Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Social Science & Medicine 169 (2016) 42–49

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Delivering risk information in a dynamic information environment: Framing and authoritative voice in Centers for Disease Control (CDC) and primetime broadcast news media communications during the 2014 Ebola outbreak

Anne Kott [a, *], Rupali J. Limaye [b, **]

[a] Johns Hopkins Center for Communication Programs, Johns Hopkins Bloomberg School of Public Health, 111 Market Place Suite 300, Baltimore, MD 21202, USA
[b] Johns Hopkins Bloomberg School of Public Health, Department of International Health, 111 Market Place Suite 300, Baltimore, MD 21202, USA

ARTICLE INFO

Article history:
Received 18 February 2016
Received in revised form
5 August 2016
Accepted 18 September 2016
Available online 20 September 2016

Keywords:
Risk communication
Ebola
Disease outbreaks
Content analysis
Media
Preparedness

ABSTRACT

Objective: During a disease outbreak, media serve as primary transmitters of information from public health agencies to the public, and have been shown to influence both behavior and perception of risk. Differences in news frequency, framing and information source can impact the public's interpretation of risk messages and subsequent attitudes and behaviors about a particular threat. The media's framing of an outbreak is important, as it may affect both perception of risk and the ability to process important health information.

Methods: To understand how risk communication by the Centers for Disease Control and Prevention (CDC) during the 2014 Ebola outbreak was framed and delivered and to what extent primetime broadcast news media mirrored CDC's framing and authoritative voice, 209 CDC communications and primetime broadcast transcripts issued between July 24 and December 29, 2014 were analyzed and coded by thematic frame and authoritative voice. Dominant frame and voice were determined for each month and for overall period of analysis.

Results: Medical frame was dominant in CDC (60%), Anderson Cooper 360 (49%), The Rachel Maddow Show (47%) and All In with Chris Hayes (47%). The human interest frame was dominant in The Kelly File (45%), while The O'Reilly Factor coverage was equally split between sociopolitical and medical frames (28%, respectively). Primetime news media also changed dominant frames over time. Dominant authoritative voice in CDC communications was that of CDC officials, while primetime news dominantly featured local and federal (non-CDC) government officials and academic/medical experts.

Conclusion: Differences in framing and delivery could have led the public to interpret risk in a different way than intended by CDC. Overall, public health agencies should consider adapting risk communication strategies to account for a dynamic news environment and the media's agenda. Options include adapting communications to short-form styles and embracing the concept of storytelling.

Public health agencies are part of a feedback loop that include the media as well as the public (Schuefele, 1999). Media serve as primary transmitters of information from public health agencies to the public, and as a result, play a critical role in framing risk of exposure to a disease outbreak (Chew and Eysenbach, 2010). How both these entities communicate to the public is important because evidence suggests that effective communication is critical to the successful management of any health threat (Covelloet al., 1989; National Research Council, 1989; Slovic, 1987).

During an infectious disease outbreak, encouraging the public to adopt specific behaviors and communicating this to them is critical to disease containment (Fung and Cairncross, 2006). There are a number of factors that impact the adoption of recommended health behaviors, with media serving a critical role, as media and public perceptions of issues and problems are intertwined (Altheide, 1997;

* Corresponding author.
** Corresponding author.
E-mail addresses: akott1@jhu.edu (A. Kott), rlimaye@jhu.edu (R.J. Limaye).

http://dx.doi.org/10.1016/j.socscimed.2016.09.029
0277-9536/

Gollust and Lantz, 2009). For instance, general public distrust of the media for sensationalizing health stories may lead to a lower adoption rate of recommended behaviors, while uncertainty around specific outbreaks influence whether or not individuals undertake precautionary behaviors, with the public less likely to follow recommended behaviors in contexts of high uncertainty (Slovic, 1987; Wray et al., 2008). Motivating the public to adopt recommended behaviors is challenging, and the public's response is typically characterized as one that makes decisions based on perception of risk, rather than actual risk (Rubin et al., 2009; Smith, 2006).

All risk communications, including communications from public health agencies and the media, are constructed to provide one perspective or another, through the use of frames, to define which issues are critical (Menashe, 1998). A frame is a central organizing idea used to suggest what is important within a particular topic or issue and affects audience attitudes and behaviors (Chong and Druckman, 2007; Gamson and Modigliani, 1989). With roots in psychology and sociology, the concept of framing is based on the assumption that how an issue is characterized and defined can influence how audiences understand that issue (Kahneman and Tversky, 1984; Pan and Kosicki, 1993). From a sociological perspective, Goffman (1974) argued that individuals cannot understand the world fully and struggle to interpret their life experiences and make sense of the world. As such, frames allow journalists to identify and classify information and, in turn, package information in an efficient way to relay such information to their audience; others have posited that media frames provide audiences with schemas for interpreting events (Entman, 1993; Gitlin, 1980). In public health, how news and public health agency communications are framed may impact public interpretation of health information (Ungar, 1998).

Information source is an important component of framing, as persuasion research indicates that information source can influence message reception, including an individual's attention to the message or message comprehension (Chaiken, 1980). These framing effects have been described through the associative network model of memory, which postulates that the human brain is a system made up of cognitive nodes and that certain aspects within a story will activate certain thoughts or feelings and nudge individuals to react in a particular manner (V Price and Tewksbury, 1997; Vincent Price et al., 1997). In addition to information source, research has shown that Americans select their primary sources of news based on alignment with their own ideological orientation, and there is evidence that those that tend to have a more conservative ideology have greater sensitivity to fear and threats, which may, in turn, affect their interpretation of messaging (Iyengar and Hahn, 2009; Shook and Fazio, 2009).

Mass media are the most important source of information in modern societies, and although many people have access to interpersonal networks or alternative information systems to seek and exchange information, mass media remain a critical element in people's acquisition of knowledge, specifically beyond an individual's direct experience (Luhmann and Cross, 2000). When it comes to decision-making and behavior, mass media play a highly influential role (Luhmann and Cross, 2000). The less personal experience an individual has with an issue, the larger the role that trust plays in the relationship between media and the user (Kohring and Matthes, 2007). Trust in media is important as it facilitates media use and moderates the relationship between media users and content, thus allowing for direct media effects (Jackob, 2010; Tsfati and Cappella, 2003; Tsfati and Peri, 2006).

