Unveiling Perceptions of Food Safety Scandals in China: An Exploratory Study with Search Engine

Xiang Chen*[1], **Bo Zhao[2]**, **Emily Blackard[3]**

1. Department of Emergency Management, Arkansas Tech University, USA

2. Ash Center of Harvard Kennedy School, Harvard University, USA

3. College of Arts and Humanities, Arkansas Tech University, USA

Corresponding author: Xiang Chen**,** Department of Emergency Management, Arkansas Tech

University, USA, E-mail: chenxiangpeter@gmail.com

Abstract

In China, the term food safety has become a buzzword that evokes concerns from individual consumers as well as food policy stakeholders. Understanding consumers' awareness of the problem is crucial to formulating custom actions to facilitate health communication and eventually improve food security. This paper employs an atypical type of social media, the online search engine, to identify public perceptions of food safety scandals in China. Using the search history derived from *Baidu*, the largest Chinese search engine in the world, the paper evaluates responses to five major food safety scandals across space, over time, and among users of different social identities. When this search history is intertwined with users' self-reported identities and residence, it provides unprecedented aid to the analysis of public knowledge about health awareness, and more importantly, prompts a new perspective to garner health information on large scales at manageable efforts and costs.

Keywords: Food safety; China; Social Media; Volunteered Geographic Information; Search Engine

Introduction

Food security, known as access to sufficient and nutritious food for all household members at all times (Reutlinger, 1986), has been heavily investigated by entities from across the public and academic spectrums in recent years. In developed nations, food security primarily explores how food can be physically accessed and readily purchased and if levels of food access relate to socioeconomic status, rate of obesity, or the contingent health consequences (Black *et al*., 2014). In developing countries like China, the topic of food security has been investigated with increasing frequency and depth in the particular arena of food safety (Cheng, 2012). In China, the term food safety has become a buzzword that evokes horrible descriptions of lethal baby formula, gutter oils, meat laced with heavy metals and cases of poisoning. This paper employs an atypical type of social media, the online search engine, to identify public perceptions of food safety scandals in China. The paper evaluates responses to major food safety scandals across space, over time, and among users of different social identities using user-generated search history derived from *Baidu*[1], the largest Chinese search engine explored by millions of internet users daily. As large-scale survey is an issue of unprecedented complexity, this paper offers social media as a potential instrument for food security research and demonstrates the social roles factored in consumers' everyday effort to procure healthy and nutritious foods.

To solicit public perceptions of food safety issues, traditional survey methods such as paper-based or online questionnaires (Haapala & Probart, 2004), telephone surveys (Fleming *et al*., 2006), and face-to-face interviews (Van Rijswijk & Frewer, 2008) have been widely employed. Although these methods benefit from custom research designs and targeting selected respondents, the sheer effort of surveyors and cost of resources involved in traditional surveys are relatively consuming. An emerging trend in large scope surveys is using self-reported data or volunteered geographic information (VGI) on social media platforms such as Flickr, Facebook, and Twitter, primarily in the spectrum of disaster response (Goodchild & Glennon, 2010) and infectious disease surveillance (Schmidt, 2012). VGI is generated by anonymous internet users, who are aware of their surrounding environment and are willing to share their observation without constrictive criteria. More importantly, the function of "geotagging" embedded in the VGI enables a multitude of geographical analyses that evaluate the spatial distribution and temporal fluctuation of information. Space and time are two important dimensions in dictating availability and quality of food, which in turn eventually exert a long-term influence on the food culture of families and their resulting health status (Chen & Kwan, 2015). The application of VGI to the topical area of food

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[1] http://www.baidu.com

security is scant. The only examples we found are cases using geo tagged information from Twitter, which reported the relationship between food references and physical as well as socioeconomic food scapes on different geographical scales (Chen & Yang, 2014; Widener & Li, 2014). The deteriorating food environment in China has prompted our attempt to explore *Baidu*, the pervasively used Chinese social media, to unveil public concerns of major food safety scandals that have occurred in recent years.

