The Wow Factor of e-Health

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Abstract
Some of the latest healthcare buzzwords are e-health, m-health or telemedicine. Is this the latest fad or is there indeed a lasting wow factor? The use of Information and Communications Technologies (ICT) to support the achievement of health outcomes, namely, e-health has the potential to transform the manner in which health services are delivered. A plethora of applications are emerging though many also quickly disappearing and users are still unsure of the true e-health benefits. In this paper, we discuss the current trends in pervasive e-health with the hope that this endeavor will assist e-health scholars channel and focus their research efforts. Having extensively reviewed extant research, we focus on health education, electronic health records (HER), standardization, and m-health. We present two case vignettes to illustrate key aspects of success.

Keywords: e-health, trends, health education, electronic health records (EHR), standardization, m-health, telemedicine, Medicine 2.0.

1 Introduction
The use of digitally-enabled technologies such as information and communications technologies (ICT) to support the achievement of health goals has the potential to transform the manner in which health services are delivered (WHO, 2011). e-Health is defined as the use of ICT to improve health and health care outcomes (Lintonen, Konu & Seedhouse, 2007; Mackert, Love & Whitten, 2009). e-Health is an emerging field which comprises the intersection of numerous disciplines, including medicine, biomedical engineering, computer and information science, statistics, health promotion and marketing, and management science (Anderson, 1997; Chiasson & Davidson, 2004; Wickramasinghe, Bali & Tatnall, 2007). ICT are touted to offer a huge potential to raise the quality, increase the efficiency, and decrease the costs of primary, secondary, and tertiary healthcare (Heinzelmann, Lugn & Kvedar, 2005). Additionally, these technologies can empower patients to better understand their medical conditions and take responsibility by making informed decisions about such conditions
More specifically, the espoused benefits of e-health include preventing and controlling of diseases by way of facilitating health information acquisition (Baker et al., 2003), customizing and personalizing information dissemination (Tate, Jackvony & Wing, 2006), detecting and treating diseases (Thomas et al., 2002), and encouraging the adoption of healthy lifestyles including weight control, physical activity, and quitting smoking (Tate, Jackvony & Wing, 2003).

For example, chronic diseases such as diabetes in addition to having a huge impact on the diabetes sufferers themselves as previously illustrated, can also be very costly to treat (AIHW, 2007, 2008). Yet, pervasive diabetes monitoring solutions can offer enormous benefits which include efficient and accurate monitoring and control of glucose levels and minimizing unnecessary hospitalizations or even just doctor visits (Wickramasinghe, Troshani & Goldberg, 2009). These solutions have also been shown to improve patients’ quality of life by preventing and controlling disease progress and instilling preventative behaviors amongst diabetes sufferers (Koch, 2006; Wickramasinghe, Troshani & Goldberg, 2010).

In this context, Chiasson and Davidson (2004) argue that although there is an increasing number of contributions to e-health research, knowledge in this area remains limited and under-developed. Additionally, as Koch (2006) and WHO (2011) argue, most modern developed healthcare systems are experiencing many challenges such as:

- Increasing demand for healthcare services due to increasing aging populations and changed lifestyles resulting often in chronic diseases.
- Increasing demand for healthcare accessibility (e.g. home care).
- Increasing need for efficiency, personalization, and quality equity in healthcare.
- Increasing and chronic staff shortages.
- Limited budgets.

There is widespread agreement in the literature that e-health can help in addressing these challenges. Thus, knowledge and understanding of current e-health trends can be useful in assisting researchers address these challenges since it can help understand why pervasive e-health solutions emerge and how they are shaped. Additionally, it can assist e-health scholars channel their research efforts. Thus, the aim of this paper is to identify existing trends in e-health research. Having extensively reviewed extant research, we first discuss health education, electronic health records (HER), standardization, and m-health. We present two case vignettes to illustrate key aspects of e-health success. The paper is subsequently concluded with a discussion of research directions.

### 2 Health education

Recent research has stressed the need for improving health literacy and education, particularly, because it can have a huge impact on individual quality of life, public health, and even more broadly, on national economies (Ball & Lillis, 2001; Gazmararian et al., 2005; Mackert, Love & Whitten, 2009). Many organizations around the world are using pervasive e-
health technologies to address health literacy and education problems. The main reason for this is attributed to the fact the e-health technologies offer adaptability, cost-effectiveness, and accessibility (Eysenbach, 2007). In addition to this, findings reported in Ball and Lillis (2001) concerning a study conducted by Deloitte & Touche and VHA Inc. reveal that two thirds of the US patients do not receive any literature in relation to their medication conditions. At least in part, this is getting patients to take matters into their own hands and look for medical information online (Ball & Lillis, 2001).