The impact of media reporting on the public's emotions has implications for risk mitigation during a disease outbreak. When a public health threat is portrayed as serious and relevant, individuals may experience fear, which may motivate them to take action to reduce this fear (Joffe, 2011; Witte and Allen, 2000). Several theoretical models demonstrate that stress and high emotional arousal impact not only an individual's ability to process information, but also the way in which that information is processed (Covello et al., 2001; Sublet et al., 1996). The mental noise model postulates that worry and stress generate internal “mental noise,” which inhibits the ability to process external information, while trust determination and negative dominance models assert that when individuals are upset, they often become distrustful of authority, are less likely to accept the validity of communications from a source of authority, and give greater weight to negative information over positive information (Baron et al., 2000; Covello et al., 2001; Glik, 2007; Renn and Levine, 1991; Sublet et al., 1996). Published reflections on the Ebola outbreaks in the mid-1990s and the 2014 epidemic noted the importance of building trust and assuaging fear within the public as key strategies to combat rapid spread of disease, and the role of the media in creating or mitigating panic (Farrar and Piot, 2014; Joffe and Haarhoff, 2002; Towers et al., 2015). Credibility of the information source has been positively associated with persuasiveness of increasing fear, suggesting that information source affects the level of fear an individual feels and in turn, can impact attitudes and behavior (Powell and Miller, 1967).

Within the health context, public opinion as well as policy-making can shift when health risks are framed in specific ways (Lawrence, 2004). Frames influence what types of information are included in media reporting, and can misrepresent and/or misconstrue scientific evidence; subsequently, decisions of policymakers may also be influenced by these misrepresentations (Hargreaves et al., 2003; Harrabin et al., 2003). Frames also impact health behavior; for example, health messages that utilize gain or loss-framed arguments have differential behavioral effects (Rothman and Salovey, 1997).

Within media reporting, framing can be conceptualized as a necessary tool to reduce the complexity of an issue, given the barriers media face with regard to airtime and constraints related to news holes (Gans, 1979). Thematic frames, or those frames that focus on broader social, political, and economic forces, encourage audiences to make connections between a specific issue and some sort of broader, macro-level factor, and findings from psychology suggest that audiences draw more inferences from stories that utilize thematic frames, compared to episodic frames (Iyengar, 1991; Schnotz, 1985).

The 2014 Ebola crisis provides an interesting lens through which to study framing, information source, and ideological orientation, as all were relevant to the crisis due to their associations with risk perception. Risk perception is comprised, among other things, of perceived susceptibility and perceived severity (Slovic, 1987). Differences in news frequency, framing and information source can impact risk perception and, as a result, subsequent attitudes and behaviors about a particular threat (Smith, 2006). When a public health threat is portrayed as serious and relevant, individuals may experience fear, which may motivate them to take action to reduce this fear (Witte and Allen, 2000). Credibility of the information source has been positively associated with persuasiveness of increasing fear, suggesting that information source affects the level of fear an individual feels and in turn, can impact attitudes and behavior (Powell and Miller, 1967).

Past disease outbreaks may provide insight into the impact of media communication on public risk perception and their subsequent fear-motivated behaviors. Some suggest that the most important lesson learned from the 2003 severe acute respiratory syndrome (SARS) epidemic was the importance of effective public communication, as constant press coverage may have led to public

overreaction and potentially affected perception of risk (Gatehouse, 2003; Hurst, n.d.; Lam et al., 2003; Smith, 2006). During the 2009 H1N1 outbreak, mass media information shaped the way in which the public interpreted the severity and susceptibility to the virus, with the public overestimating the risk of infection (Poletti et al., 2011). Previous research indicates that the public may feel more at ease when familiar risks are perceived to be under control; however, people desire more information to determine personal relevance when considering their response to unknown risks (Lion et al., 2002; Pidgeon et al., 2003; Poortinga et al., 2004).

The Centers for Disease Control and Prevention (CDC) is the nation's health protection agency and provides health information regarding health threats. As framing can impact attitudes and behaviors, this study sought to understand how risk communication regarding the Ebola epidemic was framed and delivered by the CDC, and subsequently, to what extent the primetime broadcast news media mirrored CDC's framing and choice of authoritative voice. This study sought to determine how risk communication by the nation's public health agency was interpreted, and subsequently framed and delivered, by the media to the public.

1. Methods

1.1. News selection

CDC communications and broadcast transcripts issued between July 24 and December 29, 2014 were selected for analysis. This time period was chosen because CDC released its first communication related to the Ebola outbreak on July 31, 2014 and its last communication on December 22, 2014. A week was added onto the start and end dates to ensure completeness. "CDC communications" was defined as all official telebriefing transcripts, press releases and media statements related to Ebola. A total of 45 official communications materials related to the Ebola outbreak were issued within the designated time period and downloaded from the CDC website. AdWeek ratings from the week of July 28, 2014 were used to determine the top three United States (U.S.) broadcast networks by primetime viewership: Fox News, CNN and MSNBC ("The Scoreboard: July 28, 2014"). Primetime is traditionally defined as 8pm to 11pm. Nielsen, a global company that manages the Nielsen television rating measurement system, states that more Americans watch television from 9:15pm to 9:30pm than any other period during primetime and that the end of the primetime period (10:45 to 11:00pm) is when the fewest number of viewers are watching (Nielsen, 2011). As a result, this study chose to include only primetime broadcast news shows airing from 8pm to 9pm and 9pm–10pm on each network; they included The O'Reilly Factor (Fox News), The Kelly File (Fox News), Anderson Cooper 360 (CNN), All In with Chris Hayes (MSNBC), and The Rachel Maddow Show (MSNBC). Using LexisNexis, transcripts from shows that aired during the designated time period were identified ($n = 592$) and then reviewed for the search term "Ebola." Transcripts that only mentioned Ebola in preview clips for shows airing at a later time were excluded. A total of 164 transcripts were identified for coding.

