

# **Advancement of Information System in the Health Sphere in Rural-Urban Areas of Developing Countries: A Case Study of Bangladesh**

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**Abstract:** With the proliferation of innovative technologies and swift development of applied science, many life easing amenities are being developed that has brought about a remarkable, dramatic and unprecedented change in all sectors of life including health, education, agriculture, commerce, defense and so on. Now a days application of information and communication system in health sector has become one of most talked topics and field of interest to the health researchers to explore new ways and method of health and to make health facility more economical. Basically information and communication system refers to the context that includes different technological devices and associated services like video conferencing, distance learning etc. These technological resources and new findings are being deployed in health informatics or Health Information System (HIS) which refers to a system that collect, stores, manages or transmits information related to the health of individuals or the activities of organizations that work within the health sector [1]. This is related with routine information systems, laboratory information system, disease surveillance systems, hospital patient administration systems (PAS) and human resource management information systems (HRMIS). Health informatics has gained noteworthy success in the last few decades in health sphere. But it is the irony of fate that, developing countries (Bangladesh, Nepal, Kenya, Africa and so on) are still lagging behind in deploying health informatics for want of proper guidelines, research and concern. So both rural and urban people of those countries are deprived of modern health amenities. Rather sometimes the cost is too exorbitant to pay for the people of underdeveloped countries. But the good news is that the betterment of this situation is being observed and the advancement of information system in the health sphere in rural-urban areas of these developing countries is now conspicuous. So my research will emphasize on the proper application of the Health Informatics System in the health sector of developing countries e.g. Bangladesh and expediting this process for the rapid advancement of information system in health arena.

**Keyword:** HIS, MAMA, Mhealth, Telemedicine.

## **I. INTRODUCTION**

Bangladesh is very rising country in the perspective of ICT, i.e. telecommunication, out sourcing of software and many more. But e-health yet to run a long way to touch an up to the mark level to convey its service towards the people of all stage. In Bangladesh several initiatives have been taken so far, during 4 to 6 March 2010, MIS-Health participated in the digital innovation Fair 2009 organized by the Access to Information (A2I) [23] program of the Prime Minister's office. While many spectators visited and admired the e-Health services of MIS-Health, he most encouraging thing was the appreciation by the Honorable Prime Minister Sheikh Hasina for the achievements in HIS and e-Health toward building Digital Bangladesh. On March 2 and 3, 2010, [23] the MIS-Health demonstrated its video conferencing, mobile phone health service and rural telemedicine system o the visiting ITU (International Telecommunication Union)

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Secretary General Dr Hamadoun Ibrahim Toure. The MIS-Health hosted a web-searchable database of the health facility through a website [24] [www.dghs.gov.bd](http://www.dghs.gov.bd). All health facilities have been included in this database. Several humanitarian schemes have been introduced in the last few years in digital Bangladesh, for instance- health Suggestion via cell phone, Tele-medicine, complain and suggestion via SMS, health scheme brought a total success which is a gesture of out further toil and effort in health informatics. At present there are three major MIS modules [ref s] under the Ministry of Health and Family Welfare in Bangladesh with very limited connection among them. These relate to Health, Family Planning and Nutrition programs. The progress and advancement [23] of health information system in most of the developing countries is very pathetic and miserable which is not new. Over the years, many countries did not pay much attention on I and patrons put effort mostly on ad-hoc national surveys [23], and other estimates that satisfied the global community but which was not fruitful in the long run. The last few years have decided to employ decentralization, performance-based resource allocation, as well as unprecedented demand for MDG –related health information.

## II. OBJECTIVE

Developed countries have already touched the peak. They are now fully fertilized and optimized in implementing the information system in health sector to attain a significant and praiseworthy success. Indeed, their research, exertion, forwardness, and zeal have conveyed them to the acme. On contrary the developing countries still too far behind to do so. But emergent initiatives are being taken to bring about a commendable change in health sectors. In Bangladesh perspective, applaud able advancement is noticed in health sector [2]. But these are sometimes inconsistent to be effective. According to the health service statistics, one of four people who are the health care seekers go to public health facilities [3]. Others go to non public because they fear of losing their information for want of proper facilitation of HIS. This trend is more acute in rural areas because Information system is not well figured and economical due to proper management. So the components of HIS [4] such as HIS resources, indicators, data sources, data management, information products, dissemination and use must be strengthen systematically. So the objectives to be attempted to achieve are to ensure the safest patient care by exhibiting data in required place as well as obtaining data when produced by electronic system, to discover the most auspicious way to attain an economical health care through the use of Information System, to evolve and expedite the distance health support, to promote faith and confidence over public those who are very much infrequent to use information system for health service. Though achievement of these objectives will mostly be aspiring and challenging for a developing country like Bangladesh but it may be attained through consistent, planned and motivating steps.

