Food crisis coverage by social and traditional media: A case study of the 2008 Irish dioxin crisis

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Abstract
The world of communication has changed significantly in the last decade as a result of the evolution of social media. Food crisis managers and communicators should be cognizant of the messages presented to the public by all media channels during a crisis. Using the 2008 Irish dioxin contamination incident as an example,
a quantitative content analysis was carried out to investigate the relationship between social and traditional media. Messages published in printed newspapers ($n = 141$), blogs and forums ($n = 107$), and Twitter ($n = 68$) were analysed to investigate sourcing practice, story topic and use of tone. Results revealed that traditional media relied on diverse offline sources in reporting a wide range of topics. In comparison, social media responded faster and diminished faster, using offline and online media news messages as the primary sources in reporting very limited topics. No significant difference was found in the presence of negative tone across media.

**Keywords**
content analysis, crisis communication, food safety, social media, traditional media

**Introduction**

With the increasing use of Web 2.0 technologies, media use in times of crisis has evolved from one-way communication to multi-way interactions between a range of stakeholders and publics. Not only do media transmit crisis messages, they also interpret the story for the reader, by virtue of ‘what elements of a story they report, the types of sources they use in reporting the different sides, and how they package a story’, thus functioning as an agenda builder (Driedger, 2008; McCombs and Shaw, 1972). This is widely acknowledged by journalists involved in reporting food crises: they do not simply reflect the communication strategies of stakeholders, but actively construct news stories (Hsu, 2008). Media professionals seek to respond to and reflect social preference in their reporting, and in so doing stake and maintain their position as dynamic interpreters (Petts et al., 2001).

In recent years, internet-based peer-to-peer communication and specifically ‘social media’ applications such as social networking sites like Facebook, Flickr and Twitter, serve as new information disseminators about crisis and food safety (Gassin and Van Geest, 2006; Hughes and Palen, 2009; Palen and Liu, 2007; Palen et al., 2009). A growing number of people have started relying on internet-based media forms as the primary channel to seek out crisis information (Jin and Liu, 2010; Powell et al., 2012). Social media may be better matched to crisis situations than traditional media, because the technologies allow for rapid information production and free uploading and downloading of content (Macias et al., 2009; Palen et al., 2009). As Web 2.0 technologies have enabled any individual with internet access to generate, broadcast and share information, social media functions as an information aggregator representing and reflecting upon opinions from various stakeholders, including those traditionally less likely to be heard. Hence, social media has been described as ‘a parallel public discourse representing the unfiltered viewpoints of citizens’ (Keelan et al., 2010) and ‘an instantaneous snapshot of the public’s opinions and behavioural responses’ (Chew and Eysenbach, 2010). Two distinct features of social media have enabled it to facilitate interaction: (1) it allows the continuous modification of content and applications by all users in a participatory and collaborative fashion; and (2) it facilitates the creation and exchange of user-generated content, which results in enhanced interactivity (Ding, 2009). Therefore, social media provides new means of interaction between people within or outside the time–spatial boundaries of the crisis event (Palen et al., 2009). For instance, in crisis situations, survivors, victims and observers connect with each other via social networking sites (Palen, 2008). Given that public perceptions and behavioural responses in a crisis are now potentially co-influenced by both traditional and social media, and there are both challenges and opportunities brought by social media in communication practice, it is critical for food crisis managers and communicators to develop a better understanding of its use. However, social media must be considered alongside the classical
media channels (Barnett et al., 2011). As pointed out by some scholars, food safety related communicators should be cognizant of and understand the content presented in all media channels (Rhoades and Ellis, 2010). At this point in time, only a small number of studies have examined media coverage of food crises, with almost all of them concentrating on classical media channels, for example, national televised and newspaper coverage of food safety incidents including a Canadian E.coli contamination crisis (Driedger, 2007, 2008; Driedger et al., 2009), a dioxin crisis in Taiwan (Hsu, 2008), the recall of contaminated spinach in the USA (Nucci et al., 2009), and bovine spongiform encephalopathy (BSE) and listeriosis outbreaks in Canada (Boyd et al., 2009; Gauthier, 2011); and the complex relationship between food risk reporting by traditional media and public reaction (Kitzinger and Reilly, 1997; Petts et al., 2001). There have been two studies addressing social media coverage of food crises. The first study focused on how social networking and sharing sites facilitated scientific collaboration that assisted pathogen identification (Casey et al., 2011). The second study looked at how trends in volume of social media data were used to estimate the epidemiological patterns in food-borne disease outbreaks (Chunara et al., 2012). To our knowledge, no published studies have compared the content of social media and traditional media messages during food crisis events. To address this, the current study set out to map out media discourse occurring on different media platforms during a food crisis.