One of the technologies that is receiving much attention is Web 2.0. It offers online activities that encourage interactivity and collaboration through interpersonal networking and personalization while also fostering a sense of community amongst users (Abram, 2005). There are many Web 2.0 applications that offer a huge potential for health literacy and healthcare education (Boulos & Wheeler, 2007) including wikis, blogs, podcasting, RSS feeds, social networking applications, and instant messaging (IM). We explain these in turn and illustrate them with examples about how they are being used in relation to health literature and education.

A wiki is a collaborative application that allows users to provide content while also enabling that content to be edited by anybody (Boulos, Maramba & Wheeler, 2006). In healthcare settings, wikis can be used for knowledge sharing (e.g. http://www.wikisurgery.com). Additionally, wikis offer strong localization capabilities enabling non-English posts as well. For example DiabetesPost at http://www.diabetespost.com/ enables posts to be made in Arabic.

Blogs enable users to provide online journals or web diaries that can be easily published and updated chronologically on issues of interest or on common themes including health literacy and education (Boulos, Maramba & Wheeler, 2006). Some of the most notable health education blogs include http://drugscope.blogspot.com and http://biographyofbreastcancer.blogspot.com. As blog users are not necessarily professionals, there is a substantial risk for misinformation, although, according to Boulos et al. (2006) inherent ‘collaborative intelligence’ acts as a built-in quality control and assurance mechanism for blogs.

Podcasts are location and time independent digital files that can be downloaded automatically by free software on portable devices, such as Apple iPods/iPads or MP3/MP4 players and played by users at their leisure (Boulos & Wheeler, 2007). Notable examples of health education podcasts include http://healthliteracyoutloud.com.

RSS (Really Simple Syndication) feeds are protocols that are used to indicate updates or additions to content to websites or blogs as per user-defined queries or requirements (Boulos & Wheeler, 2007). Typically, RSS works when users subscribe to RSS feeds using RSS aggregators that are typically supported in modern browsers. Aggregators crawl selected websites regularly and display feeds to users enabling them to conveniently and quickly overview updates on specific topics at any point in time at the selected websites (Boulos & Wheeler, 2007).

Social networking applications enable forming of groups of individuals that share common interests or circumstances. For example http://www.depressionnet.com.au is an Australian online community that provides comprehensive information for people living with depression. A similar social networking application is the CURE DiABETES group at
http://groups.myspace.com/cureDiABETES which is run by patients and supporters in order to help and support diabetes sufferers.

*Instant messaging (IM)* constitutes real-time online interaction between two or more users who can share text, audio, video and other types of files. A nurse-led web chat application enabling the public to interact with qualified nurses was well received by patients (Eminovic et al., 2004).

As patients wish to interact and exchange increasingly more information with healthcare providers, opportunities existing for using Web 2.0 tools and applications to enable or facilitate these interactions for literacy development and education purposes. By emphasizing education, these tools empower patients to take responsibility for their conditions, thereby making them active and responsible participants in their treatment regimen (Boulos, Maramba & Wheeler, 2006; Boulos & Wheeler, 2007; Mackert, Love & Whitten, 2009; Nicholas et al., 2001).

### 3 Electronic health records (EHRs)

Electronic health records (EHRs) represent medical information concerning patients which is meant to support healthcare-related activities and evidence-based medical decision support both directly or indirectly. This information is collected longitudinally during patient visits at any healthcare delivery setting (Raghupathi & Kesh, 2009). In addition to patient demographics, EHRs also include past medical history such as medications, problems, immunizations, radiology and laboratory results and progress notes (Raghupathi & Kesh, 2009). It is anticipated that in the future EHRs will offer rich medically relevant information in addition to text. EHRs will include still images, echocardiograms, endoscopies, and even video recordings of patient interviews or visits which will enable convenient access to expertise that is located remotely and even facilitate training of medical practitioners (Heinzelmann, Lugn & Kvedar, 2005).

EHRs can offer many benefits including complete, accurate, error-free universally accessible lifetime patient health information (Raghupathi & Kesh, 2009). They also offer significant productivity improvements in the healthcare industry (von Lubitz & Wickramasinghe, 2006). In a healthcare setting where healthcare costs are steadily increasing while pressures are growing to satisfy unmet needs and increasing competition, the promises of EHRs to offer quality and productivity constitute the main driving forces for developing them.