## III. LITERATURE REVIEW

Pragmatically, information system is not a part rather it's a whole which can be inferred from various researches, journals, books and authors comments. To enable the information system to be efficacious in the field of health, pellucid cognition as well as actual associations among the various parts of information system are the prerequisites. As the meaning of "Information System" and related nomenclatures has been growing in diversity and complexity [5], it will be merely inexpedient to leave its explanation remain questionable and vague.

### Information System (IS):

Information is a terminology from which data can be retrieved [6]. IS refers to the arrangement of interconnected components that collects, assembles, processes and propagate data [7]. **Jean-Paul Van Belle**, professor of **information technology** and director at the Centre for Information Technology and National Development in Africa at the **University of Cape Town**, narrated that Information System does not necessarily solely mean use of computer rather it is a best use of computer technology in several fields and to achieve several goals and requirements whose functions are incorporated with Inputs, Transformation Process and Outputs [8]. After scrutinizing the inconsistencies, existing hypothesis, phenomena and framework **Eli Cohen (1999)** proposed that **Information System** comprises of three components, an **informing environment**, a **delivery system** and a **task completion system** and he considered it as **Informing Science(1999)** [9]. So the information system is a discipline that may enable the human being to interpret

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the data object so that other can attain some knowledge from it. But it does not clarify the relationship between knowledge and information [10] which was not supported by Solberg et al. He stated that

*"The systematic process of developing requirements through an iterative co-operative process of analyzing the problem, documenting the resulting observations in a variety of representation formats and checking the accuracy of the understanding gained."* [11]

Though there are some subtle mismatches in different views, everyone indicates to an equilibrium point. Hence, it can be inferred that Information System is a term which is related with both technologies and human resources and functions as bridge among different types of decision at different level which will gather, organize and disseminate data.

### Health Information System (HIS):

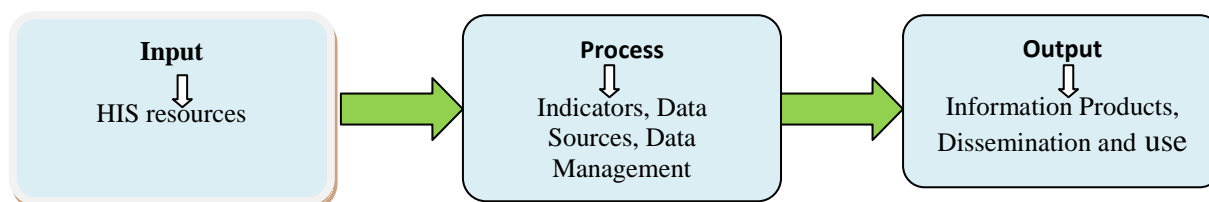
Health Information system or Health Informatics is an interdisciplinary field which is a set of subprogram and components with the target that will facilitate and ameliorate the health care facility. It's a coalescence of **information science, computer science, social science, behavioral science and health care**. [10]. Adoption of Information and communication technology has become ineluctable in health sector. Its application has been characterized through a sequence of stage which has germinated in 1960 [12]. It has colligated several field including information, technology and the assorting processes to avail the information, to track the changing information, to determine the necessary information and to make the information apprehensible and organized for enhancing its re-usability. So for implementing HIS successfully data must be well timed and reliable otherwise the attempt of implementing HIS will be futile if the available data are outdated. But only the collection of changeable and chronological data is not going to make the HIS productive. It must have valid information and to discover the difficulties and demands. Moreover, there should be a strong surveillance and response system which serves as a key component of HIS where the countries can observe, evaluate, and react immediately to public health events based on the accumulated data [13][14]. The process of collecting such generative data sometimes gets hindered due to financial constraint, lack of expertise with demographic, biomedical and public health knowledge. This is why, there is a seldom effort to make the data effective to make it perceivable to the policy maker, frontline health workers, non-health specialists or the public [13]. This sometimes generates a misconception among the people that **HIS** is vague, isolated and conflicting.

