

Judging the Value of Mobile Healthcare Solutions for Improving Outpatient Adherence

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INTRODUCTION

A serious problem in today's health care is the growing incidence of chronic diseases and conditions with dire human and financial consequences. For instance:

- The worldwide burden of chronic conditions will increase from approximately 600,000 *Disability Adjusted Life Years (DALYs)*, that is, lost years of healthy life caused by premature death or disability, to over 900,000 *DALYs* worldwide during the period 1990-2030 (WHO, 2003);
- The care of the 90 million Americans with chronic conditions consumes more than \$1,000 billion each year, 75% of national medical costs (Chin, 2002); and,
- The high incidence of chronic illnesses is one of the causes for increasing health care costs in Canada, with total health care costs reaching about 10% of the gross domestic product (GDP) (Coombs, 2002).

The implications of chronic diseases and conditions, associated with a growing elderly population that needs more medical attention (Siau, Southard, & Hong, 2002), represent a supplementary challenge for health care systems. These are already facing an increasing divergence between population demands for better care and the resources available to meet these demands (Cowling, Newman, & Leigh, 1999).

Managing some chronic illnesses in outpatient conditions may provide solutions to alleviate some of the pressure on the health care system. Keeping patients out of hospitals while providing them the best treatment

conditions possible could be a win-win situation for both people and society. However, there is a serious obstacle to this solution: patient adherence to treatment is no more than 50% on average, with dire human and financial consequences (Dezii, 2000; WHO, 2003).

The problem of low adherence in outpatient conditions on one side and the ubiquity of mobile communications and data services on the other side suggests an innovative idea: improve some forms of outpatient adherence through the use of mobile information technology (IT). This idea springs from the general approaches recommended for improving adherence in relevant medical literature (Haynes, Yao, Degani, Kripalani, Garg, & McDonald, 2005; McDonald, Garg, & Haynes, 2002). Although the philosophy of using the newest technology for promoting wellbeing may seem attractive, various human, technological, and financial issues must be considered first (Cocosila & Archer, 2005b).

On the adoption of mobile technology, an important aspect that has not been addressed adequately in the literature is the business perspective. The objective of this study is to introduce a framework for determining the business case for mobile information technology (IT) solutions that will help to increase outpatient adherence.

BACKGROUND

Chronic diseases and conditions are either infectious (e.g., HIV-AIDS, tuberculosis) or non communicable (e.g., diabetes, hypertension, or asthma). They have several distinct features:

- Duration (permanent or necessitating a long period of care);
- Consequences (caused by nonreversible pathological deterioration and associated with remanent disability); and,
- Treatment (necessitating multidisciplinary management and special conditions and training for patient rehabilitation) (WHO, 2003).

Because of the long-term treatment required, maintaining high adherence becomes a fundamental issue, especially in outpatient conditions where patient contact with health care providers is infrequent. Adherence is a complex phenomenon, still little understood, being simultaneously influenced by several categories of factors (e.g., sociodemographic, economic, medical condition-related, therapy-related, health care team, and system-related, and, above all, patient-related) (WHO, 2003). Since “current methods of improving adherence for chronic health problems are complex, labor-intensive, and not predictably effective” as McDonald et al. (2002, p. 2868) pointed out, a newer approach that uses mobile IT solutions may be justifiable. It must be recognized that the immediate influence of adherence-improving interventions may be small. However, the long-term effects on patients, their social environment, and society in general could mean a significant gain.

Mobility in the context of communication and information “should not be understood simply as a new distribution channel, a mobile Internet, or a substitute for PCs” (Yuan & Zhang, 2003). A mobile IT solution is justified only by the particular *location* of the user, who needs an information or communication service, or by the *utility* or *urgency* of that service (Mennecke & Strader, 2003). All three elements justify the use of mobile solutions to improve outpatient adherence in self-management programs for chronic illnesses. A further important characteristic of any mobile solution is the *identification of a unique person*, as stressed by Junglas and Watson (2003). Thus any communication between a mobile device and health providers would be automatically linked with the mobile device owner’s identity.

It is unrealistic to expect mobile solutions to improve adherence automatically. Mobile solutions should aim at facilitating the communication and exchange of data between the patient and the health care provider. Consequently, to maximize the chances of success, any mobile solution aimed at enhancing outpatient adher-

ence should target several adherence factors within the complexity of clinical interventions, where improving the patient-health provider relationship is a key factor. Starting from the recommendations of pertinent medical research (Haynes, McDonald, & Garg, 2002), six possible mobile health care solutions (monitoring of health parameters, reminding about taking a medication or performing a behavioural change, consulting with health providers, receiving support from family and peers, keeping informed, and being educated about the disease and treatment) and their envisioned benefits have been described in previous work (Cocosila & Archer, 2005a). These solutions address adherence factors and extend existing ways of communication and data exchange between outpatients and the health care system (e.g., mail, landline telephone, or the Web), encompassed under the definition of telemedicine (Bashshur, Shannon, & Sapci, 2005).

Existing Applications

Advances in wireless and Internet technology have already made possible the development of new health care services. Two of the most popular are remote monitoring and disease management for patients in homecare. A synthesis of some existing or proposed mobile applications, as mentioned in the literature, is presented in Table 1.

Trials of distance monitoring of blood glucose or blood pressure with the help of a computer showed improved outcomes and efficiency together with more active participation of patients (Balas & Iakovidis, 1999). Extrapolating from the success of preliminary results with the *Telephone-Linked Care* technology, Friedman, Stollerman, Mahoney, and Rozenblyum (1997, p. 424) suggest that “the market demand for technology-based delivery systems used by patients in their homes will be strong.” Husemann (2004) sees a future in the emerging field of information-based medicine for solutions like monitoring vital measurements on-the-go or for pill dispensers reminding the patients to take the appropriate medicine.

Electronic monitoring is constantly expanding and innovative devices and applications are becoming increasingly available for a variety of diseases. In particular, analysts foresee wireless medical devices helping chronically ill outpatients with asthma or diabetes (Duan, 2003; Hoise, 1999) and distance monitoring of diabetic patients has already proven to ameliorate the

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