CHILD AND MATERNAL HEALTH CARE USING TELEMEDICINE:
A CASE STUDY OF YOBE STATE, NIGERIA

Matawalli Ajagana Geidam¹, Rajesh Prasad ², Ibrahim A. Bello ³

¹, ², ³ Yobe State University, Damaturu, Nigeria
² LDC Institute of Technical Studies, Allahabad, India

ABSTRACT:
Telemedicine can be broadly described as the use of telecommunications and information technologies to deliver healthcare services at a distance. It is most useful in the development of rural area, where availability of doctors and other health facilities are very less. Recent research shows that the telemedicine has improved the child and maternity health care in the word. This paper proposed a framework (CMHC) for the use of telemedicine to improve child and maternity health care in the Yobe State, where approximately 60 percent of whole the state comes under the rural sector. We also perform a case study taking consideration of all 17 Local Government Area (LGA), 12 secondary hospitals, medical staff and population of state. Based on the facts, we find that the telemedicine is essential to improve the Child and Maternity Healthcare in Yobe State.

Keywords: Telemedicine, Telepathology, Child and Maternity health care, remote health care, telecommunication and telenuring.

[1] INTRODUCTION

Telemedicine can be broadly described as the use of telecommunications and information technologies to deliver healthcare services and exchange of valid information for diagnosis, treatment and prevention of diseases, injuries, research and evaluation, and for continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities, where distance is a critical factor [1, 3, 6, 11, 13]. Telemedicine helps to eliminate distance barriers and can improve access to medical services that would often not be consistently available in distant rural communities.

[1.1] ADVANTAGES OF TELEMEDICINE

Due to recent developments in mobile technology and video conferencing [12], healthcare professionals in multiple locations can share information and discuss patient issues as if they were in the same place [2]. Remote patient monitoring through mobile technology can reduce the need
for outpatient visits and enable remote prescription verification and drug administration oversight, potentially significantly reducing the overall cost of medical care [7, 10]. Telemedicine can eliminate the possible transmission of infectious diseases or parasites between patients and medical staff. Additionally, some patients who feel uncomfortable in a doctor’s office may do better remotely. For example, white coat syndrome may be avoided. Patients who are home-bound and would otherwise require an ambulance to move them to a clinic are also a consideration.

[1.2] DISADVANTAGE OF TELEMEDICINE

The disadvantage of telemedicine includes the cost of telecommunication, data management equipment and technical training for medical personnel who will employ it. Virtual medical treatment also entails potentially decreased human interaction between medical professionals and patients, an increased risk of error when medical services are delivered in the absence of a registered professional, and an increased risk that protected health information may be compromised through electronic storage and transmission [7]. There is also a concern that telemedicine may actually decrease time efficiency due to the difficulties of assessing and treating patients through virtual interactions. Additionally, potentially poor quality of transmitted records, such as images or patient progress reports, and decreased access to relevant clinical information are quality assurance risks that can compromise the quality and continuity of patient care for the reporting doctor [4, 5]. Another disadvantage of telemedicine is the inability to start treatment immediately. For example, a patient suffering from a bacterial infection might be given an antibiotic hypodermic injection in the clinic, and observed for any reaction, before that antibiotic is prescribed in pill form.

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 [8, 9]. 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, Telepharmecy etc. are some of them.


Keeping these facts in mind for child and maternal health care, this paper proposed a framework and its possible implementation for the use of telemedicine to improve Child and Maternal Health Care (CMHC) in Yobe State, Nigeria. According to a report presented to the
Hospital Management Board (HMB), Damaturu, Nigeria, in February 2014, the north east zone carries the stigma of having the worst child and maternal health care. With the use of the proposed model, this challenge will be definitely minimized. The proposed model uses the concept of tele-nursing, tele-surgery and other telecommunications concept helpful in healthcare. According to the same report, the state is also lacking in physical infrastructures, non-availability of expert doctors, nurses, and other basic amenities. With the introduction of Telemedicine and Information Technology, the problem related to availability of medical experts, health care facilities will be improved.

We also perform a case study taking consideration of all 17 Local Government Area (LGA), 12 secondary hospitals, 1 tertiary hospital, medical staff and population of state. Based on the facts, we find that the telemedicine is a need to really improve the Child and Maternal Healthcare in Yobe State.

Rest of the paper is organized as follows. Sec. II presents the literature review and related work in the field of telemedicine. Sec. III presents the proposed framework and its possible implementation for the Yobe State. Sec. IV presents the finding and conclusion.