According to the **Health Metrics Network (HMN)** a standard **Health Information System (HIS)** must have the following six components [15]

- HIS resources
- Indicators
- Data Sources
- Data Management
- Information Products
- Dissemination and use

These five components of HIS is subdivided into three section

- **Input** (HIS resources)
- **Process** (Indicators, Data Sources, Data Management)
- **Output** (Information Products, Dissemination and use)



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**HIS resource:** Resources includes everything from stuffs to computer. Formally, HIS resources are legislative, regulatory and planning frameworks. Apparently, to make **HIS** to function exhaustively, resources including the personnel, financing, logistics support, and Information and communication technology are required [16]. Hence, resources play a cardinal role for the development of a successful **HIS**.

**Indicators:** Indicators are the factors to determine status of the **Health**, Changing trends of health system and Health Information System. **United Nations High Commission for Refugees (UNHCR)** has promulgated 110 indicators for assessing health care system [16][17]. It has divided 110 indicators into 10 sections including **Population, Mortality, Morbidity, IPD &Referral, Laboratory, Disease Control, EPI, Nutrition, Reproductive Health, and HIV/AIDS**. On the other hand **World Health Organization (WHO)** has published **118** health indicators for determining health status among them WHO has provided definition and method of estimation of 40 kernel indicators in 2013 [18].

**Data sources:** Information is formed with data and to make Health Information System efficacious, selection of data source ought to be cautious so that bona fide, reliable, credible and veritable data can be attained. Sources of data can be public and private. In public sector, **Ministry of Health** and **National Statistics Bureau** can be the reliable public source of data. Besides, donors and development partners such as multilateral and bilateral agencies; NGOs, academic institutions, Medical Institutions, professional associations can be regarded as credible sources of health data.

**Data Management:** Data Management is a crucial part of Health Information System (HIS) because data redundancy is inescapable during the collection of data which can besmirch and obfuscate the valuable data. So, management of vast collection of data acts as significant constituent of **HIS**. During management of data, facts regarding minimizing redundancy, data simplification, removing obfuscation, data integration, data precision and other dribbling tasks must be taken into account for the successful processing to produce operable and lucid information.

**Information product:** Data are the raw materials and primarily, it is difficult to infer and estimate anything from vast amount of data. So data must be analyzed and well dealt so that it produces information. Information product is necessary for making perception on past, present and future trend of health condition. So the process of making data into knowledge must be done guardedly so that any single portion of data does not misadvise. According to **Health Metric Network (HMN)**, in spite of having **rich data**, information are poor due to reluctance and lack of proper consciousness and management of data and this indisposition is ordinarily originated from the notion that data can be used straightaway without following any delineated process [13]. Transforming data into information does not necessarily mean to form data into very high caliber data that can also mislead general populace and decision maker rather it must be legible, well organized, articulated and without any vague and flaw.

**Dissemination and use:** Dissemination is the dispersion of data through determined route using aforethought schemes to the mass population, decision makers, public health and clinical practice audiences. One point ought to be cleared that Dissemination is not diffusion rather it is formal and defined process for knowledge spreading purpose [19]. The strategies of dissemination involve encapsulating the information and using diverse channels to reach the target audiences within or across geographical location [20]. **International Monetary Fund (IMF)** has provided a comprehensive standard of dissemination [21].

After dissemination data should be used for making decisions. In this phase some problems arise due to various orthodoxy, lack of peripheral levels, consciousness and analytical capability. However, it is important to plug in data with its use that can also help the personnel related with the task of collecting of data because the use of health data are not bounded to only the health community and related organization rather it necessarily includes wider community. Dissemination and use are complementary with one another. Dissemination will be successful only when wider community and diverse society will be benefited with the use of data.

**Telemedicine:** Telemedicine is a terminology refers to the employing telecommunication and information technology in the field of health care service. Telemedicine is being used for screening, diagnosing and monitoring different types

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of diseases. To cope up with the modernistic world, to diminish the patients waiting lists, to deflect the distance barriers, to response instantaneously in clinics, to make the health service economical, to facilitate the people living in isolated communities and remote regions and to extinguish the overcrowd in clinics, hospitals, and other health centers, the requisition of telemedicine has become inevitable. This method enables the patient and the staff to communicate with both comfort and fidelity moreover facilitates by airing medical, imaging and health informatics data [22].

