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PERCEIVED EFFECT OF TELEMEDICINE ON MEDICAL SERVICE DELIVERY BY FEDERAL MEDICAL CENTERS IN NORTH CENTRAL ZONE OF NIGERIA

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B. TECH. BIOLOGICAL SCIENCES

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February, 2018

DECLARATION

I declare that the work described in this thesis is original and has not been previously submitted to any university or similar institutions for the award of any degree.

Name of Candidate: AKOR, Solomon Obotu

Signature of Candidate_____

Date_____

CERTIFICATION

We the undersigned, hereby certify that this thesis presented by AKOR, S. O. with registration number 15/8587/MLIS be accepted as fulfilling part of the requirements for the award of the degree of Master of Library and Information Science.

Title*: Perceived Effect of Telemedicine on Medical Service Delivery by Federal Medical Centers in North Central Nigeria.*

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DEDICATION

This work is dedicated foremost to Almighty God, for the grace and strength bestowed upon me throughout my study. It is also dedicated to my lovely parents who laid a solid foundation of my education.

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My sincere gratitude goes to God Almighty who has been my reason for existence and for making it possible for me to have completed this research work successfully.

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TABLE OF CONTENTS

CONTENTS

PAGE

LIST OF TABLES

ABSTRACT

The study investigated the perceived effect of telemedicine on medical service delivery by the Federal Medical Centers in North Central Nigeria. Six objectives guided the study. The study answered six research questions and tested two null hypotheses at 0.05 level of significance. The study adopted survey research design. The research was conducted in the North Central Zone of Nigeria. The population of the study was one thousand four hundred and seven (1407) medical staff (Doctors, Nurses, Laboratory Technologists and Pharmacists). The sample size was three hundred and eleven (311) respondents comprising 97 doctors, 178 nurses, 19 laboratory technologists and 17 pharmacists; this was determined using Taro Yamane formula. The instrument used for data collection was a structured questionnaire titled: Perceived Effect of Telemedicine Questionnaire (PETQ) developed by the researcher from literature reviewed. Three experts validated the instrument while split-half method was used to determine the internal consistency of the items and a reliability co-efficient of 0.76 was obtained, indicating that the instrument is reliable for the study. The instrument was administered by the researcher and four research assistants. Descriptive statistics of mean and standard deviation were used to answer the research questions while inferential statistics of Chi-square was used to test the null hypotheses at 0.05 level of significance. The findings revealed that nine (9) Telemedicine services are available to a high extent in the Federal Medical Centers in North Central Nigeria. The findings also revealed that Telemedicine exerts twelve (12) effects on medical service delivery, fourteen (14) challenges were discovered to be associated with the use of telemedicine, while eight (8) strategies were identified to mitigate the challenges of the use of telemedicine. It was also found that availability of telemedicine significantly affects medical service delivery in Federal Medical Centers in North Central Nigeria. Further analysis of data revealed that the degree of application of telemedicine exert significant effect on medical service delivery in Federal Medical Centers in North Central Nigeria. It was recommended that Federal Medical Centers should embark on drastic development of telemedicine in line with global trend in order to promote effective utilization of telemedicine services, stake holders should establish a basic understanding of what this medical technology can lead to as it will help policy makers enlighten the telemedicine debate by turning unique insights into more adequate approaches that will enrich and humanize mediated channels of health communication, thereby offering remedies and clarifications for effective health care exchange and delivery.

1.0 INTRODUCTION

1.1 Background of the Study

Many developing countries are facing various problems in delivering health care and medical services to their population. Lack of funds as well as a dramatic shortage of trained and experienced doctors and nurses, poor roads, limited transportation facilities and long distances are severe obstacles for providing health care services to rural communities and remote areas. Good quality services and medical specialists are often concentrated in urban areas. Patients cannot often afford transportation to the nearest health care center providing the necessary medical services. Provision of support and continuous medical education for those health care professionals working in rural areas are extremely difficult (Adler, 2000). Telemedicine is a feasible tool to address at least some of these issues. Telemedicine can be broadly defined as the use of information and telecommunication technologies to provide medical information and services at a distance (Field, 2002).

Telemedicine is the transfer of electronic medical data (that is, images, sounds, live video, and patient records) from one location to another. It includes the use of electronic information and telecommunication technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration (Larson, 2004).

The term is composed of the Greek word (*tele*) meaning 'far', and *medicine*. Telemedicine may be as simple as two health professionals discussing a case over the telephone, or as complex as using satellite technology and video-conferencing equipment to conduct a real-time consultation between medical specialists in two different countries. It can also involve the use of an unmanned robot (Field, 2002).

Telemedicine is most beneficial for populations living in isolated communities and remote regions and is currently being applied in virtually all medical domains. Specialties that use telemedicine often use a "tele-" prefix; for example, telemedicine as applied by radiologists is called Teleradiology. Similarly, telemedicine as applied by cardiologists is termed as telecardiology (Harrop and Curry, 1998).

The ability of telemedicine to facilitate medical care irrespective of distance and availability of personnel on site makes it attractive to both the public and private health sectors. Telemedicine allows better utilization of scarce medical personnel and resources. It enhances citizen's equality in the availability of various medical services and healthcare despite geographical and economic barriers, at a lower cost. In particular, telemedicine may be seen as a valuable tool for providing much needed medical services to remote rural areas. It promises to enhance continued medical education of young doctors, nurses and other healthcare practitioners in rural areas, both in training and in established practice (Adewale, 2004).

Healthcare system ranges from highly specialized urban areas, to small rural clinics in most part of underdeveloped and developing countries. The legacy of recent decades is an inappropriate distribution of health practitioners and expertise that are concentrated in major urban centers, while people living in rural areas have limited access to basic healthcare because of geographical isolation and poor public transportation. Telemedicine is one form of advanced technology that may be part of the solution to a number of healthcare and education problems in most underdeveloped and developing countries.

Telemedicine has been described as the use of electronic information and communications technology to provide and support health care when distance separates the participants (Field, 2002). Although this definition can include conventional telephone use, telemedicine typically refers to more recent telecommunication systems, such as interactive video conferencing, store-

and-forward image techniques, remote medical record access, and remote patient monitoring. Store-and-forward technology, defined as the process of storing images or data and forwarding them to a provider for review, was virtually unused before 1995. Total private sector tele consultation have more than doubled each year from 1995 to 1998, reaching 90,000 consultations in the United States in 1998 (Allen and Grigsby, 1998; Strode *et al*., 1999).

Information technology is regarded as an important tool for increased efficiency (Little, 1992). On the other hand the health services in this perspective represent a considerable market for information technology (Roger and Santucci, 1991). The fact that economic health depends on medical health, since health is wealth, implies that health care needed to be accessible to all including the rural communities which if compromised could undermine the entire socio-economics fabrics of the country. Today, patients are able to acquire healthcare information through the Internet, resulting in smarter patients with higher expectations and a demand for high-standard quality care. The review of the health-care system, the level of its decline, the services provided, and the general health status of Nigerians, with the available data revealed that the Nigerian health-care system is characterized by poor infrastructure, high infant-mortality rates, and poor nutritional status of children. This problem is equally compounded by high fertility rates and high maternal mortality rates (Awosika, 2005).

With the Nigeria's health care system undergoing profound changes and experiencing relentless financial pressures, there is need to consider telemedicine application in urban as well as rural settings. In many countries (Nigeria for example), Telehealth has also recently reemerged as a potentially clinically appropriate, cost effective means of supporting patients and providers in the changing health care system (Miller *et al*., 2003). It has been considered as a promising tool that addresses many of the problems of delivering health care to remote areas, as well as to areas underserved by health care professionals (Gagnon *et al*., 2004).

Although telemedicine is unique among health care services in lacking evidence of its effectiveness, the increasing demand for such evidence by health plans, patients, clinicians, and policy makers challenges advocates of clinical telemedicine to undertake more and better evaluations of its practicality, value, and affordability. However, the diffusion of Tele-health and its application will ultimately depend on its acceptance among the healthcare practitioners and the public (Gagnon *et al*., 2004).

E-Health in basic terms is moving client information without moving the client using information and communication technology to deliver and support health services. E-health describes the application of information and communication technologies across the whole range of functions that affect the health sector, from the doctor to the hospital manager, via nurses, data processing specialists, social security administrators and of course the patients.

With the specter of the growing digital divide looming large, world leaders in government, business, and civil society organizations are harnessing the power of information and communication technology (ICT) for development (Mitchell, 2000).

The healthcare system of Nigeria consists of primary, secondary and tertiary levels of care. These levels are under the three tiers of government namely Federal Ministry of Health (FMOH), State and Local respectively. The local governments provide primary level of services (lowest level of service) through Primary Health Care (PHC) centers. The state governments are responsible for secondary level of healthcare and deliver service through general hospitals. Finally it is the responsibility of the Federal Ministry of Health to deliver tertiary care through highly specialized services in teaching hospitals and federal medical centers.

The responsibilities of these three tiers of government in the delivery of health service overlap in a way. State governments provide some tertiary care through state-owned teaching hospitals,

tertiary institutions also provide PHC services through their general outpatient department while the Federal Ministry of Health through National PHC Development Agency develops policies, develops PHC physical structures and supervises the operations of PHC centers (FMOH, 2001).

In 1993, the American Telemedicine Association was established as a nonprofit organization whose goal is to promote access to medical care and health professional via telecommunication and information technology (alternatively referred to as telemedicine) and all aspect of clinical telemedicine practice, technical advances and enabling technologies and eradicates the existing problem ranging from the following.

- Inadequate medical professional.
- Inaccurate patient record.
- Time consumption.
- Insufficient storage for medical records.
- Difficult remote access.
- Difficult to retrieve patient record.

In Nigeria, Telehealth has also recently emerged as a potentially clinically appropriate, cost effective means of supporting patients and providers in the changing health care system. It has been considered as a promising tool that addresses many of the problems of delivering health care to remote areas, as well as to areas under served by health care professionals (Miller et al., 2003; Gagnon et al., 2004). It is against this background that this study attempts to examine the effect of Telemedicine in delivering medical services in Federal Medical Centers in North Central Nigeria.

1.2 Statement of the Problem

The terrible failure of public health care system in Nigeria has attracted comments and criticisms from local and national levels. The provision of adequate medical services to the citizens, particularly those residing at the rural areas has left much to be desired. Today there is rapid increase in population growth so the problem of managing health effectively becomes very difficult and in spite of the current health sector reforms by the government, the public health care system in Nigeria is still inefficient in all ramifications. Erinosho (2005) argued that the problems facing the public health care system in Nigeria could be traced to poor implementation of National Health Policy as well as other health-related policies and programmes.

When caring for people, the focus must always be on ensuring the patient receives the best quality care at all times. Using Telemedicine technologies can ensure that more people receive top quality care, faster and more efficiently from top medical specialists, no matter where they live. The fundamental problem of healthcare delivery in Nigeria includes poor funding and access to good health services by the needy in the rural areas and the poor urban city dwellers.

The fact that economic health depends on medical health, since health is wealth, implies that health care needed to be accessible to all including the rural communities which if compromised could undermine the entire socio-economics fabrics of the country.

The researcher sees this situation as obstacle to medical service delivery in many medical centers and with the situation on ground, if these hospitals continue to remain adamant to the above stated problems, medical services would not be effectively delivered to consumer. Therefore the question now is; what can be done to improve the manner in which medical service is delivered in these hospitals. It is based upon the above stated problems that this

research is aimed at identifying certain modalities on how to enhance the effect of telemedicine directly on medical services delivering in these hospitals.

1.3 Objectives of the Study

The main objective of the study was to find out the perceived effect of telemedicine on medical services delivery in Federal Medical Centers in North Central Nigeria. Specifically, the study was designed to:

1. ascertain the availability of telemedicine services in the study area.
2. identify the types of telemedicine in medical services delivery in the study area.
3. determine the degree of application of telemedicine in the study area.
4. determine the effects of telemedicine on medical services delivery.
5. find out the challenges associated with the use of telemedicine in the study area.
6. Proffer possible solutions to the challenges of the use of telemedicine in the study area.

1.4 Research Questions

The following research questions guided the study

1. What is the degree of availability of telemedicine services in federal medical centers in north central Nigeria?
2. What are the types of telemedicine in medical services delivery in federal medical centers in north central Nigeria?
3. What is the degree of application of telemedicine in federal medical centers in north central Nigeria?
4. What are the effects of telemedicine on medical service delivery in federal medical centers in north central Nigeria?

5. What are the challenges associated with the use of telemedicine in federal medical centers in north central Nigeria?
6. What are the possible solutions to the challenges of the use of telemedicine in federal medical centers in north central Nigeria?

1.5 Statement of Hypotheses

These hypotheses were formulated for the study and tested at 0.05 level of significance:

1. Availability of telemedicine does not significantly affect medical service delivery.
2. The degree of application of telemedicine has no significant effect on medical service delivery.

1.6 Significance of the Study

Investigating the effects of telemedicine on medical services delivery will be of great importance to the following category of people: the health care system, stake holders, doctors and patients, remote communities, the general populace and researchers.

To health care system: The study will help practitioners to embody and engage a sort of virtual domain, where the practice of health communication occurs in a virtual world. In particular, with the advent of Web-based medical and pharmaceutical companies (e-health sites) that provide an enormous amount of information on nearly every condition, drug, and treatment, individuals can turn to these services to conveniently and rapidly obtain information that could otherwise be obtained by physically visiting and communicating with medical practitioners or pharmacists.

To stake holders, it will have tremendous implications in that they can extend the telemedicine debate by integrating fresh insights into more acceptable approaches that will refine and humanize mediated channels of health communication.

To Doctors and Patients, the research will Save time for both doctors and patients, helps doctors manage patient's conditions effectively, helps clinicians access patient readings any time they need them, enables patients understand their condition more, helps health facilities attend to more patients and diverts the attention a doctor passes to a patient.

To remote communities, the study will help alleviate the issue of imbalances in geographic allocation of resources, facilities, and personnel in the realm of health care. As such, it will increase and strengthen access to health communication and services among disadvantaged, disserved, secluded, and restricted communities and citizens.

To researchers, this study will serve as the basis for which further study on the perceived effect of telemedicine on medical service delivery by health care providers.

To the general public, the research will help minimize the escalating and draining costs of health services to all who benefit from it. The cost involved in health care and the resources necessary to transport patients to other states or even countries can be enormous to some people. Therefore, expeditious access to telemedicine can save both time and money, also the risk of travelling or the likelihood that a patient will die in transit will be minimised.