[2] LITERATURE REVIEW

Types of Telemedicine

Telemedicine can be divided into three main categories [15]: *store-and-forward, remote monitoring* and *(real-time)* interactive services.

- **Store-and-forward** telemedicine involves acquiring medical data (like medical images, bio-signals etc.) 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

Early Systems

- 1920 (USA): Transmission of ECGs and EEGs on ordinary telephone lines.
- 1920 (USA): Medical advice services for sailors based upon Morse code and voice radio.
• 1950’s (USA): Telepsychiatry between a state mental hospital and the Nebraska Psychiatric Institute using microwave link.
• 1950’s (USA): NASA and the US Public Health Services developed a joint telemedicine programme to serve the Papago Indian Reservation in Arizona.
• 1960’s (USA): Two-way closed-circuit television systems to facilitate both the transmission of medical images such as radiographs as well as consultations between doctors.
• 1970’s (USA): Paramedics in remote Alaskan and Canadian Villages connected with hospitals in distant towns and cities using the ATS-6 satellite systems.
• 1971, Japan: First time implemented in two areas: Nakatsu-mura and Kozagawa-cho, Wakayama using telephone line for voice and Fax transmission and CATV system for image transmission.
• 1972, Japan: Between Aomori Teishin Hospital and Tokyo Teishin Hospital over 4 Mhz TV channel and several telephone lines.

Other systems came up for Tele-nursing and Child and Maternal Health Care.

Telenursing

It refers to the use of telecommunications and information technology in order to provide nursing services in health care whenever a large physical distance exists between patient and nurse, or between any numbers of nurses. As a field it is part of telehealth, and has many points of contacts with other medical and non-medical applications, such as telediagnosis, teleconsultation, telemonitoring, etc. In Australia, during January 2014, Melbourne tech startup Small World Social collaborated with Australian Breastfeeding Association to create the first hands-free breastfeeding guidance application for new mothers. The application, named Breastfeeding Support Project, allows mothers to nurse their baby while viewing instructions about common breastfeeding issues (latching on, posture etc.) or call a lactation consultant via a secure Google Hangout, who can view the issue through the mother's Google Glass camera. The trial concluded in April 2014, and 100% of participants were breastfeeding confidently [9]. Other system includes: Teleradiology, Telepathology, Teledermatology, Telepsychiatry etc.

Child and Maternal Health Care

As discussed in Introduction, health risks associated with pregnancy and child birth are high among developing nations of the world. Estimates suggests that on an average 1, 500 women die every day due to pregnancy and child birth related complications in Sub-Saharan Africa and South Asia. According to UN inter-agency estimates of 2005, 99% maternal mortality occurred in developing nations. Approximately, 250, 000 maternal deaths occurred in sub-Saharan Africa. Another one third (187,000) took place in South Asia. The following steps are needed for Child and Maternal Health Care [14]:
Need evaluation

- Patient need evaluation: Maternal mortality rate, Infant mortality rate, skilled personnel for labor, mother and child care services need to be evaluated.
- Care provider’s need: Travel distance between facilities, reduced manpower for the healthcare needs, lacking specific skills need to be evaluated.

Care service plan

- Identification of services- This includes: expert obstetric services, management of neonatal and childhood illnesses, early detection of high risk pregnancies and neonates, mother and child nutrition, vaccinations
- Source of medical services- This includes: Accredited Social care Activists (ASHA), Telemedicine equipped First referral units.
- Mode of delivery of services-This includes EHRs, empowering primary health centers, community health centers and district hospitals.

Risk analysis and business development

This would include, all possible increases and decreases in cost, increase in revenue and risk assessment. It is recommended to evaluate the business plan prior to considering the technology. Plan to include communications to pregnant women and their families, primary nursing homes and specialty centers should be defined.

Planning for Technology

- Consider listing the priorities in Step 1 (Need Evaluation): Develop specification for the equipment- Include patient operation from home if applicable, obstetricians/nurses operations, report generation, performance quality. Personal digital assistants (PDAs) or smart phones can be used to alert registered parents regarding due immunization schedules or immunization campaigns for their children.

Training site staff

Operational trainings for remote physicians, nurses and patients should be conducted.

Technology testing

Perform a pilot program by limiting the number of patients and staff members. Pilot services can be provided in one or two clinics.
Evaluation

Evaluate patient, provider and organization centric outcomes can be done in the last step.

[3] PROPOSED FRAMEWORK FOR YOBE STATE HOSPITALS

In this section, we first describe the details of Yobe State Hospitals, man power (Health Practitioners) and current populations (Courtesy: Yobe State Ministry of Health and Research). Then we discuss the proposed framework for the implementation of Telemedicine for the Child and Maternal Health Care (CHMC).

