A Systematic analysis on the Telemedicine Services in Bangladesh

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Abstract – Bangladesh is small country with huge number of populations. The health system of Bangladesh is divided into mainly two sections: Urban and rural based. Most of the expert doctors are urban based with all the modern facilities. But for the poor people of Bangladesh, limited healthcare facilities are available. In this scenario, Telemedicine is the proper method to serve this huge number of peoples. This paper analyzes the Telemedicine models of Bangladesh, finds the potential difficulties faced by the models and proposes some standard recommendations for the Telemedicine in Bangladesh. Analysis of different Telemedicine models include the working procedure of the models, essential features of the models, block diagram based analysis and activity diagram of the models. Finally, authors believe that the findings of this study can be used for the development of Telemedicine in Bangladesh.

Keywords—telemedicine; crp; dghs; dab; sndp

I. INTRODUCTION

The healthcare facilities are one of the essential basic needs for the people of Bangladesh. The Ministry of Health and Family Welfare are the government body for the people related to their healthcare facilities, enhancement of initiatives, policy development and related activities. The ratio of patients and doctors are very high in Bangladesh. As a result, peoples are not getting proper healthcare services from doctors. In rural areas there are huge shortages of doctors. In Bangladesh, first Telemedicine services were started by Center for Rehabilitation of Paralyzed (CRP), Bangladesh in 1999 to deliver expert doctors opinion to local patients. This initiative is the pioneer telemedicine projects in Bangladesh. All other projects started upon the concepts on CRP projects. Time and cost can be reduced through Telemedicine consultation for rural patients [1], [2], [3]. Medical care facilities can be improved by using telemedicine services in rural [4], [5]. Tele-consultant can affect identification and cure in telemedicine [6].

II. MATERIALS AND METHODS

In order to carry out this study, the different Telemedicine initiatives of Bangladesh are searched from 1990 to 2015. After searching through Journal papers, conferences, books, magazines, related sites and databases the findings are given in the Results sections. The detail finding on the models and recommendations are given in the Discussions and Recommendations section. The summary of the study of Telemedicine projects of Bangladesh are given in the Conclusion section.

III. RESULTS

The first Telemedicine project in Bangladesh was found in 1999 [7]. This project was initiated by Center for Rehabilitation of Paralyzed (CRP), Savar, Dhaka, Bangladesh.

A. Model-1:

Center for Rehabilitation of Paralyzed is basically for spinal injured patients in Bangladesh. Telemedicine was made possible with the support of the Swinfen Charitable Trust in the UK. At present, 9 additional CRP sub-centers across Bangladesh are running by CRP and high quality services now given to persons with disabilities. CRP offers Telemedicine services for the both in-house and outside patients from 1999. The Telemedicine service is free for the in-house patients. The patients can get the expert doctors advice from UK with free of cost. The outdoor patients will have to pay a Telemedicine fees of Taka 1000 for getting this service. CRP uses telemedicine for patients who require a second opinion from consultants in the UK. CRP have access to consultants in the UK with a variety of specialties including from the Royal Hospital, Haslar, who very kindly agreed to provide consultation free of cost. Consultants within Bangladesh are invited to provide and receive Telemedical consultation for their patients through the telemedicine link at CRP.

Spinal cord injuries in-patients get 24 hours a day treatment from CRP. Treatment for the out-patients are open from 8.00 am to 5.00 pm expect Thursday. From the financial year report of 2013-14, it was found that 58,687 patients received out-patient treatment services from CRP [8]. The flowchart for the CRP hospital telemedicine activities are shown in the figure-1:
From the flowchart of the Telemedicine activities of CRP, we can see that the technology used in this project is store and forward based. Email based consultation was the main service category for the patients. It was also helpful for the local doctors of CRP to exchange their knowledge with the foreign doctors for any special cases.

B. Model-2:

Telemedicine Reference Center Limited (TRCL) started telemedicine project in the US Trade Show 2001 in Dhaka by using Icare software and normal internet connection. It started test-run of the system between the physicians of Bangladeshi and United States [7], [9].

C. Model-3:

Sustainable Development Network Program (SDNP) Bangladesh has four nodes which were started in January 2003. These nodes are connected through VSAT to satellite. TRCL can act both as service provider and solution provider. Consultancy and diagnostic support are given to the physician at the remote end through medical experts at the SDNP head office [10].