Telemedicine has several modes including

- Store and Forward
- Real Time
- Remote Patient Monitoring (RPM)
- 

**Store and forward:** Here medical information such as medical images, bio signals are sent to the medical specialist who will evaluate these information at different time. This type of telemedicine can be considered as asynchronous where the doctor and the patient or the both parties do not have to present at the same time. Disease regarding Dermatology, radiology, and pathology can be assessed and monitor

**Real Time:** Real time mode is highly interactive. It requires the availability of both the doctor and patient so this mode is considered as synchronous. Videoconferencing instruments are used in real time mode where the necessary peripheral devices are connected with the videoconferencing tools for the purpose of interactional service. Real time telemedicine covers the following fields [22]

- Tele-audiology
- Telecardiology
- Teledentistry
- Telebehavioral Health—includes telepsychiatry
- Telehomecare
- Teleneurology
- Telenursing
- Teleradiology
- Telerehabilitation

**Remote Patient Monitoring:** In this scheme, the patient information is feed to the system through sensor devices and send to an external monitoring center. This scheme can be done in either Real time mode or Store and Forward Mode where first the data will be stored and then it will be forwarded.

RPM generally covers the following schemes [22]

- Home-based nocturnal dialysis
- Cardiac and multi-parameter monitoring of remote ICUs
- Disease management including COPD, Chronic Heart Failure, Diabetes, Coagulation, Arthritis, Depression, Obesity

## IV. FINDINGS

Emerging technologies are being used in health sphere extensively in developed countries making them adept in effective health management as well as helping developing countries to get rid of their traditional health system that has been carrying on over centuries. But it is irony of fact that, sometimes technology acts against us if we fail to use them appropriately which costs a lot and we have to pay to a great extent. Moreover due to lack of researches, proper screening, implementation and functioning HIS may be blamed and caused to halt its progress in both practical and academic field. For an instance, German academic medical centers faced such situation and three medical informatics department were shut in 2008 and 2009 respectively [26]. Furthermore there are lot of examples of security breach or hacking medical health equipment of network depended health system and devices which were accessed by the

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intruders and caused to manipulation of the whole medication system. Targeting this propensity and the feasibility of implementing several new technologies in the health sector in Bangladesh, our findings will be followed by phases mentioned below.

- Health infrastructure in Bangladesh.
- Current contribution and methods of ICT in health sectors in Bangladesh.
- Major obstacles for the new technologies to put into effect exhaustively.
- Feasibility study of adopting new technologies those are used in developed countries in Bangladesh.
- Propose new system.
- Current contribution, methods and drawbacks of ICT in health sectors in Bangladesh.

## Health infrastructure of Bangladesh:

Health sector in Bangladesh is always a field of importance to all governments of Bangladesh and all government put their best effort to make this sphere efficient. Different steps have been taken and effective steps are still being taken to make health service easier and comfortable for the people of Bangladesh.

Sector-Wide approaches widely known as SWAPs is one of the most effective steps promoted by World Bank in the late 80s mainly in third world country including Africa -Ghana, Zambia, Uganda, Mozambique, Sierra Leone, Tanzania, Senegal, Mali, Burkina Faso and in Asia -Bangladesh, Pakistan, Vietnam, Cambodia, Egypt and Yemen [37] aiming at the betterment of the people's health and integrating all sectors in a country to follow a common sector protocol for expediting the implementation of human development objectives. Secondly, The initial Health and Population Sector Program (HPSP) was initialized in 1998 and substituted by The initial Health and Population Sector Program (HPSP) in 2003[38].

To make health services more closely to people especially in rural areas Bangladesh Government constructed community clinic for every 6000 population 2001[38].

