ABSTRACT

This short paper describes the development activities of ICT applications in e-Health for improving the community healthcare services in Indonesia. A number of community telemedicine and e-Health system development activities will be described. The activities include: evaluation of ICT competences of the healthcare providers, Hands-on training for healthcare provider, establishing ADSL internet access for Community Health Centers, and the telemedicine and e-Health system developments.

The following ICT applications in e-health systems will be briefly described that include: e-health systems for community healthcare recording & reporting, outbreak management system, mobile (or movable) telemedicine systems, e-health system with paperless prescription function and mobile e-health systems. It is expected that the activities could be continuously developed involving more and more community health centers, towards achieving the MDGs, especially in healthcare and education.

1. INTRODUCTION

Indonesia is the largest archipelago country having more than 17,500 islands and more than 230 million people; it is estimated that about 60% of the population are in the rural area. For the whole country consisting of 33 provinces, a referral community healthcare system is applied; there are more than 8500 community health centres (CHC, *puskesmas* = *pusat pelayanan kesehatan masyarakat*) that perform as the spearheads of the
community health care services. Huge efforts are still needed to overcome the day–to–day healthcare challenges towards achieving the Millennium Development Goals, especially in Healthcare.

Since 1997, the Biomedical Engineering Program – Institut Teknologi Bandung (ITB) has concentrated its efforts in the development and implementation of ICT-based telemedicine and e-health systems for community healthcare. The development activities consist of different types of applications of existing ICT infrastructure in different types of Telemedicine and e-Health Systems to improve community healthcare, involving the bottom of the pyramid (CHC, Community Health Centres). Synergic collaborations among similar organizations/institutions with similar visions are highly needed. More and more ICT applications in e-Health, dedicated to continuously improve the community healthcare, are required to achieve more significant contributions. These relatively small steps, should they are implemented consistently and continuously, are expected to contribute towards achieving the MDGs in the long run.

2. ICT APPLICATIONS IN IMPROVING COMMUNITY HEALTHCARE SERVICES

In the development of ICT applications dedicated to the improvement of community healthcare services, we have involved both staff members and students in our Biomedical Engineering program. Some of the activities related to the development will be highlighted in the following sections:

2.1. Education for Healthcare Providers

We believe that Human Resource Development (capacity building) is of primary important. Since 1997, we have conducted a series of promotional activities (presentations, seminars, workshops) on the importance of ICT applications in healthcare. For more than ten years, we have been organizing and/or supporting more than 12 hands-on training activities (seminars, workshops, courses) for healthcare providers in Bandung area and Sukabumi (West Java Province). In general, there are three types of training activities: Classroom-type hands-on training, On-site hands-on training, and Hands-on training on personal (private) basis. In total, we have actively participated in the human resource development activities involving more than 250 people. Figure – 1 shows an example of the training session for the healthcare providers.

2.2. e-Health Systems for Community Healthcare Recording & Reporting

In line with the human resource development activities, we have been actively involved in the development of relatively (software and hardware)-based e-health systems for Recording & Reporting (R & R). Some specific examples of the R & R e-health applications include: healthcare administration (support), evaluation of healthcare status, R & R without/with tele-reporting, tele-coordination, limited tele-consultation. Some of the resulted e-health systems have been installed/implemented in more than 5 community health centres (CHCs), Bandung Health Office, and a maternity hospital, in
2004 – 2006. Wireless LAN (local area network) has been used for supporting the transfer of the necessary medical information, as shown in figure – 2.

2.3. ICT – based Outbreak Management e-Health Systems

Specific ICT-based e-health systems for outbreak management have also been developed since 2005. The ICT-based outbreak management systems aim to provide supports for both reporting stations (CHCs, puskesmas) and monitoring station (Health Office, Dinas Kesehatan Kota), with more reliable and user friendly “outbreak management systems”. A number of prototype e-health systems have been developed, namely: a web-based outbreak management system, PC and mobile phone-based system, SMS server and Java enabled mobile phone-based system, SMS server and Opera mini mobile phone-based system.

Different e-health systems have been developed to cater for specific locations (CHCs) with different ICT infrastructure. Figure – 3 shows a block diagram of a web-based outbreak management system.