There are a number of risks that need to be mitigated as EHR development progresses and design issues addressed. Although EHRs offer many benefits, healthcare professionals may find with EHRs they may be exchanging a set of issues with another. For example, issues experienced with traditional manual paper-based patient record systems such as lost patient charts, poor handwriting, and missing information may be exchanged with issues with data capture problems, computer crashes, programming errors, and susceptibility for viruses and other malware which are likely to affect EHRs and potentially render them useless (Glaser & Aske, 2010; Goldschmidt, 2005).
Another major issue with EHRs concerns the privacy and security of confidential personal medical and health information (Rao Hill & Troshani, 2010; Troshani & Rao Hill, 2009). For example, unethical use of such information for personal gain by disgruntled or unethical employees or even legislated use of private information without an individual’s prior consent constitute serious risks that need to be mitigated as EHRs are developed (Goldschmidt, 2005). Thus, the question that needs further research is if the espoused benefits of EHRs will indeed outweigh their risks and development costs (Rash, 2005).

Extant research shows that EHR design and development have been constrained by major challenges (Raghupathi & Kesh, 2009). First, the literature suggests that existing EHRs seem to be driven by specific vendors or technologies and ignore the diverse and complex nature of modern healthcare settings and processes (Blobel, 2006). For example, driven by specific vendors, existing EHRs do not appear to comply with portability standards (Hippisley-Cox et al., 2003). Additionally, almost all existing EHRs are based on relatively simple relational database applications which consist of patient data entry forms and report generation capabilities, but which lack the capacity to be interoperable in large-scale distributed environments and to inexpensively scale up to fully functional applications (Hippisley-Cox et al., 2003; Raghupathi & Kesh, 2009). One possible way to address these issues is to take a holistic network-centric view to EHR design (von Lubitz & Wickramasinghe, 2006).

4 Standardization

Standardization entails developing standards in the development and provision of pervasive e-health applications and limiting the use of other options (Choudrie, Papazafeiropoulou & Lee, 2003; Damsgaard & Lytinen, 2001; King et al., 1994). Standards constitute conventions that are needed for the structure and behavior of computing functions, formats and processes (Engel, Blobel & Pharow, 2006). Standards play a critical role in the transmissions of electronic information, and as such, standard development, that is, standardization, is essential for the development and widespread diffusion of pervasive e-health applications. Lack of standardization can create interoperability issues adversely impacting information exchange between and among various e-health applications, that is, e-health applications can become “information islands” and thus present difficulties to integrate with larger healthcare systems (Tang et al., 2006).

For example, standards developed for electronic payments in the finance and banking sectors worldwide have been highly successful and have become widely diffused due to the national and international standardization approaches adopted and coordination amongst key stakeholders (WHO, 2011). Similarly, governments and industry associations are collaborating by way of the Global Harmonization Task Force in order to develop standards for medical technologies (WHO, 2011).

Standardization facilitates both integration and interoperability thereby enabling industry growth and development while lack thereof can make the development of pervasive e-health applications and their integration prohibitively costly (Engel, Blobel & Pharow, 2006; Koch, 2006; Lee et al., 2009). Standardization can include many aspects of e-health, ranging from terminology, text/image communications, health hardware devices, and even security and privacy (Lee et al., 2009). For example, South Korean e-health initiatives are considering the US Health Insurance Portability and Accountability Act (HIPAA) as a security standard for...
medical data and the International Classification of Diseases (ICD) for terminology standardization (Lee et al., 2009).

5 m-Health

Mobile health or simply m-health is defined as a component of e-health whereby medical practice is supported by mobile devices including mobile phones and personal digital assistants (PDAs) or any other wireless devices (WHO, 2011). According to the International Telecommunications Union (ITU), there are over 5 billion wireless subscribers in the world, over 70% of which reside in low- to middle-income countries (ITU, 2010). The widespread accessibility and availability of mobile phones makes these devices very powerful media for reaching individuals generally (e.g. with general health promotion messages) and patients suffering from various medical conditions, in particular, by way of mobile health applications.

Evidence collected in a recent World Health Organization (WHO) study shows that there are numerous activities of m-health services that are currently being offered in member countries including health call centers, emergency toll-free telephone services, managing emergencies and disasters, mobile telemedicine, appointment reminders, community mobilization and health promotion, treatment compliance, mobile patient records, information access, patient monitoring, health surveys and data collection, surveillance, health awareness raising and decision support systems (ITU, 2010). While 83% of WHO member states offer at least one of these m-health services, many offer four to six with the most popular m-health services being health call centers (59%), emergency toll-free telephone services (55%), managing emergencies and disasters (54%), and mobile telemedicine (49%) (WHO, 2011). As might be expected, the WHO study also shows that counties in the high-income group have implemented a greater range of m-health initiatives than those in the lower-income groups while m-health call centers and healthcare help lines appear to be popular across all income groups (WHO, 2011). Additionally, all income categories identified competing m- and e-health priorities was one of the greatest barriers to m-health adoption (WHO, 2011).