The 2008 Irish dioxin contamination crisis, previously characterised as a media facilitated crisis (Jacob et al., 2011), was taken as a case study. Biologically, dioxins are highly toxic and can cause reproductive and developmental problems, damage the immune system, interfere with hormones and also cause cancer (WHO, 2010). On 28 November, 2008, contaminated animal feed fed to Irish swine led to the detection of elevated levels of a chemical indicator of dioxin contamination during routine testing of Irish pork. After the Food Safety Authority of Ireland (FSAI) confirmed that the presence of dioxins was as high as 200 times the European Union (EU) recommended limit for food safety concerns, the Irish government announced a total recall of all potentially contaminated pork products on 6 December. For the following week, the Irish pork industry’s business with foreign countries was at a standstill whilst a series of risk assessment and crisis management activities were carried out by key national and European level stakeholders. Irish pork was back on the market the morning of 12 December.

The Irish dioxin crisis represented one of the first food crises with international impact that was played out not only in traditional media, but also within social media. In 2008, social media was experiencing a boom, with an unprecedented uptake of social media users, especially in social media applications such as Twitter (New Media Lab, 2009). Using the Irish dioxin crisis as an example, this study aimed to characterise the relationship between social and traditional media coverage of the dioxin crisis, specifically by investigating how the amount of coverage changed over time, and how the messages were constructed and shaped across different media channels.

**Theoretical background and literature review**

An elaboration of agenda setting theory, called ‘quantity of coverage theory’, assumes that increased coverage turns public opinion in a negative direction, independent of the nature of the risk (Rowe et al., 2000). Also, based on the Social Amplification of Risk Framework (SARF) and theories on complexity of the relationship between media and the public, a perceived risk can be influenced by quantity of media coverage if the media capture or resonate with an existing public mood (Petts et al., 2001). These theories suggest the importance of understanding how the amount of risk and crisis reporting rises and falls over time. Accordingly, the first research question was defined as: How did the amount of coverage across the Irish dioxin crisis change in traditional and
social media (RQ1)? Following the precedent set in previous academic research on risk and crisis coverage, media content analysis in the current research mainly focused on three aspects: source, story topic and tone of voice (Driedger, 2008; Kuttschreuter et al., 2011; Liu, 2010; McCarthy et al., 2008; Nucci et al., 2009).

Source

Source activity and the relationship between story tellers and their sources are historically central to the media production process (Kitzinger, 1999). The media create a discourse of reality by relying on external sources to obtain important facts and interpretations. Previous work on sourcing routines in traditional news production has highlighted that, in crisis situations, news reporting shows a heavy dependence on messages from government officials and agencies (Li and Izard, 2003; Powell and Self, 2003). This can be explained by the model of the hierarchy of credibility (Becker, 1967, cited in Atton and Wickenden, 2005): those higher up the social hierarchies of power and privilege are regarded as more credible sources, and as such are more likely to be asked to present their knowledge. The consequences of this are outlined by Atton and Wickenden (2005):

> It holds that the pressure of deadlines and the professional demands of objectivity combine to produce an over-accessing of elite sources and thus a reiteration and perpetuation of dominant ideologies. This determinism ensures that primary definers are consequently drawn from elite groups and institutions who are both easily found and considered credible through their structural positioning and representative status. (2005: 348)

The current study defines elite sources as those with power, legitimacy and authority, such as governments and politicians, public institutions, law enforcement institutions and academic intellectuals (e.g. scientists, researchers, scientific advisors for the governments) (Atton and Wickenden, 2005).

In relation to media reporting of food crises, whether the above insights apply is questionable. For example, the examination of TV news coverage of the spinach recall of 2006 revealed that non-governmental sources were more frequently represented than governmental ones (Nucci et al., 2009). There has been a penetration of social media use in relation to food safety communication (Newkirk et al., 2012; Rhoades and Ellis, 2010), but little is known about what sources are being cited by social media users in a food crisis. As discussed, the people publishing on social media are not necessarily traditionally trained journalists or experts alone, but can also represent the lay public. In conventional journalism practice, largely developed in relation to traditional media, there are normative and enforced practices in relation to sources that do not exist in social media. Most of those who operate through social media are not governed by such strict editorial guidelines or regulations. Thus, it is unclear whether patterns of source use in social media are generally similar to traditional media. There is some evidence in the general non-food crisis literature to suggest that social media cite less elite sources (Atton and Wickenden, 2005; Liu, 2010). However, little is known about source citation and linking practices in a food crisis.

Given that little research has been carried out to address sourcing patterns by different media in food crises, this current study poses the following research question: What sources were represented in traditional and social media coverage of the 2008 Irish dioxin crisis (RQ2)?
Topic
As previously mentioned, not only do media transmit crisis messages, they can also actively interpret the story, by selecting which elements of a story they report and deciding how a story can be packaged (Craft and Wanta 2004; Driedger, 2008; McCombs and Shaw 1972). As a result of Web 2.0 technologies, such processes are no longer restricted to journalists and editors working at the front of traditional media. Online users may highlight topics that concern them most or may even introduce new topics. For instance, it has been shown that blogs can challenge the traditional media by introducing different topics and story angles (Liu 2010). Investigation into the selection of story topics by different media can help us better understand the degree to which these media may present different agendas. It should be noted that individuals vary in exposure to media channels and their sense-making process might be influenced by the agenda held by the media (Craft and Wanta, 2004). In light of this, a third question the current research sought to answer is: What topics were selected and highlighted by traditional and social media in reporting the 2008 Irish dioxin crisis (RQ3)?