1.7 Scope and delimitation of the Study

Scope

This research work will cover the medical staff in the Federal Medical Centers in North Central Nigeria. Medical staff in this work are doctors, nurses, medical laboratory technologist and

pharmacist. This research focuses on the perceived effect of telemedicine in delivering medical services.

Delimitation

1. This research was restricted to the Medical Staff who are permanent staff of the Federal Medical Centres in other to avoid every form of inconsistency that may result from a contract or temporary staff.

1.8 Operational definition of Terms

The terms were defined operationally as used in the research work.

1. Telemedicine: Telemedicine is the use of telecommunication and information technology to provide clinical health care from a distance. It has been used to overcome distance barriers and to improve access to medical services that would often not be consistently available in distant rural communities.

2. Tele-health: Tele health is the provision of healthcare remotely by means of telecommunications technology. Telehealth can also be defined as the use of "electronic information and telecommunications technology" to offer support to long distance clinical care, public health and health administration. The technology used include the internet, video conferencing, streaming media, store-and-forward imaging and wireless communications.

3. E-health: E-health is the use of information and communication technologies (ICT) for health. The e Health unit works with partners at the global, regional and country level to promote and strengthen the use of ICT in health development, from applications in the field to global governance. The unit is based in the Department of Service Delivery and Safety in the Cluster of Health Systems and Innovation.

4. Healthcare: Healthcare is the maintenance or improvement of health via the prevention, diagnosis, and treatment of disease, illness, injury, and other physical and mental impairments in human beings. ... It includes the work done in providing primary care, secondary care, and tertiary care, as well as in public health.

5. Tele-radiology: Tele-radiology is the transmission of radiological patient images, such as x-rays, CTs, and MRIs, from one location to another for the purposes of sharing studies with other radiologists and physicians.

6. Tele-cardiology: Tele-cardiology is the practice of cardiology which utilizes telecommunications, and as such is a new alternate and cost-effective means of providing cardiac care.

7. Medical Service: Medical Services means any medical or remedial care or service, including supplies delivered for the purpose of preventing, alleviating, curing or healing human illness, physical disability or injury.

2.0 LITERATURE REVIEW

Related Literature on this study was reviewed under the following sub-headings.

2.1 Theoretical Framework

2.1.1 Hooshmand (2010) theory of cost minimization

The theoretical framework for this study is based on the theoretical model of Hooshmand (2010), which has been further modified by other works, especially in the study that addressed the issue of cost from the perspective of the parents/guardians of children with special health care needs (CSHCN) when care is provided via telemedicine.

Families of CSHCN face financial burdens beyond that of families of healthy children. The cost framework for this study is a cost minimization analysis framework. Cost minimization is

a form of a cost-effectiveness analysis which presumes the effectiveness or outcomes of a program are similar but that the costs are different (Gold *et al*., 1996; Muennig, 2008).

This framework focused on the difference in costs between the comparable interventions of traditional face-to-face care and telemedicine. This study focused on the cost difference from the perspectives of the family of the CSHCN, recognizing the importance of reducing financial burden and hardship for this vulnerable population.

Using the cost-minimization framework, the study examined cost from the family perspective comparing the costs of traditional face-to-face care to care provided utilizing telemedicine. This included both direct and indirect costs as well as hidden costs recognized by the family but not evident to those outside the family or community health providers. Costs examined included travel, lodging, loss of wages, child care, and ancillary family costs such as food. The Cost framework was developed for this research project to measure both direct and indirect costs for the purpose of this research.

2.2 Conceptual Framework

2.2.1 Telemedicine

Telemedicine is defined as the use of telecommunication technologies to provide medical information and services. It may be as simple as two health professionals discussing a patient's case over a telephone line, or as sophisticated as using satellite technology to broadcast a country using video conferencing equipment.

The America telemedicine Association defines telemedicine as the use of medical information exchanged from one site to another via electronic communication for health and education of the patient or healthcare providers and for the purpose of improving patient care.

Craig (1999) considered telemedicine as a process, rather than a technology: Telemedicine connects patients and healthcare professional in a chain of care.

Telemedicine is useful as a communication tool between a general practitioner and a specialist available at a remote location. Care at a distance (also called *in* absentia care), is an old practice which was often conducted via post; there has been a long and successful history of in absentia health care, which thanks to modern communication technology has metamorphosed into what we know as modern telemedicine (Adewale, 2002).

2.2.2 Information and communication technologies in medicine

Over the past two decades an immense proliferation of Information and Communication Technologies, commonly abbreviated ICTs, could be observed. Communication networks from plain old telephone lines to mobile phone networks and satellite communication have reached almost every corner on our planet. The Internet has become a global repository of information and almost any type content from daily newspapers over share prices at the stock exchange market to specialized scientific journals are all accessible over the Internet. And finally, today's desktop computers are capable of handling complex multimedia content such as images and also movies with ease, allowing the production of digital content for basically everyone who can afford a computer. ICTs have penetrated almost all aspects of our lives.

In the health care sector there are many different applications of ICTs. The most common is probably the management of administrative data such as billing and general record keeping areas in which probably most of us do not even remember the time before ICTs. Besides, the electronic management of patient information is becoming more and more important and many hospitals are working towards digital storage of all patient associated data using electronic medical records (EMR) or electronic health records (EHR). But also in medical practice itself there are many new methods that directly depend on ICTs. In modern medical imaging such as

CT (Computer Tomography) or MRI (Magnetic Resonance Imaging) but also in standard radiology (e.g. plain thorax x-ray) the conventional, film based equipment is more and more replaced by digital radiology (DR), film-less solutions, in which all image data are primarily stored in electronic form and only transferred to film for reading in locations not (yet) equipped with digital X-ray viewing stations.

Another field where ICTs have become unavoidable is in the very heart of modern evidence based medicine today, access the evidence base has become almost impossible without the help of ICTs. Scientific articles are searched through PubMed, the on-line database of the National Library of Medicine. Articles are then accessed through "virtual libraries" in form of PDF (Portable Document Format) documents. Medical evidence databases such as e.g. Cochrane are commonly accessed over the web. Besides, there is an overwhelming amount of data accessible through the World Wide Web ranging from electronic teaching aids to on-line patient forums for almost any kind of disease.

2.2.3 Availability of telemedicine services

Telemedicine helps to eliminate distance barriers and can improve access to medical services that would often not be consistently available in distant rural communities. In developed countries, access to healthcare services and practitioners with patient-doctors interaction are increasingly being boosted by the advent of Information and Communication Technology (ICT). Without distance being a barrier, healthcare professionals can now employ the services of telemedicine towards efficient consultation with medical practitioners within and outside their geographic location, delivery of healthcare services and establishing continuous communication with their patients (Matawalli and Ibrahim, 2014).

Tools such as telemedicine, teleeducation and health informatics have of late been incorporated in the health sector to enable easy access to essential services, for example, in medical areas

from referral centers by the patients on one hand and enabling the doctor to doctor consultations for the benefit of patients (Wamala and Kaddu, 2013). The World Health Organization (2009) defines e-Health as the cost-effective and secure use of information and communications technologies (ICT) in support of health and health- related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research. Telemedicine which is a subset of e-health is an integrated system of health-care delivery that employs telecommunications and computer technology as a substitute for face-to-face contact between health service provider and client (James *et al*., 2015). Telemedicine can improve the quality and accessibility of medical care by allowing distant providers to evaluate, diagnose, treat, and provide follow-up care to patients in less economically developed countries.

The Internet which serves as the backbone on which telemedicine thrives provides opportunities to retrieve up-to-date information on different aspects of diseases interact and enhance communication among medical professionals and patients especially through videoconferencing facilities and medical data processing application in the health centers (James *et al*., 2015).

In Nigeria, not all parts of the country have access to internet and those that does pay heavily for it. Most telemedicine services are always online and in real time, hence needs a fast, stable and uninterrupted internet service. Many physicians who travel to developing countries now take their laptops with them, or check in to internet cafes to maintain their medical contacts (Nakajima and Chida, 2000) Therefore, sustaining telemedicine services in any country requires a stable communications strategy that connects the developing country with the global internet, without huge debts to pay for the connectivity.

Though telemedicine did exist even before the 20th century, but the inventions and advancement in the field of Information and Communication Technology (ICT) has eased and

increased the vast scope of telemedicine. It has become easy to send any kind of medical data anywhere across the globe for seeking medical help. Communication between the medical staff and doctors with expert opinion for the patient has changed the face of the treatment - videoconferencing, Teleradiology, Telenursing, Telepathalogy, Teleradiology and Telepharmecy. are some of them (Kituyi *et al*., 2012).

Matawalli and Ibrahim (2014) pointed out that telemedicine can be divided into three main categories: store-and-forward, remote monitoring and (real time) interactive services.

Store-and-forward telemedicine involves acquiring medical data (like medical images, bio-signals) and then transmitting this data to a doctor or medical specialist at a convenient time for assessment offline. It does not require the presence of both parties at the same time. Example includes: Dermatology, radiology, and pathology.

Remote monitoring, also known as self-monitoring or testing, enables medical professionals to monitor a patient remotely using various technological devices. This method is primarily used for managing chronic diseases or specific conditions, such as heart disease, diabetes mellitus, or asthma.

Interactive telemedicine services provide real-time interactions between patient and provider, to include phone conversations, online communication and home visits. Many activities such as history review, physical examination, psychiatric evaluations and ophthalmology assessments can be conducted comparably to those done in traditional face-to-face visits. In addition, "clinician interactive" telemedicine services may be less costly than in-person clinical visit.

2.2.4 Types of telemedicine

Telecardiology

Telecardiology is the electronic transmission of cardiac data from the patient site to a consulting site for the provision of health care services. Patient encounters and provider consultations are possible through the transmission of radiographs, ECG's, laboratory results, echocardiograms, coronary arteriograms and ultrasounds; interactive video consultations including patient examamination, stethoscopy, and medical history; and the use of store-and-forward information for second or confirmatory consultations. Telecardiology is also a component of home health services when patient cardiac data is monitored, stored, and transmitted to health care professionals who analyse, interpret, and make clinical decisions based on the data received. (Armstrong and Freuh, 2002).

Telecardiology is a rapidly growing segment of services that can be provided via telehealth technologies. Using diagnostic tools in the early phases of patient evaluation can result in the rapid triage, diagnosis, and intervention in acute and emergent cardiovascular conditions, particularly those that affect children. The use of real-time and store-and-forward echocardiography has revolutionized the local treatment of paediatric and adult cardiovascular patients and has led to more timely diagnosis and intervention (Shanit *et al*. 1996).

Assessing the need and demand for a telecardiology application requires general planning and development approaches that are applicable to the development of a telecardiology service. Reasons for the use of telecardiology for consulting providers includes the need to develop outreach services where on-site outreach is not practical or feasible; the need to continue an outreach service where cost expenditures are greater than revenue plus added value of maintaining the current service; the need to use in-person time for new patient workups not easily done via telecardiology (and thus, seeing follow-up patients via telecardiology); or to

increase productivity by decreasing travel time. An originating site (patient site) may want to use telecardiology to:

i. provide access for their local populations;
ii. bring specialty services to the local area in a collaborative fashion;
iii. decrease out migration of patients based on perception of available services and the quality of those services;
iv. decrease unnecessary transports to tertiary care facilities;
v. provide practitioner support; and
vi. Increase utilization of local ancillary services.

Telecardiology is best developed as a component of an integrated health care system, it cannot stand-alone. There must be a collaborative relationship either developed or in existence that is enhanced by the use of telecardiology. The originating site must maintain control of patient referrals, optimize on-site testing and other procedures offered locally, and believe that the service being provided belongs to the community in which they exist. The consulting (distant site) providers/organizations must allow the originating site this control over the process and not take the position that the consulting provider/organization controls the originating site's program (Armstrong and Freuh, 2002).

Teledermatology

Dermatology is a clinical specialty well suited for the use of telehealth technologies. It is one of the more common uses of both store and forward and interactive telehealth because of the visual nature of the practice. Dermatologists can provide high quality care to patients with diseases of their skin, hair, and nails using a variety of telehealth technologies. Education about cutaneous diseases and their management for patients and health care providers in underserved areas is also possible. Teledermatology utilization has grown over the past several years.

This is reflected in the 2003 survey of telehealth programs, which was conducted by the American Telemedicine Association's Special Interest Group on Teledermatology (John and Shasa, 2003). In 2002, the Board of Directors of the American Academy of Dermatology, Shanit *et al*., (2002) reported that although the number of dermatologists per 100,000 population has grown from 1.6 in 1965 to 3.3 today, the demand for services has outpaced the supply of dermatologists (Dermatology World, October 2002.). In that report, Kimball and Resneck also suggest that telemedicine can be used as a way to reach the underserved populations.

Some feel that the issue is more of maldistribution and not an absolute shortage.

This is compounded by an accelerated growth of laser and cosmetic dermatology, which has made fewer medical dermatologists available and worsened access to patients with routine skin problems. Logic suggests that although making dermatology services available via telemedicine means equal access to the service for those living in underserved areas; it will only increase the demand on the existing supply of dermatologists.

Teleradiology

Information technology enabled remote work is typically seen as an imperfect substitute for spatial proximity (Armstrong and Cole 2002, Gaspar and Glaeser 2008, Olson *et al*., 2002)**.** For night radiology, however, the use of teleradiology applications to create a new type of radiology group appears to have facilitated improvements in productivity, life style, and quality of interpretations.

Gaspar and Glaeser (1998) describe the diffusion of teleradiology applications in the United States and the "nighthawk" radiology groups that have consequently emerged. The emergence of nighthawk radiology groups, a new type of radiology group which specializes in doing night

reads has had important ramifications for the delivery of radiological services in the United States. Based on interviews and observations of radiologists, the introduction of nighthawk radiology offered a series of benefits without threatening the quality of radiology services rendered remotely.

Armstrong and Cole (2002) found that nighthawk radiology groups emerged, not out of a deliberate program of reengineering, but out of a reaction to a particular set of historical circumstances. The lessons that can be learned from the study of nighthawk radiology, however, are relevant to a host of industries with work tasks that can be easily relocated, but where relocation is seen as conflicting with quality concerns. The professional nature of radiology work, as well as the updating of quality assurance programs, played a crucial role in assuring quality, while shaping the outcomes of the use of teleradiology to outsource and offshore American radiology services.