A recent study carried out by PriceWaterhouseCoopers’s Health Research Institute (HRI) presents the case for the market for m-health applications and services. For example, in a recent survey they conducted they found that 40% of respondents are willing to pay for remote health monitoring devices and monthly service fees to send data automatically to their doctors while based on these respondents, HRI estimate that the annual market for mobile health monitoring devices ranges between $7.7-43 billion (PWC, 2010).

The PWC study also identifies three main business models that can be viable in the m-health market (PWC, 2010). First, the operational/clinical business model enables all healthcare stakeholders including providers, payers, medical device and drug companies to use m-health applications to run their operations more efficiently. Second, the consumer products and services model provides unique value-added m-health applications to individuals. Third, the infrastructure business model offers connecting and secure infrastructures that enable m-health information and services (PWC, 2010). Further research is required to evaluate the viability and effectiveness of these models in practice.
6 Case vignettes

6.1 CASE 1: On-line social networking

Leveraging from the findings of the benefits of on-line social networks for supporting and reinforcing behavior, a calorie cruncher application was developed that works in conjunction with a social network application, namely Facebook to see if users would be interested in monitoring daily food intake and exercise to support a healthy lifestyle. Based on initial pilot study results from Germany, we find that individuals aged between 18-35 are indeed desirous to adopt a healthy lifestyle if it is possible for them to get this information and then monitor their own activities in an easy to do fashion, that is, with the least amount of hassle. While this was a small pilot and further follow up studies are now being conducted in Germany and Australia, the directional data from this study constitutes a sound basis for underscoring the benefits of such an e-health solution to support an essential positive behavior in today’s society; namely that of healthy lifestyle/healthy diet.

6.2 CASE 2 DiaMonD

Based on a longitudinal study that has spanned over ten years, researchers have shown the benefits of a mobile solution for the monitoring and management of diabetes whether type 1, type 2 or gestational. The solution is pervasive and works on any mobile device smart phone, PDA or disposable mobile device. Moreover, long term use of the solution has ensured a sustained decrease to haemaglobin A1C which in turn has been noted in leading medical literature to result in significant decreases to all the key co-morbidities generally associated with diabetes.

6.3 Lessons from the Case Vignettes

The preceding two case vignettes describe respectively an e-health and m-health solution that target leading and major healthcare problems today, namely, obesity and diabetes. The technology solutions in and of themselves are not particularly complex but they do take advantage of leading advances in Web 2.0 and cloud computing technologies as well as smart phones and other mobile developments in order to provide relevant ICT solutions to support critical health needs. Most especially the respective solutions support real time information exchange anywhere, anytime, they are low cost yet effective and efficient enabling patient empowerment and without requiring laborious and expensive administrative support. We believe that such examples highlight an opportunity for any/all e-health solutions and by doing so can enable patients to enjoy superior healthcare delivery.

7 Conclusion and future research

The healthcare industry is under increasing pressure worldwide from many challenges including quality improvements, chronic staff shortages, and limited resources including financial and human resources. The use of ICT to enable healthcare and improve health outcomes, e-health, is touted to transform the healthcare industry and help address these challenges. Although, the number of contributions in e-health research is steadily growing, knowledge in this area remains still at an embryonic stage (Chiasson & Davidson, 2004).
Having extensively reviewed extant research, we have discussed current e-health trends including health education, electronic health records (HER), standardization, and m-health. We believe that this discussion can assist e-health scholars hone in their efforts and extend existing limited research in these areas.

For successful implementations to become a reality in the identified areas, adoption of corresponding e-health applications by both patients and healthcare providers is necessary (Raisinghani & Young, 2008). In order for adoption to occur, coordinated campaigns are needed to establish public awareness and understanding concerning the value of e-health applications. These campaigns can encourage open-learning and information sharing. Additionally, given the complexity of e-health applications and diversity of stakeholders that they may ultimately affect, partnerships should be fostered between the different stakeholders including vendors, patients, providers, insurers, drug and medical device companies as well as between public and private sectors (Raisinghani & Young, 2008).

New research directions can extend the areas identified in the previous sections in many ways. First, controlled studies can focus on longitudinal analyses and investigations targeting the adoption of e-health applications and services in the identified areas (Cline & Haynes, 2001). Second, cost/benefits evaluations can be carried out to assess whether the costs involved in developing e-health applications can be offset by espoused benefits that these applications promise to offer (Halkias, Harkiolakis & Thurman, 2008). Third, further research needs to investigate the demographics of the patients seeking to use e-health applications, how they use them, the information they seek and its quality, and how their behaviors can be affected (Wyatt, 1997). This can also help identify underserved communities, thereby, address equity concerns. Finally, further research can also examine the manner in which public policy can assist the development of e-health applications (e.g. subsidies, training) (Cline & Haynes, 2001).

References

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