1.2. Data analysis

This study sought to examine the content of transcripts and materials (referred to as articles) in an objective and systematic manner and used a content analysis approach, a method used to classify written documents into identified categories of similar meanings (Berelson, 1952; Moretti et al., 2011). Categories represent either explicit or inferred communication, and as there is no contact with the source being studied, is classified as a more unobtrusive method (Hsieh and Shannon, 2005). The authors first randomly selected 25 articles (of 209 total articles, or 12%). Both authors reviewed all 25 articles using a content analysis approach and an initial coding key was developed collaboratively based on relevant frames used in this set of articles. The first author then coded this set of 25 articles. The second author reviewed the 25 articles coded by the first author to discuss and decide upon changes to the coding key. Both authors then coded a random selection of five of the 25 articles using the refined coding key. When disagreements arose, the authors referred to the code list definitions to come to an agreement and the code list was revised in an iterative fashion, and an additional randomly selected five articles of the original set of 25 articles were coded by both authors to finalize the coding key. Both authors then coded the entire set of 25 articles with the agreed upon final coding key. Inter-rater reliability of these 25 articles was satisfactory ($\kappa = 0.85$). After this step, the first author then coded the remaining articles. After coding by the first author was complete, the second author reviewed a selected random sample of coded articles (approximately 10% of the articles) to verify themes. At this point in the analysis, as disagreements were few, articles were not recoded. Coded articles were recorded using Microsoft Excel (2013).

1.3. Coding categories

Articles were analyzed and coded by thematic frame and information source (Berry et al., 2007; Iyengar, 1991; Lee and Basnyat, 2013). Thematic news frames deliver information through a general content or environmental lens, while episodic news frames highlight discrete or individual events (Iyengar, 1991). News coverage during the designated time period was both thematic and episodic; while coverage included discrete or individual events (e.g., individual cases of Ebola or human interest stories), CDC and primetime broadcast news communications frequently featured commentary that provided contextual background or an environmental lens; additionally, coverage of individual cases universally included contextual background. The thematic frame was therefore chosen for this study's analysis.

Four thematic frames were identified through iterative analysis. The medical frame included communications that described the disease definition, symptoms, treatment, geographic spread, protocols for monitoring and response, and changes to treatment or monitoring; communications that referenced the fatalities, number of total cases, number of new cases, number of countries affected, and case fatality rate; and communications that referenced of new medical findings or therapies. The human interest frame included communications with profiles of Ebola patients or individuals touched by Ebola. The socio-political context frame included communications about travel bans, quarantine, or U.S. military assistance and communications that referenced the respective scale of the outbreak to others. Finally, the unconfirmed information frame included communications with speculative or unconfirmed information. Broadcast news shows often replayed press conference videos or previously taped interviews and followed the video clips with commentary. Content from replayed or previously taped videos was coded independently from commentary.

Seven information sources, which were referred to as "authoritative voice" in this study due to the fact that each source was presented in CDC and primetime broadcast news communications as an authority on aspects of the Ebola crisis, were also identified. (One) "CDC official" referred to current CDC scientists and spokespeople. (Two) "Federal official" referred to current or former federal officials, administrators and politicians. (Three) "Academic or medical expert" included doctors, medical researchers and academic scientists. (Four) "State or local official" referred to current or former local and state officials, administrators and politicians.

(Five) "Aid worker" referred to individuals who currently or previously worked on Ebola prevention and treatment outside the U.S. (Six) "U.S. health care worker" referred to health care workers and first responders caring for Ebola patients within the U.S. Finally, (seven) "Ebola patients and/or family members" referred to individuals who survived Ebola and the immediate family members of Ebola survivors or victims. In certain instances, categories overlapped; in these cases, individuals were coded based on the geographic focus of the individual's comments. Individuals with a professional background in medicine, health care or disaster response who travelled outside the U.S. to work on Ebola prevention and treatment, returned, and spoke about their experience abroad were coded as "aid worker." Individuals with the same background who spoke about the U.S. response were coded as "U.S. health care worker" unless their disaster response professional experience was in federal, state or local government, in which case they were coded as "federal official" or "state or local official," as appropriate.

2. Results

A total of 209 articles were analyzed and coded (21% CDC communications, 79% broadcast transcripts). Dominant thematic frame and authoritative voice were determined for each month and for the overall period of analysis by communications source. To determine a dominant frame, the frequency of each frame within each month and overall was tallied; frames that were equal in frequency were both coded as dominant. As a result, some primetime broadcast news shows had up to four dominant frames or authoritative voices per month.

Communications frequency, dominant thematic frame and authoritative voice were also analyzed by the primary ideological orientation of audience. This study hypothesized that ideological orientation could affect the dominant framing of communications; patterns emerged during analysis that indicated framing may have been influenced by ideological orientation. Using Pew Research Center data that scaled audience ideological orientation by television network, primetime broadcast news shows were classified on a scale from more conservative to more liberal in the following order: The O'Reilly Factor, The Kelly File, Anderson Cooper 360, All In with Chris Hayes, The Rachel Maddow Show (Pew Research Center, 2012).

2.1. Frequency of communication

During the time period of analysis, CDC issued a public comment 45 times with the largest proportion of comments in October (48%), followed by September (19%) and July (16%). Primetime broadcast news coverage of Ebola also peaked in October (65%), followed by August (13%) and September (8%). Conservative primetime broadcast news shows reported on Ebola with less frequency than moderate or mostly liberal news shows (Fig. 1). The O'Reilly Factor, for example, only reported on Ebola in July and October, whereas All In With Chris Hayes covered the Ebola outbreak throughout the entire six-month period of analysis.

2.2. Thematic frames

The dominant thematic frame for CDC communications was medical (60%), while a socio-political (21%) or human interest frame (17%) was also used; a very small percentage contained unconfirmed information (1%). Dominant thematic framing in primetime broadcast news varied by network and by primary ideological orientation of audience (Fig. 2). The medical frame was dominant in coverage by Anderson Cooper 360 (49%), The Rachel Maddow Show (47%) and All In with Chris Hayes (47%). The Kelly File reported most frequently through a human interest frame (45%), while The O'Reilly Factor coverage was equally split between socio-political and medical frames (28%, respectively). The O'Reilly Factor also had the highest percentage of communications coded as unconfirmed information (19%) among primetime broadcast news shows.