## Health workforce in Bangladesh:

Bangladesh is trying to meet the necessary workforce in health sector for satisfying the need of people. According to recent record the health workforce of Bangladesh is depicted below [39]:

- Bangladesh Government has built up 3375 Union Health and Family Welfare Center (UHFWC) for ensuring health service for rural people.
- Bangladesh has total 397 Universal Health Coverage(UHC) with 31-50 bed whose aim is to provide health services only those who are in need nor those who can pay for it that is its goal is to provide health service to the people in need without being the cause of suffering for them while paying for those services.
- Number of district level hospitals is 80
- Government medical college hospitals – 13
- Postgraduate hospitals – 6
- Specialized hospitals – 25
- Doctor to population ratio – 1:4,719
- Nurse to population ratio – 1:8,226
- Hospital beds – 51648 (over 30000 in GOB)

## Emergent of ICT in health sectors in Bangladesh.

Facts that drive the ICT to be implemented in Bangladeshi health sphere is its dense population of approximately 150 million. But the number of hospitals in comparison with population is badly insufficient. The ratio of bed to citizen is around 1:2900. Moreover in rural areas, the hospitals are poorly equipped. Furthermore, adept doctors feel themselves detached because they receive less facility for providing better treatment to the patients and less materials for continuing research work. That's why they convey their unwillingness to serve those places. Considering these issues and to cope up with the developed countries the ICT has implemented in health sectors so that, even people from remote areas may get modern healthcare.

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As a third world country though Bangladesh is lagged behind for implementing ICT in health sector in some extent compared to the developed countries but the contribution that has been made is laudable. Both in urban and rural areas are now being covered by e-health service. Though, it is ironically true that rural areas are always deprived from better health services in comparison with urban areas, but now rural areas are being served through regular basis. Bangladeshi health sector is now blessed with several ICT depended methods and applications such telemedicine, e-health, telehealth and real time web enabled systems that make health service more convenient and available.

Though many community clinics, health care centers, has been build in several places including rural and urban areas as depicted above, most of them previously were left unused due to lack of management, efficient trained IT based workforce and connectivity. But within a very short period of time Bangladesh made it possible to bring its entire districts under wireless connectivity. As it is rapidly strengthening its IT infrastructure, it is rapidly implementing ICT in health sector. Starting from 1997 to now on, 64 districts are covered with wireless technology with a great pace.

## V. METHODOLOGY

United States of America is one of the giant developed countries that puts enormous emphasize on health information system. As it is strengthening its health informatics sector day by day, the yearly savings it gains is approximately \$77 billion<sup>[27]</sup>. On the one hand efficiency in health information system contributes to health and safety benefit and on the other hand it foreshortens malady and extends the span of life. But sometimes many hospitals are unaware of the possible threat associated with the devices used for treatment. Some of the major health informatics are shown in the tabular form along with their success rate and possible risk. In our findings, we will show the detail contribution, response and benefit of the people and future planning of each of the ICT based health service.

### Telemedicine:

In Bangladesh, basically telemedicine is aimed to undertake the shortage of doctors in rural areas. It is process where the patients have the access to the beneficial medical advice through communication technology such as the internet, email, telephone and transmission of video or audio images or may be live teleconferencing.

In Bangladesh telemedicine was first installed in 1999 at Center for Rehabilitation of Paralyzed (CRP) at Savar with the accompaniment of [Swinfen Charitable Trust](#) in the UK where consultants from UK Royal Hospital, Haslar hospital consult free of cost in Bangladesh [35].

Presently, in Bangladesh, telemedicine includes the following fields of treatment [35]

- ENT (Ear, Nose and Throat)
- General Surgery
- Histopathology
- Nephrology
- Neurology
- Obstetrics and Gynaecology
- Occupational Therapy
- Ophthalmology
- Paediatrics
- Physiotherapy
- Plastic Surgery
- Radiology
- Rheumatology
- Spinal and Orthopaedic Surgery
- Urology

Bangladesh has 64 districts and currently 45 districts are now under telemedicine service. Five hospitals — Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka Medical College and Hospital (DMCH), Cancer Hospital, National Institute of Kidney Diseases & Urology (NIKDU) and Shaheed Suhrawardy Medical College

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Hospital — are now providing the telecommunication services to rural people[36]. Currently in Bangladesh there are 43 telemedicine center covering 4500 unions in Bangladesh those are connected with high speed broadband internet and well equipped with telemedicine instrument.

### Timeline of telemedicine at a glance[42]:

**1999:** Establishment of email based telemedicine for the first time by Swifine charitable making a link between Rehabilitation of the Paralyzed (CRP) in Dhaka and Royal Navy Hospital, UK.