Tone of voice
One important measure of crisis management is the amount of negative media attention it receives (Coombs, 2007; Liu, 2010). Research has shown that use of a negative tone is commonplace in news reporting, with a number of studies reporting use of negative tone in over half of headlines of health affairs articles (Brodie et al., 1998; Marcantoni et al., 2011). In relation to food crises, evidence shows that a negative tone is extensively used in TV, radio and newspapers (Boyd et al., 2009; Verbeke et al., 1999). The negative sentiment was introduced by, for example, terms or sentences blaming governments (Kuttschreuter et al., 2011) (e.g. failure, cheat, mistake) and use of potentially sensational terms such as deadly, scare and panic (Carslaw, 2008). By doing so, journalists created eye-catching messages, and as such, added news value (Kitzinger, 1999). Considering the explosion of new web technologies, crisis managers and communicators now face the additional possibility of negative attention from social media. Based on this challenge, a fourth research question was posed: Did traditional and social media channels employ different tones of delivery in covering the 2008 Irish dioxin crisis (RQ4)?

Methods
Sampling procedures for traditional media
The investigation was restricted to English media content in the UK and Ireland. Based on previous research, newspaper articles were used to represent traditional media in this research (An and Gower, 2009; Driedger, 2008; Gerhards and Schafer, 2010; Hsu, 2008; Kitzinger, 1999; McCarthy et al., 2008). Based on readership levels, readership demographics, types of newspapers and data accessibility, 16 top circulated news publications in the UK and Ireland were included in the traditional media audit. These included six daily broadsheets (Irish Independent, The Irish Times, Daily Telegraph, The Times, Financial Times, The Guardian), four daily tabloids (Evening Herald, The Sun, Daily Mail, Daily Mirror), two weekly broadsheets (Sunday Independent, The Sunday Times) and four weekly tabloids (Irish Mail on Sunday, News of the World, The Mail on Sunday, Sunday Mirror). This selection represented a wide range of readership.
The online newspaper archive LexisNexis and an Irish domestic news article database, SafeFood, were used to collate samples. Searches were performed in title, leads and the main text, using the term combination: Dioxin AND (Irish OR Ireland OR Pig OR Pork OR Crisis OR Contamination). This term combination was shown to achieve the best balance between data completeness and accuracy. The date frame was set between 1 December 2008 (one week before the first official food recall had been announced), and 28 February 2009, following a pilot study of global online news coverage of Irish pork and dioxin by the Irish Food Board, who found that 89 percent of coverage was concentrated in this period (Board Bia, 2010). Although a food crisis typically loses its attraction to traditional news agencies after a short period of time (Gauthier, 2011), it is not known if this is the case with social media. A three-month period was chosen to allow sufficient coverage in case of any long-lasting post-crisis discussions facilitated by internet users. The article search returned a dataset of 369 articles from the printed (offline) editions of specified publications. To reduce the data volume to a manageable level, a sampling strategy was introduced, where every second article in chronological order by publication (n = 184) was selected. Articles were then read by two members of the research team to exclude articles that were incomplete or irrelevant to the Irish dioxin incident. This resulted in a final sample of 141 articles. The article length ranged from 50 to 2474 words and the average was 513 words.

**Sampling procedures for social media**

Previous research has identified significant difficulties in sampling social media, especially when these samples are expected to be studied along with traditional media stories (Weare and Lin, 2000). The social media platform is regarded as a decentralised, all-purpose communication network, mixing a handful of media formats and activities (e.g. text-based, asynchronous multimedia messages, streaming audio), and therefore selecting a true representative sample may be impossible (Weare and Lin, 2000). The sample characteristics are determined by sampling methods. Until now, researchers have demarcated a few categories of tools available for extracting social media content for academic purposes, such as search engines (e.g. Google, Yahoo), self-developed open source infoveillance system (e.g. Inforvigil), search services of popular sites, (e.g. Twitter API, Facebook API, MySpace API), and commercial collector sites and software (Chew and Eysenbach, 2010; Keelan et al., 2010; Macias et al., 2009; Sutton, 2010; Weare and Lin, 2000). Out of all these possibilities, Weare suggests that collector sites are most useful for analyses concerning a particular topic (Weare and Lin, 2000). Based on this rationale and the need for retrospective access to data back to 2008, Radian 6, a social media monitoring tool and information aggregator, was employed. Using exactly the same search terms, time span and geographic restrictions that were used with online newspaper archives, around 1600 records were pulled out by Radian 6 from a number of internet-based media formats consisting of online news, forums, blogging and micro-blogging sites. Online news was excluded because the raw data file showed a large proportion of them were from mainstream news agencies (e.g. CNN, BBC, Yahoo news, official sites of newspapers) operated by traditional journalists. The final decision to include weblogs, forums and Twitter posts (short text-based messages of up to 140 characters, known as ‘tweets’) followed the precedent set in previous academic research on the use of social media in crises (Chew and Eysenbach, 2010; Ding, 2009; Hughes and Palen, 2009; Jin and Liu, 2010; Keelan et al., 2010; Liu, 2010; Palen et al., 2009; Sutton, 2010), and in experimental research where Twitter and blogs were studied together with traditional media to measure public perceptions of and reactions to crisis communication (Schultz et al., 2011). All tweets (n = 75), forum postings (n = 38), and blog postings (n = 100) published on three popular blog
sites collected by Radian 6 – Blogspot, WordPress (originated from MSN Space) and Live Journal – were extracted. In addition, a 25 percent systematic sample (every fourth posting) from less structured generic blogs were included ($n = 123$). The operation of giving priority to three widely adopted blog sites is similar to a previous study looking into blog function during Hurricane Katrina (Macias et al., 2009). As the next step, unwanted data were removed, based on the identical criteria used for printed newspaper articles, yielding a final dataset size of $n = 175$ social media postings ($n = 68$ tweets, $n = 107$ forum and blog posts), which accounted for 48 percent of all data before cleaning. The average length of selected blog and forum posts that ranged from 23 to 1105 words was 318 words. The final social media dataset for analysis was comparable in size to the traditional media sample included.

