ICT Intervention to Enhance Health Services to Mothers and Children in Remote Communities in Jordan

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Abstract. In this paper we share the experience we gained from the implementation and deployment of a proof-of-concept ICT intervention aiming at improving the health of women and children in rural and remote communities in Jordan. The intervention has a web and mobile components. The developed system serves as: (1) a tool for medical experts to disseminate awareness information; (2) a source of medical knowledge to residents of rural communities and clinics serving those communities; and (3) a tool for clinics to manage immunization of children in remote and rural areas.

Keywords: Mobile applications, Mobile pervasive applications, Mobile social networking, Health Systems.

1 Introduction

In Jordan, as in most third-world countries, quality health services are offered in capital and big cities. This is mainly because those cities offer more opportunities to medical staff to forward their careers in addition to the ease of life beside many other advantages. This leaves rural areas and remote communities deprived of specialized and experienced medical staff. It is not difficult to imagine that many medical cases will have to travel to the capital city or other big cities to obtain needed treatment; or wait till the next medical day in their region (where a consortia of medical doctors visit rural areas) to happen. This constitutes a major challenge to governments. This is also apparent even in developed countries as shown in a recent study by Lenthal et al. [1] addressing the challenges facing rural Australia as a result of decreasing numbers of nurses and midwives.

Information and Communication Technologies (ICTs) are now widely considered by developing countries as the motor of growth, the driver of efficiency and effectiveness and the tool to enhance human development. With the advancement of ICTs and the Internet, communication and web-based technologies can be exploited

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to address the challenge of virtually allowing medical expertise and knowledge to become available to rural areas and remote communities. In recent years, social networking websites (such as MySpace and Facebook) have become very popular tools to connect people and allow human-human interaction regardless of physical location. Such websites easily attract users as they are discrete, connect large number of individuals and eliminate the middlemen. While most popular networking websites are social in nature, professional networking websites can also be used as a tool to tackle issues and problems in society.

Many ICT interventions have been introduced recently to address social challenges including those of rural communities [2, 3]. One very important and priority sector is health. As mentioned earlier, quality health services are specific to large communities only and adequate services or support groups are not widely available for rural areas. Health is among the top sectors that are benefiting from the opportunities that the technology offers as shown in many studies such as [4, 5].

In this paper we report the experience gained from one project concerned with enhanced health services to women and children in remote and rural communities in Jordan. This is realized through the design and implementation of a proof-of-concept medical social networking portal. The portal is complemented by other access means, such as mobile phones to maximize the outreach of information and the utility of the system. Such intervention would provide the tool for medical practitioners to interact with the public regardless of their geographical proximity. The system allows contributions from medical doctors, medical students, nurses, pharmacists and other medical personnel in Jordan to assist stakeholders (whether doctors or patients) with questions related to health. Also, it allows interaction between users (patients) themselves to form common interest support groups. The system's information channels, such as mobile phones allow access to health information to such groups in a cost effective manner.

Health issues are wide-ranging, and for a pilot project it is challenging to find the needed experts and resources to support such wide range of health issues. It was important to narrow the scope of the problem in such a way that enables us to measure the impact of the project on rural communities. We focused the application of the system to women and children health.

This paper is organized as follows. In Section 2 we look at some facts about communities in Jordan's rural and remote areas. In Section 3 we describe the detailed design of the ICT intervention. Deployment is covered in Section 4. Preliminary evaluation of the system is reported in Section 5. We conclude the paper in Section 6.

2 Jordan's Urban and Rural Communities

Jordan is a small country with an area of approximately 92,300 km2 and an estimated population of 5,723,000 people (i.e. that is a density of 62/km2). There are 12 Governorates in Jordan. According to the Statistical Yearbook of Jordan (published in 2007 by Jordan's Department of Statistics - DoS), the population is divided between urban communities (those localities of 5000+ inhabitants) and rural communities.

Almost 17% of the population are classified as rural and 83% as urban. Amman, Irbid and Zarqa are the biggest cities of Jordan and more than 62% lives in these

governorates. The remaining governorates are larger in area and have higher percentage of rural communities. Fig 1 shows the status and the location of rural communities in Jordan.