**July 1999:** Telemedicine Reference Center Limited (TRCL) privately with co-operation of Bangladesh government initiated the process of feasibility study for the establishment of telemedicine in urban-rural areas.

**Mid-2000:** Grameenphone inducts telehealth facility in rural areas.

**2001:** Exhibition of telemedicine system using Icare software in 2001 US trade show, Dhaka.

**April, 2001:** Formation of Bangladesh telemedicine Association (BTA).

**January, 2003:** Sustainable Development Network Program (SDNP) commence with two network segments using point to point radio with bi-directional bandwidth of 2mbps.

**2003:** Commencement of telemedicine project by Bangladesh University of Engineering and Technology (BUET) with the financial co-operation from European Union (EU).

**May, 2004:** DNS diagnoses Centre, Gulshan-1 and Comfort Diagnoses & Nursing Home's started a Telemedicine centre.

**2005:** Starting of telemedicine services by Grameen Telecom (GTC) in co-operation with Diabetic Association of Bangladesh.

**November, 2007:** "ICT rural Bangladesh" with the financial help from SPIDER (The Swedish Program for ICT in Developing Regions) with the goal of improving the performance of the rural health care worker and increase the accessibility of the rural poor people in the modern health care services specially in Magura, Bangladesh.

Plan: Method one by one hospital, organization's (telemedicine process), future plan in one contact number.

### Contribution of telecommunication industry of Bangladesh in telemedicine:

Grameenphone, one of the biggest leading telecommunication industries in Bangladesh has launched a project to facilitate the underprivileged patients of urban-rural areas to provide telemedicine service.

In 2007, Telemedicine Reference Center Ltd and Grameenphone have started a unique GSM based Mhealth service "HealthLine Dial 789"[42]. Facilities it includes are

- Medical Information Facility
- SMS based LAB report
- Ambulance

Furthermore, Grameenphone undertaking their telemedicine service using a newly invented device name DICOT (Digital Imaging and Communication for Telemedicine) which is developed by Telemedicine working group of Bangladesh and which is managed by TIMES (Telemedicine Information, Management and Education system) which works as a framework for scheduling appointment, keeping patients record and billing information, generating prescription for patients and secures the exchange of information between provider and receiver. DICOT is easy to handle and has ability to send patient's information to the consultant.

The device includes:

- A general examination camera.



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- Electronic Stethoscope.
- Sphygmomanometer.
- Clinical data (images, body sounds, report, X-ray, ECG, prescriptions) transmission equipment.

## **MAMA “Aponjon” mHealth project:**

Mobile Alliance for Maternal Action (MAMA) set in motion in Bangladesh in May, 2011 by The United State Agency for International Development with the goal of decreasing the maternal and neonatal death by providing health education message to the pregnant women. Dnet, a Bangladeshi digital content developer for mobile apps and games initialed MAMA in association with Bangladesh Ministry of Health and Family Welfare (MoH&FW) and Ministry of Information and operating in the name of Aponjon [40].

At the preliminary phase Aponjon get itself collaborated with five BRAC, NHSDP, MaMoni, UIISC and Infolady Social Enterprise.

In this mHealth project, the individuals have to be subscribed by calling at 16227 or sending text message in Aponjon Customer Call Center. Besides, Dnet engaged 47 trained Community Health Workers for assisting in registration to Aponjon. After the completion of registration process with Aponjon, users receive two messages per week in the form of text or voice depending on the choice of the user. Currently Aponjon has One Million (100000) subscriber.

## **Aponjon service feature [41]**

### **Service Features**

The services of Aponjon are divided in two parts:

#### **1. Information during your pregnancy**

- 2 health messages (voice or SMS) per week, for 37 weeks of pregnancy.
- Messages start from 6th week of pregnancy and continues till to 42 weeks of pregnancy or till the baby is born

#### **2. Information for the new mother**

- 2 health messages (voice or SMS) per week for 52 weeks
- Messages start from baby's birth till your baby is 1 year old

In addition, one family member (your husband or parent or parent in-law) can get 1 health-message (voice or SMS) per week along with the expecting mother/new mother.