Teleradiology has been used for at least 60 years. In the past, film was passed through a digitizer; now most systems use direct digital capture, which allows images to be read overnight in other countries. Radiologists have promoted the Digital Imaging and Communications in Medicine (DICOM) standard for transmitting and storing data. By the late 1990s, studies showed that teleradiology reduced transports for head injuries out of rural areas and that the availability of teleconsultation with a radiologist significantly affected diagnosis and treatment plans (Liang *et al*., 2008).

Telepathology

Telepathology is the subspecialty of telemedicine in which pathology is practiced at a distance using imaging and telecommunications. But unlike other applications of telemedicine, characteristic of telepathology is that data are transmitted mainly in the form of images (Gabril and Yousef, 2010). According to Weinstein *et al*, (2007) telepathology can be defined as the

remote primary diagnosis, consensus diagnosis, case conferencing, or expert consultation of either electronically transmitted, static, digitalized images, or real-time pictures obtained using remote robotic microscopes (Weinstein *et al*., 2007). In other words, telepathology may involve the acquisition of histological, cytological, and macroscopic images for transmission along telecommunication pathways for diagnosis, consultation, or continuing medical education (Baruah, 2005).

It is a comparatively new technique in medical practice whose initial use arose from the need for real-time diagnosis of frozen section material at hospitals that lacked tissue pathologists (Nordrum, 1996). From these humble beginnings, telepathology has entered a digital age and a level of sophistication that permits the practitioners to currently view high quality real-time colour images and to control all aspects of a robotic microscope at a remote location in the course of consultations that often take a fraction of a second (Wells and Sowter, 2000).

Routinely, telepathology systems nowadays enable remote diagnosis (intra-operative frozen section and permanent section), subspecialty consultations, and better educational feedback. Second opinions, including even remote consultation across the globe, are not only technically feasible but also reasonably user friendly (Weinstein *et al*., 2001). Studies have shown that its accuracy is comparable with that of conventional light microscopy for most diagnoses. These and other advantages have influenced the decision of some developed countries which have made it a priority to incorporate telepathology applications into their healthcare systems in an effort to provide better services.

Telepathology links have evolved from the era when analog telephone lines were used characterized by slow data transfer to the extremely rapid transmission of today using wireless technology. The principal feature of telepathology is that communications are bidirectional, so data can be sent to and fro. It may employ store-and-forward method (static), real-time

approaches (dynamic) or a third approach which is a hybrid system that combines static and dynamic elements. Store-and-forward systems are more widely used owing to their simpler technical requirements and affordability. Commonly, images were submitted by email or presented on a web based platform. Store and forward telepathology has its own limitations due to the disjointed nature of the images, and the significant diagnostic errors incurred with this method have been attributed to inappropriate field selection by the submitting pathologist (Weinstein *et al*., 2007).

Although the real-time approach represents a reasonable substitute for in-person consultation and has the advantage of enhancing interaction, it is more time-consuming and expensive. Nonetheless, dynamic telepathology using fully motorized robotic systems has revolutionized the field, and a concordance rate of 99-100 % has been reported between telepathology and light microscopy diagnosis (Dunn et al, 1999; Weiss-Carrington *et al*., 1999).

Much progress has been made in the past couple of years in the field of digital imaging and virtual microscopy making the hybrid systems a lot more convenient than ever before such that 'virtual slides' can now be made where the entire slide is scanned at a very high resolution and then viewed by multiple pathologists (Leong and McGee, 2001) and without any loss of resolution. In this non-robotic real-time telepathology, the sampling error so common in static telepathology is eliminated and there is no requirement for expensive equipment. The significant deterrent is the high capacity needed for storing images which is on the average 150 Mb (Baruah, 2005).

Telepathology is less common than teleradiology, but digitization of pathology slides is becoming much more common. These are very large files, which require the ability to view color images under different magnifications. A lot of people were concerned about moving these large files across firewalls, but now a number of models being developed have the image

sitting on a server and the image can be viewed over distance without needing to be moved. Studies have shown the value of telepathology. One study demonstrated that a specialist pathologist via telemedicine was better than a staff pathologist onsite. In 74 percent of cases, the diagnosis was more precisely done (Liang *et al*., 2008).

Telepharmacology

Pharmacy has been practiced over distance for a long time. Telepharmacy is facilitated by computerized physician order entry, remote review, and even remote dispensing. Combining that with video, being able to review medications, and conducting a video consultation with a patient allows the whole pharmacy visit to occur over distance. In a recent study on 47 cancer patients, 27,000 miles of travel were saved because of telepharmacy (Gordon *et al*., 2012). Another study of six rural hospitals showed that with telepharmacy, about 19 percent of patients had one or more medication errors that were picked up by the remote pharmacists (Cole *et al*., 2012).

2.2.5 Degree of application of telemedicine

The history of distant medical assistance through communication and technology stretches back as far as to the times when electronic devices were first introduced to society. In the past century, the use of telegraphy, telephony, radio, television, and wireless communication have assisted in physician–patient communication (Wootton, 1998). Although there has been much debate regarding the first official usage of telemedicine services, the first cited telemedicine application, according to Perednia and Allen (1995), took place in 1959. A study was conducted to show the benefits of a unique form of telemedicine in the telepsychiatry setting. As such, the use of a two-way closed-circuit microwave television system provided successful telemedicine communication, training, and research between the Nebraska Psychiatric Institute and Norfolk State Hospital in Nebraska (Turner, 2003; Wittson and Benschoter, 2008).

Later, the National Aeronautics and Space Administration (NASA) played an important role in further developing telemedicine when astronauts first began flying in space. The physiological conditions of the crew were reported via communication satellites from both the spacecraft and the suits that the astronauts wore during missions. These improvements in space were applied to rural medicine in the early 1970s through the Space Technology Applied to Rural Papago Advanced Health Care program (Ausseresses,1995), as well as distant areas, isolated communities lacking medical care (i.e., in mountainous areas, islands, open plains, and arctic regions), and developing and Third World countries (Wright, 1998). Telemedicine became significantly more important in the 1980s, when costs decreased for many of the information and communication technologies on which the efforts depended.

Telemedicine Today: Four Types of Applications

Today, numerous research studies have shown that telemedicine, in its various forms and applications, is a medical practice that is increasingly used for medical treatment and services (Mair and Whitten, 2000). According to Balas *et al*. (1997), studies focusing on telemedicine in clinical settings demonstrate that this communicative modality offers enhanced performance, propitious results, and meaningful advantages. Telemedicine can be classified into various approaches or applications based on the particular niche of healthcare. According to Grigsby (1997), there are four suggested types of telemedicine applications:

i. Management of specific diseases,
ii. Use within specific specialties,
iii. Classification according to technology, and
iv. Types of clinical problems.

Management of specific diseases

Within the context and scope of specific diseases, telemedicine can be defined with regard to its application in the management of various diseases, conditions, or pathologies (Turner, 2003), such as those related to dermatological (Lesher et al., 1998), cardiological (Wirthlin *et al*., 1998), and respiratory (Nuccio, 2004) diseases. In these situations, a specific diagnosis is made, and then the disease is treated using the most appropriate form of telemedicine services available.

Past studies have demonstrated that increased access to telemedical devices has been approved and embraced among individuals with chronic and debilitating diseases (Tetzlaff, 1997).

Use within specific medical problems

Within the realm of specific medical problems and specialist primary-care consultations (Street *et al*., 2000), terms and practices such as *teleophthalmology*, *telepsychiatry*, *telepathology*, and *teledermatology* apply (Turner, 2003). Other special sectors where teleconsultations are conducted include the divisions of mental health, intensive care units, rehabilitation (Field, 2002), cardiology, surgery, and dermatology (Grigsby and Allen, 1997). In other words, the basis of specific medical problems with respect to telemedicine simply involves the integration and implementation of telecommunications devices in the context of each of the aforesaid medical areas.

Classification according to technology

Within the frame of communication and technology, this area identifies the various forms that telemedicine can take, such as everyday electronic devices, including telephones, fax machines, video transmission (Squibb, 1999), camera light boxes, videoconferencing (Capner, 2000),multimedia, electronic mail (e-mail) services, remote monitoring systems, and

interactive television units (Turner,2003). More recently, Nuccio (2004) identified a series of newly patented telemedicine devices; these include, among others, order entry systems and smart alarms. These devices are designed to deliver medical care as an attempt to minimize the gap between the availability of expertise and services in unequipped locations. In particular, smart alarms are telemedicine systems because they are technological apparatuses that transmit vital information about a patient to medical personnel when a clinical emergency is taking place. Order entry systems are inventory control systems that communicate health-related needs between the provider and the patient (i.e., medication refills, etc.; Thames, 2003).

Types of clinical problems

According to Grigsby (1997), categorizing telemedicine on the basis of the specific clinical problem refers to the procedures that are used in any particular telemedicine communication. As such, in considering the forms of telemedicine such as teleradiology and telepathology, what is generally involved in these cases is the electronic transmission of diagnostic medical pictures and clinical data originating from a location of unspecialized medical service to one of highly specialized clinicians (Turner, 2003). In this type of scenario, the data, once received by the specialized clinician, can be analyzed to determine the correct medical approach to take. Once the specialist has reached a determination, an answer can be subsequently communicated back to the inexperienced practitioner seeking guidance and direction on how to handle the patient under his or her direct supervision. With this type of interfacing, it may be possible for health care facilities in small, isolated regions and, by the same token, lacking expert practitioners, to obtain guidance from specialists located just about anywhere in the world.

2.2.6 Effects of telemedicine on medical service delivery

The previous section demonstrated that telemedicine, whether through medical practitioners or direct online channels, has been widely used and accepted as a viable option in a diversity of

areas, specialties, diagnostic conditions, and applications (Hailey *et al*., 2004; Turner *et al*., 2004). More important, the use of telemedicine demonstrates that health communication between the patient and the health care provider has been made more rapid and efficient. Nevertheless, we would hope and expect that telemedicine be more readily embraced as a tool by all medical specialists who desire to discover and ascertain its maximum potential and utility. In fact, telemedicine offers a manifold of health communication benefits to both practitioners who engage its services and the health care system in general. Every individual can benefit from telemedicine, from the patient, to the community, to physicians and other practitioners. With this prospect in mind, Jonathan and Gerald-Mark (2007) addressed and examined the effects of telemedicine applications and features in the following sections. These effects of telemedicine can be classified according to five main abilities: the ability of telemedicine to

i. Transcend geographical boundaries;
ii. Transcend temporal boundaries;
iii. Reduce costs;
iv. Increase patient comfort, security, and satisfaction; and
v. Digitize health communication via Web-based services.

Ability to transcend geographical boundaries

Telemedicine can alleviate the issue of imbalances in geographic allocation of resources, facilities, and personnel in the realm of health care. As such, it increases and strengthens access to health communication and services among disadvantaged, disserved, secluded, and restricted communities and citizens (Crowe, 1998). For instance, surgeons located in “remote areas” (Perednia and Allen,1995) and who do not have the skills or experience to handle a

particular surgical procedure can call on, through telemedicine technologies, the immediate assistance/guidance of another doctor located at a far physical distance.

In a similar vein, a casualty of military combat could receive immediate communicative assistance in the field by linking up with a doctor through a portable telecommunications system. These two examples show that the use of telemedicine has the potential not only to save more lives but also to improve health communication. It provides a sound escape or supplemental alternative from the conventional health communication in doctor–patient interactions such as those that engage face to face, in the same room encounters that are typical in relationships between healthcare practitioners, health care organizations, and practitioners and patients (Turner, 2003).

Ability to transcend temporal boundaries

Telemedicine has demonstrated its capability to improve health communication by alleviating constraints induced by time (Bloom, 1996). In fact, not only does a telemedicine task not need real-time interaction, such as in the case of a remote expert consultation (Della Mea, 1999), but it also decreases patient anxiety caused by having to wait a longtime for a health care provider.

Besides, still pictures over a phone line, amplified by direct oral communication, are user friendly and have proven to be useful in the pre-healthcare arena. Compact audiovisual technology enables fast, immediate, and personal visual and audible interaction with the patient. Now the doctor can perform auscultation and fundoscopic exams carefully and in real time.

Ability to reduce costs

Telemedicine has been shown to be such an effective medical practice in several instances that its growth and application in the health care industry have raised tremendously. What should

be emphasized here is that telemedicine in many cases can minimize the escalating and draining costs of health services to all who benefit from it (Bloom, 1996; Crowe, 1998). We all know that the costs involved in health care and the resources necessary to transport patients to other states or even countries can be enormous to some people. Therefore, expeditious access to telemedicine can save both time and money. By the same token, it may be seen as an economical tool for bringing international health care dollars to the United States (Perednia and Allen, 1995; Turner, 2003). One of the reasons for patient satisfaction with telemedicine, according to Gutske *et al*. (2000), is a reduction in waiting time, travel time, and the time involved in arranging appointments. The absence of all of these issues can facilitate health communication by eliminating many of the burdens involved in standard health care.

Ability to increase patients comfort, security, and satisfaction

Another positive aspect of telemedicine addressed by researchers and patients alike is that some patients appreciate the presence of several medical practitioners working on them concurrently. In this sense, according to Callahan *et al* (1996), many patients who underwent telemedicine treatments felt more comfortable and assured with their cases while in the company of many collaborating doctors. Theoretically speaking, these higher levels of comfort and confidence among patients could be attributed to what media richness theory (Daft and Lengel, 1986) describes as an *enriched social presence* from several attending physicians (Turner *et al*., 2003). This multi doctor presence that is, several attending medical personnel collaborating and interfacing on one medical issue at hand can relieve or diminish the uncertainty and fear by the patient regarding his or her disease. These researchers also found that the collaboration of doctors in these telemedicine settings in fact improves the reliability of the diagnoses.

This, in effect, reduces the number or frequency of diagnostic mistakes. In addition to this increased diagnostic reliability, in the same train of thought, Web-based healthcare services

(i.e., pharmaceutical companies, physicians' services, diagnostic information, etc.) offer substantial quantities and varieties of health information to Internet surfers. Plus, e-mail can be used as a communicative conduit by which medical practitioners can provide direct correspondence and advice to patients who choose to stay at home versus hauling themselves to clinics or hospitals for treatment purposes (Allen *et al*., 1996; Bloom, 1996).