**Coding protocol development**

A coding protocol was developed based on a hybrid process of inductive and deductive approaches. First, consideration was given to existing literature and the main research questions. Following this a pilot study was undertaken for which 90 media stories from both traditional and social media platforms were analysed. The main variables of interest in the coding document were source, primary story topic and tone of voice. Additional descriptive variables included title, date and media type. For the variable ‘source’, eight categories of source (see Table 1), were inspired by previous work in relation to food risk and crisis (Antunovic et al., 2008; FAO/WHO, 1999; Kornelis et al., 2007). For the variable ‘story topic’, four categories (see Table 1) were based on interpretation patterns constructed in a study comparing printed media and online mass media (Gerhards and Schafer, 2010). These top level categories were then further developed based on the findings from the pilot study, which identified a range of more specific sources and story topics. Lastly, three codes for examining tone of delivery were developed: neutral, negative and positive.

Table 1. Main coding categories, codes and descriptions.

<table>
<thead>
<tr>
<th>Sources</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Expert sources</td>
<td></td>
</tr>
<tr>
<td>European Food Safety Authority</td>
<td></td>
</tr>
<tr>
<td>National Food Safety Authority or Food Standard Agency</td>
<td></td>
</tr>
<tr>
<td>Chief scientific officer or advisor in governmental departments</td>
<td></td>
</tr>
<tr>
<td>World Health Organization</td>
<td></td>
</tr>
<tr>
<td>Laboratories that participated in dioxin contamination test</td>
<td></td>
</tr>
<tr>
<td>Health experts, medical experts and doctors</td>
<td></td>
</tr>
<tr>
<td>Toxicologists, chemists, biologists and food safety experts</td>
<td></td>
</tr>
<tr>
<td>Scientific publications and books</td>
<td></td>
</tr>
<tr>
<td>Correspondents with expertise in food and health care</td>
<td></td>
</tr>
<tr>
<td>Other expert sources</td>
<td></td>
</tr>
<tr>
<td>(2) Political sources</td>
<td></td>
</tr>
<tr>
<td>European Commission</td>
<td></td>
</tr>
<tr>
<td>Other political departments on EU level</td>
<td></td>
</tr>
<tr>
<td>National central governments and local governments</td>
<td></td>
</tr>
<tr>
<td>National Department of Health</td>
<td></td>
</tr>
<tr>
<td>National Department of Agriculture &amp; Food</td>
<td></td>
</tr>
<tr>
<td>Political parties</td>
<td></td>
</tr>
</tbody>
</table>

(Continued)
Table 1. (Continued)

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Protection Agency</td>
<td></td>
</tr>
<tr>
<td>Joint Oireachtas Committee</td>
<td></td>
</tr>
<tr>
<td>Other political sources</td>
<td></td>
</tr>
<tr>
<td>(3) Offline and online media news</td>
<td></td>
</tr>
<tr>
<td>(4) Food suppliers</td>
<td>Millstream Power Recycling company where the dioxin contamination was introduced</td>
</tr>
<tr>
<td></td>
<td>Food board or food industry consultants</td>
</tr>
<tr>
<td></td>
<td>Farmers and their associations</td>
</tr>
<tr>
<td></td>
<td>Food processors and their associations</td>
</tr>
<tr>
<td></td>
<td>Restaurants, hotels and their associations</td>
</tr>
<tr>
<td></td>
<td>Food retailers, supermarkets and their associations</td>
</tr>
<tr>
<td></td>
<td>Other sources from food industry</td>
</tr>
<tr>
<td>(5) Food consumers</td>
<td></td>
</tr>
<tr>
<td>(6) Law enforcement officials</td>
<td></td>
</tr>
<tr>
<td>(7) Non-governmental organisations (NGOs)</td>
<td></td>
</tr>
<tr>
<td>(8) Other types of sources</td>
<td></td>
</tr>
</tbody>
</table>

Primary story topics

(1) Scientific topic
- Cause: explanation of how contaminants enter the animal herds and related investigations and law suits
- Health facts: discussion on dioxin, tests of possibly contaminated food and associated health risks
- Health warning: suggestions for not taking or selling food that is potentially contaminated

