Prescription Drugs Side Effects

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Background:

Although countless people take prescription drugs, few patients have considered their potential side effects. Patients are often warned by physicians of some of the most common side effects and are given information on the full list of side effects by their pharmacy. However, few read these lists. Besides, patients tend to experience side effects which are not listed.

Moreover, these lists are not generally inclusive of all potential side effects, but are generated through effects seen by patients in the different stages of pharmaceutical trials. As a result, patients may experience new side effects not included in the list included with the information about the drug prescribed. Also of note is the fact that the likelihood of a side effect is also not always listed in this information. Some sources may categorize the side effects by frequency, but this information is not readily available at the time of prescription. Drug companies should be encouraged to update their potential side effects lists as their drugs are on the market. The FDA collects reports on unexpected side effects through a program called MedWatch (1). However, few people know of this service and take the time to report on it.

Objective:

Due to the fact that unlisted side effects have the potential to be very dangerous and listed side effects are often misunderstood as very unlikely to occur, there is a need to more effectively monitor newly discovered issues patients are having and track the already known side effects frequency in manifesting. In this case study, tweets were used to track a large sample of prescription medicine users with the following objects for a set of seven prescription drugs (Lipitor, Synthroid, Neurotin, Amoxicillin, Albuterol, Zoloft, Warfarin):

1. Analyze frequency of listed side effect experienced for each drug with the help of tweets
2. Identify each drug's unlisted side effects

Methods:

In order to accomplish these objectives, seven of the most common prescription drugs were chosen to be studied so that enough tweet data was present to create meaningful results. Then, tweet extraction was performed for the past two years using key words such as the name of the prescription drug or its generic forms. This was done by using the "getoldtweets3" package. Organizational tweets were removed in order to eliminate advertisements. This was completed using a filtering mechanism using personal-pronouns. The personal pronouns were obtained from LIWC research based words.

Then, semantic analysis was performed to filter tweets which had a cause-effect relationship. The majority of these tweets talked about side effects. Natural language processing was further used in order to clean the tweets, and filter tweets which contained any possible side effect. The

exhaustive list of side effects was created by scraping medical terms from Harvard medical dictionary and another website.

The tweets were further filtered on the basis of listed side effects per drug. This segregated the tweets as listed and unlisted. Finally, tweets with listed side effects were analyzed for frequency in order to gain a better understanding of which side effects are to be more often expected. And unlisted side effects were manually read to validate the occurrence.

Results:

Objective 1: Listed side effects frequency

Listed side effects of each drug that were tweeted: Albuterol: 61, Amoxicillin: 2, Levothyroxine: 11, Lipitor: 5, Sartarin: 67, Warfarin: 6, Neurontin: 24.

Objective 2: Identify unlisted side effects

Unlisted side effects are a relatively small proportion of overall tweets found. However, there were overarching themes in the ones that were identified. The most common unlisted side effects per each drug were found to be:

Albuterol: death and weight gain
Amoxicillin: ear infection
Levothyroxine: hypothyroidism
Lipitor: diabetes
Neurotin: neuropathy, anxiety
Warfarin: thrombosis, embolism, atrial fibrillation
Sertraline: death, insomnia, weight gain

Conclusions:

A search algorithm was created which performs the following tasks: separates organizational tweets from personal tweets, analyses semantics and keeps with cause-effect relationship, performs natural language processing to identify tweets with side effects, further segregates the side effects as listed and unlisted.

Although the proportion of unlisted side effects tweeted about for common prescription drugs is relatively low compared to listed, it is important to note that there are some. This is important information that should be reported and monitored by both the FDA and the drug company. Many of the unlisted effects can be fatal or debilitating. On the other hand, listed side effects are more commonly talked about on twitter for prescription medicines. Although people are aware of these if they read the included list of side effects with their prescription, it would be helpful to have them in order of likelihood based on frequency of users reports. Data from this project could be used to achieve this organization and help aid patients understand the safety profile of the prescription drugs they are taking.