Methodology and Result

We have identified five influential food safety scandals that were brought to global attention by Chinese media. These incidents include gutter oil (cooking oil scavenged from the gutter), plasticizer (a harmful replacement of palm oil in food production), fake eggs (fake chicken eggs made from chemical compounds), Sudan red (a chemical food dye proved to be carcinogenic), and melamine milk (infant formula tainted with melamine, a toxic additive to increase protein content in dairy products). These keywords in Chinese were used to solicit *Baidu* users' search history dated from Nov.1 2013 to Nov.30 2014. We explored the search history from only registered users who released their personal identities including gender, age, and residential city. In this respect, each search entry included in the analysis is tagged with a search time as well as is affiliated with a specific user who reported their social background. The search history database was derived in collaboration with *Baidu*, Inc. When this search history is intertwined with users' self-reported identities, it provides unprecedented aid to the analysis of public knowledge about topical food safety scandals. Figure 1 shows the major finding. In Figure 1, Baidu Index [2] is a comprehensive indicator based on the amount of searches in a given period of time. Differentiating the index by age and gender underlines interests from specific user groups. For example, observations with marked difference could be identified that (1) people aged from 30 to 39 are generally characterized by a heightened interest in food safety issues than other age groups; (2) males are significantly more interested than females; (3) people aged below 30 indicate the highest interest in finding information about the melamine milk while people above 30 have highest interest in the plasticizer; (4) males have the highest interest in the melamine milk while females are interested in the plasticizer.

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[2] Baidu has provided preliminary reports of keyword-based search history at http://index.baidu.com/. However, these analyses do not entail differentiation of users' social background.
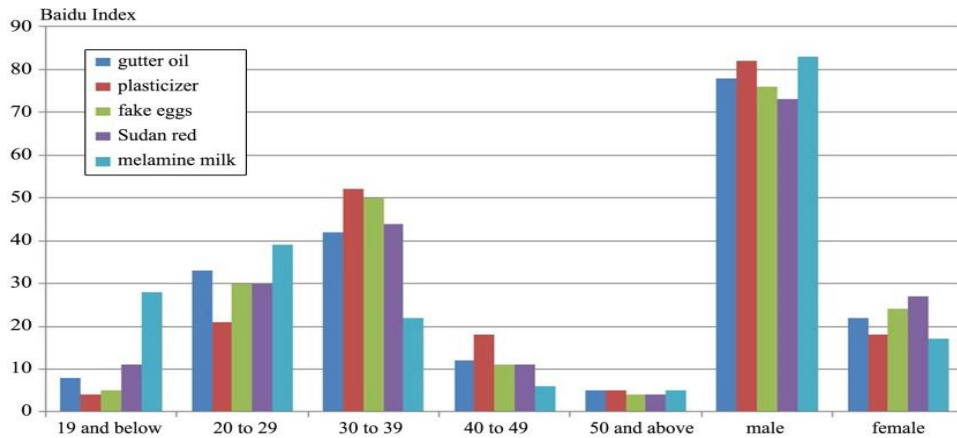
Figure 1: Baidu Index based on keyword searches of topical food safety scandals. Results are summarized by user age and gender.

As evidenced by this result, food safety issues in China obviously draw varying attention from different consumer groups. It highlights findings that those most likely to be victims of food safety scandals are not adequately informed of the severity of the problem, nor have they received sufficient nutrition education. For example, Sudan red was known as an unsafe additive in the products of Kentucky Fried Chicken (KFC), a major fast food chain in China (Cheng 2012). A recent study showed that in China, females and younger consumers are more likely to patronize fast food restaurants (Anderson & He, 2014). This study shows that these populations do not fully recognize the potential risks in their diets as do their male counterparts and older consumers. Another example is the illegal additive of melamine, which was invariably associated with contaminated infant dairy products. It is evidenced that in China, women took more responsibility in child care than men in most settings (Short et al., 2001), and as a result, their lesser vigilance on the contamination of melamine milk (as well as other food-related health risks) may be another factor exacerbating the consequences.

The spatial and temporal patterns of the search history bring in another dimension to account for the awareness of the issue, as shown in Figures 2 and 3. In Figure 2, the peak of the wave indicates an outbreak of a major food scandal and a comparison between two types of incidents differentiates levels of interest from Chinese consumers. Compared to fake eggs that were generally rare cases in the food market, the widespread and frequent occurrence of the gutter oil fueled consumers' interest to perform the searches. Figure 3 shows the spatial distribution of searches for five food safety scandals by province of China. This map, while showing provinces where the most concerns surfaced such as Beijing and Guangzhou, shared a close similarity with provinces where most incidents occurred, as traced by *Throw it*

Out the Window[3], a web platform that exposes and collects incidences of food contamination or safety violations across the country. Although both domestic and foreign media have turned an increasingly critical eye to the food safety situation in China, the study of the search history is a good complement to revealing the ineptitude of the Chinese food system from the perspective of consumers.
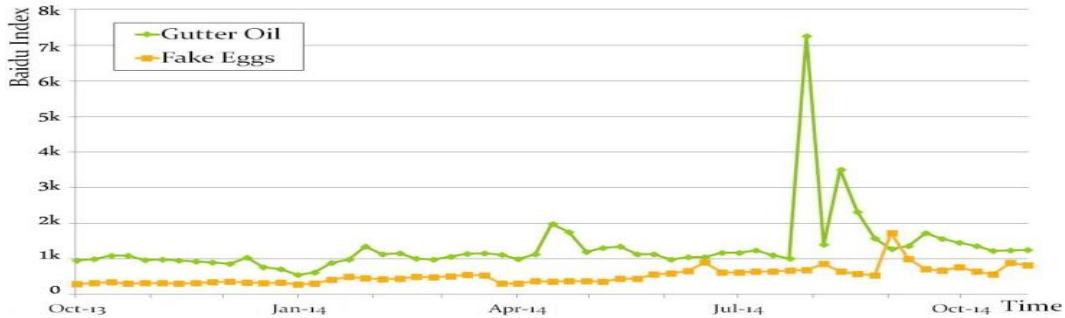