(2) Economic topic
- Macro-economic impact: the influence on Irish food and agricultural industry, employment and international trade
- Victimisation description: references to how performers in food supply chains were influenced
- Global reaction: other countries’ reactions and actions towards this crisis

(3) Political topic
- Government’s handling: measures taken by governing bodies, e.g. product recall, funds seek and compensation
- Evaluation of crisis management: positive or negative judgements on governments and authorities’ handling

(4) Social topic
- Public reaction and perception: how the lives of the public were affected and their psychological feelings
- Lessons learned: insights gained to improve food safety control, crisis management and welfare of the society
- Ethical and environmental issues: discussion over animal welfare, ethics and environmental impacts

Coding and inter-coder reliability

Following training, two independent coders both coded a systematic sample of approximately 17 percent of the stories of different media formats. Each newspaper article or social media posting was read twice to code for all sources, the primary topic, and the tone used in the headline and the main body. If several topics were equally addressed in one story, the topic highlighted in the headline (if present) and at the beginning of the main text was recorded. Tone was coded based on the manifest positive or negative wording and subjective feelings after viewing. Negative
terms included terms such as disrupting, scare and disaster. Examples of positive words are ease, safe, correct and praised. Media stories that were absent of positive or negative tone and stories that presented a mixed tone, in which neither positive nor negative tone dominated, were treated as neutral (De Brun et al., 2012; Kuttschreuter et al., 2011). The inter-coder agreement was 99.1 percent, 85.2 percent and 80.9 percent for source, primary topic and tone, respectively, Cohen’s Kappa = 0.87, 0.83 and 0.65 respectively, which indicates reliability in the coding process (Lombard et al., 2002).

The coders then coded the remaining stories, entered the results into Microsoft Excel, where they were reformatted and transferred into SPSS v18 (SPSS, Chicago, IL) for statistical analysis. Using SPSS, frequency analyses were performed to count the numbers of media stories in which a certain source was cited, a certain topic was emphasised, and a certain tone was used. The Chi-square significance test was used to examine differences between social and traditional media in crisis coverage. Conflicting codings were discussed between the two coders. When consensus could not be achieved (this only occurred with codes relating to tone of voice), a third person in the author team was involved to make the final decision.

Results

Media coverage timeline

RQ1 focused on coverage dynamics occurring in social and traditional media. The number of analysed newspaper articles and social media postings were charted to reveal how the reporting of the 2008 Irish dioxin crisis rose and fell. The media coverage was concentrated within the first week of the official announcement, accounting for 70 percent and 85 percent of total media stories for traditional and social media respectively, with a peak occurring between 8 and 10 December (Figure 1). Following this, the coverage dropped dramatically. Taking a closer look at the time period, social media was shown to surge and reach a high point earlier than traditional media, but did not climb to its highest point until traditional media had peaked.

![Figure 1. Percentage of analysed traditional (n = 141) and social media stories (n = 175) covering the Irish dioxin crisis by date.](image-url)
Source: Whose messages were cited in reporting the dioxin crisis on different media types?

RQ2 investigated whether differences in sources used existed between traditional and social media during the Irish dioxin crisis. Over 89 percent of analysed newspaper articles and blog and forum postings relied on external sources to create stories. However, the type of source used differed amongst the selected media types (Table 2). Across all eight source categories, the most frequently cited sources represented in newspaper articles were expert sources, political sources and food suppliers, cited by 58.9 percent, 56.0 percent and 44.0 percent of analysed articles respectively. No other source was employed by more than 10 percent of articles. In contrast to this, blog and forum postings used offline and online media news (e.g. BBC, Reuters, newspapers, TV and radios, Yahoo news) most often (42.1%) followed by political sources (39.3%) and expert sources (32.7%) at a comparable level, with no obvious mentions of other sources including food consumers. Chi-square tests suggest that newspaper articles were more likely to directly cite experts ($\chi^2 = 16.69, p < 0.001$), political sources ($\chi^2 = 6.85, p < 0.01$), food suppliers ($\chi^2 = 33.25, p < 0.001$), law enforcement officials ($\chi^2 = 4.31, p < 0.01$) and some other sources ($\chi^2 = 5.04, p < 0.05$). Blog and forum posts were more likely to cite offline and online media news ($\chi^2 = 47.92, p < 0.001$).

The top sources were National Food Safety Authority (41.1%), Department of Agriculture & Food (35.5%), national or local central government (e.g. prime minister, city and county councils) (26.2%), toxicologists, chemists, biologists and food safety experts (17%), farmers and their associations (16.3%), chief scientific officer and advisor in governmental departments (15.6%), food board and food industry consultants (14.9%), food retailers, supermarkets and their associations (14.9%), Millstream Power Recycling (MPR) Ltd, the company that introduced the dioxin contamination (12.8%) and political parties (12.8%). Compared with such a wide range of sources cited by newspaper articles, there were only four main sources cited by blog and forum posts. They were offline and online media news (42.1%), National Food Safety Authority and Food Standard Agencies (27.1%), national or local central government (22.4%), Department of Agriculture &

Table 2. Presence of categories of sources in newspaper articles and blog and forum postings.