Studies have shown that by taking these popular and inexpensive health communication services into account, recent demand and utilization of these services have increased significantly (Anderson, 1999). Even more amazingly, a study conducted by the Cyber Dialogue Health Practice (2002) anticipated that by the end of 2005, 88.5 million adults would be seeking health information and communication via e-health services. With this rapid and enormous elevation in Internet-based health care communicative services, one would logically expect that the demand for medical practitioners in clinics or hospitals would noticeably decrease in the near future, if in fact this has not already happened.

The multiple parties involved have expressed that the experience is a type of educational enrichment, as several sources (i.e., doctors and other medical technicians) are exchanging information at one time (Whitten, 1995) and can communicate a rich pool of valid opinions on the medical case at hand. Beyond telemedicine's general effectiveness, patients' opinions of how telemedicine has positively affected them are readily apparent from research studies focusing on patient satisfaction concerning telemedicine (Mair and Whitten, 2000).

According to Gutske *et al*. (2000), studies conducted by this team have revealed high levels of satisfaction among patients subjected to telemedicine applications. Another area of patient satisfaction emerges from the use of videoconferencing (Bashshur *et al*., 1997).

Ability to digitize health communication via web-based services

Because telemedicine embodies and engages a sort of virtual domain, where the practice of health communication or services occurs in a virtual world (Turner, 2003; Turner *et al*., 2004), conducting medical procedures and interfaces within the limitations of time and space no longer presents serious issues in the face of telemedicine technologies(Turner and Peterson, 1998).

In particular, with the advent of Web-based medical and pharmaceutical companies (e-health sites) that provide an enormous amount of information on nearly every condition, drug, and treatment, individuals can turn to these services to conveniently and rapidly obtain information that could otherwise be obtained by physically visiting and communicating with medical practitioners or pharmacists.

2.2.7 Problems of use of telemedicine

In spite of all of the promises and health communication benefits that telemedicine is capable of delivering, it also creates serious questions that obstruct or threaten its growth and implementation in various ways. Whereas Turner (2003) enumerated a variety of challenges that jeopardize the advancement and success of telemedicine, we propose four challenges that yield the greatest difficulty in telemedicine's path and clarify these in more detail than have been provided in earlier research. These four main challenges are addressed in this section:

i. Licensing and legal issues,
ii. Challenges to patient privacy,
iii. Resistance from health insurance companies, and
iv. Limited knowledge and expertise in telemedicine.

As such, we have identified and described these four challenges in detail in the following subsections (although other barricades exist that impede its progression and implementation).

Licensing and Legal Issues in Telemedicine

The first challenges which are interrelated in many respects that legally hinder the development of telemedicine include issues related to interstate licensing, legal liabilities, and institutional credentialing of physicians (Stanberry, 1998; Turner, 2003). Unfortunately, many of these legal matters are still unanswered and unresolved within both the U.S. health care and judicial systems. For example, in interstate medical transactions where mechanical devices are used for surgery or radiology, if there is a mechanical failure or glitch that results in harming the patient, deciding on who is responsible for that accident is debatable and can be a major headache for legal authorities.

Another key issue implicit in this scenario is that these practitioners who are treating and communicating with the patient are operating out of different states. Because laws regarding telemedicine and health care certification are unique in each state, legal liability, malpractice, and jurisdiction become serious matters of concern for the judicial, legal, and medical systems (Blair *et al*., 1998; Turner, 2003). For instance, in the event that an inexperienced physician located in Arizona is physically operating on a patient and is engaged in a live telemedicine communication with a specialist in New York whose guidance and direction botch the surgery and result in the patient's death, the prosecutors and legal officials in Arizona would find difficulty in placing blame and litigation on the party in New York. An issue like this one is a typical scenario in which telemedicine presents some legal and licensing issues. However, as telemedicine and its associated technology evolve, feasible solutions (i.e., legal policies and amendments) to these problems should be discovered and made available.

Challenges to Patients Privacy

Another serious impediment to the development of telemedicine includes issues related to patient privacy. According to Gilbert (1995), because multiple individuals (i.e., technicians, nurses, etc.) are generally involved in telemedicine communication, exposure of confidential records to all parties concerned becomes a threat to the privacy of that patient. Additionally, even though medical doctors accept the obligation of maintaining their patients' privacy rights, the other assisting parties involved in the telemedicine communication may not be held to the same standard (Turner, 2003). As a result of this risk to patients' privacy rights, telemedicine has struggled to gain acceptance from the legal and medical communities (Sanders and Bashshur, 1995).

However, again, as time progresses and this issue is tackled by the medical and legal communities alike, solutions should be found to eliminate privacy risks to patients. Furthermore, these solutions should generate increased acceptance of telemedicine practices by all parties concerned and, likewise, should alleviate the fear and frequency of breaches to patient privacy laws.

Resistance from health insurance companies

The next troublesome and perhaps the most significant (Turner, 2003) – obstacle that telemedicine faces in gaining adoption is the difficulty of receiving reimbursement for services from insurance companies that oppose unconventional consultations, such as the ones absent of face to face contact. For instance, according to Brecht and Barrett (1998), the U.S. Health Care Financing Administration, a national organization in charge of major health insurance companies, stipulates that reimbursement for medical services is usually available only when direct physical communication (a face-to-face appointment) is held.

However, this stipulation is not universal and required of all states. There are some states that do not demand this immediate presence in medical consultations, such as California, Texas, and Oklahoma. Plus, these states even go as far as permitting such telemedicine services as appropriate substitutes for face-to-face appointments if recommended by the attending practitioner(s) (Turner, 2003).

Limited Knowledge and Expertise in Telemedicine

The last challenge to be addressed has to do with the limited knowledge and expertise in telemedicine as well as the need for enhanced and modified telemedicine systems. In this sense, little knowledge currently exists among medical practitioners on how to effectively and practically use various forms of telemedicine. This paucity of insight into telemedicine, in effect, hinders the creativity to explore more efficient and effective modalities of telemedicine applications. As a result, teaching medical practitioners to learn and adopt this new way of accomplishing health services, through telemedicine, has become a significant hurdle to implementation (Tanriverdi and Iacono, 1999; Turner, 2003; Whitten, 1995).

Special competence is also required before implementation of telemedicine can be allowed and render success to those concerned. In this regard, a unique term, *telecompetence*, was created to describe the required skills and credentials practitioners must have in order to carry out this kind of specialized work (Turner, 2003). Telecompetence is a must in order to be a health communication expert regarding telemedicine. In particular, according to Turner (1999), there is a three-stage process involved in such health communication aptitude. As such, telecompetence consists of:

i. Planning and establishing,
ii. Learning and use, and
iii. Formalizing routines.

Unfortunately, achieving this level of competence could be considered a major adversary to telemedicine implementation, because considerable training and finances are not always available resources to enable this kind of campaign. To this end, in some medical settings where resources are limited, telemedicine may not be a feasible or affordable option.

In the following section, various forms of telemedicine are negatively criticized according to their subtractive effects on practitioner–patient communication. In each of the forms identified, individuals are left to communicate with computers and other forms of technology, all of which are absent or slight in physical human contact and exchange. As we argue, the social and communicative elements to these telemedicine modalities dehumanize, dissocialize, and depersonalize human behavior and contact. Additionally, we urge for a careful re-examination of whether telemedicine genuinely serves humanity in a positive and fruitful way.

2.2.8 Possible solutions to the challenges militating against the use of telemedicine

In taking an anti-telemedicine stance, the challenges mentioned earlier demonstrate that telemedicine is far from perfect: legal and licensing issues, patient privacy, reimbursement resistance from insurance companies, and educational deficiencies in telemedicine (Turner, 2003). Although the ability to better care for patients and save lives has improved, the scope and complexity of health care also have increased greatly. This is why telemedicine opponents should open their eyes and strive to find solutions to these challenges. A few grassroots approaches to rectifying these affairs are rallying the medical and legal communities together in order to repair these issues and seek out any means necessary to demolish these obstructive elements from interfering with telemedicine's progressive course (Perednia and Allen, 1995).

Meanwhile (Perednia and Grigsby, 1998) believe that lawyers can amend telemedicine laws to clarify and identify liability policies with regard to interstate surgical operations (when the surgery takes place in one state while a physician is located in another state).

More important, another disadvantage of resorting to telemedicine is that it is subtracting and close to eliminating our social human contact in health care settings. This concern urges health communication scholars to evaluate the specific communicative needs that have been otherwise overlooked in the literature on telemedicine. As we have seen, the social and communicative elements to these telemedicine modalities dehumanize, dissocialize, and depersonalize human behavior and contact. For example, because telemedicine can take the form of a conversation between distant users, e-mail is oftentimes adopted as a channel to carry out such discourse. Unfortunately, e-mail is appropriate only for asynchronous communication. The question arises as to whether medical technology will gradually replace patient–physician communication. We argue that it should be only an accessory to health care practitioners.

Establishing a basic understanding of what this medical technology can lead to will help health communication scholars enlighten the telemedicine debate by turning unique insights into more adequate approaches that will enrich and humanize mediated channels of health communication, thereby offering remedies and clarifications for effective health care exchange and delivery (Gilbert, 1995).

Grasping the effect on users and information exchange is a crucial factor in the adoption of telemedicine by opposing forces. Available research to provide reasonable explanations of the fundamental reasons for patient satisfaction or dissatisfaction with telemedicine and to analyze communication issues in any depth is still lacking. The idea is that future research on the use of telemedicine needs to be more scientifically rigorous to help policymakers reach informed decisions about the relevant use of this medical practice (Sanders and Bashshur, 1995).

Another logical way to achieve general telecompetence in our health care practitioners could be targeting medical schools to incorporate such training into their curricula. Because telemedicine is becoming increasingly popular in its use in the health care industry, health

communication professionals should devise methods of approaching medical schools to encourage them to integrate courses into their programs that instruct the students on the most commonly used forms of telemedicine and the forms likely to be used in the future. To this end, students would learn the most important aspects of telemedicine services and would, after receiving their certifications to practice, use these services in their everyday jobs (Turner, 2003).

2.3 Review of Related Empirical Studies

Shittu and Olamide (2007) conducted a study to determine the perception of health workers in the health-care towards telemedicine application in a new tertiary teaching hospital, a modified structured questionnaire using a prospective postal survey was administered to a cross-section of health workers in Lagos State University Teaching Hospital (LASUTH) and Lagos State University College of Medicine (LASUCOM). Only 60.9 % of respondents were familiar with this new emerging concept of telemedicine in the health care system. Although, 50 % of health workers had expressed concern about the ethical and medico-legal consideration of telemedicine practice, this was irrespective of their socio-religious background. The principal factors weighing in favour of willingness to use telehealth services were knowledge of telehealth applications (28.1 %); perception of telehealth benefits (14.1 %), reduced barriers to telehealth care among others. Most of the respondents believed that telehealth would enhance direct access to health care services (23.4 %), improve quality of care (14.1 %) among others. It is desirable to offer telemedicine to patients especially for emergency and chronic medical conditions.

Banjoko and Omoleke (2008) carried out a study to assess the Knowledge and Perception of Telemedicine and E-health by Some Nigerian Health Care Practitioners. In this study, 200 healthcare providers including doctors, nurses, pharmacists, laboratory scientists, medical

records officers radiographers, senior nursing and senior medical students were respondents in the assessment of their knowledge and perception using interviews and semi-structured questionnaire. 83 (41.5 %) of the respondents had poor knowledge of telehealth and only 42 (21 %) were aware of the country's proposed telehealth programme. 141 (70.5 %) will use telehealth services and 138 (69 %) will recommend its use to others. 134 (67 %) believed it should be included in the three tier health system while 114 (57 %) thought it should be a special programme. 162 (81 %) of the respondents were positive on the relevance and benefits of telehealth introduction to the Nigerian health system. This result underscored the need for stake holder's wide consultation and public enlightenment prior to the formulation of government policy on telemedicine due to current poor level of information. Furthermore, there is need for man power development for this programme which possesses the potential of taking specialized healthcare services to the otherwise unreached while also improving the knowledge and skills of healthcare practitioners in remote locations through distance learning.

Justice (2012) carried out a study on the assessment of telemedicine readiness in some selected states in Western Nigeria. Considering some critical factors of e-Health readiness such as need-change readiness, engagement readiness and structural readiness. The responses were analyzed statistically using descriptive analysis. The analysis was applied to determine the e-Health readiness status of health practitioners, public, patients and the mangers from the western part of Nigeria. The result of the overall evaluation of all samples shows that (i) health managers are not structurally ready, (ii) the public and patient fairly agreed but structural factor will be a constraint and (iii) the healthcare practitioners fairly agreed but structural, social influence, engagement will affect the successful adoption of the invention.

Marcia *et al*., (2014) carried out a study on the extent of telehealth use in rural and urban hospitals. Data was gotten from 4,727 hospitals in the 2013 Healthcare Information and Management Systems Society (HIMSS) and their analysis yielded these findings:

Two-thirds (66.0 % of rural and 68.0 % of urban) had no telehealth services or were only in the process of implementing a telehealth application. One-third (34.0 % rural and 32.0 % urban) had at least one telehealth application currently in use.

Among hospitals with "live and operational" telehealth services, 61.4 % indicated only a single department/program with an operational telehealth service, and 38.6 % indicated two or more departments/programs with operational telehealth services. Rural hospitals were significantly less likely to have multiple services (35.2 %) than were urban hospitals (42.1 %).

Rural and urban hospitals did not differ significantly in overall telehealth implementation rates but did differ in the department where telehealth was implemented. Urban hospitals were more likely than rural hospitals to have operational telehealth implementations in cardiology/stroke/heart attack programs (7.4 % vs. 6.2 %), neurology (4.4 % vs. 2.1 %), and obstetrics/gynecology/NICU/pediatrics (3.8 % vs. 2.5 %). In contrast, rural hospitals were more likely than urban hospital to have operational telehealth implementations in radiology departments (17.7 % vs. 13.9 %) and in emergency/trauma care (8.8 % vs. 6.3 %).

2.4 Summary of Literature Review

From the review of Literature, Theoretical framework considered Hooshmand theory of Cost Minimization. The theory focused on the difference in costs between the comparable interventions of traditional face-to-face care and telemedicine. Using the cost-minimization framework, the study examined cost from the family perspective comparing the costs of traditional face-to-face care to care provided utilizing telemedicine.

