

A Health VC for Chronic Disease Management in a Global Context

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Abstract— This paper presents an implementation of hybrid Health Virtual Community (Health VC) using a predefined model to design Health VC in a developing country. It provides an analysis of the components needed in an environment where high technology is not as available as in a developing country. We argue that virtual community researches should take into consideration a more flexible approach to model VCs and we suggest changes to the model.

Keywords-Health Virtual Communities; Virtual Communities; Online Communities; Chronic Disease Management; Chronic Disease; Modeling; Global Health; Developing Countries; LMIC.

I. INTRODUCTION

Worldwide, chronic diseases (e.g., diabetes, hypertension, cardiovascular diseases, and chronic respiratory diseases) are hitting an increased number of the population. Globally, Chronic diseases related caused 35 million death out of 58 million in 2005; moreover, the fatalities caused by cardiovascular diseases is almost twice the number of fatalities caused all infectious diseases combined (e.g., tuberculosis, malaria, AIDS) [1]. Besides the lower life expectancies, populations in developing countries suffer from chronic diseases [2]; in fact, the number of deaths from Cardio-Vascular Diseases (CVD) in developing countries is twice the same number in developed countries, and more than three-quarters of deaths related to diabetes are occurring in developing countries [1].

An intervention that uses eHealth System has the ability to allow chronic disease management. Health Virtual Communities has been identified as one eHealth tool that allow such intervention. Virtual Communities (VCs) were subject to investigation from many sides to explore their advantages and challenges. Researchers in healthcare investigated ways to use VCs for healthcare delivery and support [3][4]. In an attempt to understand and sketch the VC, models were proposed for static and mobile virtual communities [5][6].

In this paper, we will describe the development a health VC in a developing country for chronic disease management. The health VC was designed based on previously suggested model [7]. We will explain the Health VC components and

discuss the ability of this model to satisfy the requirements of virtual community definition, taking into account the technological challenges of developing countries in a global health context.

We will start with a description of the health VC for chronic disease management Virtual Community in section II. We will, then, explain the design of our Health VC in section III. We provide a discussion of our Health VC in section IV and conclude the paper in section V.

II. BACKGROUND: HEALTH VIRTUAL COMMUNITIES

A Health Virtual Community cover a wide range of clinical specialties, technologies and stakeholders [8]. Members of a Health VC can be health care providers, educators, patients, health professionals. We can classify Health VCs into two categories: professional-centered or patient-centered. A professional centered VC is focused on exchange of knowledge among professionals and forms a community of practice. Members in such communities are health professionals that interact and work in virtual teams in order to exchange knowledge and create new knowledge if possible.

Members of patient-centered VCs include health professional, patients and possibly their family members. Patient centered VCs permit professionals-to-patient and patient-to-patient communication. Health care professionals can tele-monitor and support patients and their families in their day-to-day management of their health condition. Moreover, individuals diagnosed with the same condition (e.g., chronic disease) can exchange and share health information and personal experiences. Hence, patient centered VC ensures continuity of care.

The communication between patients and their doctors improves patient care [9]. Hence, the creation of patient-centered Health VCs constitute a mean to strengthen patient-doctor interaction and flow of information, providing improved care while overcoming geographical boundaries.

Managed care is considered to take place when the right care is provided by qualified health team members to a person “at the right frequency and duration that will best support that person” [10]. Tools to remotely monitor and/or educate patients and people at risk, play an important role in managed care. This allows the patients and people at risk to

be involved in the management of their own conditions. That is the idea behind self-managed care [11].

In a Low-Middle Income Country (LMIC), in a global health context, a project involving the implementation of health VC is underway. The internet penetration in LMICs allows implementation of health VCs with potential benefits to healthcare health care providers and their patients. We will explain in the following the design of a patient-centered health VC for chronic disease management in a LMIC.