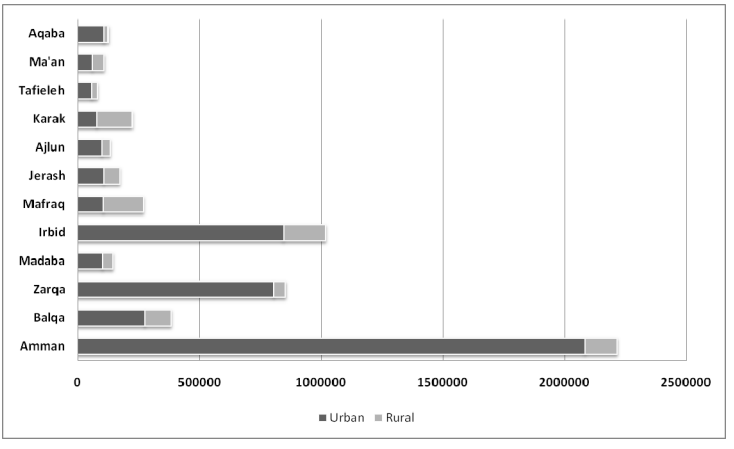

Fig. 1. Estimated Population of Jordan classified as Urban and Rural (end year 2007, Department of Statistics)

Birth rate in Jordan is average compared to the world. According to DoS, Crude child rate (per 1000) is 28; Crude death rate (per 1000) is 7; Total fertility rate for each woman is 3.7; and Population growth rate is 2.3%. Governorates are served with different types of medical centers such as Mother and Child health centers (MCH), village centers and health centers. These centers have very basic infrastructure when located in rural areas.

To understand the usage of ICT in rural communities, we designed a scoping questionnaire and distributed it to randomly selected users. The questionnaire was designed to capture personal information about the user, their background, the usage of internet, the usage of mobile phone, usage of mobile services and main health topics of interest. From analyzing the collected questionnaire (91 in totals) we report the following:

- The most usage of internet in rural Jordan are for checking the various news site, communication through e-mails and searching.
- Significant number of users in rural communities are depending on government initiatives (such as Knowledge Stations: www.ks.gov.jo) for internet access.
- It was noticed that almost 90% of surveyed users own at least one mobile phone. This is quite significant penetration rate.
- The usage of mobile phones is for the purpose of making and receiving calls as well as communication through text messages.
- Using mobile e-Government services (provided through the national SMS gateway) is still not popular among mobile users and many users are not

aware of these services. In this case, maybe the services offered under the gateway are generally more specific to urban communities.

- When asking about what are the main resources when someone would like to obtain certain medical knowledge, majority thinks that medical doctors are the most appropriate resource for medical information. Internet was a quite popular option too.
- Dietary information, diseases, alternative medicine and maternity and child care are the most searched topics for users (as shown in Fig 2).
- As for the reasons to seeking medical knowledge, the first choices were preventive care and obtaining general knowledge about medical issues (which is essential for preventive care as well).
- Who is responsible for medical awareness? The majority believed that Ministry of Health should be responsible for this task. Many also put some responsibilities on TV and Radio to provide medical awareness content to their viewers.
- How could concerned organization support medical awareness? Organizing workshops and inviting medical experts were the most popular choices.

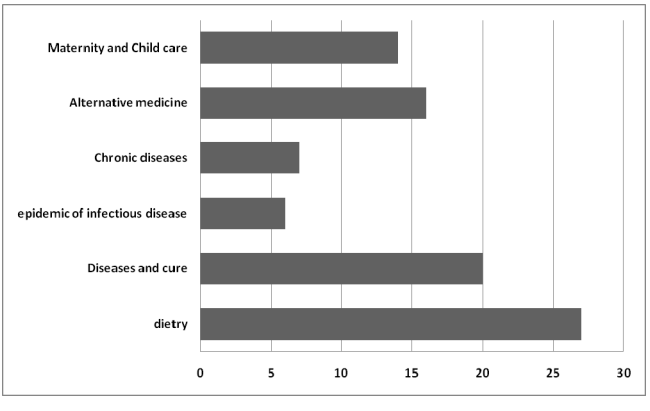

Fig. 2. Medical topics of interest. Maternity and child care is popular search subjects.