2.3. Authoritative voice

The dominant authoritative voice used in CDC communications was that of CDC officials (73%). State and local officials, federal officials and U.S. healthcare workers represented 19%, 6% and 2%, respectively, however, these secondary voices only appeared in late September and October. There was significant variance in use of authoritative voice in primetime broadcast news communications (Fig. 3). The Rachel Maddow Show most frequently interviewed or quoted state or local officials (26%), followed by federal officials (20%). The O'Reilly Factor and All In With Chris Hayes dominantly used federal officials (36% and 27%, respectively) followed by academic or medical experts (27% and 21%, respectively). The Kelly File most frequently interviewed or quoted federal officials (25%), followed by CDC officials (20%); Anderson Cooper 360 Degrees most frequently interviewed or quoted academic or medical experts (27%), followed by Ebola survivors and/or family members (19%). Replayed press conference video clips were coded with the same weight as live or taped interviews; on The O'Reilly Factor, video clips of President Obama were frequently aired followed by commentary primarily by Bill O'Reilly. The Kelly File was the only show to directly interview CDC Director Tom Frieden (a pre-taped, edited version aired).

2.4. Evolution of thematic framing and authoritative voice

Using CDC as a reference, monthly dominant thematic framing and authoritative voices used in primetime broadcast news communications were compared with dominant CDC framing and voice. CDC communications maintained the same dominant thematic frame and authoritative voice throughout the analysis period, while primetime broadcast news show use of framing and authoritative voice varied (Fig. 4). Shows with a moderate or mostly liberal leaning audience reported through a medical frame until November before diverging to a human interest frame (Anderson Cooper 360 and The Rachel Maddow Show) or socio-political frame (All In With Chris Hayes). In October, at the height of the Ebola crisis, shows with more conservative audiences reported through a socio-political frame (The O'Reilly Factor) and a human interest frame (The Kelly File), while shows with a moderate or mostly liberal leaning audience reported through a medical frame. All In With Chris Hayes and The O'Reilly Factor were the only primetime broadcast news shows to dominantly report through a socio-political frame for a month, though they did not do so at the same time.

Some patterns emerged between conservative and liberal primetime news shows. The Kelly File (with a mostly conservative audience) and All In With Chris Hayes (with a mostly liberal audience) mirrored one another through October with regard to authoritative voice. Both shows were dominated by academic or medical experts (July), followed by federal officials (August, with additional voices on The Kelly File), CDC officials (September) and federal officials (October). The O'Reilly Factor (ranked in this analysis as having the most conservative audience) and The Rachel Maddow Show (ranked in this analysis as having the most liberal audience) also showed slight similarities. Neither covered Ebola in August or December; both used only academic or medical experts

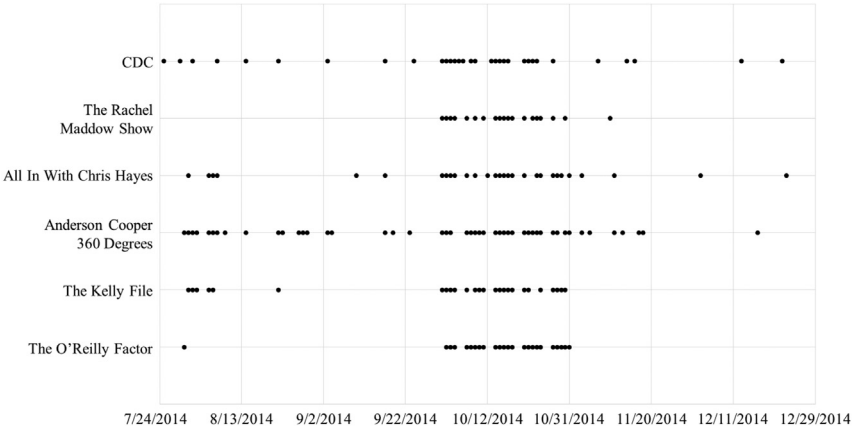

Fig. 1. Frequency of Communication. Frequency of Ebola communications issued by Centers for Disease Control (CDC) and primetime broadcast news shows.

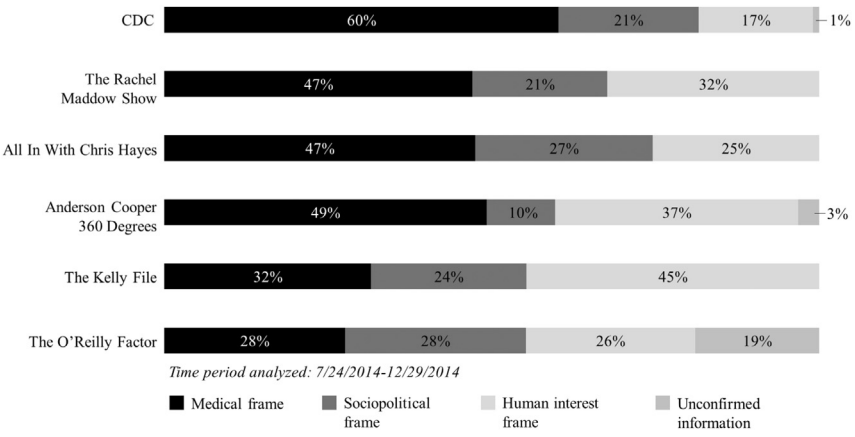

Fig. 2. Frequency of Thematic Frame. Frequency of thematic frames used by Centers for Disease Control (CDC) and primetime broadcast news shows in Ebola communications.

