor network condition, and low digital orientation of both service providers and healthcare consumers will definitely cause some variations in the manner and time that they will adapt to a virtualized healthcare system. From the second assumption, the theory predicts that healthcare service providers and consumers who accept virtualization early enough will outperform those who will accept it later.

Socio-Technical Theory: The socio-technical theory is attributable to Eric Trist, Ken Bamforth and Fred Emery, during the

World War II era, based on their work with workers in English coal mines at the Tavistock Institute in London (https://en.wikipedia.org/wiki/sociotechnicalsystem, 2017). The theory is made up of two main constructs joined together: "socio" has to do with people and society while 'technical' has to do with machines and technology. The term "socio-technical" refers to the interrelatedness of social and technical aspects of an organization. The socio-technical theory holds that business organizations are made up of human beings working together in social groups using equipment, tools, methodologies and knowledge to achieve desirable changes in the system and to bring about the achievement of corporate goals as well as outperforming competitors (Walker et al., 2016). This theory asserts that changes in organizations and the capacity of organizations to compete favorably in the market are influenced by demands from the environment which brings changes in an organization. The socio-technical theory describes how societal changes provoke or necessitates changes in the techniques, procedures, infrastructure and technologies used in organizations (Norris & Moon, 2005). The socio-technical theory is founded on two cardinal assumptions:

i) The interaction of social and technical factors creates the conditions for successful (or unsuccessful) system performance (Read et al., 2015). These interactions are comprised partly of linear 'cause and effect' relationships, the relationships that are normally 'designed', and partly from 'non-linear', complex, even unpredictable relationships, which are those that are often unexpected.

ii) Optimizing either the socio, or far more commonly the technical, tends to increase not only the quantity of the unpredictable, 'un-designed', non-linear relationships, but those relationships that are injurious to the system's performance (Read et al., 2015). Thus, the second principle of sociotechnical theory hinges on joint optimization; asserting that improving only one aspect of the organization (e.g. workforce) and abandoning the other element (technical computer systems, and other knowledge management infrastructure) will be detrimental to the system. Both the human and technological resources of an organization must be optimized simultaneously for expected results to be achieved.

The implication of the joint optimization principle of socio-technical theory in the healthcare sector is that increase in hands-on computer training of both healthcare service providers and its consumers will not birth the anticipated virtualized healthcare system until other factors such as digital gadgets and technologies, investment in medical infrastructures, improvement and of power supply, and upgrade by network service providers are fixed. Considering the high medical transportation costs, transportation risks, shortage of healthcare facilities especially in rural area, and convenience in accessing a virtualized healthcare service, it is pertinent for the healthcare system to go virtual in order to deal with all of these considerations.

CONCLUSION AND RECOMMENDATIONS

A time such as this Covid-19 pandemic period, where everyone has been asked to practice physical and social distancing as part of measures to safeguard themselves from being infected by the virus, there are calls for everyone to reduce their rate of movement. This means that no one should travel or move around except when it becomes very necessary. It therefore becomes a necessity for the healthcare system in Rivers State and the entire Nigeria nation to be virtualized so all healthcare seekers can stay at the comfort of their homes and access medical services. This work therefore concludes that a healthcare system that adopts virtualization, considering the convenience in accessing a virtualized healthcare system, will definitely avert the issue of high medical transportation

costs, transportation risks, and shortage of healthcare facilities especially in rural areas, having in place setup and access to digital gadgets and technologies, more investment in medical infrastructures, reorientation and sensitization via media houses, improvement and alternation of power supply, upgrade by network service providers, and increase in hands-on computer education.

In the course of the paper, a number of recommendations were offered. However, for our purpose here, the following specific recommendations have been considered appropriate:

1. The healthcare sector in Rivers State and the entire nation of Nigeria should encourage employees and management to go virtual in their service delivery by setting up and easing access to digital devices and technologies, improving and alternating power supply, and improving on hands-on computer education.

2. Individuals, corporate organizations and the government of Rivers State and Nigeria should as well encourage a virtualized healthcare system where patient mobile portal application, clinical and diagnostic application, remote monitoring apps, healthy living apps, store-and-forward telemedicine, laboratory information system, radiology information system, and nursing information system will be utilized by investing more in medical infrastructures, reorientation and sensitization of the entire populace, and improvement of power supply.

3. Network providers in Rivers State such as MTN, Airtel, 9mobile, Glo, Smile, Spectranet, etc. should ensure an effective and efficient network service upgrade across the entire states in order to aid uninterrupted and smooth connection and communication with all electronic devices and technologies in a virtualized healthcare system.

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