Chapter 13
Mobile Virtual Communities in Healthcare
The Chronic Disease Management Case

Christo El Morr
York University, Canada

ABSTRACT
The number of citizens with chronic diseases is increasing and is expected to grow more in the next few decades; consequently, the cost of healthcare delivery will increase, and it becomes vital for societies to investigate ways to decrease healthcare cost. On the other hand, mobile technologies are becoming widespread; besides, virtual communities (VCs) are evolving and are taking advantage of users’ mobility. This chapter explores the ways in which mobility within virtual communities can play an important role in facing the current and future healthcare challenges, suggests that mobile VCs (MVCs) can help patients with chronic disease to self-manage their health, shows the many advantages of this approach, particularly in terms of enhanced healthcare delivery and reduced healthcare cost, and discusses the challenges that this approach faces.

INTRODUCTION

Chronic Diseases

Worldwide, chronic diseases (e.g. cardiovascular diseases, cancer, chronic respiratory diseases, diabetes) are on the rise. Global chronic disease related deaths were estimated to be 35 million out of 58 million annual deaths in 2005; besides, the number of people that die annually from cardiovascular diseases is almost twice the number of people who die from all infectious diseases combined (i.e. AIDS, tuberculosis, malaria) (World Health Organization, 2005). By 2015, and for the first time in its history, Canada will have more people having an age of 65 and above, than people having an age under 15 (Institute of Aging-University of British Columbia, 2007) which will eventually cause the number of patients with chronic diseases to rise. Nevertheless, chronic diseases are not the monopoly of elderly nor of developed countries; indeed, they strike a high percentage of adults, adolescents and children.
Mobile Virtual Communities in Healthcare:

For example, 46 million U.S.A. adults (about 1 in 5) were reported with doctor-diagnosed arthritis, and 1 in 250 children has some form of arthritis or related condition (Marks, 2008); besides, diabetes and asthma are dominant chronic diseases; to be sure, 32.8% of males and 38.5% of females in U.S.A. born in 2000 will develop diabetes in their lifetime (Narayan, Boyle, Thompson, Sorensen, & Williamson, 2003); and the prevalence of overweight has increased from 15% in 1981 to 35.4% in 1996 among boys, and from 15% to 29.2% among girls; while the prevalence of obesity in children went from 5% to 16.6% for boys and from 5% to 14.6% for girls (Public Health Agency of Canada, 2002). Furthermore, up to 17 percent of the population in the United States and Canada suffers from Asthma (International Study of Asthma and Allergies in Children (ISAAC) Steering Committee, 1998; Public Health Agency of Canada, 1999), the number of Asthma patients is approximately 5 million in the US alone (Mannino, et al., 2002). In Canada, about 20% of boys and 15% of girls aged 8 to 11 have been diagnosed with asthma (Secretariat of the Commission for Environmental Cooperation (CEC), 2006). Comparable data can be found in developing countries (Yach, Hawkes, Gould, & Hofman, 2004; Yusuf, Reddy, Onnpuu, & Anand, 2001), for instance the populations in developing countries suffer from chronic diseases (World Health Organization, 2003); in fact, the number of deaths from cardiovascular diseases (CVD) in developing countries is twice the same number in developed countries, and more than three-quarters of deaths related to diabetes occur in developing countries (World Health Organization, 2005). Similar observations can be found in Latin America regarding chronic obstructive pulmonary disease (Menezes, et al., 2005) and obesity (Uauy, Albala, & Kain, 2001). In India research findings point to the fact that chronic diseases, such as cardiovascular diseases, cancer, hypertension, contribute to an estimated 53% of deaths and 44% of disability-adjusted life-years (Reddy, Shah, Varghese, & Ramadoss, 2005).

Self Managed Care

In 2006, Canada spent $148 billion on health services, which is more than three times the expenditure on health services in 1975 after taking inflation into account (Canadian Institute for Health Information, 2007). Worldwide, the rising cost of healthcare is pushing governments to find more efficient and less costly ways to deliver care.