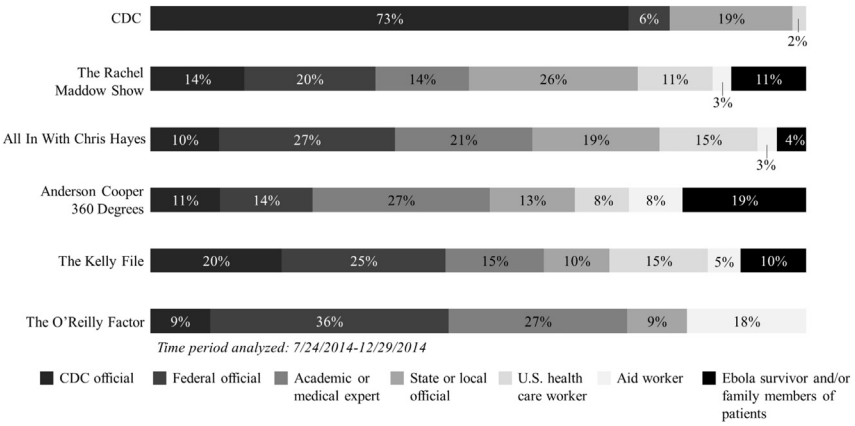

Fig. 3. Frequency of Authoritative Voice. Frequency of authoritative voice used by Centers for Disease Control (CDC) primetime broadcast news shows in Ebola communications.

or government officials as authoritative voices. Early communications (July–September) did not reflect any pattern or trend between the shows.

Several major national and international news events occurred during the same time period as Ebola and coverage of these events was included in the analyzed broadcast news show transcripts. During the period of July–December 2014, several African-American men died in U.S. police custody, the Islamic State of Iraq and Syria (ISIS) executed several international journalists, and the U.S. government engaged in high-profile, highly reported-on discussions on immigration reform. Broadcast news media commentary on Ebola reflected these events and included discussions about Ebola and race, the potential that ISIS would use Ebola as a biological weapon, and the need to close U.S. borders to control Ebola's spread. While these examples of combined coverage fell outside the coding key, instances were noted during coding and recorded for discussion.

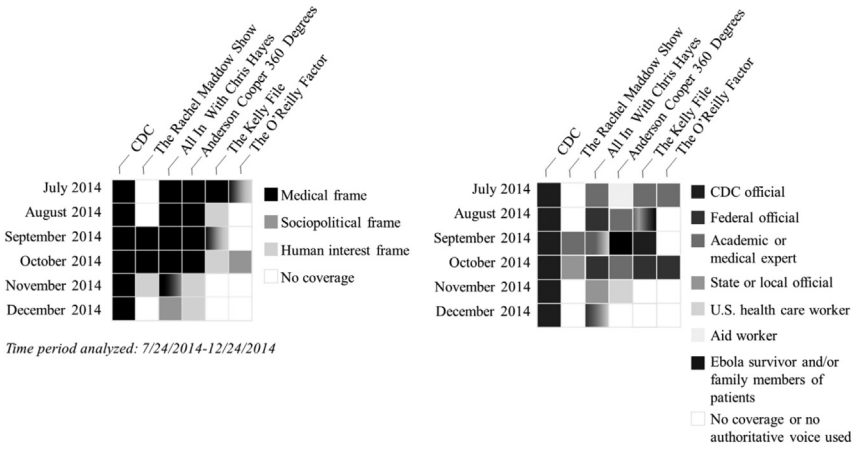

Fig. 4. Dominant Thematic Frame and Authoritative Voice, By Month. Monthly distribution of dominant thematic frames and authoritative voices used by Centers for Disease Control (CDC) and primetime broadcast news shows in Ebola communications.

3. Discussion

During a disease outbreak, risk communication is now delivered in a dynamic news environment. A dynamic news environment is one in which there is a flow of multiple dimensions and various nuanced messages in news discourse, and an environment in which news is more contextualized, textured, and multi-dimensional than conceptualizations of traditional news media (Althaus and Kim, 2006; Fenton, 2010). Technological, economic, and social changes have transformed the production of news, and the proliferation of news platforms has forced those that report on the news to question the idea that the public is a monolithic construct (Fenton, 2010). As a result, framing of health risk messages may be transmitted and interpreted in unpredictable ways. This study found that the thematic framing and authoritative voice utilized by CDC is different than the framing and voice used by the primetime broadcast news media. Thus, it is possible that the public may have interpreted their risks to Ebola in a way that is different than what CDC intended. Additionally, there was variance in frames and voice over time within the primetime broadcast news media, which may have also influenced the ways in which the public interpreted their risk over time.

CDC's Crisis and Emergency Risk Communication (CERC) handbook recommends that responders speak with one voice to ensure consistent messaging; CDC communications were dominated by one thematic frame and one authoritative voice (U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014). The results of this study show that this consistent messaging did not translate to primetime broadcast news media communications, and shows did not adopt CDC's thematic frames and authoritative voice but instead delivered the information through various frames and authoritative voices. It begs the question as to whether the one voice approach is appropriate within a dynamic information environment.

Related to a dynamic environment, the mental noise model postulates that worry and stress generate internal “mental noise,” which inhibits the ability to process external information, while trust determination and negative dominance models assert that when individuals are upset, they often become distrustful of authority, are less likely to accept the validity of communications from a source of authority, and give greater weight to negative information over positive information (Baron et al., 2000; Covello and Peters, 1996; Covello et al., 2001; Glik, 2007; Renn and Levine, 1991). The fact that coverage of Ebola was at times interwoven with coverage of other international news events may have implications for risk communications, as several theoretical models demonstrate that stress and high emotional arousal impact not only an individual's ability to process information, but also the way in which that information is processed (Covello and Peters, 1996; Glik, 2007). If non-Ebola related news events are reported on during a news show in the same segment as Ebola-related news, and elicit an emotional response from viewers, it is possible that this could impact viewers' ability to process Ebola-related risk information.

There were two other notable observations from this study that should be further explored. Regarding public interpretation of health risk messaging, The O'Reilly Factor frequently aired video clips of President Obama speaking about the Ebola crisis, which were followed by O'Reilly's personal commentary or by guest commentary and generate an interesting question about how information is ultimately received. If President Obama speaks through a medical frame, and Bill O'Reilly translates that information through a socio-political frame, how is the public's interpretation affected, if at all? This idea of multi-level message transmission and its effect on thematic framing is a research area to further explore. Additionally, research indicates that Americans select their primary sources of news based on alignment with their own ideological orientation (Iyengar and Hahn, 2009). During a public health crisis, the impact of ideological leaning on news preferences can alter how public health information is framed and potentially comprehended (Hallahan, 1999). During the Ebola crisis, some patterns in frequency, framing and use of authoritative voice during evening primetime news emerged across ideological lines, and specifically between moderate liberal and conservative news sources and extreme liberal and conservative news sources. Thus, it is possible that moderate liberals and conservatives and extreme liberals and conservatives may share preferences for how information is delivered during a public health crisis. Further research is recommended to explore this pattern.