<table>
<thead>
<tr>
<th>Categories of sources</th>
<th>Traditional media</th>
<th>Social Media</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Newspaper articles</td>
<td>Blog &amp; forum postings</td>
<td></td>
</tr>
<tr>
<td>Presence of sources</td>
<td>134(95.0)</td>
<td>96(89.7)</td>
<td>2.55</td>
</tr>
<tr>
<td>Experts</td>
<td>83(58.9)</td>
<td>35(32.7)</td>
<td>16.69***</td>
</tr>
<tr>
<td>Political</td>
<td>79(56.0)</td>
<td>42(39.3)</td>
<td>6.85**</td>
</tr>
<tr>
<td>Offline and online media news</td>
<td>8(5.7)</td>
<td>45(42.1)</td>
<td>47.92***</td>
</tr>
<tr>
<td>Food Suppliers</td>
<td>62(44.0)</td>
<td>11(10.3)</td>
<td>33.25***</td>
</tr>
<tr>
<td>Food Consumers</td>
<td>8(5.7)</td>
<td>9(8.4)</td>
<td>0.71</td>
</tr>
<tr>
<td>NGOs</td>
<td>0(0)</td>
<td>1(0.9)</td>
<td>N/A</td>
</tr>
<tr>
<td>Law enforcement officials</td>
<td>11(7.8)</td>
<td>2(1.9)</td>
<td>4.31**</td>
</tr>
<tr>
<td>Other</td>
<td>12(8.5)</td>
<td>2(1.9)</td>
<td>5.04*</td>
</tr>
</tbody>
</table>

*p < 0.05, **p < 0.01, ***p < 0.001.

N/A: failed to meet the Chi-square test requirements as less than 5 observations were found in some cells.
Food (14.0%). Our observations revealed that, the majority of tweets (88%) relied solely on offline and online media news as the external sources, with the following scheme widely adopted in many: ‘name of news agency + highlights + link’. In tweets, it is worth noting that there was a sharp peak in the daily number of citations of online and offline news on 9 December.

**Topics: What topics were emphasised across media types?**

RQ3 aimed to reveal the similarities and disparities between traditional and social media in story topic. Media mentions of certain topics were expressed as the proportion of media stories where a certain topic was the primary focus (Table 3). Data indicates that four topics dominated 88 percent of all analysed social media postings: governments’ handling (27.4%), global reaction (25.1%), public reaction and perception (18.3%) and health facts (14.9%). None of the remaining topics exceeded 4 percent. In comparison, there was no single topic that occupied over 20 percent of newspaper articles, with mentions of ‘governments’ handling’ and ‘health facts’ as the primary focus slightly higher than the others. Looking at the results in more detail, no significant difference concerning the presence of different topics was found across media types, but scientific topic was more stressed in traditional media ($\chi^2 = 6.57, p < 0.05$). However, in terms of individual topics, analysis indicates that there were significant differences between different media types. Social media differed from traditional media in placing greater focus on global reaction ($\chi^2 = 27.80, p < 0.001$), governments’ handling ($\chi^2 = 4.13, p < 0.05$), and public reaction and perception ($\chi^2 = 11.23, p < 0.01$), but paid less attention to cause ($\chi^2 = 10.82, p < 0.01$), macroeconomic impact ($\chi^2 = 8.49$, $p < 0.001$).

**Table 3.** Distribution of primary story topics in newspaper articles and social media postings.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Traditional media</th>
<th>Social media blog and forum postings and tweets</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Newspaper articles $n = 141$ (%)</td>
<td>$n = 175$ (%)</td>
<td></td>
</tr>
<tr>
<td>Scientific topic</td>
<td>47 (33.3)</td>
<td>36 (20.6)</td>
<td>6.57*</td>
</tr>
<tr>
<td>Cause</td>
<td>19 (13.5)</td>
<td>6 (3.4)</td>
<td>10.82**</td>
</tr>
<tr>
<td>Health facts</td>
<td>24 (17.0)</td>
<td>26 (14.9)</td>
<td>0.28</td>
</tr>
<tr>
<td>Health warning</td>
<td>4 (2.8)</td>
<td>4 (2.3)</td>
<td>0.10</td>
</tr>
<tr>
<td>Economic topic</td>
<td>36 (25.5)</td>
<td>50 (28.6)</td>
<td>0.36</td>
</tr>
<tr>
<td>Macroeconomic impact</td>
<td>14 (9.9)</td>
<td>4 (2.3)</td>
<td>8.49**</td>
</tr>
<tr>
<td>Victimisation description</td>
<td>17 (12.1)</td>
<td>2 (1.1)</td>
<td>16.46***</td>
</tr>
<tr>
<td>Global reaction</td>
<td>5 (3.5)</td>
<td>44 (25.1)</td>
<td>27.80***</td>
</tr>
<tr>
<td>Political topic</td>
<td>37 (26.2)</td>
<td>53 (30.3)</td>
<td>0.63</td>
</tr>
<tr>
<td>Governments’ handling</td>
<td>25 (17.7)</td>
<td>48 (27.4)</td>
<td>4.13*</td>
</tr>
<tr>
<td>Evaluation on governments’ handling</td>
<td>12 (8.5)</td>
<td>5 (2.9)</td>
<td>4.90*</td>
</tr>
<tr>
<td>Social topic</td>
<td>21 (14.9)</td>
<td>36 (20.6)</td>
<td>1.70</td>
</tr>
<tr>
<td>Public reaction and perception</td>
<td>8 (5.7)</td>
<td>32 (18.3)</td>
<td>11.23**</td>
</tr>
<tr>
<td>Lessons learned</td>
<td>11 (7.8)</td>
<td>4 (2.3)</td>
<td>5.25*</td>
</tr>
<tr>
<td>Ethical and environmental issues</td>
<td>2 (1.4)</td>
<td>0 (0)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*p < .05. **p < .01. ***p < .001.
N/A: failed to meet the Chi-square test requirements as less than five observations were found in some cells.
p < 0.01), victimisation description ($\chi^2 = 16.46, p < 0.001$), evaluation on governments’ handling ($\chi^2 = 4.90, p < 0.05$), and lessons learned ($\chi^2 = 5.25, p < 0.05$).