D. Model-4:

Store and forward based telemedicine service was started by Bangladesh University of Engineering & Technology (BUET) and Comfort Nursing Home in 2003. This pilot project continued for a certain period but due to some difficulties the project is not running [7], [9].

E. Model-5:

A pilot telemedicine project was launched by Bangladesh DNS diagnoses Centre, Gulshan-1 and Comfort Diagnoses & Nursing Home in 2004. This pilot project was stopped for the lack of proper publicity, financial and patient doctors disinterest [7], [9].

F. Model-6:

In order to access to quality healthcare and specialist doctors of Bangladesh from rural areas Diabetic Association of Bangladesh (DAB), Dhaka and Faridpur General Hospital started the pilot telemedicine project with the collaboration of Grameen Telecom in 2005. It was a real time consultation project. In some cases video conferencing system did not work properly, the quality of the images was not satisfactory, lack of dedicated bandwidth and finally the interest of the patients were not good [11], [12].

G. Model-7:

Mobile Maternal, Newborn, and Child Health (MNCH) and Telemedicine Services were started by BRAC, a leading Non Government Organization in Bangladesh for slum people. To improve the health status of the slum population, particularly women and children, BRAC initiated Manoshi project in 2007 at urban slums of nine city corporations around Bangladesh [13]. At present, this project is serving eleven city corporations. The Activity diagram of BRAC health project named Manoshi (MNCH Urban) is shown in the below Figure-2:

From the activity diagram, we can find the process of working the project Manoshi (MNCH urban) of BRAC. Shastho Sebeka and Shastho Kormi are the essential component of this project. Through them BRAC collects the slum people health data and store in the central server operated and maintained by BRAC for further health service delivery.

Mobile phone based telemedicine services are also offered to the slum peoples of Bangladesh through BRAC. In every delivery center, there are paramedics who give the health services to the slum peoples. Users can also get Telemedicine services through call center where there are panels of doctors whose are ready to address the patients problem. Doctors give the suggestions or treatment to the caller after hearing the disease details. For fruitful Telemedicine consultation, a conference is also arranged with the Shastho Kormis or Program Organizer and Doctor for the treatment of the patients. Hospitalization is also made to the nearest one
through this conference, if the patient’s condition becomes critical. The Telemedicine services offered by BRAC are shown in the activity diagram of Figure-3:

![Activity Diagram](image)

**Fig. 3.** Telemedicine services offered by BRAC

**H. Model-8:**

Medinova hospital is operating Telemedicine service from 2006 to till now [7]. This hospital has MoU with the Apollo Hospitals India for offering Telemedicine services to the people of Bangladesh. Doctors from different categories of Medinova Hospitals are engaged with the Apollo hospitals for Telemedicine service. The second or third visit with the expert doctors are made through the Telemedicine services offered by Medinova hospitals for the first time visit patients in India. The flowchart of Medinova hospital Telemedicine service is depicted in the following figure-4:

![Flowchart](image)

**Fig. 4.** Flowchart of Telemedicine Service in Medinova Hospital

The flowchart of Medinova hospital shows the overall working activities of Medinova hospital telemedicine process. Patients will have to pay USD 1000 as the fees for the service. Through this service, a patient now is getting the services from the Indian Apollo hospitals doctors without going to India.

**I. Model-9:**

Grameenphone limited launched a 24 hours health line service to all of its subscribers called “HealthLine Dial 789”. Subscribers can make a voice and video call to the licensed physician at the time of their emergency and non-emergency time. An SMS based report delivery service is also attached with this service [14].

**J. Model-10:**

Ministry of Health, Bangladesh implemented mobile phone based health services for the general people of Bangladesh in 2009. One mobile phone was given to all Upazilla and District level hospital doctors for the use of mhealth service. It was open 24 hours and 7 days. Citizens can make a phone call to the doctors of Upazilla and District hospitals and get the medical advice from them [15].

**K. Model-11:**

Telemedicine Service in Union Information & Service Centers was introduced by Access to Information project, Bangladesh in 2010. Expert doctors sitting in the MIS office delivering the health advices to UISCs every day. Through videoconferencing technology, rural people are getting medical care without going to the urban areas [16].

**L. Model-12:**

Aponjon mHealth service was started in Bangladesh by USAID in 2011 with a view to contribute to reduction in maternal and neonatal mortality. Now Aponjon is a health information service using mobile phones to improve health outcomes in Bangladesh. This service was launched in national wide in 2013 in Bangladesh. In order to give service to its receiver, customer service center is introduced for the subscribers and to entry subscribers, answer to the queries of the people and receive complains [17].