Although emerging outbreaks coupled with high levels of uncertainty present extraordinary communications challenges, public health agencies can and should adapt to operating in a dynamic environment and take into account the social context in which the outbreak is occurring. Public health agencies should also recognize that the media's communications agenda during a crisis is different from their own and adjust communications accordingly. Members of the media, like public health agencies, are compelled by principles of truth and accuracy in their communications; however, these journalistic standards are interpreted through the lens of the story and the need for multi-perspective context in reporting (Schwitzer,

2004a; Schwitzer et al., 2005). Television journalists have the added restriction of being time-bound, often reporting a news story within a 45-s window (Schwitzer, 2004b).

Disease outbreak communications can be adjusted to better suit the media's needs without compromising the health information being provided. Press releases and teleconferences provide an abundance of content, requiring reporters to synthesize the information and allowing for editorial interpretation; public health agencies could instead consider short-form communications better suited to the media's time restrictions (Sheehan and Quinn-Allan, 2015; Wetherhead, 2013). For example, a brief daily email with three or four bulleted sentences summarizing critical updates could be repurposed as a 30-s news clip. In addition, rather than adhering to one frame and voice throughout a crisis, public health agencies should consider embracing the concept of storytelling to their own advantage.

Storytelling, or the adaptation of information into a narrative, has been shown to improve information visualization, or the process by which the mind translates data, information, and knowledge into a form that enables the individual to observe and understand the information (Gershon and Page, 2001). This study's findings indicate that primetime broadcast news shows change the dominant thematic frames and authoritative voices featured in their reporting over time, effectively mimicking a story narrative, which is consistent with agenda-setting theory: The media frames information in “compelling arguments” (McCombs, 2013; Sheafer, 2007). By mirroring the media's approach, and purposefully employing new dominant thematic frames and authoritative voices in their risk communications, public health agencies may appeal to both the public's and the media's desire for a compelling storyline, which may positively impact their ability to get critical information included in the media's coverage (McCombs, 2013; Nobles and Schiff, 2004; Sheafer, 2007).

3.1. Limitations

This study has several limitations. Transcripts were only included from the top three news networks, airing between 8pm and 10pm EST during the time period of analysis. As a result, results are not generalizable across all television media outlets and programs, are not representative of morning news shows, and do not include print, radio, or new media. Additionally, framing is influenced by a variety of externalities, which this study was not able to account for in its analysis. Finally, it is unknown how the public interpreted CDC or media messaging, and future research should address this gap. Despite these limitations, this study suggests that public health agencies should take into consideration how the media frames and delivers information related to public health crises, and should respond accordingly to ensure that their risk communications are accurate, relevant, and influence the public to take the correct protective action.

4. Conclusion

Risk communication is complex and challenging. This study's findings reflect the importance of considering how the media's framing of public health messaging may impact the public's ability to process risk information and take subsequent action. There is a clear need to consider how external factors impact the media's framing of a disease outbreak and its translation of critical risk communications. By understanding and incorporating the social context and recognizing the media's unique communication needs, public health agencies will be equipped to produce messaging that meets the realities of an interconnected world.

References

Althaus, S., Kim, Y.M., 2006. Priming effects in complex information environments: reassessing the impact of news discourse on presidential approval. J. Polit. 68 (4), 960–976.

Altheide, D.L., 1997. The news media, the problem frame, and the production of fear. Sociol. Q. 38 (4), 647–668.

Baron, J., Hershey, J.C., Kunreuther, H., 2000. Determinants of priority for risk reduction: the role of worry. Risk Anal. 20 (4), 413–428. http://dx.doi.org/10.1111/0272-4332.204041.

Berelson, B., 1952. Content Analysis in Communication Research. The Free Press.

Berry, T.R., Wharf-Higgins, J., Naylor, P. j, 2007. SARS wars: an examination of the quantity and construction of health information in the news media. Health Commun. 21 (1), 35–44. http://dx.doi.org/10.1080/10410230701283322.

Centers for Disease Control and Prevention, 2014. CDC Newsroom Releases (2014 Archives). Retrieved January 16, 2015, from. http://www.cdc.gov/media/releases/2014.

Chaiken, S., 1980. Heuristic versus systematic information processing and the use of source versus message cues in persuasion. J. Personal. Soc. Psychol. 39 (5), 752–766.

Chew, C., Eysenbach, G., 2010. Pandemics in the age of twitter: content analysis of tweets during the 2009 H1N1 outbreak. PLoS One 5 (11). Retrieved from. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0014118.

Chong, D., Druckman, J.N., 2007. Framing theory. Annu. Rev. Polit. Sci. 10 (1), 103–126. http://dx.doi.org/10.1146/annurev.polisci.10.072805.103054.

Covello, V.T., McCallum, D.B., Pavlova, M., 1989. Principles and guidelines for improving risk communication. In: Effective Risk Communication. Springer, US, pp. 3–16.

Covello, V.T., Peters, R.G., 1996. The determinants of trust and credibility in environmental risk communication: an empirical study. In: Sublet, V.H., Covello, V.T., Tinker, T.L. (Eds.), Scientific Uncertainty and its Influence on the Public Communication Process. Springer, Netherlands, pp. 33–63. Retrieved from. http://link.springer.com/chapter/10.1007/978-94-015-8619-1_3.

Covello, V.T., Peters, R.G., Wojtecki, J.G., Hyde, R.C., 2001. Risk communication, the West Nile virus epidemic, and bioterrorism: responding to the communication challenges posed by the intentional or unintentional release of a pathogen in an urban setting. J. Urban Health 78 (2), 382–391. http://dx.doi.org/10.1093/jurban/78.2.382.

Entman, R.M., 1993. Framing: toward clarification of a fractured paradigm. J. Commun. 43 (4), 51–58.

Farrar, J.J., Piot, P., 2014. The Ebola emergency — immediate action, ongoing strategy. N. Engl. J. Med. 371 (16), 1545–1546. http://dx.doi.org/10.1056/NEJMe1411471.