**Tone: Which tone of voice was employed in different media formats?**

RQ4 asked about tone of delivery across media types. Analysis of the data indicates that neutral tone was employed most, by over half of media stories in their main bodies regardless of media types, and by 48.9 percent of newspaper articles and 66.0 percent of social media postings in their headlines (Table 4). Negative tones were slightly less used, even though the dioxin crisis in nature was a negative incident. Statistically, social media generated more neutral headlines ($\chi^2 = 7.19, p < 0.01$), but less positive main texts ($\chi^2 = 10.01, p < 0.01$) than traditional media.

**Discussion**

This study is one of very few case studies where a systematic and comprehensive analysis was conducted to examine the content of different media in times of food crisis. More importantly, this study represents an early attempt to understand how traditional and social media differ in covering food risk and crisis issues. The results of this study clearly demonstrate a differential between social and traditional media reporting of a food crisis event.

**No time like the present in food crisis**

Understanding how media coverage changed over time is essential; one factor that can influence risk perception is the volume of media coverage (Bakir, 2005; Kasperson et al., 1988). Similar to previous food contamination incidents (Demko, 1998; Verbeke et al., 1999), the results of this investigation suggest that, after the first official announcement confirming the presence of dioxin on 6 December 2008, media attention climbed dramatically and peaked between 8 and 10 December, the very three days that most official press releases and ministerial statements were announced (MacKenzie, 2010), and then quickly diminished to a low level on 11 December, which corresponded to the day the last official statement was made. Collectively, this suggests a link between official communications and high media coverage, as has previously been suggested (Nucci et al. 2009).

There are a number of considerations to bear in mind given the study’s findings. First, social media responded faster, which is understandable, as social media enables instantaneous responses
without the time lag inherent in editorial processes. Second, it is perhaps somewhat surprising that social media coverage of the crisis didn’t last longer than traditional media. It is well understood that traditional media works in an environment where commerce is an important driver (Carslaw, 2008). Newspapers have to sell, and as such journalists choose news stories based on the ‘value’ of the news. One factor influencing news value is timeliness; in other words, journalists are more likely to report the most recent events than reflect on earlier happenings (Curtin and Rhodenbaugh, 2001). In comparison, social media isn’t necessarily bound by such restriction. Coverage amount analysis in this study suggests little evidence of follow-up posts. Third, social media did not reach its highest coverage level until traditional media had already peaked. Given that social media made heavy use of offline and online media news, especially on the day after traditional media had peaked, it is reasonable to hypothesise that traditional media stimulated the second boom of social media by providing abundant resources as reference points. Communication professionals might thus need to take into account the mutual influences between traditional and social media when thinking about communication strategies. One could consider such strategies more like a communication system than two separate communication channels.

**Social media: A parallel public discourse or information disseminator?**

It has been found that journalists within traditional media agencies tend to rely on elite sources such as governments and scientists, and by contrast, social media has more citations from ‘speechless people’ (Atton and Wickenden, 2005; Li and Izard, 2003; Liu, 2010; Powell and Self, 2003). However, this only holds partly true in the current study. The current study found that social media used fewer elite sources than traditional media, but still placed considerable emphasis on them, second only to its use of news media sources. Furthermore, social media did not use as many non-elite sources as expected: blog and forum posts gave much less attention to food suppliers and similar to newspapers, social media rarely cited food consumers. This insight is in agreement with a media comparison investigation by Gerhands and Schafer (2010), who argued that in both media, communication is dominated by expert actors and popular inclusion does not occur. Findings from the analysis of the story topics showed that social media posts demonstrated higher reporting of public perceptions and reactions to the crisis than traditional media. However, in 2008, the level of reporting was not high enough to be considered as a parallel public discourse that allows authorities and researchers to become fully aware of and monitor public concerns, as suggested by more recent studies (Chew and Eysenbach, 2010; Keelan et al., 2010). It’s evident that, in 2008, social media were far from a heterogeneous public sphere gathering voices from a wide range of stakeholders. What the current study found was that social media users were mainly reflecting the information from expert sources rather than the opinions and reactions of the public. It is plausible to think that these findings may be an artefact of the fact that it is difficult to distinguish between those social media users who represent the ‘true’ lay public and those who are experts (e.g. conventional journalists, food industry leaders). The current study did not attempt to make such distinctions; however, it does represent a challenge for future research with social media, if the aim is to use social media to capture public opinion on a topic.