The study was able to establish the concept of variables. It discussed the types of telemedicine to include: Telecardiology, Teledermatology, Teleradiology, Telepathology and Telepharmacology. It also highlighted the effects of Telemedicine on medical service delivery, challenges against the use of telemedicine in medical services delivery as well as possible solutions to the identified challenges. Lack of professionals and unavailability of facilities are the major challenges against the use of Telemedicine identified from related literature reviewed.

Empirical studies relating to this work were reviewed such as perception of health workers in the health-care towards telemedicine application in Lagos State University Teaching Hospital (LASUTH) and Lagos State University College of Medicine (LASUCOM), Knowledge and Perception of Telemedicine and E-health by Some Nigerian Health Care Practitioners, assessment of telemedicine readiness in some selected states in Western Nigeria, extent of telehealth use in rural and urban hospitals. Through this study of literature, it was established that there is a need to review telemedicine policies and curricula of medical schools to help promote the use of telemedicine in medical services delivering. Thus, the next chapter will outline the methodology in trying to evaluate the perceived effects of telemedicine in medical services delivery in Federal Medical Centers.

3.0 METHODOLOGY

This section described the procedures that were used in carrying out the study. It includes the following: research design, the study area, population of the study, sample and sampling techniques, instrument for data collection, validation of research instrument, reliability of the instrument, method of data collection and data analysis techniques.

3.1 Research Design

In this study, Survey Research design was adopted. Survey research is one in which a group of people or items are studied by collecting and analyzing data from only a few representation of the entire group. This design was suitable for this study because the study collected data from a representative sample of medical staff of the federal medical centers in North Central Nigeria using questionnaire and which the findings would be generalized on the entire population being studied.

3.2 The Study Area

The area of the study comprises the six states and the Federal Capital Terrritory Abuja all in North Central Nigeria. These are Benue, Kogi, Kwara, Nasarawa, Niger, Plateau and the Federal Capital Territory, Abuja. The North Central Nigeria lies within the middle region (also called middle belt) of Nigeria around the rivers of Benue and Niger axis. Specifically, the study was centered on four Federal Medical Centers in the zone.

3.3 Population of the Study

The population of the study consists of one thousand, four hundred and seven (1407) medical staff (Doctors 396, Nurses 870, Laboratory Technologists 80 and Pharmacists 61) in the Federal Medical Centers of the North-central zone. There are four Federal Medical Centers in

the zone, these are: Federal Medical Center Bida, Niger State; Federal Medical Center Makurdi, Benue State; Federal Medical Center Lokoja, Kogi State; Federal Medical Center Keffi, Nasarawa State (Appendix A, 87).

3.4 Sample and Sampling Techniques

The researcher used the stratified random sampling technique for the study to draw sample from the strata of a very large population. The health workers were stratified according to their cadre namely, doctors, nurses, medical laboratory technologist and pharmacist to ensure that the subgroups in the population were represented in the sample in proportion to their numbers within the population.

The sample size of respondents that was used for this study was three hundred and eleven (311) respondents comprising 97 doctors, 178 nurses, 19 laboratory technologists and 17 pharmacists all of which are from the population of one thousand, four hundred and seven (1407). For the purpose of this study, the sample size was determined using Taro – Yamen's formula. The formula was adopted because it takes care of the level of precision required to accommodate the probable sample error (Appendix B, 89).

3.5 Instrument for Data Collection

This study employed questionnaire as data collection instrument. It was considered for this research, the most appropriate data collection instrument because of the advantages derivable from the use of this approach which include high response rate, opportunities to request for clarification if need be and detailed investigation of the physical assets.

The questionnaire which is closed ended titled; Perceived Effect of Telemedicine Questionnaire (PETQ) was developed by the researcher from literature review. The PETQ is in two sections namely; sections A and B. Section A requires information on respondents'

profile such as name of hospital, gender, status and years of experience while section B has 6 parts (1-6) with each part containing items covering a specific objective of the study. Each PETQ item has four (4) response options of Strongly Agreed (SA), Agreed (A), Disagreed (DA) and Strongly Disagreed (SD) with corresponding nominal values of 4, 3, 2, and 1, respectively.

3.6 Validation of Instrument

The instrument was subjected to face and content validity. Three experts in the field of Library and Information science assisted in vetting the measuring instrument in order to critically examine and determine the relevance of the items and indices drawn in measuring the variables included in the study, their suggestions, corrections, and ideas were incorporated into the final draft of the research instrument.

3.7 Reliability of the Instrument

The questionnaire was trial – tested using 39 medical staff (Doctors 12, Nurses 9, Pharmacist 10 and Laboratory Technologists 8) from two general hospitals: General Hospital, Makurdi, Benue State and General Hospital Minna, Niger State which were not used for the study. Responses of these staff to the items of the instrument were analyzed to determine the internal consistency of the instrument using the split-half method. A coefficient of 0.76 was obtained and this was therefore considered high enough for the study.

3.8 Method of Data Collection

Copies of the questionnaire were administered directly by the researcher and four (4) research assistants in the four (4) Federal Medical Centers under study. Questionnaires were administered to the doctors, nurses, laboratory technologists and pharmacists to investigate the effect of telemedicine on medical services delivery. The researcher and the assistants

administered and retrieved three hundred and eleven (311) copies of the questionnaire from the respondents.

3.9 Data Analysis Techniques

The data were analyzed using both descriptive and inferential statistics. Mean and standard deviation were used to answer research questions while Chi-square statistics was used to test the null hypotheses at 0.05 level of significance. The choice of mean to answer research questions is because data collected was on interval scale. The use of chi-square on the other hand was because the study also sought to determine whether variables such as availability and degree of application of telemedicine significantly affect medical service delivery in federal medical centers in north central Nigeria.

In deciding on the items for answering research questions one and three, the real limits of numbers were utilized for decision making as follows.

Very High Extent = 3.50 – 4.00

High Extent = 2.50 - 3.49

Low Extent = 1.50 - 2.49

Very Low Extent = 1.00 – 1.49

Any item with a mean value of 3.50 to 4.00 was regarded as Very High Extent, 2.50 to 3.49 was regarded as High Extent, 1.50 to 2.49 was regarded as Low Extent while any item with a mean value below 1.50 was regarded as Very Low Extent.

Bench mark of 2.50 was established to accept any item with a mean rating of 2.50 or above as agreed while any item with a mean rating less than 2.50 was regarded as disagreed for research questions two, four, five and six.

The decision rule used for the mean ($\overline{X}$) is calculated as follows: Strongly agreed (SA) = 4, Agreed (A) = 3, Disagreed (D) = 2, Strongly Disagreed (SD) = 1

Hence 4+3+2+1/ 4 = 10/4 = **2.50**

The decision rule for rejection or otherwise of hypotheses was based on the chi-square calculated value ($\chi 2\alpha$) and the critical value ($\chi 2$). A hypothesis of no significant effect was rejected for any cluster of items whose chi-square calculated value was greater than the critical value at 0.05 and with the specified degree of freedom while it was not rejected for any cluster of items whose chi-square calculated value was less than the critical value at 0.05 and with the specified degree of freedom.

4.0 RESULTS AND DISCUSSION

This section presents results of the data analysis and discusses the findings of the research. It was carried out under descriptive analysis and inferential analysis, findings and discussion of findings.

4.1 Results

The results of the study were presented according to research questions answered and hypothesis tested as follows:

4.1.1 Research question 1

What is the degree of availability of telemedicine services in Federal Medical Centers in north central Nigeria?

To answer the above question, data on degree of availability of telemedicine services was collected and subjected to analysis using mean and standard deviation as presented in Table 1.

Table 1: Mean Ratings and Standard Deviation of Respondents on the Degree of Availability of Telemedicine Services in Federal Medical Centers in North Central Nigeria (N= 311: n_1 = 97 Doctors; n_2 =178 Nurses; n_3 =91 Laboratory Technologist and 17 Pharmacists)

S/N	Items	N	$\bar{X}$	SD	Remark
1	Reliable internet service	311	2.83	.79	High Extent
2	Computerized laboratory system	311	2.81	.85	High Extent
3	Computerized pharmacy system	311	3.08	.88	High Extent
4	Search and locate patient system	311	2.94	1.01	High Extent
5	Real-time patient consultations	311	2.95	.88	High Extent
6	Remote monitoring of patient's vital signs and conditions	311	2.95	.58	High Extent
7	The storing and forwarding of critical health information for analysis and diagnosis	311	3.09	.95	High Extent
8	The provision of specialized services over long distances	311	2.65	1.03	High Extent
9	The wide availability of health information to patients and care givers	311	3.46	.82	High Extent

N= number of respondents, $\bar{X}$= mean of respondents SD = Standard deviation of respondents.

Result in Table 1 showed the responses of respondents on degree of availability of Telemedicine Services in Federal Medical Centers in North Central Nigeria. All the nine items recorded mean scores ranging from 2.65 to 3.46 indicating that their mean values were within the real limits of mean 2.50 and 3.49. This showed that all the telemedicine services in Federal Medical Centers in north central Nigeria are available to a high extent. The Table further showed that the standard deviation of the items ranged from .58 to 1.03, indicating that there was less variability in the opinion of the respondents on the degree of availability of telemedicine services in federal medical centers in North central Nigeria.

4.1.2 Research question 2

What are the types of telemedicine in medical services delivery in Federal Medical Centers in north central Nigeria?

To answer the above question, data on types of telemedicine in medical services delivery in federal medical centers in North central Nigeria was collected and subjected to analysis using mean and standard deviation as presented in Table 2.

Table 2: Mean Ratings and Standard Deviation of Respondents on Types of Telemedicine in Medical Services Delivery in Federal Medical Centers in North Central Nigeria (N= 311: n_1 = 97 Doctors; n_2 =178 Nurses; n_3 =91 Laboratory Technologist and 17 Pharmacists)

S/N	Types of Telemedicine	N	$\bar{X}$	SD	Remark
10	Telecardialogy	311	3.01	.75	Agreed
11	Teledermatology	311	3.31	.94	Agreed
12	Teleradiology	311	3.13	.91	Agreed
13	Telepathology	311	3.03	.65	Agreed
14	Telepharmacy	311	2.84	.63	Agreed
15	Telenursing	311	2.87	.70	Agreed
16	Store and forward	311	2.82	.65	Agreed
17	Remote monitoring	311	2.84	.65	Agreed
18	Real time (interactive)	311	2.84	.69	Agreed

N= number of respondents, $\bar{X}$= mean of respondents SD = Standard deviation of respondents.

Data presented in Table 2 showed the responses of respondents on types of Telemedicine in Medical Services delivery. All the nine items recorded mean scores ranging from 2.82 to 3.31 indicating that their mean values were above the cut-off point of mean 2.50. This showed that all the items were agreed by respondents as the types of telemedicine in medical services delivery in federal medical centers in north central Nigeria. The Table further showed that the standard deviation of the items ranged from .63 to .94, indicating that there was less variability in the opinion of the respondents on the types of Telemedicine in Medical Service Delivery in Federal Medical Centers in North Central Nigeria.

4.1.3 Research question 3

What is the degree of application of telemedicine in Federal Medical Centers in north central Nigeria?

To answer the above question, data on degree of application of telemedicine was collected and subjected to analysis using mean and standard deviation as presented in Table 3.

Table 3: Mean Ratings and Standard Deviation of Respondents on the Degree of Application of Telemedicine in Federal Medical Centers in North Central Nigeria (N= 311: n_1 = 97 Doctors; n_2 =178 Nurses; n_3 =91 Laboratory Technologist and 17 Pharmacists)

S/N	Degree of Application of Telemedicine	N	$\bar{X}$	SD	Remark
19	Management of specific diseases	311	2.83	.62	High Extent
20	Use within specific specialties	311	2.78	.65	High Extent
21	Classification according to technology	311	2.76	.61	High Extent
22	Types of clinical problems	311	2.80	.63	High Extent
23	Provide access for their local populations	311	2.76	.61	High Extent
24	Bring specialty services to the local area in a collaborative fashion	311	3.44	.67	High Extent
25	Decrease out migration of patients based on perception of available services and the quality of those services;	311	3.33	.73	High Extent
26	Decrease unnecessary transports to tertiary care facilities;	311	3.18	.77	High Extent
27	Provide practitioner support	311	3.16	.77	High Extent
28	Increase utilization of local ancillary services.	311	3.28	.65	High Extent

N= number of respondents, $\bar{X}$= mean of respondents SD = Standard deviation of respondents.

Data presented in Table 3 showed the responses of respondents on degree of application of Telemedicine in Federal Medical Centers in North Central Nigeria. The result revealed that all the ten items recorded mean scores ranging from 2.76 to 3.44 indicating that their mean values were within the real limits of mean 2.50 and 3.49. This showed that there was high degree of application of telemedicine in federal medical centers in north central Nigeria. The Table further showed that the standard deviation of the items ranged from .61 to .77, indicating that there was less variability in the opinion of the respondents on the degree of application of Telemedicine in Federal Medical Centers in North Central Nigeria.

4.1.4 Research question 4

What are the effects of Telemedicine on Medical Service delivery in federal medical centers in north central Nigeria?

To answer the above question, data on effects of telemedicine on medical service delivery in federal medical centers in North central Nigeria was collected and subjected to analysis using mean and standard deviation as presented in Table 4.

Table 4: Mean Ratings and Standard Deviation of Respondents on Effects of Telemedicine on Medical Service Delivery in Federal Medical Centers in North Central Nigeria (N= 311: n_1 = 97 Doctors; n_2 =178 Nurses; n_3 =91 Laboratory Technologist and 17 Pharmacists)

S/N	Effects of Telemedicine	N	$\bar{X}$	SD	Remark
29	Rapid and efficient communication	311	3.30	.72	Agreed
30	Alleviate imbalances in geographical allocation of resources	311	2.81	.75	Agreed
31	Decreases patient anxiety	311	2.81	.76	Agreed
32	Increases access to health facilities	311	2.94	.81	Agreed
33	Elimination of real – time interaction	311	2.86	.88	Agreed
34	Reduces cost	311	2.87	.79	Agreed
35	Reduction of waiting / travel time	311	2.85	.60	Agreed
36	Increases patent comfort	311	3.32	.87	Agreed
37	Several medical practitioners can work on a patient concurrently	311	2.95	1.06	Agreed
38	Higher reliability of the diagnosis	311	3.43	.83	Agreed
39	Increases patent security and satisfaction	311	3.09	.76	Agreed
40	Increases convenience	311	3.30	.82	Agreed

N= number of respondents, $\bar{X}$= mean of respondents SD = Standard deviation of respondents.