Figure 2: Temporal variations of Baidu Index based on keyword searches of melamine milk and fake eggs .
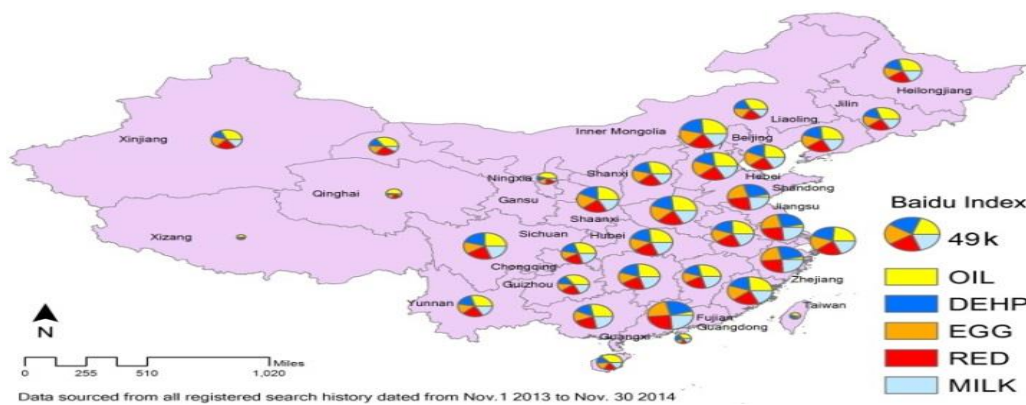

Figure 3: Spatial distribution of Baidu Index based on keyword searches of topical food safety scandals: OIL (gutter oil), DEHP (plasticizer), EGG (fake eggs), RED (Sudan red), and MILK (melamine milk).

Conclusions

Social media as an emerging tool to monitor the outbreaks of pandemics and natural hazards has been a heated topic in the last five years. The analyses and visualization of spatiotemporal patterns of food safety scandals are not new in the realm of public health. However, this paper is the first to introduce the instrument of search engine as a proxy of surveying public responses to these incidents. Comparing to traditional surveys that constitute costly labors and self-reported VGI that raised reliability questions (Ruths & Pfeffer, 2014), data solicited from search engines are more representative of the populations

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[3] http://www.zccw.info/

because of the sheer amount of user base. This disparity of individual vigilance on food security as revealed in the study provides an alternative to the evaluation of health communication and the effectiveness of food policies.

Understanding consumers' awareness of the problem is crucial to formulating custom actions to improve food security. As a complementing strategy, social media could serve to reveal the extent and social dimensions of consumer knowledge in unprecedented spatial and temporal scope. However, behavioral studies based on social media platforms are compromised by the selection bias as well as alteration to the true context by filters and spammers (Ruths & Pfeffer, 2014). Similarly, using search engine data must be open to scrutiny. Compared to the VGI data, the larger user base of search engines is an obvious benefit that lessens the concern about representativeness in sampling. This benefit is coupled with two underlying issues that should be examined with caution: (1) these search entries, labeled by the residential city of the user, are not precisely geotagged with a pair of coordinates. This means the self-reported city may not be the city the user currently lives in; (2) unlike typical VGI data that can be streamed down through open Application Programming Interface (API) portals, search engine data with a proprietary nature are strictly governed and are thus lacking accessibility to the majority of public users. Using alternative approaches (e.g., the IP address of the search entry) to georeference a user and acting on policies of data sharing can largely improve data integrity while helping formulate actionable and constrained policy initiatives to benefit research on food security.

As a concluding remark, in addition to identifying consumer awareness and government response, more research is needed on many specifics that correlate to the causes and effects of each matter of concern in the production, processing, distribution, and consumption of food products. The problem of food safety in China affects the health and lives of over one billion people every day, and has global implications as a result of more and more food flowing through China's processing and packaging plants. Only with data garnered in concrete, comprehensive research can the government understand and appropriately prioritize and address food safety. A clear picture of the influences surrounding the perspective of consumers can improve knowledge of health communication and eventually prompt actionable policies to hold the food industry accountable to a higher standard.

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