A Predictive Framework to Identify Potential Diversion by Health Care Providers

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Abstract: Drug diversion committed by health care providers is increasing in the United States. Automated dispensing systems (ADSs) are implemented in many hospitals and care facilities, and contain a wealth of information within its database of drug dispensing transaction history. The objective of this paper is to develop a predictive framework for identifying potential drug diverters by analyzing their transaction behavior with data mining algorithms. A 4-day sample of data (4/1/2015 - 4/4/2015) was studied. The results show that Decision Table classifier has higher accuracy than Logistic Regression, Decision Tree, Naive Bayes, and K-means Clustering, with high sensitivity, precision (NPV), and Receiver Operating Curve (ROC) area, combined with a low false positive rate.

Keywords: Drug diversion, Automated dispensing systems, Data mining.

1. Introduction

According to the Uniform Controlled Substances Act of 1994, diversion could be defined as “the transfer of a controlled substance from a lawful to an unlawful channel of distribution or use” (McCammon, 2013). Diversion can happen through a number of channels: illegal purchase of prescriptions from the pharmacist or via the Internet, obtaining a number of prescriptions from multiple doctors, stealing prescription pads, prescriptions forgery, drug stealing from patients, pharmacies, distributors, or manufacturers, or drug smuggling (Inciardi et al., 2006). While many different classes of medications could be involved in drug diversion, there are three types of medications that are frequently abused: opioids, central nervous system (CNS) depressants, and stimulants (National Institute on Drug Addiction, 2014). One of the most dangerous types of diversion is the diversion of controlled substances by health care providers.

Nurses form the main segment of the health care professional community and have the more direct contact with patients than other health care professionals. Among many different types of nurses, nurses from certain departments have more access to controlled substances, which fosters diversion. Trinkoff and Storr (1997) discovered that nurses in emergency room and psychiatric departments had higher rates of drug abuse than other types of nurses. According to the United States Department of Labor (2007), a total of 91.7% of nurses are women, and women are known to be more likely to abuse prescribed medications than men (National Council of State Boards of Nursing, 2011). During the period between 2008 and 2014, there were more than 200 state and federal prosecutions regarding diversion by health care providers. A total of 15% of these involved drug diversion for personal use while the rest concerns drugs diversion for profit (Eisler, 2014).

One measure to reduce diversion by healthcare providers is through the use of automated dispensing systems (ADSs). One of their possible uses is exploiting the technology for diversion detection purposes. The main objective of this paper is to explore the possibility of using ADS data to identify possible diversion related transaction with data mining algorithms.

The remainder of this paper is structured as follows: Section 2 represents a literature review on studies related to the use of ADS transactions to identify diversion. In Sections 3, the methodology used is described in detail. In Section 4, the performance of the data mining algorithms was discussed. Finally, Section 5 provides concluding remarks.