In this context, self-managed care appears to be one aspect of the solution. Self management of one’s health condition, increases autonomy and improves care quality as part of a managed care policy (Meuser, Bean, Goldman, & Reeves, 2006). While homecare is an important part of healthcare strategies, millions of people in the developed countries will be sick while they are studying or working outside their homes; therefore, finding ways to help people manage their health while they are on the move and away from a point of care, becomes an important part of the solution.

Supplied by telemonitoring functionalities, self management of chronic disease permits patient autonomy and allows daily activities to continue with minimal intervention of healthcare professionals at a point of care (hospitalization, emergency department, nurse visits, etc.) allowing intervention to take place only when needed.

While telemedicine applications exit and are diverse in application (patient care and monitoring, tele-cardiology), few telemedicine applications are mobile and targeting chronic diseases (Xiao & Chen, 2008). From a telemedicine perspective self managed care through mobile technology constitute a kind of an extension of telemedicine services.

Nowadays, youth use the internet and mobile phone on a daily basis; besides, youth are the “social network” generation, a fact confirmed by the massive adoption of social networking services (e.g. Facebook®, MySpace®, etc.) and the different applications and research directions evolving in the social networking field (Brendel & Krawczyk,
Mobile Virtual Communities in Healthcare:

2008). Capitalizing on the former two aspects, i.e. mobility and social networking, we suggest that mobile virtual communities (MVCs) can play an important role in self-managed healthcare policies. Mobile virtual communities are systems that allow people to gather as a community using mobile technologies, in order to achieve common aims and goals. The MVC concept is an extension to the VC concept that emerged at the beginning of the 1990's with the proliferation of the World Wide Web.

In the next paragraphs, we will explore virtual communities (VCs) as well as the MVCs; then we will outline how chronic disease management can profit from mobility in virtual communities, and discuss the advantages and challenges of such approach.

VIRTUAL COMMUNITIES AND MOBILITY

Virtual Communities

In the 1990’s and due to the internet phenomena, a particular kind of communities was born: the Online Community, also known as VCs (VCs). VCs varied in the technologies they use and the wide domain of applications. In the 1990’s mobility emerged in the telecommunication industry and had a remarkable impact of VC research; particularly on the design, the infrastructure to use, the services to offer, the usability of the interface, the security, and the users’ privacy.

VCs advantages and challenges have been investigated in the health field in applications. Health Virtual Communities can be defined as a group of people using information and communication technologies to deliver health care services; they cover a wide range of clinical specialties, technologies and stakeholders (Demiris, 2005). Studies have showed that the information (symptoms and preferences) provided by patient to their doctors is effective in improving patient care (Cornelia, Thomas, Marguerite, Gilbert, & Samir, 2003); thus, virtual communities have been developed in order for a virtual team to provide care for patients at home (Pitsillides, et al., 2004), to provide care for dying patients (Demiris, Parker Oliver, Porock, & Courtney, 2004), and to provide support for patients with cancer, HIV and coronary artery diseases (Gustafson, et al., 2001, 2002).

Mobility in VCs

Exploring mobility within virtual communities was a logical next step that has taken shape following the proliferation of mobile technology since the mid 1990’s, which led the way to the concept of Mobile Virtual Communities (MVCs). Researchers in MVCs investigated different aspects of mobility and their implications in virtual communities in order to find solutions to the many challenges it faces; for instance to find appropriate technologies that support un-interrupted services (Wang, Green, & Malkawi, 2002), appropriate user interface that overcome the small screen limitations (Axup, Viller, & Bidwell, 2005; Glissmann, Smolnik, Schierholz, Kolbe, & Brenner, 2005). The MVCs applications ranged from leisure (Brown, Chalmers, Bell, Hall, & Rudman, 2005) to health and human rights (El Morr, Subercaze, Maret, & Rioux, 2008). Besides, challenges related to security (Halpert, 2005), privacy (Häkkilä & Chatfield, 2005) and trust (Ali Shaikh & Omer, 2005), as well as to finding profitable business models were investigated (Schubert & Hampe, 2005). Finally, an effort has been made to classify MVCs based on the degree of virtualization they permit, the degree of mobility they empower and the degree of cooperation they allow (El Morr, 2007).