2.4. Mobile Telemedicine System for Ambulance and Movable Community Health Centre

Since 2005, special efforts have been dedicated to the development of “mobile telemedicine system with multi communication links”. Basically, the mobile telemedicine system consists of: a base unit (to be installed in a hospital or healthcare unit) and a mobile/movable unit (to be installed in an ambulance or in a movable vehicle). The system has been designed to select an acceptable (existing) communication link at a particular location of the mobile (or movable) unit. The system can measure and transfer different types of medical information (e.g. ECG signals, blood pressure, temperature, SpO2) from the mobile (movable) unit to the base unit. Two prototypes have been produced and successfully tested; one set (pair) of prototype will soon be installed in Sukabumi (West Java). A simplified block diagram in figure – 4 shows the “Mobile Telemedicine Unit” [left] and the “Base Unit” [right]. Different types of existing telecommunication infrastructure can be automatically selected, thus the term “multi communication links”. Figure – 5 shows the picture of the Mobile Telemedicine Unit.

2.5. e-Health System with Paperless Prescription Function

The “e-health system with paperless prescription function/capability” has been designed to be used in a community health centre (CHC). It consists of a specially developed web-based software package which has the following main functions: to do recording of patient data (patient registration), to prepare medical record (during medical examination phase) and paper-less prescriptions with ADEs (adverse drug events) alert, to prepare the prescribed medicine for each patient, and to prepare different types of patient and medicine regular reports, and to send the appropriate reports to the District Health Office as needed. By using the “e-health system with paperless prescription capability”, it is expected that in the long run, the following advantages could be obtained: -to improve the efficiency of the healthcare services -to reduce the overall processing time
-to reduce the overall processing time for preparing/producing different types of regular reports
-it is also expected that healthcare services could be further improved.
Since the existing community health centres have different human resources and ICT infrastructure (the number personal computers, telephone lines, internet access, etc.), we have prepared three different e-health system configurations:
-Minimum e-Health system configuration, consisting of a single PC with an appropriate software package.
-Medium size e-health system configuration consists of 2 to 3 PCs with the appropriate software package and simple networking.
-Full size e-health system configuration consists of at least 6 PCs with the appropriate software package (installed in a PC server) and a hub networking.
Figure – 6 shows a screen shot of the main page of the e-health system with paperless e-prescription function.

2.6. Other Applications of the e-Health Systems

Using similar e-health system configuration, but with specially developed software packages, some other application specific e-health systems have been developed and/or under development. Some application examples include the following mobile e-health systems:
-Mobile Telemedicine Kit for Disaster Reliefs
-Healthcare Promotion using SMS (Short Messaging Service)
-SMS-based Reminder e-Health System for Tuberculosis Management
-e-Health System for Safe Motherhood Program

With the increasing availability of the ICT infrastructure and developers’ experience, it is expected that more and more community healthcare applications could be developed and improved.

3. RESULTS AND LESSONS LEARNT

From the development and implementation activities of different types of e-health systems described above, the following points could be noted:
-The importance of Human Resource and Human Resource Development for e-Health
-Challenges to overcome the “e-Readiness Challenges” & “Cultural Problems”
-Continuing supports needed (in terms of policy, funding, and technical)
-Availability of telecommunication infrastructure
-Cost consideration (capital and operational costs).

There should be at least one (permanent) institution/group responsible to consistently & continuously provide/maintain the “ICT applications in Healthcare & Education”, Consistent Government’s policy & political will towards the goal, Continuous promotion activities needed, Continuous and consistent activities leading to the improvements of the quality of life through improving the community healthcare & education.
Moreover, in the development/implementation activities, we should involve government institutions, private industries (as part of their Corporate Social Responsibility, CSRs), the whole community to achieve sustainability. In the long run, it is expected to achieving the MDG especially in healthcare.

4. CONCLUDING REMARKS

- Despite the challenges and problems faced during most of the e-health system developments and implementations, the outcomes are in general very promising and encouraging.
- Further development and implementation activities should be qualitatively improved and quantitatively multiplied, so that more and more e-health systems will be implemented in more community health centres.
- Involvement of government institutions, private industries (as part of their Corporate Social Responsibility) and the whole community are required, to achieve sustainability.
- Significant contribution towards achieving the MDGs is highly expected in the long run.

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REFERENCES


SUPPORT FIGURES, DIAGRAMS, PICTURES

[Please, find all the figures in a separate file]