Abstract

The use of mobile technologies to support medical care is often referred to as mHealth. In this paper we will look at how a mHealth knowledge sharing environment can support local communities in Ethiopia, by placing them in the solution space to fight communicable diseases. The research will use an interventionist action research approach to a community’s problem. As such it will identify the key factors in developing a community based mHealth application. Because, such mHealth applications involve a socio-technical phenomenon, a socio-technical lens will be used for the purpose of analyzing the data.

Keywords mobile health, community based mobile health, knowledge sharing

Introduction

The use of mobile technologies to support medical care is often referred to as mHealth. mHealth encompasses a wide range of technologies. In this paper we will be looking at a specific type of mhealth that involves the use of mobile phones to support local communities in Ethiopia in their fight against communicable diseases. In low income countries the lack of information and the low level of healthcare support have led to a situation whereby preventable diseases continue to infect individuals and spread throughout a community. In order to develop a local knowledge base and create community support for medical health information exchange, mHealth applications appear to offer significant promise.

While the penetration rate of mobile phones in Ethiopia is just 34% as of 2014 it is still significantly higher than broad band and land line penetration in the country. For a comparison, in 2012 the number of physical telephone lines in use was 797,500 while the number of mobile cellular telephones in use was 20,524 Million (The world fact book, accessed Jan 2014). Mobile phones are the most accessible form of telecommunications networks and as such targeting these devices to address local health issues holds promise. These devices can run a wide range of applications which enable users to connect to various cloud infrastructures and a network of individuals. However, there is still a lack of user participation in the development of applications available for mobile systems development (Sheh and Shen, 2001). Healthcare services are also frequently disjointed and locked into provider-defined silos that ignore wider community needs (PW Cooper, 2013). In today's ever changing and complex information systems environments, inclusion of user’s requirements may not be sufficient. Users themselves need to be participants in the design and enhancement of mobile health information systems so that their knowledge and experience can be included. Therefore, we believe that there is a need to design and develop a mHealth community based model as an effective means to exchange local knowledge on communicable diseases. In countries, such as Ethiopia there is a high percent of illiteracy (61% of Ethiopians are classified as illiterate according to UNCIEF) and there is no one common language used within the nation. Therefore, enabling the design of technologies that can be easily accessed by local groups of individuals will be essential in the development of such health applications.

The availability of different computing and communication devices in the hands of many people with the authority to assemble both the devices and services has changed the way people work, socialize, and play (Scheepres and Middleton, 2013). New developments within mobile information systems such as
Advancements in mobile applications and wireless networks also encourage new user groups to ask for new services that are being utilized in quite new environments (Krogistie, 2001; Scupola, 2011). This development is transforming the standard e-services into m-services which is characterized by fixed locations to anytime, anywhere, and anyone transactions making mobile phones a critical component of the new digital economy (Scupola, 2011). Mobile phones having the above features and when powered with mHealth applications brings the capability of a better healthcare service compared to the conventional wired healthcare information systems (Wu et al, 2008).

To develop mHealth applications one must consider the highly diversified nature of its stakeholders. The actors include those who participate in acquiring, designing, developing, and deploying technology at the programmatic level, and customers/users who envision desired goals and create meaning and value by continuously creating and recreating specific information services (Montealegre et al, 2014). At the adoption level it is the individual adopters who make the decision on how to assemble their devices and services on these devices (Scheepres and Middleton, 2013). Thus giving a role to mobile health users and participants in the solution space of community health issues will be a step to further improve healthcare services.

Previous IS literature has been criticized for placing more emphasis on organizational outcomes than humanistic outcomes (Sarker et al., 2013); favoring organizational or business objectives and outcomes over societal or human outcomes (Drechsler, 2012). However, as a result of access that many people have to mobile computing devices and the development of broadband Internet infrastructure are playing an important role for the introduction of more socially minded IT applications. mHealth systems are among these applications. IS research is also criticized favoring method driven and/or theory driven research than research driven from the society’s problem (Hevner and Chaterjee, 2010). In order to bring focus on humanistic outcomes of IT, it is most beneficial to intervene in a real social problem. Community health issues are such a social problem where effective management and sharing of community’s knowledge and experience through healthcare knowledge sharing systems will have impact on the management of the problem.