Health Virtual Communities

Health Virtual Communities can be defined as a group of people using information and communication technologies to deliver health care services;
they cover a wide range of clinical specialties, technologies and stakeholders (Demiris, 2005). The stakeholders and participants of Health VCs are health care providers, educators, patients, health professionals (e.g. nurses). Health VCs can be divided into three types depending on the objectives they aim to achieve; a VC can be (1) Patient Centered, (2) General Public Centered, or (3) Professional Centered.

Examples of professional centered VCs include knowledge exchange and research teams. Members in these communities are health professionals that interact and work in virtual teams in order to exchange knowledge and create new knowledge if possible (Davies, Duke, & Sure, 2003; Maret, Hammoud, & Calmet, 2004). Indeed, Medical tele-consultations among peers, medical personnel can significantly improve the quality of diagnosis and treatment. Professional centered VCs are made available for professionals in order to build a knowledge network (KN) (Clark, 1998; Willard, 2001). Members in KNs capture, access, use, create, and define knowledge (Merali & Davies, 2001). The use of professional centered VCs for knowledge networking has been a subject of research interest from different aspects (Davies, et al., 2003; Maret, et al., 2004). Health professional researchers use VCs in an effort to cooperate and collaborate, exchange knowledge and create it. Professional centered VCs aim to support researchers by providing them with tools that allow them to coordinate their work, to create and disseminate knowledge, as well as to educate the public and non-governmental organizations (El Morr, et al., 2008).

Patient centered VCs involve usually patients, their family members, and a health professional delivers health care services to community members. Patient centered VCs permit professional-to-patient and patient-to-patient communication. Indeed, health care professionals can form virtual teams to provide care and support in disease management; individuals diagnosed with the same chronic or life threatening disease, or undergoing the same treatment, can exchange and share health information and personal stories. Thus, patient centered VC can support continuity of care through the exchange of messages and resources. The most known example in of this type of communities is the Comprehensive Health Enhancement Support System (CHESS) research project that addressed cancer and HIV patients (Gustafson, et al., 2001, 2002; Temesgen, Knappe-Langworthy, Marie, Smith, & Dierkhising, 2006). Other VCs addressed drinking problems (Cheng & Arthur, 2002). COSMOS is a VC dedicated for cancer patients (Arnold, Daum, & Krcmar, 2004; Arnold, Leimeister, & Krcmar, 2003).

General public centered VCs are open and include educational services, discussion forums, and access to health information, offering public health informational services; they are dedicated for a specific segment of the population, such as women (@neWorld, 2008; The Center for Health Enhancement Systems Studies, 2008; Women’s Health Matters Network, 2008).

Opportunity

Information and Communication Technologies (ICT) provide the opportunity to implement mobile self managed care. Mobile phones and Internet, have a high penetration rate - this phenomenon is not limited to developed countries but extends to developing countries as well. Indeed, the penetration rate of both the Internet and mobile communication is higher in developing countries: the number of internet users in Africa increased by 66.6% between 2003-2004, the highest growth in the world (United Nations, 2005), similar phenomenon can be observed in the mobile phone field in all developing countries combined (United Nations, 2005). Therefore, the solutions provided for mobile self-managed care can tend themselves to patients in developing countries.