3 Designing ICT Intervention

The main aim behind the design of the pilot project was to measure the advantages and impact of ICT interventions in enhancing health care services and support health clinics and hospitals in rural and remote communities. The focus of our evaluation was on women and children health care services. During the life of the project we attempted to answer the following key research questions: (1) Could ICTs contribute to the enhancement of the general health of rural and remote communities? (2) How ICTs can be effectively exploited to improve the general health of rural and remote communities? and (3) What incentives structures could be utilized to stimulate participation in ICT-based health networks (particularly participation of doctors and health practitioners)?

3.1 Stakeholders

One of the early stages in the project was to identify the primary stakeholders who directly interact with the system. We can categorize the stakeholders as follows:

- *Medical content consumers:* individuals who use the system to obtain medical knowledge through the various channels available for the project. They can either be registered users or use the system as anonymous.
- *Medical content producers:* those who populate the database with required medical knowledge whether diagnosis, awareness ... etc. To be able to use the system, they need to be registered
- *Medical experts:* those who filter incoming information to ensure validity and consistency. They need to be registered and be granted privileges to rate any piece of incoming information.
- *Administrators:* those who will manage system users and manage existing accounts.

There are also secondary stakeholders who affect and are affected by the system: Ministry of Health (MoH), NGOs working in rural areas and e-Government portal.

3.2 Requirements

There are three main type of users, who can carry out six different types of interactions with the system: (1) guest users can browse the public information on the project and view the various content provided by the website, as well as ask anonymous questions to the medical experts; (2) registered users, in addition to having access to the same functionality as guests they can participate in the activities where only registered users are allowed to participate such as forum, adding content (for medical experts) and supervising content to check validity and correctness (for content supervisors); (3) administrator who additionally take the responsibility of user and system management activities.

The system was developed to meet the following main requirements: (i) allowing content consumer to interact with the system and access stored knowledge and provide them with the tool to post medical questions; (ii) the system able to store information about stakeholders who would like to be contacted to receive awareness information and information about organized events; (iii) allowing content producers (medical expert) to log in to the system and maintain medical knowledge and answer questions; (iv) allowing content supervisor to log in to the system and receive notification of new material added to the system and to rate them and filter them accordingly; (v) allowing system administrator to define new users and manage existing ones as well as manage system components; and (vi) allowing clinics serving rural and remote areas to manage vaccination process of children.

3.3 System Design

Fig 3 shows the architectural design of the ICT. For the mobile module, it was designed to realize the following functionality:

- A sub module to manage the posting of medical questions (all users with mobile access). Users were allowed to either send the questions by short message (SMS) or use a dedicated application if they have a java enabled phones.
- A sub module to manage the replies to questions or blocking questions (specific to registered medical experts). This is done through SMS text.
- A sub module linked to a web page which manages the sending of awareness material to mobile users (specific to registered medical experts).
- A sub module to manage vaccination of children automatically.

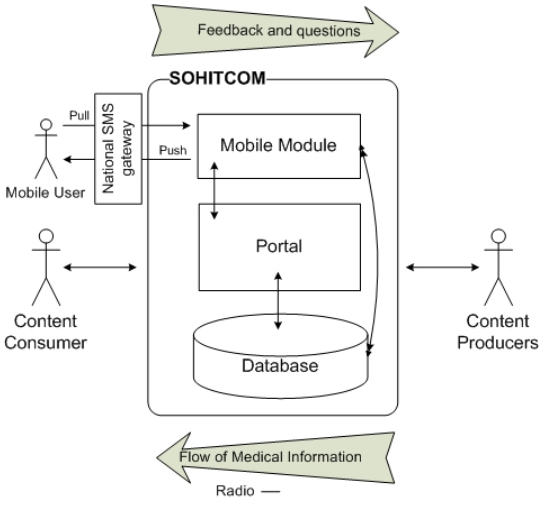

Fig. 3. Architectural Design of the System showing both the portal and the mobile modules

For the portal, it was designed to allow users to post medical questions (all users whether registered or not), post replies to questions or blocking questions (medical experts), forum discussion (all registered users), post medical content (medical experts), filter medical content (content supervisors) and user and system management (administrator).