Fenton, N., 2010. New Media, Old News: Journalism and Democracy in the Digital Age. SAGE Publications.

Fung, I.C.-H., Cairncross, S., 2006. Effectiveness of handwashing in preventing SARS: a review. Trop. Med. Int. Health 11 (11), 1749–1758. http://dx.doi.org/10.1111/j.1365-3156.2006.01734.x.

Gamson, W.A., Modigliani, A., 1989. Media discourse and public opinion on nuclear power: a constructionist approach. Am. J. Sociol. 95 (1), 1–37.

Gans, H.J., 1979. Deciding What's News: a Study of CBS Evening News, NBC Nightly News, Newsweek, and Time. Northwestern University Press.

Gatehouse, J., 2003. SARS: fear and loathing in Toronto. Maclean's 116 (18).

Gershon, N., Page, W., 2001. What storytelling can do for information visualization. Commun. ACM 44 (8), 31–37. http://dx.doi.org/10.1145/381641.381653.

Gitlin, T., 1980. The Whole World Is Watching: Mass Media in the Making & Unmaking of the New Left. University of California Press.

Glik, D.C., 2007. Risk communication for public health emergencies. Annu. Rev. Public Health 28 (1), 33–54. http://dx.doi.org/10.1146/annurev.publhealth.28.021406.144123.

Goffman, E., 1974. Frame Analysis: an Essay on the Organization of Experience. Harvard University Press.

Gollust, S.E., Lantz, P.M., 2009. Communicating population health: print news media coverage of type 2 diabetes. Soc. Sci. Med. 69 (7), 1091–1098. http://dx.doi.org/10.1016/j.socscimed.2009.07.009.

Hallahan, K., 1999. Seven models of framing: implications for public relations. J. Public Relat. Res. 11 (3), 205–242. http://dx.doi.org/10.1207/s1532754xjprr1103_02.

Hargreaves, I., Lewis, J., Speers, T., 2003. Towards a Better Map: Science, the Public and the Media. Economic and Social Research Council, Swindon, UK.

Harrabin, R., Coote, A., Allen, J., 2003. Health in the News: Risk, Reporting and Media Influence. King Edward's Hospital Fund for London, United Kingdom.

Hsieh, H.F., Shannon, S.E., 2005. Three approaches to qualitative content analysis. Qual. Health Res. 15 (9), 1277–1288.

Hurst, M. D. (n.d.). SARS fears prompt many schools to cancel student trips to Toronto. Educ. Week, 22(10).

Iyengar, S., 1991. Is Anyone Responsible? How Television Frames Political Issues. The University of Chicago Press.

Iyengar, S., Hahn, K., 2009. Red media, blue media: evidence of ideological selectivity in media use. J. Commun. 59 (1), 19–39.

Jackob, N.G.E., 2010. No alternatives? the relationship between perceived media dependency, use of alternative information sources, and general trust in mass media. Int. J. Commun. 4 (0), 18.

Joffe, H., 2011. Public apprehension of emerging infectious diseases: are changes