To implement self-managed care we can build on the knowledge and experiences in VCs, and particularly in MVCs, to suggest a solution for
Mobile Virtual Communities in Healthcare:

Mobile Virtual Communities in Healthcare: an efficient and less costly healthcare delivery, away from the point of care, relieving healthcare resources (hospitals, doctors, nurses) in order to take care of more urgent and more complex health situations. Research on telemonitoring has shown that care delivery is more efficient when nurses can serve remotely patients since home based telemonitoring reduces the number of days spent in hospital and lead to cost savings compared to nurse telephone support (John G.F. Cleland, 2006; John G. F. Cleland, Louis, Rigby, Janssens, & Balk, 2005). Comparable results could be expected by implementing a patient centered MVC for self-management of chronic diseases.

**RESEARCH PERSPECTIVES IN CHRONIC DISEASE MANAGEMENT**

The projects involving virtual communities’ applications in healthcare covered a wide range of health cases and tackled a variety of aspects. Different virtual communities were developed to support practitioners (Luiz Olavo Bonino da Silva, Renata, & Marten van, 2005; Santos, Guizzardi, & Sinderen, 2005), or support cancer patients (Krcmar, Arnold, Daum, & Leimeister, 2002). Aspects like trust (Ebner, Leimeister, & Krcmar, 2004), sociability and usability (Becker, 2004; Maloney-Krichmar & Preece, 2005), roles and relationships inside a community (Maloney-Krichmar, 2002) were also studied. Besides, some researchers traced the development of internet based healthcare communication (Denis, 2002), as well as the virtual communities applications in healthcare (Demiris, 2005; Siau & Shen, 2006) and in chronic disease management in particular (Winkelman & Choo, 2003). Mobility also started to be undertaken quite recently for cancer patients’ support (J.M. Leimeister, Daum, & Krcmar, 2002; J. M. Leimeister, Daum, & Krcmar, 2003; Moreno & Isern, 2002) and telemonitoring through mobile phones (Hubert, 2006).

Chronic disease management is two folds, caregiver to patient and patient to patient. The caregiver to patient relationship can be supplemented by the communication through a virtual community, while patient to patient relationship can be created through a VC that enables peer support. A systematic review of peer to peer (patient to patient) interaction showed no evidence of virtual communities harming patients, though conditions under which mutual support can be more effective in a VC needs more investigation (Eysenbach, Powell, Englesakis, Rizo, & Stern, 2004). The patient-patient relationship involves the exchange of knowledge between patients based on their experience of their health conditions. Moreover, beside mutual moral support, the information and knowledge that patients generate represent a wealth of information that can be made available to researchers who can thus have insight into aspects of the patients’ health that wouldn’t be available otherwise, such as patient suffering, coping strategies, behaviour, etc. This knowledge can provide practitioners and researchers with precious information that could be used to enhance healthcare delivery protocols, and make longitudinal prospective or retrospective studies.

Building a MVC for self management of chronic diseases (1) needs a versatile design that can be used for a wide variety of diseases, and (2) should enable caregiver-patient as well as patient-patient relationships. In the following paragraph, we will present a model for a MVC for self management of chronic diseases and present the aforementioned two features, based on Kawash-El Morr-Itani Model (K.E.I.) model (El Morr, 2007; Kawash, El Morr, & Itani, 2007).

**A Versatile MVC Model for Chronic Disease Management**

In order to build a versatile MVC that allows self management of chronic diseases, we propose a model built around the service oriented architecture concept. The center of this model is a platform that offers several services that can be used by the community members. A member can discover the
Mobile Virtual Communities in Healthcare:

Figure 1. The general architecture of a mobile virtual community platform for chronic disease management

![Diagram of mobile virtual community platform]

services available on the MVC and use them. The central service being the Context Awareness Service; it provides the VC members with the ability to discover members’ contextual information (e.g. location based services). The telemonitoring service is the second core service in the design; it provides disease-specific telemonitoring services. Figure 1 illustrates this model.

