A Framework for Studying Patterns of Effective Medication Adherence

Upkar Varshney, Department of Computer Information Systems, Georgia State University, Atlanta, GA, USA

Neetu Singh, Department of Computer Information Systems, Georgia State University, Atlanta, GA, USA

ABSTRACT

Medication adherence has been studied extensively in the healthcare literature. Most of the studies focus on improving medication adherence using interventions, including those based on wireless and mobile technologies, and measure average medication adherence level. This is useful in differentiating between patients with high and low levels of adherence. In practice, the same average medication adherence could be achieved by patients with widely different adherence patterns. In this paper, the authors propose that in addition to average medication adherence level, the patterns of adherence should also be studied. The patterns of adherence can be obtained using wireless medication systems and set of actions/decisions can be communicated to these systems or mobile applications for medication management. The authors present a framework, some metrics including Effective Medication Adherence, and results related to the patterns of adherence. Their results show that pattern of adherence has significant impact on the effective medication adherence. Also, higher levels of effective adherence can be achieved for more flexible medication regimen, such as those with higher values of maximum inter-dose time. It is also possible for a patient with lower average adherence but a desirable pattern of adherence to have higher effective medication adherence than a patient with higher average adherence with less desirable pattern.

Keywords: Effective Medication Adherence, Framework, Medication Adherence, Patterns of Adherence, Wireless Medication Systems

INTRODUCTION

With 3 billion prescriptions every year in US (Fenton, Blyler, & Heinssen, 1997; Dunbar-Jacob & Mortimer-Stephens, 2001), the cost of medications has been increasing significantly. Further, it is estimated that only between 50 to 60% of such medications are consumed as prescribed (Fenton et al., 1997). The reasons for not taking medication include forgetfulness (30%), other priorities (16%), decision to omit (11%), lack of information (9%), and emotional factors (7%) (Osterberg & Blaschke, 2005). The non-adherence to medications leads to 125,000 deaths and $90 billion in additional hospitalization and procedures every year in USA (Varshney, 2009). In general, 80% medication adherence is considered satisfactory; however
a higher level may be needed for some specific conditions, such as 95% for HIV medications. We focus on studying medication adherence for people who are staying at home, and not in a specialized care center (nursing homes and assisted living) where medications are professionally managed.

The adherence to medication has been monitored since the time of Hippocrates, when “the effects of various potions were recorded with notations of whether the patient has taken them or not” (Osterberg & Blaschke, 2005). Currently, some patients devise their own medication management using the spatial features of their homes, daily routines, and how and when they visit certain places to help remember to take medications (Palen & Aaløkke, 2006). In general, most interventions in the literature (Fenton et al., 1997; Dunbar-Jacob & Mortimer-Stephens, 2001; Osterberg & Blaschke, 2005; Varshney, 2009; Palen & Aaløkke, 2006; Siegemund & Florkemeier, 2003; Wan, 1999; McDonald, Garg, & Haynes, 2002) can be classified among three classes: patient support/motivation, reminders/monitoring and improved scheduling. Wireless technologies, such as sensors, RFID, personal area networks such as Bluetooth, wireless LANs among others, can be used to improve adherence to medications by supporting some of the interventions (Varshney, 2009). The specific reasons include (a) personal nature of wireless technologies, (b) immediate attention given by the users, (c) widespread use even among the elderly, and (d) mobility needed to support daily activities of patients. In simple terms, the use of wireless technologies in medication adherence involves reminding patients to take their medications at certain times. The implementation is usually a pill container with alarms that go-off at certain times and the pill container also remembers how many times it has been opened and closed. More sophisticated implementations include Magic Medicine Cabinet (MMC), which enables reminding, vital signs, and interaction with healthcare professionals (Wan, 1999). Smart Medicine Cabinet uses RFID tags to monitor medication boxes and to communicate with a cell phone (Siegemund & Florkemeier, 2003). It also supports reminders, query for contents (medications), expiry date detection, and medication recalls. Any failure or inaccessibility to such system could lead to the patient missing an important dose. The systems described above are not portable, thus very limited for patients with varying social and travel schedules. Another work focuses on a wireless-based smart medication system which can support (a) communication with patients, (b) monitoring of medication consumption, (c) context-sensitive reminders to patients, and (d) multiple interventions for medication adherence (Varshney, 2011).

**Average Medication Adherence**

As discussed above, medication adherence is studied by measuring the average value of adherence by counting or inferring the number of doses taken and dividing it by the number of prescribed doses. Such simple metric is helpful in differentiating higher level of adherence from lower level of adherence. However, there are several reasons that such averaging of medication adherence may not accurately reflect how well or poorly the patient has been taking the prescribed medications. For example, three different patients with satisfactory adherence of 80% may have taken the doses very differently. The first patient took 80% of the doses at prescribed times, while the second patient may not have taken any doses for the first 20% of the days and then took medications for the 80% of the days. Worst, the third one may not have taken the doses during the first 80% of the days and then finished 80% of the doses in the last 20% of the days.

Although the average adherence level can differentiate among patients with significantly different levels of adherence, such as one with 80% and another with 40%, patients with enormously diverse dosing behavior can achieve the same average levels of medication adherence. Also, some patients with lower average adherence achieve more or less same outcomes as patients with higher average adherence. In a study, some patients with medication adherence range in 60-79% had similar outcomes as
10 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the product's webpage:

www.igi-global.com/article/a-framework-for-studying-patterns-of-effective-medication-adherence/105582?camid=4v1


www.igi-global.com/e-resources/library-recommendation/?id=2

Related Content

Secure Route Discovery in DSR against Black Hole Attacks in Mobile Ad Hoc Networks

www.igi-global.com/chapter/secure-route-discovery-dsr-against/61750?camid=4v1a
A Parallel Software Architecture for the LTE Protocol on a Multi-Core Mobile Modem
www.igi-global.com/article/a-parallel-software-architecture-for-the-lte-protocol-on-a-multi-core-mobile-modem/96965?camid=4v1a

www.igi-global.com/article/hierarchical-agent-monitored-parallel-chip/42987?camid=4v1a

Secure Video Transmission Against Black Hole Attack in MANETs
www.igi-global.com/chapter/secure-video-transmission-against-black/71899?camid=4v1a