Data presented in Table 4 showed the responses of respondents on effects of telemedicine on medical service delivery. Results obtained revealed that all the twelve items recorded mean scores ranging from 2.81 to 3.43 indicating that their mean values were above the cut-off point of mean 2.50. This showed that all the items were agreed by respondents as the effects of telemedicine on medical service delivery in federal medical centers in north central Nigeria. The Table further showed that the standard deviation of the items ranged from .60 to 1.06, indicating that there was less variability in the opinion of the respondents on the effects of telemedicine on medical service delivery in federal medical centers in north central Nigeria.

4.1.5 Research question 5

What are the challenges associated with the use of Telemedicine in Federal Medical Centers in North Central Nigeria?

To answer the above question, data on challenges associated with the use of telemedicine in federal medical centers in North Central Nigeria was collected and subjected to analysis using mean and standard deviation as presented in Table 5.

Table 5: Mean Ratings and Standard Deviation of Respondents on Challenges Associated with the Use of Telemedicine in Federal Medical Centers in North Central Nigeria (N= 311: n_1 = 97 Doctors; n_2 =178 Nurses; n_3 =91 Laboratory Technologist and 17 Pharmacists)

S/N	Challenges of Telemedicine Utilization	N	$\bar{X}$	SD	Remark
41	Inadequate medical practitioners	311	2.84	.92	Agreed
42	Inadequate patient record	311	3.26	.68	Agreed
43	Time consumption	311	2.86	.93	Agreed
44	Insufficient medical records	311	3.62	.68	Agreed
45	Difficult remote access	311	3.59	.71	Agreed
46	Difficulty in retrieving record	311	2.80	.92	Agreed
47	Unfavorable government policy	311	2.84	.92	Agreed
48	Poor funding	311	3.23	.66	Agreed
49	Poor internet facilities	311	2.83	.94	Agreed
50	Ethics and legal issues	311	3.19	.68	Agreed
51	Challenges to patient privacy	311	3.19	.69	Agreed
52	Insecurity	311	3.21	.70	Agreed
53	Poor level of satisfaction	311	3.18	.70	Agreed
54	Inadequate of infrastructure	311	2.80	.95	Agreed

N= number of respondents, $\bar{X}$= mean of respondents SD = Standard deviation of respondents.

Data presented in Table 5 showed the responses of respondents on challenges associated with the use of telemedicine Results obtained revealed that all the fourteen items recorded mean scores ranging from 2.80 to 3.62 indicating that their mean values were above the cut-off point of mean 2.50. This showed that all the items were agreed by respondents as the challenges associated with the use of telemedicine in federal medical centers in north central Nigeria. The Table also showed that the standard deviation of the items ranged from .66 to .95, indicating that there was less variability in the opinion of the respondents on the challenges associated with the use of Telemedicine in Federal Medical Centers in North Central Nigeria.

4.1.6 Research question 6

What are the strategies for mitigating challenges associated with the use of Telemedicine in Federal Medical Centers in North Central Nigeria?

To answer the above question, data on strategies for mitigating challenges associated with the use of telemedicine in federal medical centers in North central Nigeria was collected and subjected to analysis using mean and standard deviation as presented in Table 6.

Table 6: Mean Ratings and Standard Deviation of Respondents on Strategies for overcoming the Challenges Associated with the Use of Telemedicine in Federal Medical Centers in North Central Nigeria (N= 311: n_1 = 97 Doctors; n_2 =178 Nurses; n_3 =91 Laboratory Technologist and 17 Pharmacists)

S/N	Strategies	N	$\bar{X}$	SD	Remark
55	Amendment of telemedicine laws	311	3.19	.70	Agreed
56	Clarification of liability policies	311	3.17	.71	Agreed
57	Incorporation of telemedicine in the curricula of medical schools	311	3.17	.73	Agreed
58	Adequate funding	311	3.16	.71	Agreed
59	Public enlightenment	311	3.60	.76	Agreed
60	Provision of adequate facilities	311	2.81	.96	Agreed
61	Improvement in licensing issues	311	2.77	.94	Agreed
62	Reimbursement from insurance companies	311	2.80	.95	Agreed

N= number of respondents, $\bar{X}$= mean of respondents SD = Standard deviation of respondents.

Data presented in Table 6 showed the responses of respondents on strategies for overcoming challenges associated with the use of telemedicine Results obtained revealed that all the eight items recorded mean scores ranging from 2.77 to 3.60 indicating that their mean values were above the cut-off point of mean 2.50. This showed that all the items were agreed by respondents as the challenges associated with the use of telemedicine in federal medical centers in north central Nigeria. The Table also showed that the standard deviation of the items ranged from .70 to .96, indicating that there was less variability in the opinion of the respondents on strategies for mitigating the challenges associated with the use of telemedicine in federal medical centers in north central Nigeria.

4.1.7 Hypothesis 1

Availability of telemedicine does not significantly affect medical service delivery in federal medical centers in north central Nigeria.

To test the above hypothesis, the mean ratings of respondents were analyzed using chi-square statistical tool as presented in Table 7.

Table 7: Chi-Square Test of Influence of Availability of Telemedicine on Medical Service Delivery in Federal Medical Centers in North Central Nigeria

	Df	$\chi 2$	$\chi 2\alpha$	Sig.	Alpha Level	Remark
Pearson Chi-square	24	36.42	65.117	.012	.05	S, R
Number of Valid Cases		311				

Df = degree of freedom, $\chi 2$= critical value, $\chi 2\alpha$ = chi-square calculated, Sig. = P-value; P < .05, S= Significant, R= rejected

Table 7 showed a chi-square calculated value of 65.117 which is greater than the critical value of 36.42 at .05 level of significance and with 24 degrees of freedom (i.e. $\chi 2\alpha = 65.117 > 36.42$). This indicates that availability of telemedicine significantly affect medical service delivery in federal medical centers in north central Nigeria. Therefore, the hypothesis which states that availability of telemedicine does not significantly affect medical service delivery in federal medical centers in north central Nigeria was rejected.

4.1.8 Hypothesis 2

The degree of application of telemedicine has no significant effect on medical service delivery in federal medical centers in north central Nigeria

To test the above hypothesis, the mean ratings of respondents were analyzed using chi-square statistical tool as presented in Table 8.

Table 8: Chi-Square Test of Effect of Degree of Application of Telemedicine on Medical Service Delivery in Federal Medical Centers in North Central Nigeria

	Df	$\chi 2$	$\chi 2\alpha$	Sig.	Alpha Level	Remark
Pearson Chi-square	24	36.42	193.376	.000	.05	S, R
Number of Valid Cases		311				

Df = degree of freedom, $\chi 2$= critical value, $\chi 2\alpha$ = chi-square calculated, Sig. = P-value; P < .05, S= Significant, R= rejected

Result in Table 8 showed a chi-square calculated value of 193.376 which is greater than the critical value of 36.42 at .05 level of significance and with 30 degree of freedom (i.e. $\chi 2\alpha$ = 193.376 > 36.42). This indicates that degree of application of telemedicine exert significant effect on medical service delivery in federal medical centers in north central Nigeria. Therefore, the hypothesis which states that degree of application of telemedicine has no significant effect on medical service delivery in federal medical centers in north central Nigeria was rejected.

4.2 Findings of the Study

The following findings emerged from the study based on the research questions answered and hypotheses tested.

1. It was found from the study that all the nine Telemedicine services in Federal Medical Centers in North Central Nigeria are available to a high extent.
2. The study also revealed that there are nine (9) types of telemedicine in medical services delivery in federal medical centers in north central Nigeria.
3. The study further revealed that there is high degree of application of telemedicine in federal medical centers in north central Nigeria.
4. Telemedicine exerts twelve (12) effects on medical service delivery in federal medical centers in north central Nigeria.
5. Analysis of data from the study further showed that fourteen (14) challenges are associated with the use of telemedicine in federal medical centers in north central Nigeria.
6. It was also found that eight (8) strategies could be adopted to mitigate the challenges of the use of telemedicine in federal medical centers in north central Nigeria..
7. Further analysis of data revealed that availability of telemedicine significantly affects medical service delivery in federal medical centers in north central Nigeria.

8. The results of the study also revealed that the degree of application of telemedicine exert significant effect on medical service delivery in federal medical centers in north central Nigeria.

4.3 Discussion of Findings

The findings of the study are discussed as follows:

The findings of the study on research question one in Table 1 revealed that all the nine telemedicine services in Federal Medical Centers in North Central Nigeria are available to a high extent. The telemedicine services were: reliable internet service, computerized laboratory system, computerized pharmacy system, search and locate patient system, real-time patient consultations, remote monitoring of patient's vital signs and conditions, the storing and forwarding of critical health information for analysis and diagnosis, the provision of specialized services over long distances and the wide availability of health information to patients and care givers. Further analysis of data revealed that availability of telemedicine significantly affects medical service delivery in federal medical centers in north central Nigeria. The finding was in agreement with James *et al* (2015) who found that the internet which serves as the backbone on which telemedicine thrives provides opportunities to retrieve up-to-date information on different aspects of diseases interact and enhance communication among medical professionals and patients especially through videoconferencing facilities and medical data processing application in the health centers.

The above finding was also in congruous with Nakajima and Chida (2010) who found that most telemedicine services are always online and in real time hence needs a fast, stable and uninterrupted internet service. Many physicians who travel to developing countries now take their laptops with them, or check in to internet cafes to maintain their medical contacts (Therefore, sustaining telemedicine services in any country requires a stable communications

strategy that connects the developing country with the global internet, without huge debts to pay for the connectivity. The finding is also in line with the work of Matawalli and Ibrahim (2014) who pointed out that interactive telemedicine services provide real-time interactions between patient and provider, to include phone conversations, online communication and home visits.

The results of the study on research question two in Table 2 shows that there are nine (9) types of telemedicine in medical services delivery in federal medical centers in north central Nigeria. The telemedicine types were: Telecardialogy, Teledermatology, Teleradiology, Telepathology, Telepharmacy, Telenursing, Store and forward, Remote monitoring and Real time (interactive). The finding is in line with the work of Shanit *et al*. (1996) who found that the use of real-time and store-and-forward echocardiography has revolutionized the local treatment of paediatric and adult cardiovascular patients and has led to more timely diagnosis and intervention. The authors also pointed out that the reasons for the use of telecardiology for consulting providers includes the need to develop outreach services where on-site outreach is not practical or feasible; the need to continue an outreach service where cost expenditures are greater than revenue plus added value of maintaining the current service; the need to use in-person time for new patient workups not easily done via telecardiology (and thus, seeing follow-up patients via telecardiology); or to increase productivity by decreasing travel time.

The result obtained from analysis of data on research question 3 in Table 3 revealed that there is high degree of application of telemedicine in federal medical centers in north central Nigeria with mean scores ranged from 2.76 to 3.44. The finding agrees with the findings of Turner, (2003); Wittson and Benschoter, (1972) who conducted a study to show the benefits of a unique form of telemedicine in the telepsychiatry setting where it was found that the use of a two-way closed-circuit microwave television system provided successful telemedicine communication,

training, and research between the Nebraska Psychiatric Institute and Norfolk State Hospital in Nebraska. The result is also in line with the work of Mair and Whitten (2000) whose study shows that telemedicine, in its various forms and applications, is a medical practice that is increasingly used for medical treatment and services. The finding is also supported by Balas *et al*. (1997) who conducted studies focusing on telemedicine in clinical settings demonstrate that this communicative modality offers enhanced performance, propitious results, and meaningful advantages.

Finding emanating from research question 4 revealed that telemedicine exerts twelve (12) effects on medical service delivery in federal medical centers in north central Nigeria with mean score ranged from 2.81 to 3.43. The test of hypotheses also revealed that the degree of application of telemedicine exert significant effect on medical service delivery in federal medical centers in north central Nigeria. The finding is in line with the work of Crowe, (1998) who pointed out that telemedicine can alleviate the issue of imbalances in geographic allocation of resources, facilities, and personnel in the realm of health care. Furthermore, it increases and strengthens access to health communication and services among disadvantaged, disserved, secluded, and restricted communities and citizens. The finding also agrees with the work of Crowe (1998) who asserted that the costs involved in health care and the resources necessary to transport patients to other states or even countries can be enormous to some people. Therefore, expeditious access to telemedicine can save both time and money. the finding is also in line with the work of Turner and Peterson, (1998) who opined that with the advent of Web-based medical and pharmaceutical companies (e-health sites) that provide an enormous amount of information on nearly every condition, drug, and treatment, individuals can turn to these services to conveniently and rapidly obtain information that could otherwise be obtained by physically visiting and communicating with medical practitioners or pharmacists.

The result obtained from analysis of data on research question five in Table 5 revealed fourteen (14) challenges are associated with the use of telemedicine in federal medical centers in north central Nigeria. The challenges include; inadequate medical practitioners, inadequate patient record, time consumption, insufficient medical records, difficult remote access, difficulty in retrieving record, unfavorable government policy, poor funding, poor internet facilities, ethics and legal issues, challenges to patient privacy, insecurity, poor level of satisfaction and inadequate of infrastructure. This finding collaborate the work of Turner (2003) who enumerated a variety of challenges that jeopardize the advancement and success of telemedicine, he proposed four challenges that yield the greatest difficulty in telemedicine's path and clarify these in more detail than have been provided in earlier research. Gilbert (1995) investigated a serious impediment to the development of telemedicine includes issues related to patient privacy and found that, because multiple individuals (i.e., technicians, nurses, etc.) are generally involved in telemedicine communication, exposure of confidential records to all parties concerned becomes a threat to the privacy of that patient. In addition, even though medical doctors accept the obligation of maintaining their patients' privacy rights, the other assisting parties involved in the telemedicine communication may not be held to the same standard.