Mutual Support: Patient to Patient Communication

Kawash-El Morr-Itani (K.E.I) mobile virtual community model has already been proposed as a versatile model built around a producer and consumer roles; each member of the MVC can play both roles by producing information or consuming it. The MVC platform can track users and generate a snapshot of the community as presented in figure 2. The snapshot represents members as spot circles in a geographical area (e.g. location of a member in a city). The size of the member spot is defined by users and represents the user level of awareness; indeed, a member who needs a high level of awareness, i.e. to be aware of members (or actions happening) in a large geographical area, will assign a large radius to her/his circle.

Members can receive notifications of the presence of another member when their corresponding circles (representing their required awareness) overlap. In Figure 2, MVC members A and B are represented by 2 circles that are intersecting with D circle (representing member D). Therefore, members A and B will receive notification of the presence of D in their neighbourhood and D will receive notifications of the presence of A and B in her/his neighbourhood. The radii of A, B and D are different since each member defines a different awareness level; for instance, A was keen to meet members in a geographic area larger than B. The awareness level and other parameters can be defined by the each member using a platform’s service.

The relationships between members’ spots are calculated based on simple arithmetic. Two members can be in one of the following two major states:

- **Disjoint**: The members’ spots are mutually exclusive; such is the case of A and C in figure 2
- **Intersect**: The members’ spots have a common area; such is the case B and D as well as B and α in figure 2

Therefore, members can be aware of each other’s presence in a simple and yet efficient way that does not require extensive computing power.
Mobile Virtual Communities in Healthcare:

The platform can always map the members’ positions and, using simple mathematics, compute the members’ circles that intersect. Community members with intersecting spots will be notified of each other’s presence. Obviously, each member can use an MVC membership management service to customize her/his member’s parameters; for instance, a member can make her/his contextual information available to other members, or can hide this information. Besides, a member can choose to stop receiving alerts from the MVC, or decide on the time slots and the dates she/he wishes to receive these alerts. As previously mentioned, members can also use the mobile membership management service to tune the radius of their spots which represent the size of the geographic areas of interest to them, the center of which being their own position in the city at any time.

Using the MVC, members can be aware of each other’s presence in the city, and consequently communicate and exchange information. Members with chronic diseases can therefore use the MVC to for mutual support by exchanging life experiences. Besides, each patient can communicate some information related to the chronic disease to other members of the community (e.g. a healthy recipe, a new scientific finding). The patients can also use the MVC to foster sociability in the community; thus, members can use a shared calendar service to set appointments with other members for a healthy dining, or a group jogging, or other kind of healthy activities.

Patient Monitoring: Patient to Caregiver Communication

The same MVC can be used to connect patients and caregivers. Once a patient situation needs attention (e.g. very high or very low glucose level in the blood, an elderly has fallen down), the device monitoring the patient’s health, or the patient herself/himself, can generate an alert and propagate it to the nearest paramedic using the telemonitoring service on the VC platform. The MVC should have available a telemonitoring service that allows caregivers and patients to exchange securely health information and thus to monitor patients health. A context awareness service would be able to determine the position of the patient based on their GPS enabled mobile devices. Once an anomaly has been detected the telemonitoring service notifies the most available or nearest caregiver and/or the patient. The caregiver can take a corrective action: sending an ambulance, calling or notifying the nearest paramedic, calling the patient, etc. (see figure 3)
Mobile Virtual Communities in Healthcare:

Figure 3. Communication between patient and health care professional using a dedicated chronic disease management MVC

Mobile Chronic Disease Management Scenarios

We will illustrate in the next two scenarios how can Mobile VCs be of support for chronic disease management. The two scenarios are in relation with diabetes and obesity.