Community based healthcare knowledge sharing systems must place the society in the solution space when developing mHealth systems. The objective of this research is to add to previous work and gaining deeper knowledge of how co-creating a mHealth knowledge sharing system can best meet specific societal needs. To reach its objective, the research will use an integrated design science-action research method. This integration according to Lee (2007) has the potential to bring about greater rigor and relevance.

The primary research question addressed by this proposal is: What are the key factors in developing a community base mHealth application that is meant to be used by Ethiopian citizens?

Socio-technical approach to community-base mhealth application development

Socio-technical design will help address the complex issues related to people, task, structure, and technology as it helps to explore the methods of structuring the social system so as to make it self-managing (Morris, 2009). It supports end-users to be direct participants in defining system requirements and helps to understand the workplace, inter-organizational networks, social worlds and cultural setting (Scacchi, 2004). This approach enables information system developers to understand system requirements, and for users to understand and communicate effectively with developers to continuously design and redesign the information systems (Scacchi, 2004; Whitworth and Moor, 2009). Continuous improvement is important because whenever new tools are released into community, we are likely to see new systems of behavior evolve that better meet the real needs of the community than the initial intervention design (Coiera, 2006). This urges making the community play a role in the design and redesign process. Having the above features, socio-technical theory will be used as a theoretical lens for conceptualizing and analyzing the concepts for the design of a mHealth information system to address a health problem in the context of healthcare industry in Ethiopia.

Moreover, socio-technical system research is adaptable to changing conceptions and practices (Sarker et al., 2013) considering the human social dimension and recognizing the effect of technology on humans who use it and the effect of the users on the design (Whitworth and Moor, 2009). Both (the social and technical) components of the socio-technical system need to be integrated and must work together.
smoothly so that the overall system can achieve its true potential (Whitworth and Moor, 2009). The design or redesign of the system must seek out the impact each subsystem has on the other (Cartelli, 2007). This gives recognition to social context in software and systems engineering (Morris, 2009). Focusing on the human aspect of system design is not also sufficient (Balloni, 2010). Participation is more important.

**Community healthcare**

As healthcare continues to grow in cost and people demand better quality healthcare, community intervention is one method to be considered in addressing local health problems. Community healthcare is delivered in a broad range of methods (Ho, 2008), this study will focus on the use of a mHealth knowledge sharing environment. Such an intervention is considered important because the community can have unique skill sets and expertise for managing their member's lives, dealing with their frustrations, and striving to ensure health of its members and to reduce people’s vulnerability to disease and illness (Eng and Parker, 2002).

Problems are manifested through an accumulation of events, behaviors, and symptoms during a period of time (Eng and Parker, 2002). This hints community intervention as has a potential to manage the phenomena most effectively because the point at which a problem begins is as indeterminate as the point at which help becomes effective (Eng and Parker, 2002). This places the community at the core of its problems and solutions for rendering help. Perception of disease is related to a person's socio-cultural reality which shapes both one's behavior and ability to respond to disease (Okafor and Amzat, 2007). In this regard community intervention has become important for disease control and prevention. Community partnership and intervention brings the society together, increases available resources, and focuses on the concern and problem of community to achieve better results than any single group could have achieved alone (Butterfoss and Kegler, 2002). In order for communities to develop their capacity to deal with their own problems; people should participate in making, adjusting, or controlling the major changes taking place in their environment. This is because self-imposed or self-developed changes have meaning and permanence (Butterfoss and Kegler, 2002). It is also known that consensus building and active involvement of diverse constituencies, holistic approaches, and application of individual’s skills and resources in collective efforts to meet their own needs are the underlying community approaches to problem solving (Butterfoss, and Kegler, 2002). Application of knowledge sharing strategies and providing appropriate tools to support this will be of paramount importance. Knowledge sharing environments are ideal mechanisms to introduce such interventions and address complex problems, yet little is known about how should such systems be designed and developed in under developed countries with low literacy rates.