afoot? Public Underst. Sci. 20 (4), 446–460. http://dx.doi.org/10.1177/0963662510391604.
Joffe, H., Haarhoff, G., 2002. Representations of far-flung illnesses: the case of Ebola in Britain. Soc. Sci. Med. 54 (6), 955–969. http://dx.doi.org/10.1016/S0277-9536(01)00068-5.
Kahneman, D., Tversky, A., 1984. Choices, values, and frames. Am. Psychol, 39 (4).
Kohring, M., Matthes, J., 2007. Trust in news media development and validation of a multidimensional scale. Commun. Res. 34 (2), 231–252. http://dx.doi.org/10.1177/0093650206298071.
Lam, W., Zhong, N., Tan, W., 2003. Overview on SARS in Asia and the world. Respirology 8, S2–S5. http://dx.doi.org/10.1046/j.1440-1843.2003.00516.x.
Lawrence, R.G., 2004. Framing obesity the evolution of news discourse on a public health issue. Harv. Int. J. Press Polit. 9 (3), 56–75. http://dx.doi.org/10.1177/1081180X04266581.
Lee, S.T., Basnyat, I., 2013. From press release to news: mapping the framing of the 2009 H1N1 A influenza pandemic. Health Commun. 28 (2), 119–132. http://dx.doi.org/10.1080/10410236.2012.658550.
Lion, R., Meertens, R.M., Bot, I., 2002. Priorities in information desire about unknown risks. Risk Anal. 22 (4), 765–776. http://dx.doi.org/10.1111/0272-4332.00067.
Luhmann, N., Cross, K., 2000. The Reality of the Mass Media. Stanford University Press.
McCombs, M., 2013. Setting the Agenda: the Mass Media and Public Opinion. John Wiley & Sons.
Menashe, C.L., 1998. The power of a frame: an analysis of newspaper coverage of tobacco issues-United States, 1985-1996. J. Health Commun. 3 (4), 307–325. http://dx.doi.org/10.1080/108107398127139.
Moretti, F., van Vliet, L., Bensing, J., Deledda, G., Mazzi, M., Rimondini, M., et al., 2011. A standardized approach to qualitative content analysis of focus group discussions from different countries. Patient Educ. Couns. 82 (3), 420–428.
Nielsen, 2011, September 13. What Time Is Really Primetime? Retrieved from. http://www.nielsen.com/us/en/insights/news/2011/what-time-is-really-primetime.html.
National Research Council, 1989. Improving Risk Communication. National Academy Press.
Nobles, R., Schiff, D., 2004. A story of miscarriage: law in the media. J. Law Soc. 31 (2), 221–244.
Pan, Z., Kosicki, G.M., 1993. Framing analysis: an approach to news discourse. Polit. Commun. 10 (1), 55–75.
Pew Research Center, 2012. 2012 News Consumption Survey. Washington, DC. Retrieved from. http://www.people-press.org/2012/09/27/in-changing-news-landscape-even-television-is-vulnerable/.
Pidgeon, N., Kasperson, R., Slovic, P., 2003. The Social Amplification of Risk. Cambridge University Press.
Poletti, P., Ajelli, M., Merler, S., 2011. The effect of risk perception on the 2009 H1N1 pandemic influenza dynamics. PLoS One 6 (2). Retrieved from. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0016460.
Poortinga, W., Bickerstaff, K., Langford, I., Niewöhner, J., Pidgeon, N., 2004. The British 2001 foot and mouth crisis: a comparative study of public risk perceptions, trust and beliefs about government policy in two communities. J. Risk Res. 7 (1), 73–90. http://dx.doi.org/10.1080/1366987042000151205.
Powell, F.A., Miller, G.R., 1967. Social approval and disapproval cues in anxiety-arousing communications. Speech Monogr. 34 (2), 152–159. http://dx.doi.org/10.1080/03637756709375535.
Price, V., Tewksbury, D., 1997. News values and public opinion: a theoretical account of media priming and framing. In: Progress in Communication Sciences, vol. 13. Praeger, pp. 173–212.
Price, V., Tewksbury, D., Powers, E., 1997. Switching trains of thought the impact of news frames on readers' cognitive responses. Commun. Res. 24 (5), 481–506. http://dx.doi.org/10.1177/009365097024005002.
Renn, O., Levine, D., 1991. Credibility and trust in risk communication. In: Kasperson, R.E., Stallen, P.J.M. (Eds.), Communicating Risks to the Public. Springer, Netherlands, pp. 175–217. Retrieved from. http://link.springer.com/chapter/10.1007/978-94-009-1952-5_10.
Rothman, A.J., Salovey, P., 1997. Shaping perceptions to motivate healthy behavior: the role of message framing. Psychol. Bull. 121 (1), 3–19. http://dx.doi.org/10.1037/0033-2909.121.1.3.
Rubin, G.J., Amlôt, R., Page, L., Wessely, S., 2009. Public perceptions, anxiety, and behaviour change in relation to the swine flu outbreak: cross sectional telephone survey. Br. Med. J. 339, b2651. http://dx.doi.org/10.1136/bmj.b2651.
Schnotz, W., 1985. Selectivity in drawing inferences. Adv. Psychol. 29, 287–326.
Schuefele, D.A., 1999. Framing as a theory of media effects. J. Commun. 49 (1), 103–122.
Schwitzer, G., 2004a. A statement of principles for health care journalists. Am. J. Bioeth. 4 (4), W9–W13. http://dx.doi.org/10.1080/15265160490908086.
Schwitzer, G., 2004b. Ten troublesome trends in tv health news. BMJ 329 (7478), 1352. http://dx.doi.org/10.1136/bmj.329.7478.1352.
Schwitzer, G., Mudur, G., Henry, D., Wilson, A., Goozner, M., Simbra, M., Baverstock, K.A., et al., 2005. What are the roles and responsibilities of the media in disseminating health information? PLoS Med. 2 (7), e215. http://dx.doi.org/10.1371/journal.pmed.0020215.
Sheafer, T., 2007. How to evaluate it: the role of story-evaluative tone in agenda setting and priming. J. Commun. 57 (1), 21–39. http://dx.doi.org/10.1111/j.1460-2466.2006.00327.x.
Sheehan, M., Quinn-Allan, D., 2015. Crisis Communication in a Digital World. Cambridge University Press.
Shook, N., Fazio, R., 2009. Political ideology, exploration of novel stimuli, and attitude formation. J. Exp. Soc. Psychol. 45 (4), 995–998.
Slovic, P., 1987. Perception of risk. Science 236 (4799), 280–285. http://dx.doi.org/10.1126/science.3563507.
Smith, R.D., 2006. Responding to global infectious disease outbreaks: lessons from SARS on the role of risk perception, communication and management. Soc. Sci. Med. 63 (12), 3113–3123. http://dx.doi.org/10.1016/j.socscimed.2006.08.004.
Sublet, V.H., Covello, V.T., Tinker, T.L., 1996. Scientific Uncertainty and its Influence on the Public Communication Process. Springer Science & Business Media.
The Scoreboard: July 28, 2014. (n.d.). Retrieved May 6, 2015, from http://www.adweek.com/tvnewser/the-scoreboard-monday-july-28-2/234852.
Towers, S., Afzal, S., Bernal, G., Bliss, N., Brown, S., Espinoza, B., et al., 2015. Mass media and the contagion of fear: the case of Ebola in America. PLoS One 10 (6), 1–13. http://dx.doi.org/10.1371/journal.pone.0129179.
Tsfati, Y., Cappella, J.N., 2003. Do people watch what they do not trust? exploring the association between news media skepticism and exposure. Commun. Res. 30 (5), 504–529. http://dx.doi.org/10.1177/0093650203253371.
Tsfati, Y., Peri, Y., 2006. Mainstream media skepticism and exposure to sectorial and extranational news media: the case of Israel. Mass Commun. Soc. 9 (2), 165–187. http://dx.doi.org/10.1207/s15327825mcs0902_3.
Ungar, S., 1998. Hot crises and media reassurance: a comparison of emerging diseases and Ebola Zaire. Br. J. Sociol. 49 (1), 36–56. http://dx.doi.org/10.2307/591262.
U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2012. Crisis and Emergency Risk Communication. Retrieved from. http://emergency.cdc.gov/cerc/resources/pdf/cerc_2012edition.pdf.
Wetherhead, D., 2013, January. Preparing leaders to communicate during a crisis. Public Relat. Tactics. Retrieved from. http://www.prsa.org/Intelligence/Tactics/Articles/view/10042/1071/Preparing_leaders_to_communicate_during_a_crisis?utm_source=prsa_website&utm_medium=facebook_like&utm_campaign=facebook_like.
Witte, K., Allen, M., 2000. A meta-analysis of fear appeals: implications for effective public health campaigns. Health Educ. Behav. 27 (5), 591–615. http://dx.doi.org/10.1177/109019810002700506.
Wray, R., Becker, S.M., Henderson, N., Glik, D., Jupka, K., Middleton, S., et al., 2008. Communicating with the public about emerging health threats: lessons from the pre-event message development project. Am. J. Public Health 98 (12), 2214–2222. http://dx.doi.org/10.2105/AJPH.2006.107102.