

Adverse drug events: 'Insights' from Google search volume

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Objective

To investigate the use of search volume data from Google Insight for the detection and characterization of adverse drug events.

Introduction

Adverse drug events (ADEs) are a major cause of morbidity and mortality (1, 2). However, postmarketing surveillance systems are passive, and reporting is generally not mandated (2). Thus, many ADEs go unreported, and it is difficult to estimate and/or anticipate side effects that are unknown at the time of approval. ADEs that are reported to the FDA tend to be severe, and potentially common, but less serious side effects are more difficult to characterize and document.

Drugs with a high risk of harm outweighing the therapeutic value have recently been subjected to a greater level of interest with the Food and Drug Administration's Risk Evaluation and Mitigation Strategies (REMS) (3). However, no rapid method to detect if the REMS produce the desired effect and assessment of the impact is conducted by the drug manufacturer.

Increasingly, Americans have been turning to the internet for health-related information, largely by the use of search engines such as Google. The volume of searches for drugs and ADEs provides a unique insight about the interest in various medications and side effects as well as longitudinal changes.

Methods

We generated a list of the 179 most commonly used drugs in the United States in 2008 based on the Agency for Healthcare Research and Quality's Medical Expenditure Panel Survey (MEPS). Using this list of drugs, we consulted MicroMedex, a drug database, for information regarding possible ADEs for each drug. Next, we then obtained search volume data from Google Insight for all possible pairs of drugs and ADEs.

Using a set of searches restricted to only the known ADEs for a given drug, we coded each ADE as either common or other as listed by MicroMedex. Based on this categorization, we conducted a Wilcoxon two-sample signed rank test. Finally, we constructed a negative binomial model to explain the number of ADEs found by Google Insights. The total number of detected ADEs was modeled using the number of common ADEs in MicroMedex, the number of other ADEs in MicroMedex and the number of prescriptions for the drug based on 2008 data from MEPS as covariates.

A second list of 149 drugs with REMS was obtained from the FDA and search volume as collected for each of the drugs. We fit a generalized linear model to the data starting 1 year before and ending 1 year after the initial REMS approval date. The model included a dummy variable indicating if the month occurred before or after the initial approval of the REMS. The interaction between this variable and the time covariate was used to determine if the REMS had any impact on interest as measured by search volume.

Results

Both the Wilcoxon signed rank test and the negative binomial model indicate that Google Insight more readily detected common ADEs compared to the other ADEs. The Wilcoxon rank sum test indicated a shift toward more complete detection for the common ADEs compared to other ADEs ($p < 0.001$).

The negative binomial had similar results. The marginal increase in the number of ADEs detected by Google at the median for both the common and other ADEs was similar at 1.27 and 1.29, respectively. However, the median values were 7 and 39, respectively.

Only 40% (59/149) of drugs with a REMS approval demonstrated a change in slope with 90% confidence. The remaining 60% (90/149) indicated no significant change in interest over the time frame.

Conclusions

Our data help validate the use of Google Insights and search volume as a means to estimate the relative incidence of ADEs. In addition, internet search volume can be used as a rapid means for detecting new or changing ADEs after approval. Finally, the severity and frequency of ADEs may vary within a particular drug class, and search volume may provide additional information for guiding clinicians to select a given drug within a class.

The release of the REMS failed to create a change in search volume for the majority of the drugs. This may be due to prior elevated interest as the result of previous safety alerts or may be an indication that the REMS fails to create increased awareness of the risks of the drug. Further analysis of FDA safety alerts or change point analysis may provide a greater understanding of the effect of various risk management methods.

Keywords

adverse drug events, Google Insights, post-marketing surveillance

References

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