Findings emanating from research question 6 revealed that eight (8) strategies could be adopted to mitigate the challenges associated with the use of telemedicine in federal medical centers in north central Nigeria. Such strategies include: amendment of telemedicine laws, clarification of liability policies, incorporation of telemedicine in the curricula of medical schools, adequate funding, public enlightenment, provision of adequate facilities, improvement in licensing issues and reimbursement from insurance companies. This finding agrees with the finding of Perednia and Grigsby (1998) that lawyers can amend telemedicine laws to clarify and identify liability policies with regard to interstate surgical operations (when

the surgery takes place in one state while a physician is located in another state). More important, another disadvantage of resorting to telemedicine is that it is subtracting and close to eliminating our social human contact in health care settings. This concern urges health communication scholars to evaluate the specific communicative needs that have been otherwise overlooked in the literature on telemedicine. The authors cited above added credence and validity to the findings of this study.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

This section is presented under the following sub-headings: summary, conclusion and recommendations.

5.1 Summary

This study covered the background of the study which states that telemedicine can be broadly defined as the use of information and telecommunication technologies to provide medical information and services at a distance. The background also covered statement of the problem which state that Lack of funds as well as a dramatic shortage of trained and experienced doctors and nurses, poor roads, limited transportation facilities and long distances are severe obstacles for providing health care services to rural communities and remote areas. The statement of the problem also stated that the problems facing the public health care system in Nigeria could be traced to poor implementation of National Health Policy as well as other health-related policies and programmes. Objective of the study is to find out the effect of telemedicine on medical services delivery by Federal Medical Centers in North Central Nigeria. Research questions were posed based on the specific objectives of the study. The hypotheses were also formulated based on the objective of the study and the study will be significant to the health care system, stake holders, doctors and patients, remote communities, the general populace and researchers. The scope of the study was restricted to 311 medical staff (Doctors, Nurses, Pharmacists and Laboratory Technologist of Federal Medical Centers (FMC Bida, Makurdi, Lokoja and Keffi) in North Central Nigeria.

Review of Literature was done under sub-headings such as theoretical framework (Cost Minimization Framework developed by Hooshmand in 2010), conceptual framework, information and communication technologies in medicine, telemedicine, availability of telemedicine services, types of telemedicine, degree of application of telemedicine, effects of

telemedicine on medical services delivery, challenges associated with the use of telemedicine, possible solutions to the challenges associated with the use of telemedicine, empirical studies and summary of the review.

Research methodology, Survey design was used. Area of the study were the four Federal Medical Centers in North Central Nigeria namely: Federal Medical Center Bida, Federal Medical Center Makurdi, Federal Medical Center Lokoja and Federal Medical xenter Keffi. One thousand four hundred and seven (1407) medical staff (Doctors, Nurses, Laboratory Technologists and Pharmacists) as the population of the study. The sample for the study was three hundred and eleven (311). The instrument for data collection was questionnaire made up of six (6) sections. The questionnaire was validated by three experts in the field of Library and Information science. In order to establish the reliability of the instrument for the study, the validated instrument was administered to 39 medical staff from two general hospitals: General Hospital, Makurdi, Benue State and General Hospital Minna, Niger State which was not part of the study sample but had similar characteristics to that of the study area. In order to ensure a high percentage of return, the questionnaires were personally distributed to the respondents by the researcher and researcher's assistants and collected immediately. The researcher used descriptive and inferential statistics to analyse each item on the questionnaire for the purpose of answering the research questions and testing of the hypotheses.

Result and Discussion, based on the data presented and analysed, It was found from the study that all the nine telemedicine services in federal medical centers in north central Nigeria are available to a high extent. The study further revealed that there is high degree of application of telemedicine in federal medical centers in north central Nigeria.

Further analysis of data revealed that availability of telemedicine significantly affects medical service delivery in federal medical centers in north central Nigeria.

5.2 Conclusion

Based on the finding of the study, it was concluded that the degree of application of telemedicine exert significant effect on medical service delivery in federal medical centers in north central Nigeria. The finding support the work of Banjoko and Omoleke (2008) who opined the need for man power development for this programme which possesses the potential of taking specialized healthcare services to the otherwise unreached while also improving the knowledge and skills of healthcare practitioners in remote locations through distant learning.

5.3 Recommendations

Based on the findings from this study, the following recommendations are made:

1. There is need for basic training and familiarity with the computer and associated communication systems in order to facilitate the use of telemedicine and telehealth applications and systems.
2. Health communication professionals should devise methods of approaching medical schools to encourage them to integrate courses into their programs that instruct the students on the most commonly used forms of telemedicine and the forms likely to be used in the future.
3. Establishing a basic understanding of what this medical technology can lead to will help health communication scholars enlighten the telemedicine debate by turning unique insights into more adequate approaches that will enrich and humanize mediated channels of health communication, thereby offering remedies and clarifications for effective health care exchange and delivery.
4. The surveyed Federal Medical Centers should embark on drastic development of telemedicine in line with global trend in order to promote effective utilization of telemedicine services.

5.4 Limitation of the Study

The following limitations were encountered in this study:

Night Shift Duty

Most of the medical staff (Doctors, Nurses, Pharmacist and Laboratory Technologist) are on night shift which makes it difficult for the researcher to get their attention.

5.5 Suggestion for further Studies

On completion of this research, the researcher discovered that there are some areas that needed to be researched into. Thus, further research has been suggested to be carried out in the following areas listed below:

1. Telemedicine Acceptability in South Western Nigeria: Its Prospects and Challenges.
2. Knowledge and Perception of Health Workers towards Telemedicine application in Federal Medical Centres in North Central Nigeria.
3. Development of a Framework for Collaborative Healthcare Services Delivery.
4. Impact of Improved Telecommunication Services on Health Care Delivery in Universities Teaching Hospitals in North Central Nigeria.
5. Extent of Telehealth Use in Rural and Urban Hospitals in North Central Nigeria.

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APPENDIX A

Population of the Study

S/no	Name of hospital	No. of Doctors	No. of Nurses	No. of Lab. Technologists	No. of Pharmacists	Total
1	FMC Bida	106	230	26	19	381
2	FMC Lokoja	101	218	21	14	354
3	FMC Makurdi	98	213	19	17	347
4	FMC Keffi	91	209	14	11	325
	Total	396	870	80	61	1407

Source: field survey, 2016

APPENDIX B

Sample Size of the Study

S/no	Name of Hospital	No. of Doctors	No. of nurses	No. of Lab. Technologists	No. of Pharmacists	Total
1	FMC Bida	28	48	6	5	87(28.9 %)
2	FMC Makurdi	25	46	5	4	80(25.8 %)
3	FMC Lokoja	23	44	5	5	77(23.7 %)
4	FMC Keffi	21	40	3	3	67(21.6 %)
Total		97(31.2 %)	178(57.2 %)	19(6.1 %)	17(5.5 %)	311(100 %)

Source: field survey, 2016

APPENDIX C

Sample Size Determination

Taro Yamane formula for a finite population is given as:

$$n = \frac{\mu}{1+ \mu(e)^2}$$

Where:

n = the sample size

μ = the finite population

e = level of significance

1 = unity (a constant)

Given that the finite population (μ) is 1407 and the level of significance is (e) is 0.05

$$n = \frac{1407}{1 + 1407\ (0.05)^2}$$

$$n = \frac{1407}{1 + 1407\ (0.0025)}$$

$$n = \frac{1407}{1 + 3.52}$$

$$n = \frac{1407}{4.52}$$

n = 311.

APPENDIX D

Questionnaire

Department of Educational Foundations and General Studies, College of Agricultural and Science Education. University of Agriculture Makurdi. Benue State

12th July, 2016

Dear Respondent,

I appreciate you for the time and willingness to participate in this survey exercise consistent with the ongoing research titled 'Perceived Effect of Telemedicine on Medical Service Delivery by Federal Medical Centers in North Central Nigeria'. The questionnaire has been designed with you in mind to obtain your response regarding how important you think certain factors are to the application of telemedicine in medical services delivery in federal medical centers.

Your contribution to this research is very important in obtaining feedback and also in contribution to application of telemedicine by highlighting challenges and suggesting possible solutions.

The information you provide is confidential and as such will not be used outside the scope of this research.

Thank you

Yours faithfully,

Akor Solomon Obotu

QUESTIONNAIRE ON THE EFFECTS OF TELEMEDICINE ON MEDICAL SERVICE DELIVERY IN FEDERAL MEDICAL CENTRES IN NORTH CENTRAL NIGERIA.

Section A: Demographic Data

1. Name of Federal Medical Centre ……..

2. Gender: male [ ] Female [ ]

3. Status:

i. Doctor [ ]
ii. Nurses [ ]
iii. Lab. Technologist [ ]
iv. Pharmacist [ ]

4. Years of experience:

1-10 [ ] 11-15 [ ] 16-25 [ ] 26 years and above [ ]

Section B: Questionnaire for Respondents

1). what are the telemedicine services Available in the study area?

For each of the following statement, please indicate by tick in the box whether you agree to; Strongly Agreed (**SA**), Agreed (**A**), Disagreed (**D**) and Strongly Disagreed (**SD**).

S/N	**Services Available**	**SA**	**A**	**D**	**SD**
1	Reliable internet service				
2	Computerized laboratory system				
3	Computerized pharmacy system				

4	Search and locate patient system				
5	Real-time patient consultations				
6	Remote monitoring of patient's vital signs and conditions				
7	The storing and forwarding of critical health information for analysis and diagnosis				
8	The provision of specialized services over long distances				
9	The wide availability of health information to patients and care givers.				

2). what are the types of telemedicine practiced in the study area

S/N	**Types**	**SA**	**A**	**D**	**SD**
10	Telecardialogy				
11	Teledermatology				
12	Teleradiology				
13	Telepathology				
14	Telepharmacy				

15	Telenursing				
16	Store and forward				
17	Remote monitoring				
18	Real time (interactive)				

3). what is the degree of application of telemedicine in the study area?

S/N	**Degree of Application**	**SA**	**A**	**D**	**SD**
19	Management of specific diseases				
20	Use within specific specialties				
21	Classification according to technology				
22	Types of clinical problems				
23	Provide access for their local populations				

24	Bring specialty services to the local area in a collaborative fashion				
25	Decrease out migration of patients based on perception of available services and the quality of those services;				
26	Decrease unnecessary transports to tertiary care facilities;				
27	Provide practitioner support				
28	Increase utilization of local ancillary services.				

4). what are the effects of telemedicine on medical service delivery in the study area?

S/N	**EFFECTS**	**SA**	**A**	**D**	**SD**
29	Rapid and efficient communication				
30	Alleviate imbalances in geographical allocation of resources				
31	Decreases patient anxiety				
32	Increases access to health facilities				

33	Elimination of real – time interaction				
34	Reduces cost				
35	Reduction of waiting / travel time				
36	Increases patent comfort				
37	Several medical practitioners can work on a patient concurrently				
38	Higher reliability of the diagnosis				
39	Increases patent security and satisfaction				
40	Increases convenience				

5). what are the challenges associated with the use of telemedicine in the study area?

S/N	**CHALLENGES**	**SA**	**A**	**D**	**SD**
41	Inadequate medical practitioners				
42	Inadequate patient record				

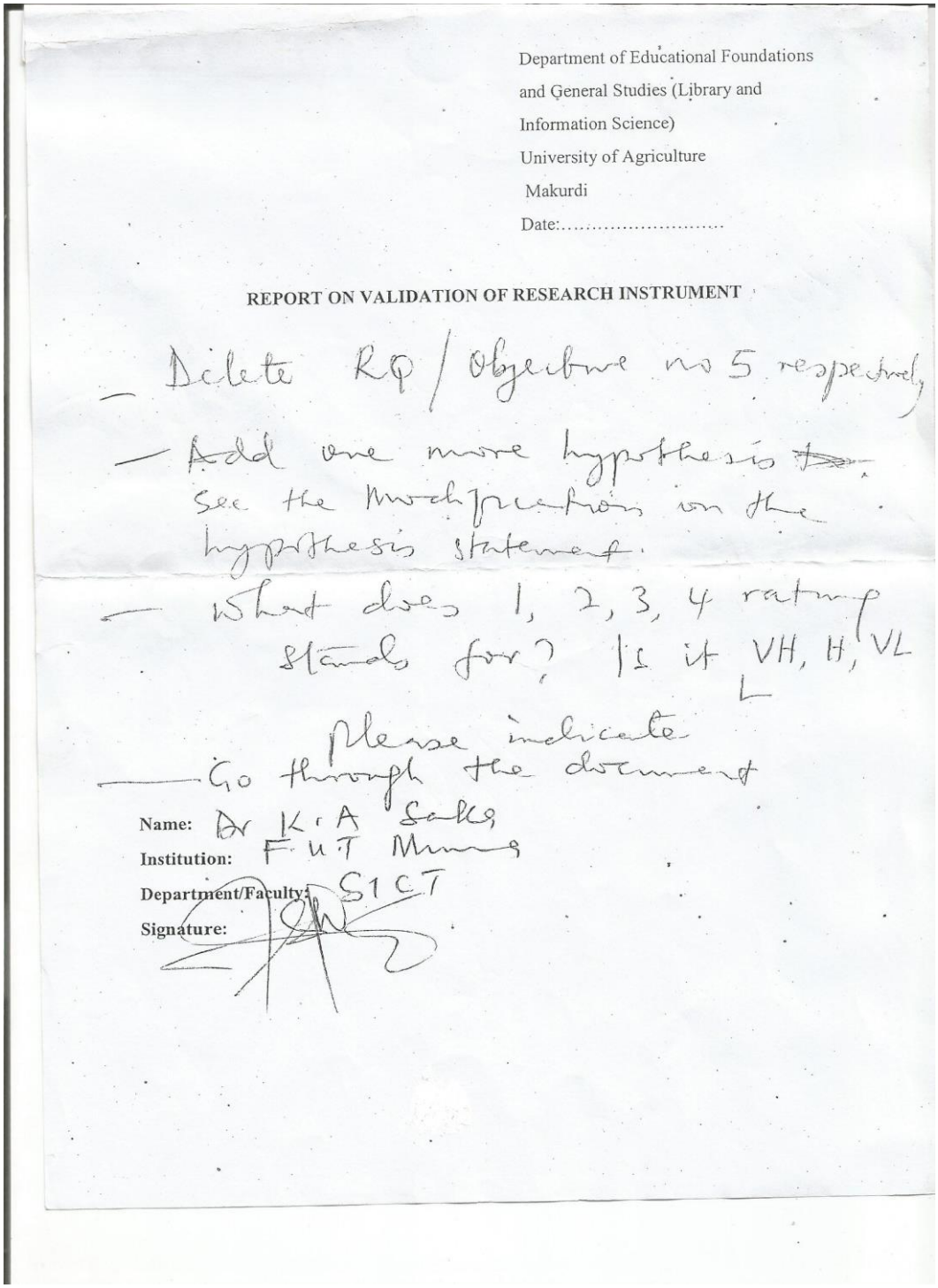
43	Time consumption				
44	Insufficient medical records				
45	Difficult remote access				
46	Difficulty in retrieving record				
47	Unfavourable government policy				
48	Poor funding				
49	Poor internet facilities				
50	Ethics and legal issues				
51	Challenges to patient privacy				
52	Insecurity				
53	Poor level of satisfaction				
54	Lack of infrastructure				

6). what are the possible solutions to the challenges against the use of telemedicine in the study area?

