Asthma Internet Searching: A Surveillance and Rapid Response Opportunity?

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Abstract

While real-time location-specific information about asthma incidents and triggers could help clinicians in planning targeted treatment, such information is difficult to collect. We therefore analyzed publicly-available asthma Internet searches and their relationship to asthma triggers across major cities. Preliminary results suggest that asthma searches could serve as a proxy for asthma incidents, and combined with asthma triggers, could provide clinicians an important tool for the rapid prevention and treatment of asthma exacerbations in specific geographic locations.

Introduction

Although there is a growing understanding of the mechanisms precipitated by asthma triggers such as tree pollen[1], clinicians lack real-time, location-specific information about asthma incidents and their triggers to guide treatment. For example, a sharp increase in asthma incidents in a city, coupled with specific pollen counts, could help clinicians to mobilize appropriate and timely educational and treatment resources. However, collecting data about asthma incidents in real-time is difficult, and conducting studies across different locations is impractical. We therefore used a visual analytical approach to explore the relationship of asthma Internet search activity to outdoor asthma triggers, and whether such searches could serve as a proxy for asthma incidents in future surveillance and response systems.

Method

As a feasibility study, we selected two US cities in the north (New York and Chicago) and two cities in the south (Dallas and San Diego), and retrieved the following public data for each city over the years 2008-2010: (a) Average monthly temperature, and (b) Tree, weed, and grass pollen counts quantified as 0, 1, 2, 3 and 4 representing low, medium, high, and very high respectively (National Allergy Bureau). Next, we used *Google Insight* to extract all searches related to asthma conducted from each city during the same periods. To construct a Boolean search query representing consumer search, we combined the top-10 search terms related to asthma from Google Insight, with terms extracted from the Mayo Clinic asthma website targeted to consumer health. As shown in Figure 1, we used *Hive plots*[2] consisting of a stacked graph plotted on radial axes to visually and compactly represent the data. The variables for each year were normalized using *min-max*, and plotted on the 12 axes using a tool available at: http://wodaklab.org/hivegraph/graph. Axes were colored to represent the average temperature for each month based on a heatmap. Figure 1 shows only 2 of the cities over 2 years using a matrix layout for a compact overview of the data.

Results and Conclusion

The Hive plots revealed location-specific similarities and differences. As shown in Figure 1A and 1B, asthma searches (gray area) were positively correlated with tree pollen (brown area) [2009: r=0.75, 2010: r=0.76]. Because a recent study in New York[3] showed a strong correlation between tree pollen and ED visits, the results suggest that asthma searches contain important information about asthma incidents. As shown in Figure 1C and 1D, a similar correlation occurs in Dallas but earlier in March and April. Furthermore, an increase in asthma searches in September and October appears to be correlated with a combined increase in weed, grass, and tree pollen. Such multivariate patterns, displayed visually in real time, could in the future help clinicians to rapidly identify asthma trends and their causes, enabling rapid prevention and treatment of asthma exacerbations in specific geographic locations.

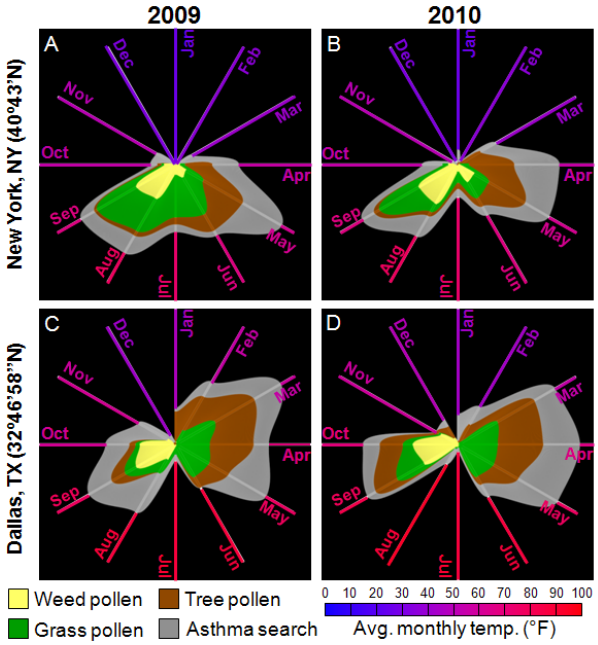

Figure 1. Hive plots of two cities over two years revealing how asthma searches relate to different types of pollen.

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References

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