Scenario 1: Diabetes

Mary is a student at Knowledge University; she is diabetic. The accurate management of her health condition is centric to her well being and her daily life. She was very glad to participate in the new launch of the first Mobile VC for diabetes management at her university: The Diabetes Management Community or “DMC”. She met a health professional in the on-campus clinic, discussed with her the practicality of her health situation and how she is managing her health daily; and then joined the DMC via a website that she could access in the clinic. Since then, Mary started receiving on her mobile/cell phone some daily health advice, as well as reminders to take her medications on time and to measure her blood glucose level; all these three services are of prime importance for to manage well her health. Furthermore, Mary could collect the measurement she takes using her blood sugar level measurement device, and send them through her Bluetooth enabled mobile phone to the DMC; these measurements were received by one of the many health professionals moderating the DMC. In case of an anomaly, the DMC system generates an SMS notification/alarm that is sent to Mary as well as the healthcare professional who is managing her case; the latter will contact Mary by phone whenever she/he estimates necessary. In the case of an emergency, the healthcare professional can call an ambulance and send to it the exact location of Mary due to a location based service offered by the DMC. Mary is also given the choice to push a specific screen option, or a combination of buttons, that sends an SOS request with her location to the DMC system. The latter dispatches a message to the appropriate parties and sends the request to the ambulance nearest to Mary’s location.

Besides, Mary has just joined a new service in the DMC that notifies her daily (though she could have chosen a different notification frequency) about healthy food recipes and moderate physical activities that suit her health situation. She could even download a video teaching her how to practice the physical activities. Lately, she bought a Bluetooth enabled pedometer that she is using during her daily jogging sessions to register the distance she traveled. When she ends her jogging session, she uses her Bluetooth enabled mobile phone to upload the pedometer data to a newly added DMC service that collects members’ jogging
related data (e.g. number of meters, date, time, etc.). The DMC healthcare professional reacts weekly to her pedometer measurements in an encouraging way in order to give her moral support (eventually giving her a phone call); besides, the system sends her succinct reports on her physical activity by email or SMS. Mary feels more comfortable, secure and in control of her health situation since she has joined the DMC.

Scenario 2: Obesity

Dico, a young computer professional is obese; he did try several times to stick to a one diet or the other without success. He tried formulae that were published in a local newspaper or that was televised in a show; but he could not always implement them either because they were not tailored to his needs or that he forgot few details; besides he really needed the moral support to continue a diet; and sometimes he felt he wanted to talk to people who are living the same experience. The issue that mostly frustrated him was finding each day a different recipe that is suitable for his diet!

Yesterday, Dico’s family physician, discussed with him this new thing called “Diet Community” or DietC, established by a group of physicians and dieticians. He subscribed to DietC; he only needed to enter few parameters such as his mobile phone number, his name, his weight and height that allow the computation of his body mass index (BMI), and few other health indicators. His physician advised him with a specific diet that was also entered into his DietC profile. Since that moment Dico was receiving daily on his mobile 3 times a day 3 meal suggestions for breakfast, lunch and dinner that are tailored for his specific needs. Besides, each week, Dico is sending to the DietC his new weight measurement via SMS or mail or web. He had also the chance to go online to the DietC web based interface and display a chart showing how he is progressing, or search for new information or simply have a chat with some other fellows in DietC and discuss progress, difficulties, and seek peer moral support. A year later, Dico was pleased to discover a message in his mailbox concerning a new mobile service that allows community members to discover, among other things: (1) healthy food restaurants in the geographic area around them at any moment, and (2) the presence of other members around an area of interest. This new service allowed Dico and other members to arrange common healthy dinners and lunches, in restaurants or in a member’s house; in the latter case, every member used to bring a special food he/she prepared at home and share the meals. Dico found this feature particularly helpful and supportive. Besides, these common dinners and lunches helped strengthening his sense of belonging to a real community of people he now knows in person.

Finally, Dico’s family physician could always go online to see how Dico is progressing and called him from time to time to give him advice and support him or propose an appointment for follow up; that particularly meant a lot for Dico since it added a personal touch to his relation with his family physician.

Dico and some other members even signed to participate in a study conducted by few psychologist who wanted to access DietC in order to understand the determinants of the members’ behaviour and suggest improvements on DietC service.