Results from this study showed that a large majority of tweets referred to online news media messages with URL included. This finding corresponded to a previous study by Chew and Eysenbach (2010). They found that during the 2009 H1N1 outbreak, 90.2 percent of tweets provided URL references with the majority of those linked to mainstream and local news websites. Blog and forum users also intensively relied on news media as their primary source. As discussed earlier, the media are not simply an information disseminator but can also play a number of other
roles such as building agendas, facilitating interaction and aggregating general opinion. However, from the results of this study, it can be suggested that in the 2008 Irish dioxin crisis, Twitter mainly functioned as a news information disseminator, with blog and forums also playing such a role, but at a lower intensity.

Different interpretation of the Irish dioxin crisis

It seems clear that the Irish dioxin crisis was differently interpreted by traditional media and social media via emphasising and excluding certain topic elements, and thus they functioned to build slightly different agendas. Overall, traditional media represented by newspaper articles showed a broadly equal distribution of attention among various topics, which implied it offered a more thorough perspective on food crisis events. Most of the differences in selecting and highlighting story topics between media types is explicable in terms of the insights of previous research. For instance, macroeconomic impact, victimisation description, governments’ handling and lessons learned were highlighted by traditional journalists, as economic consequences and identifiable victims are vital triggers that capture their attention, and evaluations and responsibility distribution adds news values in crisis reporting (Driedger, 2007, 2008; Littlefield and Quenette, 2007). In comparison, discourses on blog and forum sites laid more focus on global reactions, facts on governments’ handling and public reactions. These latter findings are likely to reflect the global nature of the internet and social media and also to reflect individuals’ concern about the effects of the crisis and its management on them personally. Historically, one assessment of risk and crisis management was the amount of negative media attention received. With the boom in social media, food risk managers need to monitor negative discourse on social networking sites. Tone of voice analysis on mass media coverage of the 2008 Irish dioxin crisis didn’t show notable differences between media types. This is in contrast with Liu’s findings, which showed that blogs were more likely than mainstream newspapers to use a negative tone when covering crises (Liu, 2010). It’s interesting to see that newspaper articles presented more negative tones in headlines than in the main text, and blog and forum postings were the opposite. The reason behind this might be that some editors in traditional media succumb to the temptation of creating eye catching headlines and fail to think carefully about the use of negative words (Carslaw, 2008).

Research difficulties, limitations and directions for future work

One difficulty encountered was to demarcate the boundary of ‘social media’. There are many descriptions of the concept of ‘social media’ (Kaplan and Haenlein, 2010); however none of them set up a clear boundary between social and traditional media. From the researchers’ perspectives, media platforms being distinguished as ‘social media’ should possess at least two features: free participation and interactivity. Free participation means a majority of internet users are allowed to engage in media publishing activities, and interactivity means media users are enabled to communicate freely with authors or other users on the same platform. Based on these two propositions, in the present study, online news was excluded from social media because the raw data file showed a large proportion of online news were from professional news agencies (e.g. BBC, Yahoo news) and the official sites of printed newspapers, which were obviously mainly operated by traditional journalists. Facebook is a largely popular social networking site that meets the previously defined social media criteria. However, it was not included, as the majority of Facebook posts back in 2008 were, and indeed still are, protected by privacy settings.

There is a limitation of note in the current study. Given that the task of trying to characterise the identity of authors of social media posts is often impossible, this study was unable to carry
out in-depth author analysis. This made it impossible to report that all online content was from ordinary citizens. In fact, based on the researchers’ familiarity with the dataset, it is believed that a proportion of social media posts were written by users with considerable expert knowledge on food safety, food manufacturing and related legislation and regulation systems.

It is expected that this study will encourage further investigations into similarities, disparities and synergies between different media types in reporting food crises. In conjunction with well-established psychological theories addressing issues such as risk and crisis perception, and behavioural intentions, gaining knowledge about media content on different platforms could benefit stakeholders in speculating about media effects and possibly enable more successful management of future crisis events. For instance, it may be suggested from the present study that the Irish dioxin crisis was perceived more as a threat to international trade of Irish meat than a domestic disaster by those who learnt about it from social media, insofar as social media content focused more on global reaction, and less on national economic impact and victims in the food supply chain. Having suggested ways in which traditional and social media differed in their coverage of a food risk issue, the question of the effects of these differences is raised. As such, future investigations, as well as seeking to deepen the consideration of how coverage of risk issues is differentiated across traditional and social media, are encouraged to consider the impact of this. As social media continues to expand, the effect of relying on this rather than traditional media as a source of information in food risk crises will assume great theoretical and practical interest.

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