### **Service Charge**

- Registration through SMS is free
- Call us for registration and we will call you back: To minimize your cost of registration once you call us on 16227 and let us know that you would like to register, our customer care agent will disconnect your call and we will call you back right away. Thus registration through Call Center is almost free!
- Voice (IVR) charge : Tk 2.00 (+vat) per message
- SMS charge : Tk 2.00 (+vat) per sms

Sample message from Aponjon (It is an audio message in Bengali language written in text in English): “You are running 32 weeks of pregnancy. This your doctor(Daktar Apa) speaking. The breast milk is the best food for your baby. The first milk you make is very thick and creamy colored. It is called colostrums. It will help your baby grow strong and keep disease away. You should start breastfeeding within in an hour of birth. At this stage, some people may tell you that you should give the baby some little honey to the child after being born. Honey, Ghee, or oil can be harmful for the baby at this time. Breast milk contains all the nutrients necessary for a baby to grow. The baby does not need anything other than breast milk for the first six (6) months. There are several danger signs that may present during child birth. Next week I will tell you about them in detail. Aponjon will be right beside you.”

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## **E-health:**

Health care centers are now configured with several automated software. IBM Health Integration is one of them which helps to accomplish the task of storing patients information, disease management, compliance and research based on patients chronological data and provides up to date information on demand.

## **Problems associated with current methods:**

It is undoubtedly agreeable that ICT has tremendous impact for upbrining the health services in developed as well as in developing countries of health sectors. The constant development and implementation of ICT in health sector also results in socio-economic development in Bangladesh. But there are some problems and bugs associated with these ICT based health technologies, by detecting and removing those, these current methods and system may be implemented in more effective manner. In this section problems associated with current ICT based health technologies will be depicted.

## **Telemedicine:**

In Bangladesh Telemedicine facility has been launched and being carried out for providing health services to both urban and rural regions. Now people in bucolic region are benefited with this service where as previously those are deprived of this basic need. As an emerging method of health service its success is unprecedented and praiseworthy. But sometimes, its purpose fails due to several constraints. Some drawbacks pertaining to telemedicine can be attributed as follows

- Communication gap between health professional and patient hinders the process of telemedicine. In telemedicine communication takes place through the transfer of still images or videos those are not sometimes properly manipulated by the health care professionals. Doctor does not have any tangibility to examine the disease very cautiously. As a result, sometimes health professionals remain unable to come into a successful end of the medication process.
- As the whole medication process depends on technology, bugs may cause the system to be malfunctioned. Moreover, it may lengthen the process of treatment due to slow and erroneous connection.
- Wireless based telemedicine technologies may be trespassed by the intruders which may results in the manipulation of the whole system. Furthermore, patient's information may also be compromised which violates the private policy of patients information.
- The services and the policy of payment of the health professionals are not still determined and the fixation of those may be proven as challenging.
- Unfamiliarity of the doctors and patients depending on the regions, behavior and regulations may come out as a problem during the treatment session.

**Recommendation for new method:** As the healthcare system is being dependent on ICT and in most of developed countries is now fully maintaining their Health Information System, it has become crucial for Bangladesh to implement Health Information System more efficiently from now on to ensure better health care services. Since Mhealth, telemedicine, E-health have been being implemented in Bangladesh, the process of managing them, the process of implementing them more effectively must be very lucid and well structured to ensure the health services to be reached to everyone in both urban and rural areas. Though those systems bringing success in health sector in Bangladesh, but due to stochastic management, sometimes data lost or not found in order which causes the data to be collected over and over again which is time consuming and which also hinder the process of preserving a sustainable Health Information System.

When a patient get registered with any Mhealth service, his/her information is only stored to that specific provider's database not in any central database. So the patient has to provide his/her information over and over again as he get registered with as many health services as he/she wants. This really creates randomness and data get redundant which hinder the process of analyzing Health Information System for taking further action to make HIS more improved.

In Bangladesh, currently 43 telemedicine centers hospitals including public and private are providing telemedicine services to both urban and rural people. But every time the service seeker has to provide some data which can be

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retained once for preventing the redundancy of data. Moreover, the lack of integrated data source, the cognitive process about the up to date health information system impeded.

So the only solution to this is to make a nationwide integrated health database to maintain the patient’s information and to make them convenient for accessing from anywhere when required. This will enable the health centers to monitor the patient health condition frequently.