**Mobile Health**

A mHealth knowledge sharing environment has the potential to improve the healthcare environment in Ethiopia and leverage community involvement. Its meaning will emerge from how it is applied and redesigned by the community within existing healthcare systems (PW Cooper, 2013). Mobile innovation is flexible, can be adjusted to fit the knowledge of different users and their technological aptitude, and users in turn can influence its further development (Andersson et al, 2007). The community is thus expected to be part of the solution space applying the knowledge gained from the knowledge sharing mhealthcare system. The implementation of such a technology on the widely accessed mobile phones will increase the success of the intervention.

Past research in the area of mHealth has focused on the usability of a mobile electronic medical records (Wu etal, 2008), a case-based decision support studies for intelligent patient knowledge management (O’Sullivan, et al, 2007), studies on compliance behavior in a mobile healthcare system (Lowry et al, 2014), and factors determining consumers resistance to mobile health applications (Gurtner, 2014), etc. Most research done on mHealth however does not focus on developing means for a community to take part in finding solutions for its local health problem. Failure to mobilize the knowledge and experience of the community may contribute to the failure of the mHealth information system. This paper will investigate the key factors for developing a community based knowledge sharing information system to address local health problems. mHealth is suitable for such a system due to the fact that it is convenient,
inexpensive, can provide quality patient care, and is used to transform healthcare into prevention-based and patient-focused systems (PW Cooper, 2013). There is no doubt that the inclusion of the mHealth users as participants to further develop and enhance it as per their local knowledge and experience will add value both to the acceptance and improvement of the system (Whetton and Georgiou, 2010).

Research Methodology

As the objective of this research is to design a mHealth information system for solving social health problems in a community, it is expected to produce an artifact while intervening in a certain problem situation. Action research suits as its concern is concern on specific fields and aspects of organizational and sociological research (Drechsler, 2012). It argues complex social processes can be studied best without splitting it into component parts by intervening and introducing changes (Baskerville, 1999). The community’s intervention together with the technology to be used will introduce a change in social, task, technology, and organization and the relationship that exists between them. In the context of health it may also introduce a change in disease management and control. Action research is also important for new or changed systems development methodologies which involves the introduction of changes and is interventionist (Baskerville, 1999). Researchers and subjects will co-participant in the enquiry and change experiences carried out in an intervention in a natural setting (Baskerville, 1999; Lee, 2007).

Socio-technical design can be seen as a complex design process that includes interaction between the technical and social systems in order to encompass the totality of the design (Mumford, 1995; Miah et al., 2012). In addressing such complex issues, action research carries out interventions in an organizational setting where people are at the core. Socio-technical phenomena can occur in different action contexts and it discusses both the abstract artifact and the means and examples of its instantiation to specific application contexts (Andreas and Philipp, 2014). To be in line with this, the context and application of the current mHealth knowledge sharing system will follow an interventionist approach focusing on a selected community health problem as a case and will follow a case study approach. This helps in understanding the socio-cultural practices and social structure or organization intervention to its treatment and prevention. The intervention on the other hand will introduce careful understanding of the decision making, resource allocation and financial authority within the community ensuring effective control programs (Ricci, 2012). So to bring a positive change on individuals and the community, it requires instilling knowledge strategies from the community to the current health systems through seamless integration of new knowledge into the day to day routine service delivery (Ho, 2008).

The in-depth case study is a tool for such interpretive investigation where a frequent visit to a field site is required (Ho, 2008). Case studies are well designed and suited to understand a complex phenomenon such as IT and ubiquitous interactions among organizations, technologies, and people holistically (Dubé and Paré, 2003). The objective of this research is to design a system to bring social changes especially behavioral changes in a community. Empirical data will be collected through unstructured interview from the healthcare professionals and the community (physicians, nurse, health extension workers, and the community).

Conclusion

This emerging work looks to expand the boundaries of mHealth application design to encompass a socio-technical lens to address embedded cultural issues and societal norms in a community health practice in the developing world. This work not only expands our knowledge of mobile application development but also will aid in the solution to a real world problem being faced in Ethiopia.

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