DISCUSSION

Advantages

Mobility in the chronic disease management case would offer many advantages, the main ones being: improving patients’ independence, enhancing patient productivity, providing continuity of care, decreasing healthcare cost, empowering patients, providing better health, increasing clinical knowledge, increasing information symmetry, and enhancing the quality of life.
Mobile Virtual Communities in Healthcare:

Indeed, managing self-health while in mobility increases patient independence, the patient is no longer bound to home or to a point of care, she/he can continue their activities while taking care of herself/himself. Since the loss of independence has a direct impact on the health related quality of life (HRQL) (Karin, et al., 2004) the increased independence would be expected to have a positive impact on the HRQL. Besides, with patient increased autonomy the patient productivity is improved, and his/her contribution in the society is increased as well, due to less absenteeism at work or college/school, and due to a better health that has a direct impact productivity (Tompa, 2002).

On the other hand, mobility in chronic disease management will provide better continuity of care for patients since it allows healthcare professionals to reach out for patients when necessary and to advise them when needs be while these patients are distant, thus complementing the care given at a clinic or hospital. The overall approach would have a direct impact on the cost of healthcare; indeed, more autonomous and better supported patients will less likely visit emergency departments or hospitals, which would result in a decrease in the healthcare cost. Moreover, the whole framework empowers patients; indeed, patient members of such communities are supposed to take care of themselves and co-handle their health with a caregiver, it is known that patient empowerment has a positive impact on health (Angelmar, 2007). Furthermore, the direct implication of the patient in their care in a virtual community while they are continuing their daily activity, allows gathering a phenomenal amount of data related to their conditions and experiences, a situation that wouldn’t have been possible without mobile VCs; therefore, clinical knowledge would grow as a result of analysis of the information gathered from the patients’ experiences and behaviour. In addition, the patient is expected to have access to more information through her/his interactions with a health professional and access to information through knowledge dissemination mean in the mobile VC; this would help to fill the gap of information between the patient and health professional balancing to some extent the well known information asymmetry between both parties. Overall the patients are expected to experience a better quality of life.

Challenges and Limitation of Mobility

Nevertheless, this approach raises many challenges that should be overcome in order for it to be successful; the main challenges are: the “have nots”, lack of face to face interaction, need for usability and support, managing stress and resistance to change, providing trust, security, confidentiality and policy monitoring, and need for multidisciplinary research.

A basic limitation that is rarely mentioned is the “have nots” problem; many people will either have no mobile device to access the services provided, or would find the experience too ‘technical’ and lacks the human touch i.e. the face to face interaction with a human (Brunett & Buerkle, 2006; Rheingold, 2001). Besides, the interaction via the different devices (e.g. mobile phone, PDA, computers) will be a challenge for patients, especially for elderly and people with disabilities, as well as for healthcare professionals; hence, the need for user centered design; indeed, usability is of major importance for the success of any information system in healthcare and other sectors (Preece, 2000) and its lack can lead to disastrous consequences (Vicente, 2004), a difficult to use, difficult to learn or remember, user interface impedes the adoption of technology; in this perspective a user centered approach to the interface design would be a must. Since these MVCs are dedicated for patients with chronic diseases, a special attention should be given to situations where the physical capabilities of the member patients does not allow the usual interaction models with a device (e.g. use of buttons, touching a screen). Such situations may arise for people with disabilities (e.g. visual impairment
Mobile Virtual Communities in Healthcare:

due to diabetes). In such cases, designers need to create new model of interactions using speech recognition to command the devices, or sensors to send an alert in case a patient, such as an elderly, need attention (e.g. falling down, change of some vital parameters) to launch an alert.

Furthermore, healthcare professionals will be managing patients while they are away; therefore, a continuous technical support for health professionals is a must to insure a successful experience with their use of the MVCs. This situation is linked to another challenge as well, that the healthcare professionals stress, one concern resides in the fact that if technology helps the professionals to commute less, and hence to spend more time with patients and less time on the roads, then this will result in the health professionals seeing more patients during their working hours, and therefore experience more stress and suffer from a “burn out” already experienced by nurses (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002). A more usable interface and more support can play an important role in helping professionals manage their work without adding stress from technology failure and drawbacks in usability. Besides, usability and support address another concern related to resistance to change (Longo, 2007; Romm, Pliskin, & Clarke, 1997), without the former, the latter will increase and will jeopardize a successful implementation of a mobile VC; in this context, managing change and addressing caregivers’ concerns are vital needs.