**M. Model-13:**

Grameen Phone in corporation with the Ministry of ICT, Bangladesh has started the Telemedicine services at Jessore District in 2013. Peoples of Jessore are getting the health services with the payment of only BDT 200 or 300 from the expert doctors. This process reduces the travel cost and time for patients [18].

**N. Model-14:**

Government of Bangladesh has implemented Telemedicine services with the help of Ministry of Health and Family Welfare. Initially the service was limited to 8 Government specialized hospitals only [19]. At present 78 hospitals are operating this project. But Government of Bangladesh will expand this project phase wise at the Upazilla level. All Upazilla health complexes will be under the coverage of telemedicine services. In this process, health services will be available to the rural people of Bangladesh. At present Government Medical Colleges, District Hospitals and Specialized hospitals are the Telemedicine service providers and selected Upazilla health complexes are the Telemedicine
service receivers. The hardware organization of this project is shown in the figure 5:

![Hardware Organization of a Government Telemedicine Center](image)

When any outdoor patient is come to the hospital for telemedicine services, he/she will have to buy a ticket from ticket counter with the payment of only 3 taka. Doctors referred the telemedicine patients to the Telemedicine center for the expert opinion. The service engineer checks the doctor’s referral documents and selects the patient’s disease category. He has a Telemedicine service schedule prepared previously from the corresponding service provider. After examining the schedule, a date and time is fixed for the consultation. At the time of consultation, local hospital doctor, patient, service engineer and expert doctors are present in the conference. Local doctors collect the patient’s history manually and record the other health information. There is a Remote Medical Diagnostic device which is used at the time of consultation to send the patient information directly to the expert doctors. At present five vital human body signals like ECG signal, Temperature, Stethoscope, BP and SPO2 signal can be sent and monitored both in service provider and service receiver’s monitor for live presentation. After a live discussion with the patient and others, a prescription is prepared in the remote center which is given to the patient. The prescription is saved with the patient ID and token number. This ID and token number is used in future for the findings of the history of the patients.

IV. DISCUSSIONS AND RECOMMENDATIONS

This paper presents and analyzes the Telemedicine initiative of Bangladesh. From the analysis, we came to know that most of the initiatives were in project basis. But the present Government of Bangladesh took the Telemedicine project as a priority basis and enhancing the project phase wise. The details finding are given in the following Table I and Table II:

From the study conducted by Lal B Rawal and others, we came to know that no extra benefits are given for health workers who work in rural areas. As a result, no one wants to stay in rural areas for a long time and satisfactorily engage in the treatment of huge number of rural patients [20]. Telemedicine can play a vital role in these types of cases.

**TABLE I: SUMMARY OF THE FIRST SEVEN TELEMEDICINE PROJECTS OF BANGLADESH**

<table>
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<tr>
<th>Model Name</th>
<th>Findings</th>
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| CRP        | 1. Uses store and forward based Telemedicine  
2. Digital camera is used for capturing images  
3. No real time technology is used  
4. Indoor patients are free for Telemedicine and outdoor patients need 1000 taka for consultation.  
5. No storage for patient data. |
| TRCL       | 1. Telemedicine services between Bangladeshi physicians and United States.  
2. Used Icare software  
3. Internet is used for the service. |
| SNDP       | 1. VSAT is used for this project  
2. Connected different nodes of Bangladesh.  
3. Different consultancy and diagnostic support are given |
| BUET and Comfort Nursing Home | 1. Uses store and forward based Telemedicine  
2. This project was running for short period of time. |
| Bangladesh DNS diagnoses Centre, and Comfort Diagnoses & Nursing Home | 1. This project was discontinuous for financial reasons  
2. Lack of promotional activities found  
3. Patient disinterest also observed |
| DAB and Faridpur General Hospital | 1. Hardware failure was found in this project  
2. Internet connection was disrupted  
3. Power failure was frequent  
4. Performance of the camera used was not satisfactory  
5. Radio link was used for Internet connectivity  
6. 600 taka was the fees for consultation |
| BRAC MNCH  | 1. Slum people are the beneficiary of this project  
2. Patient data is stored in the BRAC data center for further use and treatment plan  
3. Limited cost for the service  
4. Android phone is used for the information entry and update |
From the findings of the Telemedicine models of Bangladesh, we can conclude that different initiatives were taken for the development of Telemedicine in Bangladesh. The initiatives taken from 1990’s to early 2000 were all store and forward basis. This process was time consuming and patients will have to wait for the treatment. The recent initiatives from both Government and Private hospitals are real time based through video conferencing.