III. A VIRTUAL COMMUNITY FOR CHRONIC DISEASE MANAGEMENT

Healthcare VCs emerged in the online environment as an attempt to benefit from the advantages VCs offer for patients [4] such as those with chronic diseases [3] or diabetes and hypertension [5]. Mobile VCs present also many possibilities, and many models have been proposed to use them, with in a general context [6] or in the health sector [12] (e.g., for cancer patients [13][14]). Our project consists of building a collaborative health virtual community in Lebanon to enhance equity in access to primary care in rural areas and Palestinian refugee camps. The research team includes researchers from the American University of Beirut, Lebanese Ministry of Public Health (MoPH), the United Nations Relief and Works Agency (UNRWA), York University, and University of Toronto.

In Lebanon, a LMIC, 84% of all deaths are due to chronic diseases [15]. Age-standardized death rates from CVDs diabetes reach 404.4 and 262.7 per 100,000 individual, respectively [16]. This problem is intensified in disadvantaged populations in the rural areas and the Palestinian refugee camps. Non-Governmental Organization (NGO) that run primary health care centers available in the underserved rural areas often suffer from limited resources [17].

This project takes a proactive integrated approach that couples community-based and health care initiatives. A health VC is being developed in order to support both patients and healthcare providers in 10 primary health care (PHC) centers located in rural areas and enrolled in the Lebanese Ministry of Public Health (MoPH) PHC National Network (Network) and 6 UNRWA PHC centers will comprise the study population. Agency (UNRWA) centers will comprise the study population. These centers are randomly assigned into the intervention and control groups. The intervention has two components:

- **A Provider Oriented Component:** it targets the physicians (supply)

- **A patient Oriented Component:** it targets patients having appointments at the primary care centers and suffering from diabetes and hypertension (demand). Another aspect of the patient oriented component includes screening potential patients in the community.

We designed a health virtual community to provide the necessary tools. The hardware and software infrastructure was already provided by the network connection between the healthcare community centers and the MoPH. The tools needed for doctors and patients can be summarized in 3 sub-

systems: patient-oriented, provider-oriented and a service-oriented one.

A. *Provider-oriented Sub-System*

The healthcare providers need to have access to information related to the clinical guidelines, the physician-patient communication strategies, and online forums and Frequently Asked Questions (FAQ). An online portal was designed to enable healthcare providers from the PHC centers to meet and discuss online. Moreover, a FAQ section was designed to contain health information relevant to diabetes and hypertension. A coordinator of the Forum was designated to receive questions from the healthcare providers in the PHC centers, formulate answers, and ultimately create new FAQs. The clinical system and the online portal would be independent, and any information to be posted on the portal was to be de-identified to protect patients' and health providers' privacy.

B. *Patient-oriented Sub-System*

The patient oriented component was composed of targeted consumer Short Message Service (SMS) containing either health information related to disease self-management or reminders to appointments at the community PHC centers. We have used the Application Programming Interface (API) of a commercially available SMS service available in the local market to integrate our SMS-based patient oriented component into the existing system at the community centers.

Regarding the patient e-education material; even though Lebanon has a high penetration of internet (52%) and cell phone use (3,350,000 mobile-cellular telephone subscriptions, equivalent to 78.65 subscriptions per 100 inhabitants) [18], smart phones were not judged to be a good tool in the rural communities. The eHealth research team decided to deliver the educational material targeting screened patients, using a more accessible medium, namely a.

C. *Service-oriented Sub-System*

The provider-patient relationship had to be managed through two components: a health indicators collection component and an appointment-scheduling system component.

The health indicators component was needed to enter clinical data related to the collection of the baseline and the evaluation of the intervention. The MoPH provides the clinical system in the community centers; however, we needed to update it in order to collect the additional clinical indicators (e.g., rate of controlled glycated hemoglobin or HbA1c, controlled hypertension, and annual eye exam). The related additional modules were designed using a minimalist approach; the design was straightforward and did not add complexity to the already existing system.

The appointment-scheduling system component was designed through an existing commercial service. We have decided to use the commercial Application Programming Interface (API) to embed the SMS messaging strategy into

the clinical application that is present in the community centers.