Yobe State Health Care Centers at a Glance

Currently, the Yobe State is divided into 17 Local Government Area (LGA), having total population of 2,995,997 (in year 2013). An executive summary of health centers and manpower (Health Practitioners) is given in the following Tables I and II. Table III shows the human resource for the 12 secondary hospitals. Fig.1 depicts the human resource for the twelve (12) secondary hospitals.

Table I: Summary of Health Centers in Yobe State

<table>
<thead>
<tr>
<th>Health Centers</th>
<th>Present No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tertiary</td>
<td>1</td>
</tr>
<tr>
<td>Dispensary</td>
<td>234</td>
</tr>
<tr>
<td>General Hospitals (Secondary)</td>
<td>12</td>
</tr>
<tr>
<td>Child Health Centers</td>
<td>8</td>
</tr>
<tr>
<td>Health Center</td>
<td>47</td>
</tr>
<tr>
<td>Health Clinics</td>
<td>97</td>
</tr>
<tr>
<td>Health Post</td>
<td>56</td>
</tr>
<tr>
<td>Maternity Care Centers</td>
<td>47</td>
</tr>
<tr>
<td>Model PHC Centers</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>517</td>
</tr>
</tbody>
</table>
Table II: Summary of Man Power (Health Practitioners) in Yobe State

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Present No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors</td>
<td>56</td>
</tr>
<tr>
<td>Nurses</td>
<td>837</td>
</tr>
<tr>
<td>Midwives State Own</td>
<td>45</td>
</tr>
<tr>
<td>MSS Midwives</td>
<td>29</td>
</tr>
<tr>
<td>SURE-P Midwives</td>
<td>62 CHEWS-1 Nurses</td>
</tr>
</tbody>
</table>

Table III. Summary of Human Resource of the 12 Secondary Hospitals

<table>
<thead>
<tr>
<th>S/N</th>
<th>Total Population of the State (in year 2013)</th>
<th>Total Number of Doctors in the State</th>
<th>Average No. of people served per Doctor</th>
<th>Total No. Medical staff</th>
<th>Average No. of people served per Medical staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2995997</td>
<td>56</td>
<td>53499</td>
<td>632</td>
<td>4740</td>
</tr>
</tbody>
</table>

Total Population of the State = 2,995,997

Figure: 1. Present Human Resource for 12 Secondary Hospitals
From Fig. 1, it is clear that the Yobe State is seriously lacking in Doctors and other medical facilities. Table I shows that the state is having very less number of child and maternity health care centers with respect to the respective population of state. Hence introduction of Telemedicine can improve these health care facilities.

**Proposed Framework for CHMC**

In an effort to reduce existing maternal mortality rate and infant mortality rate, we want to develop a model involving Mother and Child Tracking system (MCTS). MCTS facilitates universal access to maternal and child health services. This system not only allows healthcare providers for efficient use of the technology, but, also enables empowerment of patients. Fig. 2 depicts the proposed framework for child and maternal health care system. Following are salient the features of the model:

- There are two centers: Referral Center and Nodal Center. Referral center is having different types of server, medical experts and same set of server and other level of expert are also there with Nodal Center.
- There are two ways in which patient can use the services of referral system. One way is to register through the nodal center and expert at nodal center will guide them. This is applicable for the patients living in rural areas and having less idea about technology. Other way is that the patient can connect themselves with referral system by using mobile, land line, personal computer to access the facilities in the nodal center. This is applicable for the patients having good idea of technology.
- The web based database application tool of CMHC permits real time entry of information related to pregnant women and children. Information can include maternal and child care services provided by or received, at any public or private care facility.
- The framework enables generation of a work plan for base level service in identification of high risk patients or those in need of specific services.
- Mobile based SMS technology is used to ease information exchange between policy makers, health managers and administrators at different tiers of health care delivery system.
- Pregnant women can register CMHC and can empower themselves with information on the best service required.
- Tracking scheduled services are also facilitated by CMHC framework.
- Information on scheduled vaccinations can be retrieved using this technology.
[4] CONCLUSION

Telemedicine has enormous benefits in the sector of health care. Various applications can be developed for the telemedicine to provide better services using ICT with combined effort of medical science. It can help to improve the quality of Child and Maternal Health Care (CMHC) in rural areas of Yobe State. From the facts presented in the above sections, we can see that the telemedicine will improve the health facility in rural areas. It also helps in providing expert opinion to the remote areas that are deprived of advanced medical facilities.
REFERENCES