The most challenging issues for the Telemedicine projects are connectivity issue. Stable internet connectivity is must for smooth telemedicine. Minimum 2 Mbps dedicated internet connectivity is must for Telemedicine. But these requirements are not ensured in most of the projects. Sometimes internet connection was disrupted at the time of consultation. Considering this, Bangladesh Government is expanding the country wide internet connectivity to all union level.

The study conducted by Emmanuel Kwame Darkwa and others in 2015 shows that the living status in rural areas is very poor. High regulations of Doctors and Nurses are found in rural areas for the lack of facilities. Most of the Doctors are urban based. As a result, healthcare system of rural areas is greatly hampered in Bangladesh [21]. Considering the recent study, this paper recommends to give allowance to the rural people of Bangladesh. Authors expect that the results and the health professionals whose are involved in the Telemedicine system. We believe that this system makes them more attentive and effective for the delivery of health care.

From the paper written by Sherwin I. DeSouza and others in 2014, we can find that 99% respondents want to receive health-related information on their mobile phones. This survey indicated that the mobile phone is used for communicating health information in India [22].

In most of the Telemedicine projects implemented in Bangladesh are lack of data storage facilities and there are no standard formats of patient data. Different models use different format of data. As a result, interoperability of data is not possible within hospitals. So our study suggests a uniform format patient data for the global use. A policy should be developed under the guideline of the experts from both Government and Non Government organizations.

The hardware used in Telemedicine projects is different from one model to another. Most of the models use analog hardware to measure vital information of patients. Government projects use Remote Medical Diagnosis Instrument to measure maximum five vital signs. So our study recommends to develop a different tools to measure the vital human signals which can be easily transferred to remote doctors and database for the quick delivery of patient treatment.

From our study, we can find that the operating cost of Telemedicine is also different. Most of our rural people are very poor. They are now living under the poverty line. So our study recommends fixing this cost minimum so that poor people can afford the cost and use the system.

Most of the Telemedicine projects in Bangladesh work well for a certain period of time. Our study found that the lack of publicity and users acceptance is the main reason for the failure of these projects. So this paper suggests for taking proper steps and necessary publicity policy for the wide use of the Telemedicine services in our country.

At present Government Telemedicine project that is running in the government hospitals are the largest projects in Bangladesh. According to the plan of Government, this project will be expanded to all the Upazilla level. Our study suggests of storing the patient data in a central database which can be accessed from any platform by following a standard protocol. The vital human body signal collections tools should be developed in such a way to collect more vital signs at a time in a cost effective way.

V. CONCLUSION

This paper studies the past and ongoing telemedicine services of Bangladesh. From the analysis of the models, we have shown the important characteristics of the projects. The difficulties of the models are critically found and the recommendations are given based on them. The government of Bangladesh has taken massive plan to introduce Telemedicine in both private and public sector for the rural people of Bangladesh. Authors expect that the results and the

<table>
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| **Medinova Hospital** | 1. Use customized software for the storage of patient data and management  
2. The cost of the service is $1000  
3. Real time video conferencing is used in this project |
| **HealthLine Dial 789** | 1. Grameenphone used this service as Mobile based  
2. SMS based lab report delivery service is also used |
| **mHealth by Ministry of Health** | 1. Mobile phone is used as the consultancy purpose of District and Upazilla level people at any time round the clock. |
| **Access to Information project** | 1. Laptop is used for Telemedicine  
2. Wireless modem is used for Internet connection  
3. Video conferencing is used in this project |
| **Aponjon mHealth** | 1. This service is mhealth based  
2. This service is now Nationwide in Bangladesh |
| **Ministry of ICT and Grameenphone project at Jessore** | 1. TIMES and DICOT is used for consultancy and record keeping purpose  
2. Taka 200 to 300 is required for the registration of patients to get services from this project |
| **Ministry of Health and Family Welfare** | 1. Largest telemedicine service provider in Bangladesh  
2. 78 centers are now running through this project  
3. Real time technology is now used  
4. No central storage for patients data  
5. Hardware failure is seen in some centers  
6. Connectivity and power failure is frequent in remote areas |
proposed recommendations of the study will help the researchers and policy makers for the further development of standard telemedicine model in Bangladesh.

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