The design of the Health VC is presented in Figure 2.

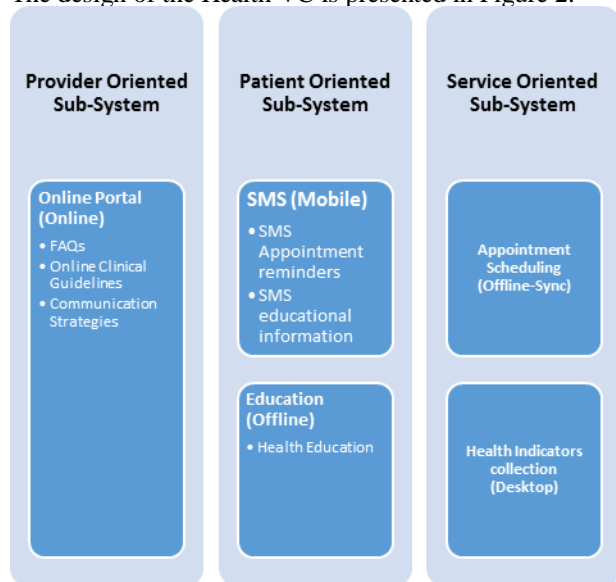


Figure 1. The Health VC Design

IV. A HYBRID VC MODEL

Based on our analysis and design of the Health VC, we find that the models proposed in the literature [5, 6, 19-24] are more focused on developed countries and exclude the situation in developing countries. We suggest a more inclusive design of a hybrid virtual community model that takes into consideration that the VCs can be developed using a myriad of technologies. Some of these technologies can be traditional (e.g., DVDs), others can be desktop based, while others can be off-line and then synchronized once they are connected to the whole system.

We suggest a three dimensional hybrid model for virtual communities that takes into account the diversity of technologies that can be available to implement a virtual community. The model, shown in Figure 3, is composed of

- *Hybrid Communication Mechanisms* that allows for Synchronous (e.g., online) and/or asynchronous (e.g., offline/synchronization) communication between members
- A *Hybrid Infrastructure* that can be web-based, desktop-based, and/or offline (e.g., DVD)
- *Hybrid Delivery Channels* that allow multichannel communication with the community members, including mobile, non-mobile (Desktop), and offline (e.g., DVD)

This model is inclusive of experiences in developing countries that have different levels of access to ICT.

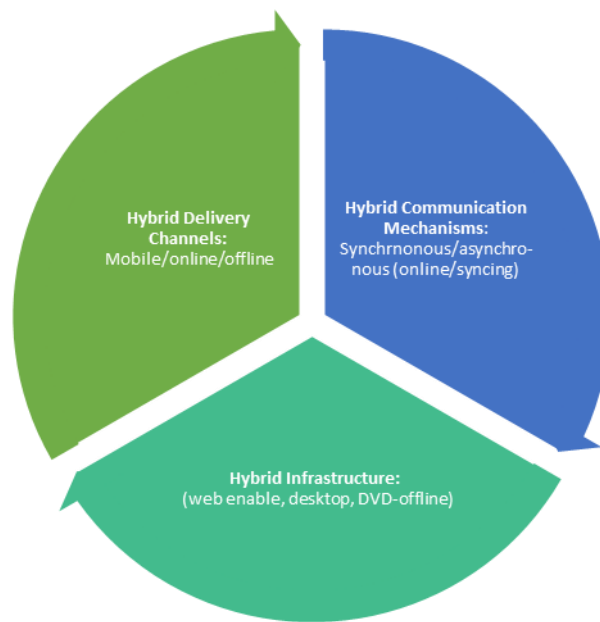


Figure 2. A Hybrid Virtual Community Model

V. DISCUSSION

The actual analysis and design of the Health VC faced many challenges. Our model may look surprising as it contains off-line material and information that need to be synchronized at a certain point in time. Nevertheless, our model complies with the definition of a virtual community.