3.4 Implementation

There have been many work reported in the literature concerned with the development of ICT4D interventions. A good example is [6] focusing on mobile applications. Our intervention was developed using the following technologies: Java Server Pages (JSP) and Java Servelet for the Dynamic Interaction with the users in the user interface; J2ME to develop mobile application; Hyper Text Mark-up Language (HTML) for the Content of the static pages in the system; JavaScript for the validation of the data entered by the users; AJAX for the smooth interaction in items (Data Swap without DB Rendering); The Tag-libs technology for the Modularity and Template adaptation in Inner and Main Pages; MySQL for database functionality; and XML for the optimized and structured data transfer.

4 Deployment

The web portal was available for users to browse content and interact with the Q&A facility. The mobile module was made available to download and install. Also the SMS engine was made available in cooperation with the national SMS gateway. We selected five clinics serving rural communities. The selection was based on needs analysis done jointly with the Ministry of Health. We provided those clinics with the minimum hardware needed for the operation: a basic netbook, a Java enabled mobile phone and internet connection. Adequate training was given to the health workers in those clinics to start using the system.

5 Evaluation

We made the necessary awareness about the availability of our intervention to concerned stakeholders and we started to collect the needed information to answer our research questions. Valuable information were collected (either by interviews or questionnaires) from various stakeholders with this regards. We discuss the analysis in terms of system functionality.

For using the system as *awareness tools*, we noticed that all stakeholders expressed their satisfaction an appreciation of it. Clinics and Medical staff were able to connect with large number of users and disseminate important advices and information effectively and efficiently (in terms of time and cost). They reported more feedback to their announcements than previous methods, including printed materials with no guarantee that it will reach the intended audience.

For the *Q&A facility*, there have been some major issues. One important issue is responsibility from issuing an online advice or answer to a question. Health worker were reluctant to participate in this module worried that they might be officially blamed for misdiagnosis or misinformation. The majority of participating medical experts believed that more work need to be done both in terms of legal infrastructure and technological infrastructure to aid online diagnosis. Another issue was financial compensation for their time spent in the system.

Perhaps the most successful module was the vaccination management system. This is specific to clinics and it allows them to register newborn babies. The system then automatically calculates the vaccination program based on MoH guidelines. The system issues automatic reminders to parents regarding the date for a specific vaccine. Also the system issues statistical information to clinics about number of needed vaccines per day to allow them to prepare those vaccines and make them available. Both users and medical experts expressed their extreme satisfaction with this module since it help tackling and important issue which is children missing vaccination (quite high in rural areas).

Overall, and in spite of the advancement in mobile applications developments and innovations, there are certain challenges: (i) Concrete evidence: we are in need of a robust analysis and evaluation tools and standards of mobile intervention in health to help designing better and effective services; (ii) Legislations: this is quite important to

establish a clear policies and laws to govern ICT interventions and their deployment; (iii) Sustainability of ICT interventions, sustainability is important issue for ICT4D projects. There should be clear understanding of how to fund these projects and to continue to provide resources and (iv) Capacity building: there should be focus on building the competency of various stakeholders in terms of ICT usage. Also mobilize resources to bridge the technological gap between urban and rural communities.

6 Conclusion

In this paper we described a proof-of-concept ICT intervention to enhance health services provided to rural communities in Jordan. Evaluation from the system shows that ICT plays an important role in enhancing services and outreach for a large section of users in a cost and time efficient manner. Evaluation showed that using ICT to manage awareness and manage vaccination is useful and can help overcoming several challenges. More investigation is needed to deal with smooth and effective online communication between patient and health workers. Future work will focus on widening the evaluation to include more clinics and region in rural Jordan to reach a working system that can be adopted nationally. Also an important future work is to investigate the security of such system given the sensitive information it deals with.

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