### Objective of the proposed model:

- To reduce the data redundancy of data.
- To reduce the annoying registration time and to expedite the preliminary process.
- To make the data accessible from anywhere by the authorized health professionals
- To facilitate the Health Information System to be consolidated to make rapid decision.
- To convey Health Information System to rural areas of Bangladesh.

### Requirement for the proposed model:

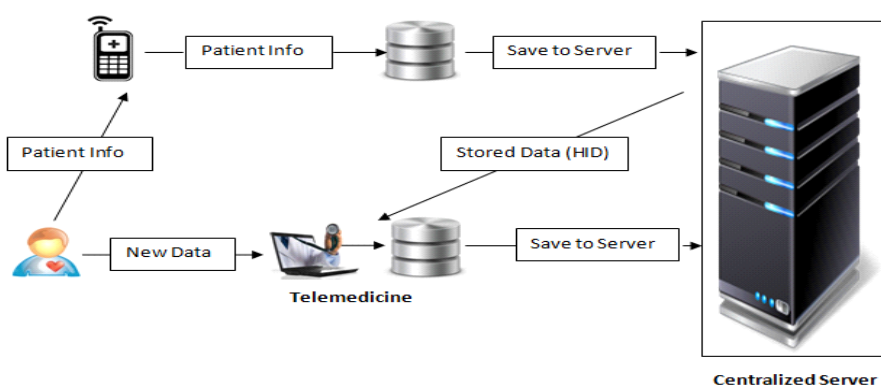
- Centralized and consolidated data center with distributed functionalities.
- Establishment of standard protocol for efficient management of vast quantity of data
- High speed internet connectivity for accessing and manipulating data.

### Working functionality of proposed model:

In this model, every patient will hold a unique ID, name “HID (Health ID)” by which he/she will be identified every time he/she get registered with new service or during the use of any health service registered previously. Next time this HID will be assigned to every newborn child like assignment of their citizenship ID.

All the health services including mhealth, telemedicine, e-health have to be merged with only one database. Patients’ information will be stored in their own server and in the centralized server simultaneously by the HID.

Data of similar type stored once, cannot be stored for the second time. For example, if a patient Date of Birth (DOB) is once stored in any of the mobile health service, need not to be input again during the registration process with any other services like mhealth, telemedicine etc. Data of a individual patient which were stored previously will be appeared only by inputting the HID.



The operational diagram of this proposed model is depicted below:

### Feasibility study of the proposed model:

The first and foremost requirement for the proposed model is the internet connectivity to ensure the access to the patients information from anywhere in the country.

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As the mhealth, telemedicine and other health services are operating with their own server, the only work to be done is to make a centralized server and to merge those individual servers with the centralized server to make the data available directly from centralized server.

Bangladesh is strengthening its Internet infrastructure for enabling everyone to gain access to the World Wide Web. In spite of several hindrance and constraints, internet facility is being brought to the people in both urban and rural areas of Bangladesh. Internet users are increasing with a rapid growth due to its easy accessibility and reduce in price. Bangladesh got connected with high speed internet connection SEA-ME-WE 4 which is a submarine optical fiber connectivity whose landing station is located at Cox’s Bazaar [44]. Moreover Bangladesh joined its second submarine cable SEA-ME-WE-5 and expected to be in operation from the first quarter of 2016 [45].

It is also good news that, the price of internet is reducing remarkably in the history of technology field in Bangladesh. From 2007 to now on internet price per bandwidth has been reduced by approximately 90 percent only in 7 years.

The chart of reducing internet price is depicted below[46]

Year	Price per bandwidth	Percentage reduced	Updated prices
2007	75000	64%	27000
2008	27000	64%	12000
2012	12000	16.66%	10000
2014	10000	20%	8000

Overall price reduced from 2007 to now: 89.33%

So, from the above table, it can be inferred that, internet connectivity is no longer a problem and internet connectivity can be provided at a very cheap and affordable cost. As a result, the proposed model can fully be implemented.

## VI. CONCLUSION

As a prospective country Bangladesh is getting technologically advanced day by day. Previously, rural people of Bangladesh are badly deprived of developed and modern health services. But with the bless of Information and Communication Technology, people of Bangladesh in both urban and rural areas are enjoying the health services at any time at their fingertip. Coping up with the developed countries, it is fortifying its health sector with the help of ICT to render best health service ever. And the proposed model, if implemented, will add a new degree in health sector because of its effective operative functionalities.

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