Preece [25] suggests a working definition for online community that is broad enough to cover a wide range of communities but precise enough to fit into social science definitions. According to Preece (2000), an online community consists of:

- Socially interacting people performing special roles or satisfying their needs
- A purpose, which is the reason behind the community
- Policies to govern people's interaction
- Computer systems that support social interaction

Weissman [26] identifies two types of systems that form when humans get together: the organization type designed for a specific aim and the association type formed out of the individuals' dedication for shared objectives or beliefs. Had systems been of the former or latter type, they all share all or some of the characteristics that are outlined by Weissman. These are causal reciprocity, purpose, design, roles, circumstances, officers, passion, needs, loyalty, and access.

Our system complies with both Preece's definition of online communities or VCs, as well as Weissman's ten characteristics of communities.

Our Health VC:

- Is composed of socially *interacting people* constituting the *users* of the Health VC. There are four types of users of the Health VC: patients, health providers, fieldworkers, and the forum coordinator. Users perform special *roles*; the fieldworkers aim to screen the population and schedule appointments, the healthcare providers provide the diagnosis and patient follow-up, they interact with the portal (forum) coordinator for FAQs and access the online modules. Finally, the portal coordinator manages the online forum and answers questions related to new situations sent by healthcare providers remotely. The patients get access to educational materials (DVDs) and to SMS health messages and appointments reminders. Patients have mainly the role of information consumers while both fieldworkers and healthcare providers are information producers and consumers (e.g., access to information on the online portal). The coordinator is mainly a producer of information.
- Has a *purpose* to provide equity in access to healthcare for populations with chronic diseases in rural areas and /or deprived areas, using eHealth tools.
- Is endowed with strict *policies* to govern the way users (e.g., healthcare providers, fieldworkers, coordinator, and patients) interact with the system. Patients receive SMS messages, they cannot generate information; the fieldworkers feed the system with appointments. Healthcare providers enter clinical information into the community centers information system; and send questions and receive answers on the portal. The coordinator receives questions, organizes them and feeds answers into the forum.
- Comprises a computer system that supports the users' roles described. It is true that the computer system is not integrated in some aspects, for instance, the portal, community centers clinical system, and the field appointment scheduling; however, this does not diminish the fact that a computer system is in place and facilitates the users' tasks in order to achieve the community purpose.

If we look at Weissman's ten characteristics of a community, we find that our model satisfies them:

- *Causal reciprocity*: this aspect is about the usual "give and take" that drives people to stick together and it applies to our Health VC model where patient users are interested in consuming the information and clinicians and fieldworkers are interested in providing care.
- *Passion, needs, loyalty, and circumstances*: are all embedded in our system. Our Health VC facilitates

users' task to live their passion to achieve an aim (equitable healthy living), and fulfill their needs (be healthy, provide care). The loyalty to the Health VC is driven by the benefit each user gets out of it. The circumstances that created the community are related to enhancing public healthcare delivery in rural areas.

- *Purpose* and *roles*: are both described in our above discussion to Preece's characteristics.
- *Design*: the design of our Health VC facilitates the fulfillment of the purpose by coordinating the roles of the members.
- *Access*: is given to all users to fulfill their roles, e.g., internet connection, laptops and information system.
- *Officer*: is the system administrator that oversees the Health VC to make sure that all components are working well and that all users are abiding by the policies in place.

We conclude that having parts of a model offline, or not in sync, or not web-based does not affect the fact that the model describes well a Virtual Community.

VI. CONCLUSION

This paper presents a Hybrid Health Virtual Community model and analyzes its components based on a research project in a developing country. Some of the model components present asynchronous and off-line aspects; however, the model aligns with the definition of a virtual community and the characteristics of communities in general. VC models suggest usually a continuous online presence and access to advanced ICT devices; we provided a more comprehensive and an *inclusive* model that encompasses the circumstances of the developed countries while taking into account the ICT situation in developing ones.

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