S/N	POSSIBLE SOLUTIONS	SA	A	D	SD
55	Amendment of telemedicine laws				
56	Clarification of liability policies				
57	Incorporation of telemedicine in the curricula of medical schools				
58	Adequate funding				
59	Public enlightenment				
60	Provision of adequate facilities				
61	Improvement in licensing issues				
62	Reimbursement from insurance companies				

APPENDIX E

Evidence of Validation



Department of Educational Foundations
and General Studies (Library and
Information Science)
University of Agriculture
Makurdi
Date:.....

REPORT ON VALIDATION OF RESEARCH INSTRUMENT

- Delete RQ / Objective no 5 respectively
- Add one more hypothesis
See the modification on the hypothesis statement.
- What does 1, 2, 3, 4 ratings stands for? Is it VH, H, VL, L
Please indicate
- Go through the document

Name: Dr K.A Saka
Institution: F.U.T Minna
Department/Faculty: SICT
Signature:

Department of Educational Foundations
and General Studies (Library and
Information Science)
University of Agriculture
Makurdi
Date: 10-10-16

REPORT ON VALIDATION OF RESEARCH INSTRUMENT

The research instrument has been carefully studied, and necessary corrections have also been applied where necessary.
Thanks

Name: Chiks-Ike, P. O.
Institution: Federal University of Tech. Minna.
Department/Faculty: Library/Infor. Tech. & I.C.T
Signature: [signature] 10-10-16

Department of Educational Foundations
and General Studies (Library and
Information Science)
University of Agriculture
Makurdi
Date: 15/07/2016

REPORT ON VALIDATION OF RESEARCH INSTRUMENT

Are you looking at the effectiveness of Telemedicine service delivery or its role in medical service delivery in Rural communities. Please make this clear in your statement of the problem.

Is Telemedicine service delivery already in existence in the Rural area of your study, but ineffective/ineffective? — make this clear.

(*---this research is aimed at identifying certain variables on how to enhance---)

Objective — I suggest that your first objective should ascertain availability of Telemedicine in---

Question on availability should come first before the Types of Telemedicine, followed by Depen

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Institution: LIT. Dept. School of SICT
Department/Faculty: Federal
Signature: 10/10/2016

Instrument (section B) — Effects could be negative or positive

1 * Please reflect this in the options provided

2 * I suggest that there should be a question on Availability.

APPENDIX F

Reliability Output

Reliability Test

Cronbach's Alpha	0.702173761
Split-Half (odd-even) Correlation	0.764267697
Spearman-Brown Prophecy	0.866385184
Mean for Test	107.1875
Standard Deviation for Test	10.71050156
KR21	2.70297846
KR20	2.726916894

Respondents	Subjects
39	32

Respondents	DR. 1	DR. 2	DR. 3	DR. 4	DR. 5	DR. 6	DR. 7	DR. 8	DR. 9
Subject1	3	4	2	2	2	4	4	2	3
Subject2	4	2	1	3	1	2	2	3	3
Subject3	4	3	2	4	2	3	3	4	2
Subject4	4	3	3	4	3	3	4	2	4
Subject5	2	2	2	4	2	2	2	4	4
Subject6	3	3	1	3	1	3	3	3	4
Subject7	2	2	1	2	1	2	2	2	2
Subject8	4	4	2	4	2	4	1	4	4
Subject9	3	2	1	2	1	2	3	2	3
Subject10	4	4	2	4	2	4	2	3	3
Subject11	2	2	1	2	1	2	1	2	3
Subject12	3	4	4	3	4	4	1	4	1
Subject13	4	2	4	2	4	2	2	2	2
Subject14	2	3	1	4	1	3	4	3	3
Subject15	4	2	2	2	2	2	2	2	2
Subject16	2	1	2	3	2	1	4	4	1
Subject17	3	2	2	2	2	2	2	2	2
Subject18	2	4	4	4	4	4	3	3	3
Subject19	4	4	4	2	4	4	1	2	4
Subject20	4	2	1	4	1	2	2	1	3
Subject21	2	4	4	2	4	4	4	2	4
Subject22	3	4	1	4	1	4	2	1	2
Subject23	1	2	1	2	1	2	4	2	4
Subject24	4	3	2	4	2	3	2	2	4
Subject25	2	4	4	4	4	4	3	2	4
Subject26	3	3	2	4	2	3	4	1	3

APPENDIX G

Results of Data Analysis

DESCRIPTIVES VARIABLES=item1 item2 item3 item4 item5 item6 item7 item8 item9 item10 item11 item12 item13 item14 item15 item16 item17 item18 item19 item20 item21 item22 item23 item24 item25 item26 item27 item28 item29 item30 item31 item32 item33 item34

item35 item36 item37 item38 item39 item40 item41 item42 item43 item44 item45 item46 item47 item48 item49 item50 item51 item52 item53 item54 item55 item56 item57 item58 item59 item60 item61 item62

/STATISTICS=MEAN STDDEV MIN MAX.

Descriptives

Notes

Output Created		02-DEC-2017 05:57:02
Comments		
Input	Data	C:\Users\RICH\Documents\solo sav.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	311
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.

	Cases Used	All non-missing data are used.
Syntax		DESCRIPTIVES VARIABLES=item1 item2 item3 item4 item5 item6 item7 item8 item9 item10 item11 item12 item13 item14 item15 item16 item17 item18 item19 item20 item21 item22 item23 item24 item25 item26 item27 item28 item29 item30 item31 item32 item33 item34 item35 item36 item37 item38 item39 item40 item41 item42 item43 item44 item45 item46 item47 item48 item49 item50 item51 item52 item53 item54 item55 item56 item57 item58 item59 item60 item61 item62 /STATISTICS=MEAN STDDEV MIN MAX.
Resources	Processor Time	00:00:00.06
	Elapsed Time	00:00:00.06

[DataSet1] C:\Users\RICH\Documents\solo sav.sav

Descriptive Statistics

Availability of Telemed Services	N	Minimum	Maximum	Mean	Std. Deviation
Reliable internet service	311	1	4	2.83	.788
Computerized laboratory system	311	1	4	2.81	.851
Computerized pharmacy system	311	1	4	3.08	.882
Search and locate patient system	311	1	4	2.94	1.014
Real-time patient consultations	311	1	4	2.95	.884
Remote monitoring of patient's vital signs and conditions	311	2	4	2.95	.583
The storing and forwarding of critical health information for analysis and diagnosis	311	1	4	3.09	.956
The provision of specialized services over long distances	311	1	4	2.65	1.03
The wide availability of health information to patients and care givers.	311	1	4	3.46	.821
Valid N (listwise)	311				

Descriptive Statistics

Types of Telemed Service Delivery	N	Minimum	Maximum	Mean	Std. Deviation
Telecardialogy	311	2	4	3.01	.749
Teledermatology	311	1	4	3.31	.944
Teleradiology	311	1	4	3.13	.915
Telepathology	311	2	4	3.03	.654
Telepharmacy	311	1	4	2.84	.627
Telenursing	311	1	4	2.87	.700
Store and forward	311	1	4	2.82	.649
Remote monitoring	311	1	4	2.84	.654
Real time (interactive)	311	1	4	2.84	.689
Valid N (listwise)	311				

Descriptive Statistics

Degree of Application of Telemedecine	N	Minimum	Maximum	Mean	Std. Deviation

Management of specific diseases	311	2	4	2.83	.626
Use within specific specialties	311	1	4	2.78	.649
Classification according to technology	311	1	4	2.76	.613
Types of clinical problems	311	1	4	2.80	.632
Provide access for their local populations	311	1	4	2.76	.609
Bring specialty services to the local area in a collaborative fashion	311	1	4	3.44	.675
Decrease out migration of patients based on perception of available services and the quality of those services;	311	1	4	3.33	.730
Decrease unnecessary transports to tertiary care facilities;	311	1	4	3.18	.767
Provide practitioner support	311	1	4	3.16	.776
Increase utilization of local ancillary services.	311	1	4	3.28	.655
Valid N (listwise)	311				

Descriptive Statistics

Effects of Telemed on Medical Service Delivery	N	Minimum	Maximum	Mean	Std. Deviation
Rapid and efficient communication	311	1	4	3.30	.720
Alleviate imbalances in geographical allocation of resources	311	1	4	2.81	.752
Decreases patient anxiety	311	1	4	2.81	.763
Increases access to health facilities	311	1	4	2.94	.811
Elimination of real – time interaction	311	1	4	2.86	.877
Reduces cost	311	1	4	2.87	.791
Reduction of waiting / travel time	311	1	4	2.85	.599
Increases patent comfort	311	1	4	3.32	.876
Several medical practitioners can work on a patient concurrently	311	1	4	2.95	1.061
Higher reliability of the diagnosis	311	1	4	3.43	.827
Increases patent security and satisfaction	311	1	4	3.09	.763

Increases convenience	311	1	4	3.30	.818
Valid N (listwise)	311				

Descriptive Statistics

Challenges of Telemed Utilization	N	Minimum	Maximum	Mean	Std. Deviation
Inadequate medical practitioners	311	1	4	2.84	.918
Inadequate patient record	311	1	4	3.26	.681
Time consumption	311	1	4	2.86	.933
Insufficient medical records	311	1	4	3.62	.684
Difficult remote access	311	1	4	3.59	.708
Difficulty in retrieving record	311	1	4	2.80	.919
Unfavourable government policy	311	1	4	2.84	.925
Poor funding	311	1	4	3.23	.667
Poor internet facilities	311	1	4	2.83	.945
Ethics and legal issues	311	1	4	3.19	.684
Challenges to patient privacy	311	1	4	3.19	.694

Insecurity	311	1	4	3.21	.698
Poor level of satisfaction	311	1	4	3.18	.705
Lack of infrastructure	311	1	4	2.80	.947
Valid N (listwise)	311				

Descriptive Statistics

Strategies for mitigating the Challenges of Telemed Utilization	N	Minimum	Maximum	Mean	Std. Deviation
Amendment of telemedicine laws	311	1	4	3.19	.704
Clarification of liability policies	311	1	4	3.17	.706
Incorporation of telemedicine in the curricula of medical schools	311	1	4	3.17	.730
Adequate funding	311	1	4	3.16	.714
Public enlightenment	311	1	4	3.60	.764
Provision of adequate facilities	311	1	4	2.81	.961

Improvement in licensing issues	311	1	4	2.77	.941
Reimbursement from insurance companies	311	1	4	2.80	.952
Valid N (listwise)	311				

```
CROSSTABS
  /TABLES=AvailabilityofTelemed BY MedicalserviceDelivery
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT
  /COUNT ROUND CELL.
```

Crosstabs

Notes

Output Created		03-DEC-2017 05:21:18
Comments		
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	Active Dataset	DataSet1
	Filter	<none>

	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	311
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each table are based on all the cases with valid data in the specified range(s) for all variables in each table.
Syntax		CROSSTABS /TABLES=AvailabilityofTelemed BY MedicalserviceDelivery /FORMAT=AVALUE TABLES /CELLS=COUNT /COUNT ROUND CELL.
Resources	Processor Time	00:00:00.06
	Elapsed Time	00:00:00.06
	Dimensions Requested	2
	Cells Available	174762

[DataSet1] C:\Users\RICH\Documents\solo sav.sav

Case Processing Summary

Hypo1	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Availability of Telemed * Medical service Delivery	311	100.0%	0	0.0%	311	100.0%

Availability of Telemed * Medical service Delivery Crosstabulation

Count

		Medical service Delivery			Total
		2.00	3.00	4.00	
Availability of Telemed	7.00	0	0	20	20
	8.00	0	0	20	20

	9.00	23	22	0	45
	11.00	23	20	23	66
	12.00	0	47	0	47
	13.00	20	0	0	20
	14.00	0	45	0	45
	15.00	0	3	25	28
	16.00	20	0	0	20
Total		86	137	88	311

```
NPAR TESTS
  /CHISQUARE=Availability of Telemed
  /EXPECTED=EQUAL
  /MISSING ANALYSIS.
```

Chi-Square Test

Frequencies

Availability of Telemed

	Observed N	Expected N	Residual
7.00	20	34.6	-14.6
8.00	20	34.6	-14.6
9.00	45	34.6	10.4
11.00	66	34.6	31.4
12.00	47	34.6	12.4
13.00	20	34.6	-14.6
14.00	45	34.6	10.4
15.00	28	34.6	-6.6
16.00	20	34.6	-14.6
Total	311		

Test Statistics

	Availability of Telemed
Chi-Square	65.177[a]
Df	24
Asymp. Sig.	.012

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 34.6.

Case Processing Summary

Hypo2	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Degree of Application * Medical service Delivery	311	100.0%	0	0.0%	311	100.0%

Degree of Application * Medical service Delivery Crosstabulation

Count

		Medical service Delivery			Total
		2.00	3.00	4.00	
Degree of Application	8.00	1	0	0	1
	9.00	9	1	3	13
	10.00	7	12	10	29
	11.00	17	36	19	72
	12.00	16	30	19	65
	13.00	21	32	21	74
	14.00	6	18	10	34
	15.00	6	7	6	19
	16.00	3	1	0	4
Total		86	137	88	311

Chi-Square Test

Frequencies

Degree of Application

	Observed N	Expected N	Residual
8.00	1	34.6	-33.6
9.00	13	34.6	-21.6
10.00	29	34.6	-5.6
11.00	72	34.6	37.4
12.00	65	34.6	30.4
13.00	74	34.6	39.4
14.00	34	34.6	-.6
15.00	19	34.6	-15.6
16.00	4	34.6	-30.6
Total	311		

Test Statistics

	Degree of Application
Chi-Square	193.376[a]
df	24
Asymp. Sig.	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 34.6.