Some of the current limitations of current mobile devices are related to the battery life time and the processing power of the devices. Though, upcoming capabilities of mobile devices, such as in the case of 3G mobile phones and smart phones, promise to overcome these limitations. It would be safe to expect that mobile devices will overcome processing power limitations in the future, and will be more adapted for health MVC applications. Moreover, increased network bandwidth in the future will increase the capability of permit mobile devices offer reliable e-health services such as MVCs.

Nevertheless, security is a very delicate matter in the health field (Abdul-Kareem, 1998; Aljarch & Rossiter, 2002; Furnell, et al., 1998) indeed, the data exchanged is very sensitive and any breach in security can have a tremendous impact on one’s life (i.e. denial of job or insurance); finding, the right balance between security of the system and the flexibility of the service is a challenge for the success of mobile VCs. Data in MVCs does not only involve user (e.g. patient) data but also the user’s location, therefore security related to location and context disclosure in general is an important factor to consider (Consolvo, et al., 2005). Other security issues would relate to the frameworks used for MVCs’ implementation, in this regard mobile agents are playing a prominent roles and designing a security model for agent-based community is necessary (Chhetri, Price, Krishnaswamy, & Seng, 2006; Malik, Qureshi, Ali, Ahmad, & Suguri, 2005; O’Sullivan & Studdert, 2005; Page, Zaslavsky, & Indrawan, 2004; Spyrou, Samaras, Pitoura, & Evripidou, 2004).

Nonetheless, implementing security solutions is not enough; indeed, security and privacy policies should also be developed in order to clarify the confidentiality obligations and responsibilities of those accessing patients’ information (nurses, physicians, etc.) (Kokolakis, Gritzalis, & Katsikas, 1998); moreover, in order to make sure that the confidentiality is maintained finding strategies to monitor policies’ implementation is imperative. Furthermore, establishing trust mechanisms between the different mobile VCs’ members should be investigated; indeed, trust is one main aspect in health care service delivery (Carter, 1998; van der Bijl, 1998; Williams, 2008).

Finally, studying the determinants of members’ behaviour remains an important factor in health mobile VCs (Smith, Orleans, & Jenkins, 2004), the aim would be to deliver an effective healthcare service; we believe that a healthcare oriented mobile VC research and development (R&D) can only be addressed in a multidisciplinary way; but although this adds some complexity to R&D, it provides an opportunity for innovation.
CONCLUSION

In an era where the population is ageing, the number of citizens with chronic disease is increasing and the cost of healthcare delivery is on the rise; minimizing the healthcare cost becomes important endeavor. On the other hand, mobile technologies are becoming widespread and virtual communities are evolving taking advantage of users’ mobility; we believe that tapping into these two fairly new domains provides an opportunity to manage chronic disease and alleviates challenges in the healthcare system. Our approach presents many advantages for patients; indeed, it can enable a better quality of life and would have a positive impact on their health; besides, it may decrease healthcare delivery cost, and has a positive impact on patient productivity and on the society in general. Though, several challenges are ahead, especially in terms of health data security, confidentiality, and device and software usability; indeed, a user-centered design approach would be essential for the success of mobile VCs for chronic disease management. Finally, spreading the positive outcomes to the marginalized population is a challenge for researchers, governments and social justice advocates.

REFERENCES


Canadian Institute for Health Information. (2007). Health Care in Canada. Ottawa, Ontario: Canadian Institute for Health Information.


Mobile Virtual Communities in Healthcare:


Mobile Virtual Communities in Healthcare:


