12-14-2015

# Framing Risk, Responsibility, and Resolution: A Mixed-Methods Study Exploring Traditional and Social Media Coverage of the 2014 Elk River Chemical Spill

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# FRAMING RISK, RESPONSIBILITY, AND RESOLUTION: A MIXED-METHODS STUDY EXPLORING TRADITIONAL AND SOCIAL MEDIA COVERAGE OF THE 2014 ELK RIVER CHEMICAL SPILL

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Submitted in Partial Fulfillment of the Requirements

For the Degree of Doctor of Public Health in

Health Promotion, Education, and Behavior

The Norman J. Arnold School of Public Health

University of South Carolina

2015

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## DEDICATION

I dedicate this work to my family. To my mom for taking such good care of Avery every single day so that I could focus on my research; to my dad for believing in me and encouraging me to achieve my goals; to my husband for going on this journey with me from start to finish, always generously offering his full and unwavering support; and to my daughter Avery for giving me the best reason to work in a field that is committed to making this a more fair and equitable world.

**ACKNOWLEDGMENTS**

I would like to express my deepest appreciation to my committee chair, advisor, and mentor, Dr. Daniela Friedman, who does all that is in her power to make her students famous. Her guidance, patience, and kindness have helped to make my doctoral experience a positive one. She is the utter epitome of a good mentor, and I will also be thankful to have had her support throughout my time at USC. I would like to also thank the other extraordinary researchers and teachers who served on my dissertation committee, Dr. Heather Brandt, Dr. Mindi Spencer, and Dr. Andrea Tanner, who each made a unique contribution to this research. Dr. Brandt reminded me to always consider the community's interests first, which helped me to form strong relationships with community partners. Dr. Spencer helped me to develop and decide on this research topic, which allowed me to pursue my interests in both Appalachian health and health communication. Finally, Dr. Tanner served as an external yet indispensable committee member, as her expertise in framing and communication was a significant asset to this study. With their support, I am able to submit this dissertation with a sense of pride in work well done. I also want to thank MPH student Courtney Schrock who assisted with coding many news stories and tweets in the process of determining intercoder reliability for this project. Last, but certainly not least, I want to thank my partners at the Kanawha-Charleston Health Department for their help with this research and the community stakeholders who volunteered their time to make this study possible.

## ABSTRACT

**Background:** The 2014 Elk River Chemical Spill raised policy questions concerning chemical safety and revealed an immediate need for improved emergency communication. This two-phase study explored how media presented causes of and long-term solutions to the spill through an examination of media frames. The study also explored how health risks were communicated through traditional and social media. The specific aims of Phase I were to examine media coverage in the days following the spill and compare coverage across media channels. The specific aims of Phase II were to understand how public health stakeholders perceived coverage of the spill and how those perceptions compared to actual coverage. **Methods:** This innovative research approach consisted of a content analysis of 1,492 print, television, and online media stories and tweets (Phase I) and 11 in-depth interviews with stakeholders who were involved in responding to the crisis. **Results:** Content analysis and interview findings were largely complementary, demonstrating that stakeholders' perceptions of coverage were consistent with actual coverage. Attribution of responsibility was the most dominant frame in overall coverage but the dominance of particular frames changed according to time period. Differences in frames were also found across media channels. Media coverage placed blame largely on the private company that owned the faulty storage tank for causing the spill while coverage of solutions typically focused on the government's role in preventing future spills. Although traditional media stories were significantly more likely than tweets to include health information, traditional media still underutilized

public health sources and provided limited information about health risks. Even though Twitter was not a common or reliable source of health information, findings demonstrate that it was important in the spread of other types of information. **Conclusions:** The study suggests that media played a role in influencing policy-related outcomes of the spill. It also suggests that while news media play an important role in the spread of crisis information during a crisis, there is a need for more deliberate coverage of health information through the use of public health sources. Finally, the study demonstrates how social media serve multiple important functions during crises.

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# CHAPTER 1

## Introduction

### A Public Health Disaster in Appalachia

On January 9, 2014, 10,000 gallons of a chemical called crude 4-methylcyclohexanemethanol (MCHM) and an unknown amount of propylene glycol phenyl ether (PPH) escaped from a ruptured storage tank at Freedom Industries and spilled into West Virginia's Elk River (West Virginia Department of Health & Human Resources [WVDHHR], 2014a). The spill occurred just 1.5 miles upstream from the state's largest water intake, shutting down the drinking water supply of 300,000 residents (16% of the state's population) in nine counties for up to 10 days (Osnos, 2014; Roger, 2014). By the evening of January 10th, nearly 700 people had called the state's poison center (Jonsson, 2014). Over the next two weeks, 584 people visited emergency departments reporting illnesses related to the spill, and of those, 13 were hospitalized (WVDHHR, 2014a).

The Elk River chemical spill has been called one of the most serious incidents of chemical contamination of drinking water in U.S. history (Osnos, 2014). Chemical contamination has been a longtime concern in this region of West Virginia, known as the "Chemical Valley" due to its high concentration of chemical plants (Cantrell, 2004; Parker, 2014; United Press International, 1985). The Elk River spill was the state's third major chemical accident in five years and fifth major industrial accident in eight years (Gabriel & Davenport, 2014; Osnos, 2014; Roger, 2014).

The accident served as a wake-up call for state residents, bringing attention to the need for more stringent regulations of chemical storage sites to prevent future spills. With aging aboveground chemical storage tanks in communities throughout the U.S. (Niquette, Snyder & Drajem, 2014), public officials, concerned citizens, bloggers, and journalists have raised difficult questions regarding water safety, state and federal policy, corporate accountability, and environmental justice. These largely unanswered questions are of national relevance, as the water traveling down the Elk River eventually flows into the next river and state, and then into the next, making West Virginia's problem a national problem.

During a natural or manmade disaster, the media are primary transmitters of risk communication (CDC, 2014a; Glik, 2007). In addition to providing the public with the information they need to take self-protective action, the media influence how people and communities respond to disasters (Clayton, Koehn, & Grover, 2013). One way the media does this is by helping individuals determine how much importance to attach to an event and to the issues that it raises, potentially affecting public agendas and disaster policies (Barnes et al., 2008; Birkland, 1997, 2006). Through framing, the media also influence the public's understanding of an event including the causes of it and the solutions to addressing issues related to it (de Vries, 2004; Entman, 1993).

This two-phase exploratory study examined how both traditional media and social media were used to distribute and frame information about the Elk River chemical spill during and immediately following the incident (i.e., the time period in which the water ban was in effect). The study focused particularly on media coverage related to health

risks, causes of the incident, and solutions to ensuring similar incidents do not occur in the future.

For Phase I, content analysis was used to examine the use of Semetko and Valkenburg's (2000) news frames (e.g., attribution of responsibility, conflict, human interest) in media coverage of the disaster. By analyzing a variety of media content, the study also compared across among media channels. Additionally, the study explored how coverage and frames changed over time.

Content analysis findings informed Phase II of the study, which included semi-structured interviews with stakeholders who played significant roles in the risk and crisis management of the spill from a public health perspective. Interview questions focused on stakeholders' perceptions of media coverage of the incident, particularly related to causes of the spill and solutions to preventing future spills. Questions also focused on the use of social media to communicate health risks and other incident-related information. Stakeholder views on coverage complemented findings of the content analysis, providing a deeper understanding of media coverage of an industrial, manmade disaster.

This study was the first to systematically analyze news media coverage of the Elk River chemical spill and to offer a retrospective look at stakeholders' perceptions regarding media coverage of and use during the incident.

## Specific Aims and Research Questions

The purpose of this research was to understand how traditional and social media framed coverage of the Elk River chemical spill during and immediately following the incident. Additionally, the study sought to understand how health risks related to the spill were communicated through traditional and social media. Lastly, the study sought to

understand how community and government stakeholders perceived coverage of the event and what value they placed on the various media used to communicate disaster-related information. The study's specific aims and research questions are as follows:

**PHASE I:**

**Specific Aim 1: To assess media coverage of the 2014 Elk River chemical spill in the days immediately following the incident. Coverage in local and national newspapers (e.g., *Charleston Gazette*, *The New York Times*), network and cable television news (e.g., ABC, NBC, Fox News), online news (i.e., CNN, Huffington Post), and social media (i.e., Twitter) will be examined.**

RQ1: What was the volume and scope of media coverage about the chemical spill?

RQ2: What were the dominant frames in media coverage of the chemical spill and how did these frames change over time?

RQ3: How did media present causes and solutions related to the incident and the prevention of similar events?

RQ4: What tone (i.e., positive, negative, neutral) was used in media's description of governmental responses to the incident?

RQ5: How did media communicate health risks related to the incident?

RQ6: What individuals, groups, or organizations were the commonly cited sources of information (e.g., interest group representatives, public health officials, residents, government officials) included in media coverage?

RQ7: What role did Twitter play in the spread of online news through transmission and retransmission ("retweets") of messages including hyperlinks?

**Specific Aim 2: To compare coverage of the 2014 Elk River chemical spill across media channels and sources.**

RQ8: How did dominant media frames vary by media channel (i.e., newspaper, TV news, online news, social media)?

RQ9: How did causes and solutions presented by local print media compare to solutions presented by national print media?

RQ10: How did tone (i.e., positive, neutral, negative) in coverage of the government's response to the incident compare between local print and national print media?

**PHASE II:**

**Specific Aim 3: To understand how community, government, and nonprofit stakeholders view the incident and media coverage of the water crisis.**

RQ11: What value do stakeholders see in the role news media and social media played in the spread of information following the incident?

RQ12: What are stakeholders' views on the media's presentation of causes and solutions related to the incident based on their recollections of news media coverage?

RQ13: What are stakeholders' views on the ways in which the media communicated health risks related to the incident based on their recollections of news media coverage?

**Specific Aim 4: To determine how stakeholders' recollections and perceptions of coverage compared to dominant frames identified in Aim 1.**

RQ14: How did stakeholders' recollections of coverage differ from the dominant messages and frames found in Specific Aim 1?

**Preview**

While this chapter provided an overview of the study's purpose, specific aims, and research questions, Chapter 2 highlights the significance of this research in the context of the Appalachian region, risk and crisis communication, and media framing theory. Chapter 3 provides a description of the research approach, data collection tools, and data analysis. Two manuscripts are included in Chapter 4, with the first manuscript exploring media framing of the spill and the second manuscript focusing on media's communication of health risks and outcomes related to the spill. Finally, Chapter 5 provides a discussion of the research findings as well as implications for future research. The chapter also highlights strengths and limitations of the research and lessons learned.

# CHAPTER 2

## Background & Significance

### The Elk River Chemical Spill

Located in the heart of the central Appalachian region, West Virginian communities have suffered widespread ecological degradation and face serious health risks from increasingly destructive coal mining practices (Bell & Braun, 2010; Hendryx & Ahern, 2008; Hendryx, 2012; Palmer et al., 2010). All stages of mining coal, from its extraction to its transportation, pose health risks to both miners and those living near mining sites (Hendryx, 2012). Crude MCHM, the chemical that spilled into the Elk River, is a surfactant used to clean coal in the processing stage (Board, 2014). In media reports, West Virginia Governor Earl Ray Tomblin distanced the spill from the coal industry by stating that the spill was "not a coal company incident" but rather "a chemical company incident" (Ward, 2014). Although the coal industry's dependence on companies such as Freedom Industries is undeniable, perhaps the more important issue relates to policies and regulations designed to prevent these types of accidents from occurring.

Despite recent industrial accidents in the state, including the death of a plant worker at Dupont after a toxic phosgene was released and the death of two workers at Bayer CropScience Institute after a pesticide tank exploded (Parker 2014, Osnos, 2014; Wald, 2009), there continues to be resistance toward increased environmental regulation and governmental protection (Gabriel, Wines, & Davenport, 2014 NYT; Osnos, 2014).

Increased regulation has commonly been viewed as a threat to the state's economy and to people's jobs.

Historically, the coal and chemical industries have been significant economic drivers of West Virginia's economy (Osnos, 2014). Although both industries have experienced declines in the state, coal and chemicals are still among West Virginia's top exports. Coal was the state's top export in 2012, valued at a $7.4 billion, and accounted for nearly 65% of total exports that year (Sartarelli et al., 2014). In 2012, the chemical manufactures clustered in the Chemical Valley made up 20% of the state's overall manufacturing base (Sartarelli et al., 2014). The chemical industry was the state's second largest product export, valued at $797 million, in 2013 and also had the highest share (20%) of manufacturing jobs that year (Sartarelli et al., 2014).

When the chemical spill occurred, there were no state laws in place that required monitoring of Freedom Industries or aboveground storage tanks (Manuel, 2014). The last time Freedom Industries had been inspected was in 1991 (Brodwin, 2014). In response to the spill, the state unanimously passed Senate Bill 373, "the Spill Bill," which required the West Virginia Department of Environmental Protection to conduct annual inspections of aboveground chemical storage tanks (Office of the Governor, 2014a; West Virginia Legislature, 2014). At that time, there were many who believed the state needed to do more (Schlander, 2014), addressing issues related to clean water that were not fixed by a bill that focused specifically on aboveground storage tanks. When the state completed inspections on January 1, 2015, it was discovered that approximately 1,100 tanks did not meet standards outlined in Senate Bill 373 (Howard, 2015). Even so, just a year later, Senate Bill 373 was amended, scaling back regulations with the passage of Senate Bill

423 (Marra, 2015; Office of the Governor, 2015). It is also important to note that almost one year after the spill, six former officials of Freedom Industries, the company responsible for the leak, were charged with violating the Clean Water Act (Moghe, 2014), demonstrating the importance of not only policy creation but also enforcement.

The lack of regulation made apparent by the Elk River spill was not only at the state level but also at the federal level. MCHM was grandfathered in with more than 62,000 other chemicals that did not pose "unreasonable risk" as a result of the Toxic Substances Control Act, a bill passed in 1976 (Cogan, 2014; Schlander, 2014). Few studies have been conducted on MCHM and those that have were conducted on laboratory animals, which exhibited health problems with their livers, kidneys, and brains when exposed to the chemical at high doses (WVDHHR, 2014a). Federal law requires companies to have data sheets for all chemicals used at a specific site (Schlander, 2014). Although the data sheet for MCHM has many gaps, the "hazards identification" section reads: "WARNING! HARMFUL IF SWALLOWED! CAUSES SKIN AND EYE IRRITATION. AT ELEVATED TEMPERATURES, VAPOR MAY CAUSE IRRITATION OF EYES AND RESPIRATORY TRACT" ("Safety Data Sheet," 2011).

When the leak occurred, officials knew little about MCHM and its potential effects on humans (Biello, 2014; CDC, 2014c; Cogan, 2014; Manuel, 2014). With insufficient data on human health risks, the Centers for Disease Control and Prevention (CDC) concluded that a level of 1 ppm or below would not likely cause adverse health effects (CDC, 2014c). West Virginia American Water began screening water and lifting do-not-use orders based on that figure on January 13, 2014 (Manuel, 2014), but then just two days later, the West Virginia Bureau for Public Health announced that pregnant

women should continue drinking bottled water until MCHM was no longer detectable (WVDHHR, 2014b). The uncertainties and mixed messages surrounding the water's safety left the public distrusting of information related to the spill (Gabriel, 2014; Manuel, 2014; McEvers, 2014). As a result, Manuel (2014) concluded that communication during the incident period failed to reflect principles of effective crisis and risk communication based on CDC's Crisis and Emergency Risk Communication (CERC) model.

**Information Seeking in Disasters**

Although definitions and conceptualizations of disasters vary by academic field, disasters are commonly categorized as natural (e.g., hurricane, flood) or manmade (e.g., chemical or oil spill), but sometimes they are both (CDC, 2014a), as in the case of Hurricane Katrina and the Fukushima nuclear power station disaster, when natural disasters played a role in causing catastrophic manmade disasters. Crisis and risk communication are closely related to the disaster literature, as communication before, during, and after an event greatly influences whether the public takes protective actions in a disaster situation (Glik, 2007). In the public health field, crisis communication commonly refers to communication that occurs in response to an unexpected event or public emergency that requires immediate response (CDC, 2014a). Risk communication is based on more general practices and circumstances than crisis communication and tends to focus information on particular outcomes related to a behavior or exposure to environmental hazards (CDC, 2014a; Glik, 2007). Instead of taking place in response to an emergency or immediate crisis situation, risk communication is frequently used in public health prevention campaigns to provide educational information about a specific

environmental issue and how to address it (Fearn-Banks, 2007; Guidotti, 2013).

Crisis and Emergency Risk Communication (CERC) combines elements of crisis and risk communication, encompassing the urgency of crisis communication while communicating risks to the public (CDC, 2014a; Reynolds & Seeger, 2005). The goal of CERC is to provide people affected by a disaster with the information they need to make the best decisions about their safety and wellbeing within a narrow timeframe (Reynolds & Quinn, 2008). The CERC model offers six principles of effective crisis and risk communication: 1) be first; 2) be right; 3) be credible; 4) express empathy; 5) promote action; and 6) show respect (CDC, 2014a, p. 2). These were the six principles that Manuel (2014) concluded were largely not apparent in communications related to the Elk River chemical spill.

During a natural or manmade (or human-made) disaster, news media are primary transmitters of risk and crisis communication (CDC, 2014a). News coverage of disasters from 2000 to 2010 captured the public's attention more than any other issue, with the 9/11 terrorist attack, Hurricane Katrina, and Hurricane Rita ranking as the most closely tracked stories of the decade (Pew, 2010). Today people turn to multiple media sources for news. According to Pew Research Center, 50% of Americans consider the Internet as a main news source, ranking below television (69%) but above newspapers (28%) and radio (23%) (Caumont, 2013). Preferred news sources vary by age group, with 71% of people ages 18 to 29 citing the Internet as a main news source, ranking it above television (55%), newspaper (22%), and radio (19%). More people are also getting news from social media, with 19% reporting that they had received news the previous day on social media. That percentage increased to 30% for people in their 30s and to 34% for people

ages 18 to 24 (Caumont, 2013).

Information seeking during a disaster differs from everyday news seeking behaviors. In a 2012 survey, the American Red Cross found that television news was the preferred source of emergency information, with 81% of respondents seeking information from television news media during emergency situations, particularly natural disasters (American Red Cross, 2012). Following television news, preferred sources were local radio stations (64%), online news (55%), mobile applications (20%), local organizational or governmental websites (20%), and social media (19%) (American Red Cross, 2012).

Information seeking patterns during the Elk River chemical spill were somewhat reflective of those national survey results. To assess the effectiveness of emergency response and make recommendations for improvement, CDC collaborated with the West Virginia Bureau for Public Health (WVBPH) to conduct a Community Assessment for Public Health Emergency Response (CASPER) in April 2014. The survey revealed that the primary sources for information about the spill were television (85.4%), word-of-mouth (50.3%), newspaper (47.4%), and the Internet (36.3%) (CDC, 2014b). Almost 80% of households learned about the chemical spill on the day of the incident, with most households (54%) learning about the spill from television sources. Most households (58%) also considered television as the most reliable source of information, followed by the Internet (8.5%), word-of-mouth (6.7%), and social media (5.6%) (CDC, 2014b). Based on these results, the WVBPH recommended focusing on television messages during crises.

**Social Media Use in Emergencies**

Social media has dramatically changed how people collect, share, and process

information—in everyday life and in the context of emergencies. Although traditional media are still the primary sources of emergency information, based on current trends, social media play an increasingly important role in crisis communication. Today 74% of online adults now use social media, up from 8% in 2005 (Pew, 2014b). Facebook is the most dominant platform, followed by Twitter (19%) and Instagram (17%) (Pew, 2014c). These and other social media platforms are changing how the public, government officials, and emergency professionals communicate during natural and manmade emergencies (Lindsay, 2010; Merchant, Elmer & Lurie, 2011; Veil, Buehner, & Palenchar, 2011).

According to the 2012 American Red Cross survey referenced above, social media is the fifth most popular way to get information during an emergency, with 19% of survey respondents reporting that they had used social media to seek information about an emergency. In addition to seeking and sharing information about an emergency, social media users share personal information with others during emergencies including their safety status (American Red Cross, 2012). By bringing people together through the sharing of personal information, social media provides users with emotional support during and after a crisis (Choi & Lin, 2009).

Disasters such as the Elk River chemical spill present health authorities, agencies, and organizations with significant communication challenges related to providing timely and accurate health information. Those challenges are exacerbated by the public's growing expectation that information should be delivered with great speed and breadth and increasing unwillingness to wait for information to trickle down from authorities through traditional media channels (Crowe, 2011; Sjobert et al., 2013).

With nearly one in five people seeking emergency information on social media (American Red Cross, 2012), authorities focusing on emergency preparedness and management need to know how to integrate these powerful communication tools into emergency response plans. Social media allows emergency information to be shared and re-shared, potentially reaching millions of people within a short time period at a very low cost. Social media also allows authorities to post real-time information as an emergency or crisis event unfolds and provides opportunities for authorities to address rumors and manage the spread of miscommunication (CDC, 2014a).

There are numerous real-life examples that demonstrate how social media is changing communication during and in the aftermath of disasters. A Pew Research Journalism Project report stated that "Twitter served as a critical lifeline" before and in the aftermath of Hurricane Sandy (Guskin & Hitlin, 2012). More than 20 million tweets were sent about the storm between October 27 and November 1, 2012, with 34% of tweets containing news and information (Guskin & Hitlin, 2012). Tweets primarily included news and information, but "tweeters" also shared personal accounts, photographs and videos, and hopes for safety (Guskin & Hitlin, 2012).

Social media also provides officials with a way to communicate directly with the public instead of through traditional media sources. As a result, social media messages sometimes, and perhaps frequently, reach the public before traditional media. In the aftermath of the 2013 Boston bombing, the Boston Police Department (BPD) began communicating through Twitter (American Red Cross, 2013). This led to an increase in BPD Twitter followers, increasing from 40,000 pre-event to 335,000 after the bombings (American Red Cross, 2013). The BPD used Twitter to monitor and correct

misinformation and rumors including misinformation reported by traditional news media. The BPD was also first to make the official announcement of the second suspect's attainment via Twitter (American Red Cross, 2013). After the BPD's tweet, local reporters shared the information, demonstrating a shift in how information is communicated. Instead of relying on press releases and interviews with officials, news media can now access information from officials and the public through social media, making social media a potentially effective source of information for news media.

During the Elk River chemical spill, local media used social media as an information source and as a tool to inform the community (Corio, 2014). A television anchor at a CBS affiliate learned about the chemical spill and the "do-not-use" order through Twitter (Corio, 2014). A journalist from one of the state's major newspapers also learned about the spill through Twitter (Corio, 2014). While news reporters and journalists were visiting social media pages in search of new information, the public was visiting news media's social media pages. Media organizations reported an increased growth in the number of people visiting their social media pages, demonstrating that their social media pages were important tools for informing the public (Corio, 2014).

West Virginia American Water and state agencies also used social media to communicate directly with the public. In some respects, social media provided the companies and agencies involved in the spill more control over the message. In other respects, however, it resulted in a loss of control, as social media allowed both official organizations and the public to simultaneously and instantaneously share their versions of what had happened. Social media also provided affected residents and concerned citizens from across the nation—and potentially the globe—with a forum to respond to the

messages being sent by officials.

**Media Framing of Issues and Events**

**Media's role in shaping public perceptions of disasters.** In a disaster, the communication goals of crisis and emergency managers are different from those of the news media. While crisis managers are primarily concerned with helping the public prepare for and respond to disasters, news media are often interested in identifying causes of disasters and placing blame on those who are responsible (Ewart & McLean, 2015; Liu, 2009; Seeger, Sellnow, & Ulmer, 2003). News media ultimately have the power to shape the public's perceptions of who is responsible for a particular program or disaster based on how they frame coverage (Iyengar, 1991). In fact, research suggests that an important function of the framing process is to identify systematic faults (including policy) and place blame on those who are responsible (De Vries, 2004). At its most basic level, *framing* theory suggests that news media can influence how audiences feel about an issue (Scheufele, 1999).

The media also have the ability to influence what issues the public perceives as important through a function called *agenda setting* (Fahmy et al., 2007; Scheufele & Tewsbury, 2007). McCombs and Shaw (1972) introduced agenda setting theory, arguing that the mass media have an agenda setting function. According to Fahmye et al. (2007), "the main assumption in agenda setting is that the more an issue is covered, the more the public perceives it as important" (p. 25). By giving specific events or issues more extensive and prominent coverage, the media influences how much importance the public attaches to an issue or event, potentially influencing public agendas and policies as well

as disaster outcomes (Barnes et al., 2008; Birkland, 1997, 2006; Iyengar & Kinder, 1987; McCombs & Shaw, 1972).

Through an examination of agenda setting in media coverage of disasters, Birkland (1997) developed a theory based on *focusing events*, "sudden, unpredictable events" such as natural and manmade disasters that influence the social policy-making process (p. 1). Although not all focusing events lead to true policy change, Birkland (2006) suggested that it is likely that they increase awareness of disaster-related issues (and ultimately promote learning) within the policy-making system. By changing the public's perception about the likelihood that certain events could occur (such as the 9/11 terrorist attacks), disasters may highlight the inadequacy of current policies and the need for policy change (Birkland, 2006). Birkland & Lawrence (2009) suggested that "social policy learning" involves learning new information about problems, their causes, and their potential solutions (p. 1421). In contrast, "instrumental policy learning involves learning whether and to what extent existing policy instruments—laws, regulations, norms, standard operating procedures—successfully achieve their goals" (p. 1421). They suggested that policy change resulting from a recent disaster involves both types of learning. Although Birkland and Lawrence (2009) focused primarily on agenda setting, framing also appears to play a role in the policy learning process, especially related to how people identify and evaluate current and proposed policies.

Highlighting one of the primary differences between agenda setting and framing, Scheufele & Tewksbury (2007) suggested that the former is about "*whether* we think about an issue" and the latter is about "*how* we think about it" (p. 14). Some scholars, however, view agenda setting and framing as more similar than dissimilar, particularly

when focusing on second-level (or attribute) agenda setting (Coleman et al., 2009). Wanta, Golan & Lee (2004) suggested that while traditional (or first level) agenda setting influences what we think about, second-level agenda setting influences how we think, which is similar to the way Scheufele and Tewksbury (2007) distinguished agenda setting from framing more broadly. Also making connections between agenda setting and framing, Entman (2007) described agenda setting as the "first function of framing," explaining that agenda setting defines problems that warrant public and government attention (p.164). Further, Entman (2007) argued that second-level agenda setting, particularly, is based on the core purposes of framing: "to highlight the causes of problems, to encourage moral judgments…and to promote favored policies" (p. 165). Policy options may be implicit or explicit in news stories covering an issue or event, but often when the story includes a discussion of causes or attributions of responsibility, policy options and preferences are explicit (Pan & Kosicki, 1993, 2003).

Ultimately, both second-level agenda setting and framing consider how the media depicts issues, not which issues receive the most prominent coverage, which is more closely related to traditional or "first-level" agenda setting (Weaver, 2007). According to Weaver (2007), the main difference between second-level agenda setting and framing is that framing includes "a broader range of cognitive processes—such as moral evaluations, causal reasoning, appeals to principles, and recommendations for treatment of problems—than does second level agenda setting" (p. 146).

**Media framing definitions and functions.** Similar to agenda-setting research, framing research commonly focuses on the relationship between policy issues in news coverage and the public's perceptions of those issues (Boydstun & Glazier, 2013; de

Vreese & Boomgaarden, 2003; Iannarino, Veil, & Cotton, 2015; Iyengar, 1991; Iyengar, 1996). Framing is more frequently studied than agenda setting and is in fact the most widely used theory in mass communication research (Matthes, 2009; Weaver, 2007). Its foundations lie in the fields of psychology (Bartlett, 1932; Kahneman & Tversky, 1984), sociology (Goffman, 1974), and linguistics (Lakoff & Johnson, 1981). Since Goffman published his influential book, *Frame Analysis*, in 1974, frame analysis has grown in popularity, especially in the field of media studies (D'Angelo, 2002; Entman, 1991, 1993, 2007; Gamson & Modigliani, 1987; Iyengar, 1991; Iyengar & Kinder, 1987; Pan & Kosicki, 2003; Scheufele, 1999; Semetko & Valkenburg, 2000; Shoemaker & Reese, 2013).

Within the field of media studies, there is no one agreed upon definition of framing (Entman, Mattes & Pellicano, 2009; Kim, Scheufele, & Shanahan, 2002; Matthes, 2009; Semetko & Valkenburg, 2000; Weaver, 2007). Researchers, instead, offer several related but distinct definitions of framing (Entman, 1993; Gamson & Modigliani, 1987; Gitlin, 1980; Iyengar, 1991; Semetko & Valkenburg, 2000). In a systematic review of media framing studies, Matthes (2009) found that Entman's (1993) definition was the most frequently cited. Entman (1993) explained that framing is the mechanism by which the media selects certain aspects of a perceived reality and make them more salient to the receiving audience. Those selected frames "promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendations" (Entman, 1993, p. 52). According to Entman (2007), framing "shapes audience members' interpretations and preference through priming. That is, frames introduce or raise the

salience or apparent importance of certain ideas, activating schemas that encourage target audiences to then think, feel, and decide in a particular way" (p. 164).

In their coverage of an event, media producers (e.g., reporters, editors) select frames by emphasizing certain aspects of the event and selecting what elements of a story to include and exclude (Birkland, 1997). The selection of frames may be intentional or unintentional. Birkland and Lawrence (2009) suggested the framing process and selection of frames is most apparent when an issue or event is controversial. In those situations, various groups and people including interest groups, politicians, and journalists often focus in on and sometimes promote particular frames (Andsager, 2000; Birkland & Lawrence, 2009; Pan & Kosicki, 1993).

Scheufele and Tewksbury (2007) argued that regardless of whether frames are selected intentionally or unintentionally, framing is an essential tool for journalists to simplify complex issues for mass audiences, limited media time (e.g., airtime), and space (e.g., columns). Further Gitlin (1980) suggested that framing is inevitable because journalists need it to interpret and organize large amounts of complex information and allows them "to package it for efficient relay to their audiences" (p. 7). This definition relates to Gamson and Modigliani's (1989) notion of framing, which described frames as the "central organizing idea…for making sense of relevant events, suggesting what is at issue" (p. 3). Frames, however, not only help journalists organize and "package" information but also help their audiences organize information by using frames to interpret and label information (Goffman, 1974).

Researchers interested in examining how frames emerge commonly focus on the frame-building process as opposed to frame-setting process (de Vreese, 2005). Frame-

building research focuses on the social and structural factors that influence the selection of media frames (de Vreese, 2005; Kim, Carvalho, & Davis, 2010). Factors internal to journalism such as individual characteristics, journalistic practices, and organizational constraints influence how journalists frame an issue (Kim et al., 2010; Zhou & Moy, 2007). There are also external factors that are equally as important and significantly influence media frames (Semetko & Scammell, 2012). Examples of external factors include social values, interest groups, elite influences, social movements, and governmental stances (Semetko & Scammell, 2012; Zhou & Moy, 2007). In contrast to frame building, frame-setting research is interested in how media frames shape audiences' interpretations and opinions of particular issues or events (de Vreese, 2005; Zhou & Moy, 2007).

**The role of sources in media framing.** While journalists are largely responsible for frame selection, there are people and organizations outside the newsroom that help develop and shape news coverage as well. Because the primary role of the media is to report news, not to convey risk and crisis information, journalists and other content creators rely on individuals, organizations, and officials serving as sources for initial accounts of an event (Adam, Allan, & Carter, 1999). When covering medical-related topics, complex scientific subjects, or public health epidemics, news media have relied heavily on expert sources (Shih, Brossard, & Wijaya, 2008; Tanner, 2004; Tanner & Friedman, 2011).

Journalists often view government officials and other authority figures as preferred news sources, not because they are more accessible but because they are generally viewed as more credible (Shoemaker & Reese, 2013). The more credible a

source is perceived, the more influence that source exerts (Druckman, 2001). As a result, dominant public figures and major organizations are more commonly used as sources than less powerful people and groups (Shoemaker & Reese, 2013). Taking advantage of the public spotlight, there are also interest groups, policymakers, and other stakeholders that actively seek to promote a particular cause or issue solution, potentially having a significant influence on media agendas, frames, and messages (Baumgartner & Jones, 1993; Crawley, 2007; Scheufele & Tewksbury, 2007). Instead of contacting these sources, journalists may find that they are the ones being contacted by such groups, and the more these sources and their perspectives are included in coverage, the more their definitions of and solutions to an issue are represented in media coverage relative to competing perspectives and frames (Adam, Allan, & Carter, 1999).

**Media Framing Analysis**

**Approaches to frame analysis.** There are multiple scholarly approaches to frame analysis including both qualitative and quantitative strategies, with scholars sometimes using a mixed method approach (Vandenberg, Price, Friedman, Marchman, & Anderson, 2012). Matthes and Kohring (2008) described five of the most common approaches to frame analysis: "a hermeneutic approach, a linguistic approach, a manual holistic approach, a computer-assisted approach, and a deductive approach" (p. 259). They do, however, acknowledge that there is overlap across all approaches and that some studies are based on combined approaches. Matthes and Kohring (2008) describe hermeneutic approaches as being qualitative and relying on small samples, with frames being examined in depth without quantification (e.g., Boni, 2002). Similar to a hermeneutic approach, Matthes & Kohring (2008) describe a linguistic approach as identifying frames

by examining "the selection, placement, and structure of specific words and sentences in a text" (p. 260). Further, this approach clearly determines "linguistic elements that signify a frame" (Matthes & Kohring, 2008, p. 260). Clarke, Friedman, & Hoffman-Goetz, (2005), Entman (1991), and Pan and Kosicki (1993) used a linguistic approach in their framing studies.

Although Matthes and Kohring (2008) identified similarities between hermeneutic studies and the linguist approach, they suggest the manual-holistic approach is quite different, as frames are generated through qualitative analysis of news content and then are coded using manual content analysis (e.g., Collins, Abelson, Pyman, & Lavis, 2006; Simon & Xenos, 2000). Studies using this approach might identify frames through an initial review of media texts or content, define those frames in a codebook, and then code articles through a quantitative content analysis of the text. In contrast, a computer-assisted approach does not involve manually coding frames or frame elements; instead researchers use computer-assisted content analysis to analyze media content (Matthes and Kohring, 2008). With this approach, there is no manual coding and the researcher identifies frames by examining specific words used in media texts (Coe, 2011; Coe, 2013).

The four approaches described thus far derive and define frames from an initial exploratory analysis, using an *inductive approach* (Matthes, 2009). Studies that are inductive in nature allow frames to emerge from the text as they analyze content rather than defining frames a priori (Culley, Ogley-Oliver, Carton, & Street, 2010; de Vreese, 2005). The last approach Matthes & Kohring (2008) described is a *deductive approach*, deriving frames from the literature prior to analyzing texts (deVreese, Peter, & Semetko,

2001; Dirikx, 2010; Elo & Kyngas, 2008; Ewart & McLean, 2015; Kim, John, Andrew, & Mullins, 2011; Suran, Holton, & Coleman, 2014). An influential and widely cited deductive study was Semetko and Valkenburg's (2000) investigation of the prevalence of five generic news frames. They conducted a quantitative content analysis of newspaper and television stories, using a binary coding system to indicate the presence or absence of each of the news frames. Having a clear idea of the types of frames that are likely based on literature helps ensure that frames not defined a priori are not overlooked (Semetko & Valkenburg, 2000).

Researchers sometimes prefer deductive approaches to inductive approaches because they are more easily replicated and are particularly advantageous for large samples and for detecting differences in media framing over time (Elo & Kyngas, 2008; Semetko & Valkenburg, 2000). In contrast, an inductive approach is more labor intensive, commonly based on small samples, and difficult to replicate (Semetko & Valkenburg, 2000), though there are advantages to this approach as well. In a systematic review of framing studies, Matthes (2009) found that 37% of studies published between 2000 and 2005 derived frames deductively up from 19% between 1990 and 1999, suggesting that quantitative studies using deductive frames is on the rise (Matthes, 2009). It is possible to employ both deductive and inductive approaches when conducting frame analysis (Bullock, 2007; Matthes, 2009; Rogan, 2010; Spratt et al., 2007).

There is an additional type of analysis that Matthes & Kohring (2008) did not include in their approaches to frame analysis, and it is what Entman, Matthew, and Pellicano (2009) referred to as a manual-cluster approach. Instead of coding the whole frame, this approach involves "splitting up the frame into separate variables or elements"

and then conducting a factor analysis of those elements to reveal the underlying structure of the frame (p. 181). This is the approach Semetko and Valkenburg (2000) used in the identification of five major news frames. More recently, VanderKynff, Friedman, & Tanner (2014) used this approach to analyze media framing of organ donation on YouTube.

A more general way to look at the examination of frames is through Entman's (1993) view that frames can be identified by "the presence or absence of certain keywords, stock phrases, stereotyped images, sources of information, and sentences that provide thematically reinforcing clusters of factors or judgments" (p. 52). Based on that description, the first step of discovering a frame is to identify particular words in a text (Entman, 1991). Those words may ultimately constitute a frame, functioning as *framing devices* that carry the frame (D'Angelo, 2002).

**Generic and issue-specific frames.** Media frames are often conceptualized as *generic* and *issue specific* (Matthes, 2009). In a systematic review of media framing studies, Matthes (2009) found that 78% of studies used issue-specific frames and 22% used generic frames. Of course, it is possible for studies to incorporate generic as well as issue-based frames (Boydstun & Glazier, 2013; Calderon, Roses, & Rivera, 2007). In fact, researchers have recommended that crisis framing research would benefit from applying both generic and issue-specific frames to provide a more comprehensive understanding of crisis coverage (Liu and Kim, 2011).

Because generic frames (also sometimes referred to as general frames) are not issue specific, they can be identified across different issues (Calderon et al., 2007; de Vreese, 2005; Matthes, 2009). One advantage to using generic frames to analyze media

coverage is that they make it possible to compare frames by issue, medium, location, and more (deVreese, Peter, & Semetko, 2001). Commonly studied generic frames include Iyengar's (1991) thematic and episodic frames (Hoffman-Goetz, Friedman, Clarke, 2005; Suran et al., 2014) and Semetko and Valkenburg's (2000) five news frames (i.e., attribution of responsibility, conflict, human interest, economic consequences, and morality) (An & Gower, 2008; Calderon et al., 2014; Holt & Major, 2010).

In contrast, issue-specific frames (also sometimes referred to as thematic frames) are based on the idea that each issue or event has different relevant frames (Kiwanuka-Tondo, Albada, & Payton, 2012; Matthes, 2009). An advantage to using issue-specific frames is that they allow researchers to investigate media framing of particular event in greater detail (deVreese et al., 2001). The downside, however, is that issue-specific frames are by nature more difficult to generalize and compare since every issue would have a different frame (deVreese et al., 2001).

**Recent Research on Media Framing of Disasters**

There is a significant and growing body of research that explores media coverage of public health issues and how that coverage can affect the way the public responds to health-related issues (Atkin, Smith, McFeters, & Fergusan, 2008; Borah, 2009; Calloway, Jorgensen, Saraiya, & Tsui, 2006; Foster, Tanner, Kim, & Kim, 2014; Harris, Moreland-Russell, Tabak, Ruhr, & Maier, 2014; Hilton et al., 2014; Jarlenski & Barry, 2012; Kim, Tanner, Foster, & Kim, 2014; Kiwanuka-Tondo et al., 2012; McKeever, 2013; McWhirter & Goetz, 2014; Rose, Friedman, Marquez, & Fernandez, 2013; Tanner, 2004; Vandenberg et al., 2012; Thrasher et al., 2014). There is, however, less research focusing on news coverage of disasters and public health issues in the event of a disaster.

Much of the recent research focusing on the media's role in disaster and crisis coverage has focused on Hurricane Katrina (Barnes et al., 2008; Ben-Porath & Shaker, 2010; Choi & Lin, 2008; Cohen, Vijaykumar, Wray, & Karamehic, 2008; Haider-Markel, Delebanty, & Beverlin, 2007; Houston, Pfefferbaum, & Rosenholtz, 2012; Huckstep, 2009; Macias, Hilyard, & Freimuth, 2009; Miles & Morse, 2007; Tierney, Bevc, & Kuligowski, 2006; Voorhees, Vick & Perkins, 2007); the H1N1 influenza virus infection (Chew & Eysenbach, 2010; Chung & Yum, 2013; Hilton & Hunt, 2010; Husemann & Fischer, 2015; Lee & Basnyat, 2013; Liu & Kim, 2010; Sandell, Sebar, & Harris, 2013; Scarcella et al., 2013; Vasterman & Ruigrok, 2013), and the Fukushima nuclear power plant incident (Binder, 2012; Calderon et al., 2007; Friedman, 2011; Li, Vishwanath, & Rao, 2014; Utz, Schultz, & Glocka, 2013). Researchers examining these events commonly used content analysis to identify framing patterns and to study media's agenda setting function.

Although researchers focusing on Hurricane Katrina primary focused on newspaper and television coverage of the event, much of the research focusing on the Fukushima incident explored the role of social media and on online news in disaster communication (Binder, 2012; Friedman, 2011; Utz et al., 2013). This shift in media focus suggests a shift in the media environment between 2005, when Hurricane Katrina struck ground, and 2011, when the Fukushima incident occurred. Research focusing on the 2009 H1N1 infection was split between traditional and newer media such as online news sources and social media.

Research has suggested that certain frames may be more dominant in disaster coverage. Dominant frames, however, may vary by disaster type and by disaster stage or

time period. In their examination of news coverage of the most severe U.S. natural disasters occurring between 2000 and 2010, Houston et al. (2012) found that media covered disasters for shorter periods of time when compared to other issues. They also found that coverage focused on the current impact on people, the built environment, and the natural environment; disaster-related economics; and the state and region related to the event. Although what they called "the environment frame" (which captured death and destruction) was the dominant frame the initial days of coverage, the human-interest frame was the most dominant frame two months post event.

Also in the context of natural disasters, Brunken (2006) found that human interest and conflict frames dominated newspaper coverage of Hurricane Katrina, with the human-interest frame becoming less prominent in coverage by week four but the conflict frame remaining constant. Barnes et al. (2008) also examined news coverage of Hurricane Katrina, focusing on both media framing and agenda setting. They found that the majority of articles focused on response and recovery, as well as the accountability of the federal government for disaster response. They suggested that these findings indicated that disaster response is commonly viewed as the responsibility of the government (Barnes et al., 2008). Further, they argued that the media's focus was not only on reporting the news but also on informing and influencing policy makers. Based on those findings, Barnes et al. (2008) argued that it is critical for public health practitioners to understand how the media gathers and distributes information so that they can help present a public health-oriented agenda that focuses on policies to prevent future disasters.

In the context of an accidental manmade disaster, Kuttschreuter and colleagues (2011) found that disaster coverage changed over time, with frames focusing on conflict and responsibility becoming more dominant during peaks in newspaper coverage of an explosion a fireworks facility in The Netherlands. Muschert (2009), who focused on coverage of the Columbine shooting, also found that media frames changed over time, with initial coverage focusing on the specifics of the event and coverage further out from the actual event focusing on the national salience. Those findings were consistent with Chyi and McCombs' (2004) previous finding that Columbine coverage focused on the national significance of the tragic event in later coverage. Chyi and McCombs (2004) related their findings to "frame changing," a strategy used to reframe events in an attempt to keep the story alive. Muschert & Carr (2006) referred to frame changing as a process of "salience maintenance" (p. 749). Frame changing, however, may occur more organically, with certain frames being more appropriate for specific phases of an event. For example, Adam, Allan, & Carter (1999) suggested reframing of issues occurs according to three phases of an event: 1) the normalcy phase, 2) investigation phase, and 3) the restoration phase. Media frames would then correspond with each phase. This is just one example of how researchers have defined the stages of disasters and the responding role of media.

Media coverage and dominant frames may vary depending on the values of a particular news organization. Colistra (2010) studied media coverage of a historical event, the West Virginia Buffalo Creek mine disaster of 1972, an environmental disaster that raised similar questions as the Elk River spill only in the context of a much more tragic and catastrophic event. The Buffalo Creek disaster occurred when more than 100

million gallons of coal wastewater (commonly referred to as "sludge") resulted in the death of 125 people and property damage valued at $50 million (Colistra, 2010). Using a qualitative approach, Colistra (2010), used Semetko and Valkenburg's (2000) five news frames to guide the content analysis of newspaper coverage of the disaster. Findings showed that media frames depended on the political leanings of newspapers, more specifically, between a historically pro-coal, conservative newspaper and a pro-union, progressive newspaper. Recovery efforts dominated coverage in the conservative newspaper. In contrast, the conflict/attribution of responsibility frame was most dominant in the progressive newspaper.

In addition to factors at the organizational level, sources included in media coverage can influence media framing of disasters including what causes and solutions are presented as being associated with a particular event (Salwen, 1995). Salwen's research (1995) of Hurricane Andrew coverage demonstrated that sources were more likely to assign blame than to give praise to the government, particularly at the federal level. Perhaps unsurprisingly, Salwen (1995) also found that sources were more likely to praise themselves and blame others when reflecting on disaster causes and responses. Also focused on sources, Priest, Walkers and Templin (1991) found in their analysis of the Loma Prieta Earthquake and Hurricane Hugo coverage that sources were predominantly governmental, and those sources were likely to discuss government solutions. Although sources sometimes offer solutions, some research suggests that they may be more likely to offer causes to problem (Ewart & McLean, 2015; Smith, Cho, Gielen, & Vernick, 2006; Walters & Hornig, 1993). Outside of the risk and crisis communication literature, however, researchers have found the opposite to be true,

concluding that solutions are more frequently cited than causes when analyzing social issues such as poverty and obesity (Barry, Jarlenski, Grob, Schlesinger, & Gollust, 2011; Kim et al., 2011).

Other research exploring media coverage of disasters has been more interested in exploring the inclusion of expert sources and the role they play in determining media content. Cohen et al. (2008) were particularly interested in examining newspapers inclusion of public health information and use of public health sources. They found that most news articles did not report on public health risks related to Katrina and that only 14% of articles included a public health source. They suggested that this finding may demonstrate a general shortage of in-depth health coverage or may indicate a lack of concern regarding public health threats.

**Recent Research of Social Media Use in Disasters**

The Internet has changed risk and crisis communication, particularly the role of traditional media. People now seek information from a wide range of sources including both traditional and "new" media (Freberg, Palenchar, &Veil, 2013). When a disaster occurs, the public can now seek information almost instantly, searching for specific information through general online searches using keywords, accessing online news sources, and asking questions on social media. In addition to seeking out information, the public can now generate content through numerous social media platforms and services. In some cases, public users generating content on social media report new information and offer speculations about a disaster even before traditional news media (Van de Meer & Verhoeven, 2013).

With more widespread use of social media during crises (American Red Cross, 2012), there is intensified interest in understanding how it has been used in the past and can be used in the future. Multiple researcher teams have analyzed social media content to learn how crisis managers and public users have used these tools to communicate during various types of crises (Binder, 2012; Chew & Eysenbach, 2010; Cho, Jung, & Park, 2013; Freberg, Saling, Vidoloff, & Eosco, 2013; Lachlan, Spence, & Lin, 2014; Kim & Liu, 2012; Liu & Kim, 2011; Muralidharan et al., 2009; Schultz, Utz, & Goritz, 2011; Sung & Hwang, 2014; Tirkkonen & Luoma-aho, 2011; Van der Meer & Verhoeven, 2013).

Researchers have been particularly interested in understanding more about the dissemination of information and how users share information through social media (Chew & Eysenbach, 2010; Genes, Chary, & Chason, 2014; Kim, 2014; Sutton et al., 2014). Genes et al. (2014) were interested in understanding how government agencies used Twitter to communicate with the public during two major weather storms. More specifically, they examined types of information most frequently disseminated or "retweeted." They found that tweets that included simpler vocabulary but were longer than average were the most commonly retweeted (Genes et al., 2014). Previous research found that the inclusion of URL (or link) increased the likelihood that a tweet would be retweeted (Bhattacharya, Srinivasan, & Polgreen, 2014; Suh, Hong, Pirolli, & Chi, 2010). Other research, however, has not found that to be true. Genes et al. (2014) discovered that including an URL had no such affect on retweets in their examination of how information from city and state governments spread on Twitter during weather-related emergencies.

Researchers have also been interested in comparing multiple types of media to understand differences in how crisis information was perceived by audiences according to medium (Schultz et al., 2011; Utz et al., 2013). Schultz et al., (2011) found that people were more likely to share news from online newspapers than from social media because they viewed traditional sources as more credible, which is consistent with Utz et al.'s (2013) findings. In contrast, Lachlan et al. (2014) argued in an examination of the use of Twitter during Hurricane Sandy that social media platforms are increasingly gaining credibility as information sources. With more official sources including governmental agencies and national organizations participating in social media, a continued increase in the credibility of social media is likely.

Researchers have compared traditional and social media to see how content, structure, and framing of crisis information is similar and different according to media type (Van der Meer & Verhoeven, 2013; Kim & Liu, 2012). Kim and Liu (2012) compared how organizations used different media to disseminate crisis information in response to the spread of H1N1 and found that traditional media contained more in-depth information than social media. They suggested that this might have been because organizations had not taken advantage of the full potential of social media during the crisis. Other research has highlighted differences in the types of sources used by traditional media as compared to social media. In an examination of online newspapers and blogs during a political crisis, Liu (2010) found that online news articles included more quotes from official sources than blogs did. This may or may not be true during other types of crises.

Research suggests that similar to patterns of traditional media coverage during a crisis, social media content changes depending on the state or phase of the crisis. Chew and Eysenbach (2010) found that H1N1-related tweets primarily contained news and information, but over time, the prevalence of personal accounts of H1N1 increased. Takahashi, Tandoc, & Carmichael (2015) also found that the tweets changed over time in their examination of Twitter use during and after the 2013 Typhoon Haiyan in the Philippines. Specifically, they discovered that tweets on second-hand reporting and memorialization decreased in the aftermath of the storm as the number of tweets related to relief efforts increased.

In an analysis of public tweets sent after a chemical plant explosion, Van der Meer and Verhoeven (2013) found that in the initial stage of the event (prior to extensive traditional media coverage), an "alarm frame" (indicating public fear) was the dominant frame used in public tweets. Following extensive traditional media coverage, the dominant frame used in public tweets was categorized by more general crisis information, which was also the dominant frame in traditional media coverage. They concluded that Twitter served primarily as an information sharing resource (Van der Meer & Verhoeven, 2013).

In an analysis of tweets sent during the Fukushima nuclear power plant disaster, Binder (2012) found differences in Twitter content and structure over time. One interesting finding that also demonstrated the interconnectedness among traditional and social media was that tweets were more likely to include hyperlinks to traditional news outlets further out from the actual event. Binder (2012) suggested that the finding indicated that users deferred to those perceived as more expert to make interpretations or

meaning of the event in its aftermath. Other research has also found that Twitter users frequently include hyperlinks to traditional media sources when sharing information during a crisis (Merry, 2013; Yi, Choi, & Kim, 2015).

Much of the research examining the role social media plays in disaster and emergency settings has focused on microblogs (e.g., Twitter) and social networking (e.g., Facebook) platforms. In recent years, Twitter has been a particularly popular source of information during crises, both domestically and internationally, playing a dominant role in the spread of information during the 2009 H1N1 crisis (Freberg, et al., 2013); the 2012 Hurricane Sandy disaster (Lachlan et al., 2014; Lachlan, Spence, Lin, & Del Greco, 2014); the 2009 crash of US Airways Flight 1549 (Veil, et al., 2011); the 2011 Waldo Canyon wildfire in Colorado Springs (Sutton et a., 2014); the 2013 Boulder Floods (Sutton, League, Sellnow, & Sellnow, 2015); the 2010 Haiti earthquake (Gurman & Ellenberger, 2015; Muralidharan et al., 2011); the 2014 Dutch Chemie-Pack chemical plant explosion in Moerdijk (Van der Meer & Verhoeven, 2013); and the 2011 Fukushima nuclear power station disaster in Japan (Binder, 2012).

Freberg, Saling, Vidoloff, and Eosco (2013) made a case for using Twitter through their examination of crisis messages related to Hurricane Irene on social media, concluding that the most effective crisis information was communicated through Twitter and that Twitter was a primary source of information. Research has also demonstrated the important role Twitter played in political advocacy during the 2010 Gulf Oil Spill (Merry, 2013). Environmental groups used hashtags and hyperlinks to traditional news sources to make connections between the Gulf spill and other oil spills, ultimately highlighting those connections to underscore key advocacy points (Merry, 2013). These

studies bring attention to the unique aspects of social media, and Twitter specifically, that make it a valuable communication tool to the public and crisis responders in a disaster setting. Further research is needed to learn how best to integrate social media with more traditional forms of communication to spread accurate and timely information during disasters.

**Conceptual Model**

There are multiple ways to conceptualize framing theory and research, and so there is not one unified theoretical perspective for studying framing. Today this is further complicated by the emergence and widespread use of new media. Framing research has been divided into studies examining *media frames* and studies examining *audience frames*, although some studies have been designed in a way that allows researchers to study both (de Vreese et al., 2001). While research on media frames has been primarily concerned with how issues are presented and covered by media, research focusing on audience frames has focused on how audiences interpret issues and events (de Vreese et al., 2001). Another way framing research has been conceptualized and categorized is by its consequences, which de Vreese (2005) suggested occur on the individual level (e.g., an altered personal attitude as the result of a frame) or on the societal level (e.g., collective action based on certain frames).

Framing research has also been divided into *frame-building* and *frame-setting* processes (Scheufele, 1999). By focusing on how frames emerge, frame building explores how both *extrinsic*, *or external*, factors (e.g., the political system) and *intrinsic*, *or internal*, factors (e.g., ideology orientation of the journalist) influence the selection of frames (Scheufele, 1999; Zhou & Moy, 2007). Scheufele (1999) proposed that there are

five factors that may influence how journalists frame an issue or event: "social norms and values, organizational pressures and constraints, pressures of interest groups, journalistic routines, and ideological or political orientation of journalists" (p. 307). In contrast, frame setting commonly focuses on audience frames, taking an individual's prior knowledge and predispositions into consideration when determining how frames may affect interpretations of issues and events (Scheufele, 1999).

In an attempt to bring together scattered theories and conceptualizations of framing, Entman (1993) proposed a common understand of framing through the development of a research paradigm. According to Entman (1993), framing involves selection and salience. He suggested framing "is to select some aspect of perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (p. 52).

Entman's (1993) conceptualization of framing has been the dominant paradigm of the framing process until more recently when D'Angelo (2002) argued that there are multiple framing paradigms and that framing research would benefit from conceptualizing frames more broadly. D'Angelo (2002) suggested that the three dominant paradigms are 1) cognitive, 2) critical, and 3) constructionist. Cognitive framing research is interested in how news frames interact with individuals' existing knowledge and schemas or frames (D'Angelo, 2002). In contrast, critical framing research views frames as the result of "newsgathering routines by which journalists convey information about issues and events from the perspective of values held by political and economic elites" (D'Angelo, 2002, p. 876). Critical framing research is largely characterized by

domination and takes the context of framing into consideration (Hardin & Whiteside, 2010). The final paradigm, constructionist, views frames as "interpretive packages" that reflect the positions of "politically invested 'sponsors' (e.g., sources) in order to both reflect and add to the 'issue culture' of the topic" (D'Angelo, 2002, p. 877). Viewing the constructionist paradigm through a feminist lens, Hardin & Whiteside (2010) suggest that by relying on frames that "resonate with themselves and with media consumers," journalists reinforce the status quo. Considering how organizational factors, external conditions, and sources influence frame selection also aligns with a constructionist view (Van Gorp, 2010). D'Angelo (2002) ultimately suggests that it is beneficial for researchers to use a combination of these three paradigms to guide framing studies.

Based on the theoretical concepts and categories described above, the current research considers factors involved in frame building but also explores connections between media and audience frames in an exploration of frame setting. Further, I conceptualized a frame as an "emphasis in salience of different aspects of a topic" (de Vreese, 2005, p. 53), which is consistent with Entman's (1993) definition of framing. Also similar to Entman's (1993) conceptualization of framing, I viewed frames in this study as promoting a "problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" and focused specifically on the causal and treatment elements, akin to my discussion of causes and solutions (p. 52).

Because I was particularly interested in considering how the cultural, political, and social context of the Elk River chemical spill may have influenced the selection of news frames, my personal interests most closely reflect those ideas expressed by the critical and constructionist paradigms. Both of these paradigms involve assumptions

about power and its relationship to how content is created by media and received by audiences (Hardin & Whiteside, 2010). In my examination of the media's selection of frames and presentation causes and solutions, I considered the cultural, political, and social context of the incident as well as the internal and external factors that may have influenced journalists selection of frames and messages. The study also considered how media frames interact with audience frames during the frame setting process. Although the current study did not test or specifically examine how media frames influenced audiences' views and opinions, there was an assumption based on previous research that specific frames (e.g., conflict frames, attribution of responsibility frame) do potentially influence public opinion (de Vreese, 2005; Iyengar, 1991; Pan & Kosicki, 1993). Instead of exploring whether media frames influence audience frames, this study focuses more on the extent to which audiences identity commonly used frames in coverage and how they process those frames in their evaluation of a crisis event, enhancing our understanding of how the frame setting process may work in crisis settings.

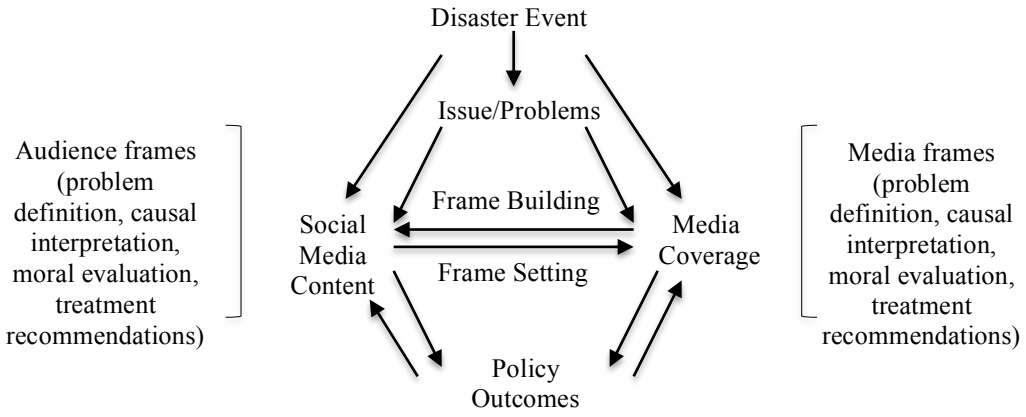


Figure 2.1: An Integrated Approach to the Frame-Building and Frame-Setting Processes (Zhou & Moy, 2007)

Another important component of this research was the interaction between social media (and Twitter specifically) and traditional media coverage and how social media

influences the frame-building process. The study's conceptual model borrows heavily from the conceptual framework Zhou and Moy (2007) developed to study the relationship between online public opinion and traditional media during frame-building and frame-setting processes, which ultimately influence societal consequences including policy change. Although researchers are just beginning to study and understand the relationship between traditional and social media, Zhou and Moy (2007) have suggested that social media (specifically online public opinion) has a significant frame-building impact on traditional media but only in the initial stage of issue or event coverage.

Although not explicitly reflected in the conceptual model, the final component of the study relates to media's communication of health-related information including risks related to drinking or using the contaminated water. Because the inclusion of health-related information depends largely on the availability of research and official information, experts, spokespersons, and officials are often viewed as key components of the newsgathering process during a disaster (Barrett, 2005; Walters & Hornig, 1993; Wray et al., 2008). This further demonstrates how media routines and processes influence not only the selection of frames but also the selection of content.

**Significance**

This study considered how social media and traditional news media covered the Elk River chemical spill, particularly focusing on the identification of dominant frames and the inclusion of health-related risk information. Given the public's reliance on media during times of crisis (Glik, 2007), media framing and coverage of an environmental disaster such as the Elk River chemical spill potentially carries great influence on the ways in which people interpret causes of and solutions related to the event. Examining

how media presented coverage related to causes of and solutions to the spill (including solutions to preventing similar disasters in the future) is particularly important given the location of the incident in West Virginia's Chemical Valley, a region vulnerable to accidental disasters due to the high concentration of industries (Cantrell, 2004; Parker, 2014).

Also important given the context of the spill is understanding more about the ways in which media relay health risk information to the public. How people respond to environmental hazards relates to perceptions of risk not actual risk (Glik, 2007), further demonstrating the need to understand more about the ways in which media represented risks to the public's health. Understanding more about media's presentation of risk information is necessary to provide insight into how public health practitioners and crisis managers can work with traditional media and use social media to deliver health-related information during disasters.

From a disaster preparedness and response and public health perspective, this is a timely study. Healthy People 2020 includes an objective to "increase the proportion of crisis and emergency risk messages intended to protect the public's health that demonstrate the use of best practices" in print and broadcast news stories (U.S. Department of Health & Human Services [HHS], 2011). This objective supports the broader Health Communication and Health Information Technology goal to "use health communication strategies and health information technology (IT) to improve population health outcomes and health care quality, and to achieve health equity" (HHS, 2011). Currently, there is limited research examining media coverage of public health issues and health risks in the context of a human-made, industrial disaster. Thus, this study was

among the first to examine how health risks are communicated through both traditional and social media in a disaster setting.

From a mass communication perspective, the study contributes to an ongoing body of research that seeks to solidify core framing concepts, theories, and approaches. The study also contributes to media research focused on the framing of disasters, particularly related to the communication of causes and solutions of disaster-related issues. Although it was not a primary objective of the research, the study also adds to researchers' understanding of how Semetko and Valkenburg's (2000) five new frames function in disaster news coverage. This is important to determining the applicability of general news frames when reporting on disasters. Brunken (2006) and Kuttschreuter et al. (2011) used these five news frames in their analysis of media coverage of natural disasters, and Liu and Kim (2011) adapted these five news frames to analyze H1N1 coverage. Additionally, Calderon et al. (2014) found in an examination of newspaper coverage of the Fukushima nuclear power plant accident that only three of the five generic news frames applied to coverage of that particular event. By examining the use of the five generic news frames by multiple media sources and channels, this study provided an opportunity to further understand how these frames are used in disaster coverage.

Ultimately, this interdisciplinary study contributes to the fields of mass media, risk and crisis communication, disaster preparedness and response, and public health. The research makes contributions to these fields by informing our understanding of how local and national news media frame accidental environmental disasters that impact human health and how those frames may influence the public's interpretations of disasters and views on their future prevention. Contributing to a growing body for research in the

realms of risk and crisis communication and media framing, this research also enhances our understanding of the role social media play in the spread of health-related risk information during a disaster and how social media may influence traditional news media's selection of media frames.

**Innovation**

This study was the first to systematically analyze and compare media coverage of the spill. The study viewed the Elk River chemical spill as a focusing event, which Birkland (1997) defined as a "sudden, unpredictable event" that has the potential to influence public policy (p. 1). This was based on an assumption that the incident raised several policy-related questions, particularly those related to a lack of state and federal regulation including the enforcement of regulations that were already in place. It is important to consider these complex policy-related questions in the context of a state that benefits economically from the coal and chemical industries and has historically been anti-regulation (Davenport & Southall, 2014).

This study considered how media presented causes and solutions to the Elk River spill as an attempt to also understand how dominant cultural values, ideologies, and political orientations may have influenced the frame-building process. The qualitative component of the study was particularly beneficial to examining the relationship between the cultural and political context of the spill and media framing of the incident. The research approach, which included a quantitative content analysis in conjunction with qualitative interviews, is not typical of framing research. Few framing studies have linked content analysis with in-depth interviews (e.g., Jacobson, 2014; Wakefield & Elliot, 2003; Wirth et al., 2010), as many studies only include a content analytical component

(Matthes, 2009). When interviews have been conducted as part of framing studies, interviews have typically been with journalists, not with stakeholders beyond the media field (Dahinden, Koch, Wyss, & Keel, 2011; Matthes, 2009). Although it is uncommon, framing studies have implemented multi-method approaches that include media content analysis, interviews with journalists, and focus groups with public audiences (Briant, Watson, & Philo, 2013; Mistry & Driedger, 2012; Salathong, 2013). Additionally, studies have combined media content analysis and focus groups with public audiences to learn what media sources audiences accessed for information on particular issues and how they viewed media's presentation of those issues (Vicsek, 2011).

By interviewing a diverse group of stakeholders, representing multiple sectors, the current research examined how individuals who were involved in the risk and crisis management of the Elk River spill viewed and assessed media coverage of the event. Interviews with stakeholders rather than journalists helps us to better understand connections between media and audience frames, as studies including interviews with journalists have tended to focus on how internal factors such as news routines and constraints on the newsroom influence journalists' selections of frames (Dahinden et al., 2011; Salthong, 2013). Additionally, interviews with stakeholders from multiple fields (e.g., public health, emergency response, and crisis management) provides insight into how expert and technical information can be better communicated through both social and traditional media.

Finally, the inclusion of traditional and social media is also relatively innovative, particularly when considering media framing of disasters. The study's conceptual model acknowledges the interactions between social and traditional media as well as the roles of

frame building and frame setting in influencing policy outcomes related to the spill. The study also considered what role Twitter and other social media played in spread of crisis information and specifically information about health risks, contributing to a growing body of research dedicated to understanding how social media is used and can be better used during crises and emergencies.

# CHAPTER 3

## Methods

### Overview of Research Design

The purpose of this project was to understand how news media and social media framed coverage of the Elk River chemical spill and the subsequent water crisis. The study also sought to understand how community and government stakeholders perceived coverage of the incident and what type of value they placed on various media in the communication of disaster-related information. To achieve these goals, the study used a mixed-methods research design that included two distinct research phases. The study's specific aims are listed below by phase:

**Phase I: Quantitative content analysis of media**

**Aim 1:** To assess media coverage of the 2014 Elk River chemical spill in the days immediately following the incident. Coverage in local and national newspapers (e.g., *Charleston Gazette*, *The New York Times*), network television news (e.g., ABC, CBS, NBC), online news (e.g., CNN, Huffington Post), and social media (i.e., Twitter) were examined.

**Aim 2:** To compare coverage of the 2014 Elk River spill across media channels.

**Phase II: Qualitative interviews with stakeholders**

**Aim 3:** To understand how community, government, and nonprofit stakeholders view the incident and media coverage of the water crisis.

**Aim 4:** To determine how stakeholders' recollections and perceptions of coverage compared to dominant frames identified in Specific Aim 1.

For Phase I, I conducted a quantitative content analysis to investigate the frames used by multiple media sources in their coverage of the Elk River chemical spill between January 9 and February 1, 2014. Content analysis is a technique that allows researchers to systematically examine media texts in a valid and replicable way (Krippendorff, 2004; Riffe, Lacy, & Fico, 2014). I used a deductive approach, which is preferred when making comparisons among groups and when analyzing a large sample of data (Elo & Kyngas, 2007; Semetko & Valkenburg, 2000), both of which were true of this study as I compared media frames and content across multiple channels and had a large sample size. I used a combination of generic and issue-based frames to examine media coverage.

For Phase II, I conducted in-depth, semi-structured interviews with stakeholders representing diverse agencies and organizations who played an active role in the risk and crisis management of the spill. Interview questions focused on stakeholders' recollections and perceptions of media coverage pertaining to the incident. Specific Aim 4 was included to bring the findings of Phase I and Phase II together, comparing stakeholders' recollections of coverage with dominant media frames and content themes in actual coverage.

**Phase I: Content Analysis**

**Sample.** This study examined media coverage of the Elk River chemical spill over a 24-day timespan, which was conceived in two time periods. Time Period I began on January 9 (the day the spill was discovered and West Virginia American Water issued a "Do Not Use" water order) and ended on January 20 (the day the official state of

emergency ended) (FEMA, 2014; WVDHHR, 2014a). Time Period II began January 21 and ended February 1, 12 days following the official state of emergency declaration. In addition to feasibility concerns, this time period was chosen because the most intensive media coverage of a disaster typically occurs within just weeks of an event, with peak institutional response occurring between three and six months after the event (Birkland, 1997).

In order to examine a broad representation of media, the study included a purposively selected sample of local newspapers (i.e., the *Charleston Gazette* and *Charleston Daily Mail*); national newspapers (i.e., *The Wall Street Journal* and *The New York Times*); major network and cable television networks (i.e., ABC, CBS, NBC, CNN, and Fox News); online news sites (i.e., CNN.com and HuffingtonPost.com); and social media (i.e., Twitter). This media sampling intentionally included an assortment of liberal, conservative, and moderate media outlets based on the Pew Research Center's "Political Polarization and Media Habits" report (2014b).

All news articles, transcripts, and tweets retrieved through the search were coded; however, only media focusing explicitly on the Elk River chemical spill were included in the final analysis. In total, 1505 stories and tweets were retrieved using the searches below. Seventy-six were excluded from the analysis because they did not meet the inclusion criteria.

***Print media sample.*** *The Wall Street Journal* and *The New York Times* were selected as the two national newspapers primarily because they are among the top five circulated daily newspapers in the U.S. (Associated Press, 2013). Representing local newspapers, the *Charleston Gazette* and *Charleston Daily Mail* were selected because of

their proximity to the spill and are among the top newspapers circulating daily in West Virginia (ANR, 2011).

Newspaper articles published during the time period of interest were retrieved using *LexisNexis* and *Factiva* databases. Search terms included "West Virginia" in combination with one or more of the following: "Elk River," "water," "Freedom Industries," "chemical spill," "chemical leak," and "MCHM." The search identified 19 articles from *The Wall Street Journal*; 22 articles from *The New York Times*; 259 articles from the *Charleston Gazette*; and 183 articles from the *Charleston Daily Mail*. Seventy stories were omitted from the analysis because they did not explicitly relate to the spill or were repeat stories.

***Television news.*** Three broadcast news networks (ABC, CBS, and NBC) and two cable news channels (CNN and Fox News) were selected to provide a broad look at coverage of the incident. Due to feasibility issues related to locating and retrieving transcripts from local stations, local television news reports were not included in the study. This approach is common in media content analyses using television news content (Foster, Tanner, Kim, & Kim, 2014; Kim, Tanner, Foster, & Kim, 2014). Television news transcripts were retrieved from *LexisNexis* using the search terms listed above. The search retrieved 15 transcripts for ABC; 25 for CBS; 21 for NBC; 110 for CNN; and 4 for FoxNews. Four transcripts were omitted from the analysis because they did not relate to the spill or were repeat stories.

***Online news.*** Online news selections were based on rankings from the three leading online measurement firms: comScore, Nielsen, and Experian Hitwise (Sasseen, Olmstead, & Mitchell, 2013). Although each firm ranks online news sites based on

different criteria, there are similarities among their rankings. Yahoo-ABC News, CNN Digital Network, Huffington Post, and MSNBC Digital Network were ranked as four of the top five news sites by each of the firms, with the fifth site varying by firm (Sasseen, Olmstead, & Mitchell, 2013).

The HuffingtonPost.com and CNN.com were selected as the online news sources for this study. Yahoo! News was not chosen because of search engine limitations, as it was only possible to retrieve news stories up to one month prior to the search date. Although MSNBC is easily searchable by keyword, it was not selected because of the small number of articles published on the spill during the time period of interest. In addition to being easily searchable by keyword and date range, HuffingtonPost.com and CNN.com represent two different types of online news sites. HuffingtonPost.com is a news aggregator site, retrieving articles from many sources. In contrast, CNN.com is a focused-provider news site, providing news from a limited number of sources. Including each type of online news site is important since researchers found differences in the types of sources and content that aggregator and focused-provider news sites provided in cancer news coverage (Hurley & Tewsbury, 2012).

To gather online news articles from CNN.com, I conducted keyword searches using terms from above in *LexisNexis*, which retrieved 16 stories. Although *LexisNexis* has access to articles published on HuffingtonPost.com, it was difficult to distinguish news articles from blog posts. Because this study was only interested in news articles since blogs are more commonly categorized as social media, I used the search engine provided on HuffingtonPost.com, as it provided an option to filter search results by news or by blogs for a particular date range. Using the keywords from above, the search

yielded 31 unique stories. One online story did not meet the inclusion criteria, leaving a final sample size of 46 stories.

***Social media.*** Twitter was selected as the social media platform for this study because it is publicly searchable and previous research has found it to be the leading (in terms of volume) and most effective (in terms of crisis content) social media platform used during disasters (Freberg et al., 2011; Sung & Hwang, 2014). To analyze Twitter content, I searched for tweets posted during the time frame of interest that contained the hashtag #wvwatercrisis, which I determined was the most frequently used hashtag in incident-related tweets based on a search using tweetarchivist.com, a free service that allows users to search for tweets by hashtag, location, or keyword. Hashtags are keywords or abbreviations that begin with the prefix # and are used to organize tweets around specific topics. Tweets containing hashtags are easily identified through Twitter's search function, which is available to both Twitter users and non-registered visitors of the website.

Only tweets including #wvwatercrisis and that contained an explicit reference to the disaster were included in my analysis of Twitter content. This is similar to the sampling strategy Harris et al. (2014) used in an analysis of tweets related to childhood obesity and Merry (2013) used to analyze tweets related to the 2010 oil spill in the Gulf of Mexico. Genes et al. (2014) also collected tweets containing specific hashtags to analyze tweets about Hurricane Sandy and Storm Nemo.

My search retrieved 3,995 public tweets when considering only top tweets. Twitter's search function allows users to conduct searchers for all or for top tweets (which is based on a Twitter algorithm based on engagement as indicated by retweets,

replies, and more) ("FAQs About," 2014). In addition to restricting results to top tweets for feasibility purposes, it was also determined that the top tweets would be the most influential since they received the most views and shares.

There is considerable variability in the sample sizes that previous researchers have used to examine tweets using content analysis. Binder (2012) analyzed a 5% sample of tweets, analyzing every 20th tweet, in an examination of tweets related to the Fukushima-Daiichi nuclear power plant disaster. Scanfeld, Scanfeld, and Larson (2009) analyzed a 10% random sample of 52,000 tweets. Robillard, Johnson, Hennessey, Beattie, and Illes (2013) also analyzed a 10% random sample of 9,200 tweets focusing on dementia. Similarly, Mollema et al. (2015) analyzed every 10th tweet or social media post in their examination of social media use during the 2013 measles outbreak in the Netherlands. To ensure an adequate sample size, I included a sample size of 800 (20%) tweets for the current study, analyzing every 5th tweet. NCapture, an add-on feature for QSR NVivo 10, allowed me to save a static file of all tweets containing the hashtag #wvwatercrisis. Two tweets were omitted from the analysis because they were not related to the spill.

**Data collection tools and procedures.**

***Framing Measurement Tools.*** The current study employed a deductive approach to deriving generic and issue-based frames (Calderon et al., 2007; Matthes, 2009; McGinty, Webster, Jarlenski, & Barry, 2014). Code selection was based on the research questions listed under Specific Aim 1 and previous research analyzing the use of frames in disaster coverage. The bullets below include examples of codes and frames. (See Appendix A for the complete codebook.)

- *RQ1* focused on the volume and scope of media coverage. I developed a general set of codes that varied depending on the specific media channel. The codes developed to analyze tweets differed considerably from those used to analyze traditional media coverage. Example codes for traditional media included media outlet (e.g., *The New York Times*, CNN.com); story date; story length (i.e., number of words); story location as indicated by the byline (e.g., Charleston); geographic focus; and story type (e.g., news, editorial). In contrast to traditional media, example codes for Twitter included user type (e.g., private person, government representative, media outlet); inclusion of a photograph or image; number of "favorited" tweets; and purpose of tweet (e.g., announce meeting, provide health risk information, mobilize citizens (e.g., ask them to sign petition or call an elected official). Falling under the scope of media coverage, I also included codes for all media types to identify references made to previous industrial disasters in the state and the use of "Chemical Valley" in the story.
- *RQ2* focused on identifying dominant frames in media coverage and changes in those frames over time. Generic frames included Semetko and Valkenburg's (2000) five news frames. All 20 questions included in the original instrument were included in the codebook. Items were used to assess the presence of the following news frames: 1) attribution of responsibility (i.e., implies a particular individual, group, or organization is responsible for the disaster and its consequences); 2) human interest (i.e., presents the human emotional aspect of an event), 3) conflict (i.e., refers to conflicts between individuals, groups, or organizations); 4) economic consequences (i.e., includes information related to

the financial consequences of a disaster); and 5) morality frame (i.e., references religious tenants or moral prescriptions) (Semetko & Valkenburg, 2000). This coding instrument employed a binary (Yes/No) coding strategy.

- *RQ3* focused on causes and solutions related to the spill. The items comprising the "attribution of responsibility" frame in Semetko & Valkenburg's (2000) instrument largely captured causes and solutions (e.g., "Does the story suggest solutions to the problem?" and "Does the story suggest some level of the government is responsible?"). Complementing those items, I created issue-specific items and frames to capture additional information related to causes such what level of government was deemed as responsible for the spill if any. Additionally, codes were developed to determine if solutions were included in news stories or tweets and, if so, whether those solutions relied on action from particular people or groups (e.g., local government, state government, private corporations). Codes were also developed to identify the inclusion of a "call to action" focused on the government (Huckstep, 2009).
- *RQ4* focused on tone. In addition to examining dominant frames, this study assessed media's use of tone in coverage of the spill related to governmental preparedness and response. Tone was viewed as part of media framing and as an additional mechanism through which the media influences the public to think a certain way about an issue or event. By examining tone, the study explored how media framed the assessment of the government's response to the disaster through a positive tone (i.e., expressed positive feelings toward governmental efforts such as praising officials for their actions), negative tone (i.e., expressed negative

feelings toward governmental efforts such as ridiculing or questioning officials for their actions or lack of action), or neutral (i.e., expressed no judgment or a balanced mix of judgments) (Brunken, 2006; Kuttschreuter et al., 2011; Lee & Basnyat, 2013; Sheafer, 2007). Tone was coded using a 3-point ordinal scale (i.e., 1) positive, 2) neutral, and 3) negative), as published elsewhere (e.g., VanderKnyff et al., 2014), with six items used to assess tone related to the local, state, and federal government's preparedness and response.

- *RQ5* focused on understanding how media communicated health information related to the spill. Binary codes were used to assess whether particular health-related information was present or absent. Issue-specific frames were also developed to identify the types of health information included in news stories and tweets such as health risks (e.g., rash, nausea); preventive information (e.g., not bathing in the water); and treatment information (e.g., instructions for when to contact a medical doctor or how to contact poison control).
- *RQ6* asked what individuals, groups, and organizations were commonly used as sources in media coverage of the incident. Sources were defined as people or organizations providing direct or indirect quotes used in news stories. Coders examined the sources (e.g., public health official, state government official, federal government official, for-profit representative) of information included in each story. The list of sources included in the codebook was derived from previous research examining sources in the context of disasters and from an initial review of media coverage of the incident (Cohen et al., 2008). Codes were used to

determine whether or not specific sources were mentioned in stories using a binary coding scheme (i.e., present/absence).

- *RQ7* focused on what role Twitter played in the spread of online news through transmission and retransmission. Twitter-specific codes were included to examine the inclusion of hyperlinks (i.e., yes, no); hyperlink type if included (e.g., blog, online news source); and number of retweets (Harris, et al., 2014).

***Intercoder Reliability.*** I worked with a graduate student who had experience with coding from other content analysis projects. Based on previous content analysis research (Palmer & Tanner, 2012; Tanner & Friedman, 2011; VanderKnyff et al., 2014), intercoder reliability was established by randomly selecting a 10% stratified sample of stories and tweets for coders to analyze. Cohen's kappa was used to determine intercoder reliability, with an alpha of 0.70 or above indicating strong agreement for exploratory research (Lombard, Snyder-Duch, & Bracken, 2002). Cohen's kappa is effective in determining intercoder reliability when two individuals are involved in the coding process. Strong intercoder reliability is an essential component to a study's reproducibility and validity (Krippendorff, 2004; Riffe et al., 2014).

The overall Cohen's kappa value for the coding sheet was .72, a score indicating "substantial agreement" according to guidelines developed by Landis and Koch (1977). Percent agreement was calculated by item, and then the mean kappa values were calculated for each topic area, e.g., general content ($k$=.84), tone ($k$=.65), sources (k=.72), generic news frames ($k$=.67), with the values for individual items ranging from .57 to 1.00.

**Data analysis.** All data were entered manually into IBM SPSS Statistics 20 (IBM Corp., 2011), a statistical software program. For Specific Aim 1, the unit of analysis was an individual story for the print, television, and online news analysis component and a post (i.e., tweet) for the Twitter component. Images, graphics, or other visual elements were not included as part of the content analysis.

Using SPSS, I ran nonparametric descriptive statistics including frequencies, percentages, means, standard deviations, and ranges for all variables of interest. Descriptive statistics provided a broad look at the volume and scope of media coverage as well as the inclusion of content themes related to the presentation of solutions, use of sources, and inclusion of information about health risks (RQ1, RQ3, RQ4, RQ5, RQ6). Additionally, through descriptive statistics, I was able to learn more about the scope of Twitter content by examining what percentage of tweets contained links to traditional media sources, the most common purposes of tweets, and what types of users were using Twitter to communicate about the disaster. An independent-samples t-test was used to assess whether inclusion of hyperlinks to traditional news outlets or stories sources increased retweet rates (RQ7).

Semetko and Valkenburg (2000) conducted a principal component analysis (PCA) with varimax rotation to determine that the 20 items they used to identify dominant news frames clustered into five distinguishable frames. To examine whether their 20 items clustered into five distinguishable frames when analyzing media coverage of the Elk River spill, an exploratory factor analysis (EFA) was conducted in R Core Team (2015). Tetrachoric correlations, a special case of polychoric correlations, were specified since the variables of interest were dichotomous (Wirth & Edwards, 2007).

In Semetko and Valkenburg's (2000) analysis, one item from the attribution of responsibility frame ("Does the story suggest the problem requires urgent action?") was eliminated due to low factor loading. Based on that finding, I also omitted that item from further analysis. Although Semetko and Valkenburg (2000) had already ran a reliability test on their coding scheme, I also conducted Cronbach alpha tests on each set of questions to ensure reliability. Nunnally and Bernstein (1994) suggested that .70 is an acceptable reliability coefficient. Based on that guideline, alpha values suggested mixed reliability of the coding scheme for the majority of news frames: attribution of responsibility (.55), human interest (.75), conflict (.61), economic consequences (.75), and moral (.55).

In order to compare the use of news frames across the two time periods, I calculated a "percentage used" variable to serve as a standardized frame score. The percentage used variable was calculating by adding the number of "yes" responses to items falling under each frame. For example, if there were 2 "yes" responses to the five human interest items, the standardized score for that frame would be 2/5 or 40%. To compare dominant frames over Time Period I (January 9–20) and Time Period II (January 21–February 1), I conducted a series of independent samples t-tests to determine if there were differences in the use of each frame between time periods based on the standardized frame score (RQ2). (Manuscript I includes results from the analyses using the "percentage used" variable but does not include results of the EFA, which are included in Chapter 5.)

For Specific Aim 2, which involved multiple comparisons among groups, I conducted a Welch's ANOVA for each frame in conjunction with a Games-Howell post-

hoc test (recommended when there are unequal variances) to determine if there were significant differences in the dominant frames across media channels (RQ8). Because my data violated the assumptions of the Chi-square test of independence, I conducted Fisher's Exact tests to examine how causes and solutions (categorical data) varied between local and national print media (RQ9). Similarly, I conducted Fisher Exact tests to examine how tone (ordinal data) compared between local and national print media (RQ10).

**Research Approach Phase II**

**Sample.** For the in-depth, semi-structured interviews (Specific Aim 3), I recruited a purposive sample of 11 stakeholders who were actively involved in managing and/or responding to the disaster from a public health perspective. I used snowball sampling, which is a sampling strategy that yields a study sample through referrals made by people who know others who might be willing to participate in the study (Biernacki & Waldorf, 1981). Two public health officials served as "informants" to identify others who qualified for inclusion in the study (Bailey, 1994). Then participants during that stage were interviewed and asked to identify additional people who might be interested in participating in the study.

Selecting stakeholders from different sectors (e.g., government, community) and fields (e.g., public health, environmental protection), my recruitment goal was 10 to 12 participants, which was based on saturation and sufficiency as well as on practical considerations related to time and cost. Saturation is often conceived as the gold standard by which samples are determined in the health sciences (Guest et al., 2006). Saturation is defined as the "point at which no new information or themes is observed in the data"

(Guest, Bunce, & Johnson, 2006, p. 59). As researchers observe similar themes again and again, they gain empirical confidence that a particular category is saturated (Glaser & Strauss, 1967). Sufficiency, which refers to having a broad enough frame to reflect the population of interest fairly, is also often used to determine sample size (Seidman, 2006).

The final participant sample included two state government officials; two local government officials; one medical doctor who led an emergency response organization; one environmental scientist who specialized in water safety; and five leaders of local nonprofits and citizen-action groups focused on health, safety, and the environment.

**Recruitment.** Dr. Rahul Gupta, who was recently appointed as Commissioner of the West Virginia Department of Health and Human Resources' Bureau for Public Health and served as the executive director of the Kanawha-Charleston Health Department at the time of the Elk River chemical spill, worked with me to identify key stakeholders to invite to participate in the study. Nasandra Wright, environmental health director of the Kanawha-Charleston Health Department, also assisted with recruitment, sending an initial email invite to stakeholders regarding participation in the study. I followed up with invitees by email and phone upon receiving referrals from Dr. Gupta and Ms. Wright. At the end of each stakeholder interview, I also asked participants if they were interested in recommending others to join the study as part of the snowball sampling strategy used in this study (Biernacki & Waldorf, 1981).

**Setting.** The Elk River chemical spill occurred in West Virginia, a state that ranks 44th in overall health outcomes (America's Health Rankings, 2014) and ranks among the states with the highest cancer incidence and cancer death rates in the nation (CDC, 2011). The spill affected communities in nine West Virginia counties: Boone, Cabell, Clay,

Jackson, Kanawha, Lincoln, Logan, Putnam, and Roane (Office of the Governor, 2014b). Focusing on this nine-county area, I conducted interviews with community, nonprofit, and governmental stakeholders who played active roles in responding to the disaster. Seven of the 11 interviews were conducted in person, with five taking place at the Kanawha-Charleston Health Department in a private conference room and the other two taking place at the private offices of stakeholders. The final four interviews took place over the telephone.

**Interview Questions and Topics.** The interview topics and questions reflected in the interview guide (see Appendix B) addressed the research questions related to Specific Aim 3, which focused on stakeholders' recollection and perceptions of media coverage of the spill. To help build rapport with participants, I began by asking a general question (Question 1) about what they recalled about the days following the discovery of the chemical leak. I then asked more specific questions related to media use and coverage. Questions 2–9 focused on stakeholders' views on the role media played during and after the incident (RQ11). Questions 10–11 focused on media coverage of causes of and solutions to problems related to the spill (RQ12), and questions 12–13 asked about how health risks related to the spill were communicated by news and social media (RQ13). To ensure I covered key topics, question 14 asked if participants had any information to add that may be relevant to the discussion.

**Data collection.** I used an open-ended, semi-structured interview approach for this study. A semi-structured interview approach was chosen to achieve consistency among the topics covered during each interview (Corbin & Strauss, 2015). Interviews ranged in length between 25 and 61 minutes, with interviews lasting an average of 36

minutes. Seven of the 11 interviews took place in Charleston, West Virginia, over a two-day span. Due to logistical challenges related to travelling from my home in Kentucky to the 9-country region in West Virginia, the final 4 interviews were conducted over the telephone. Telephone interviews are a common and accepted way to collect qualitative data (Berg, 2001). A common reason for choosing to conduct telephone interviews instead of in-person interviews relates to geographic challenges that make it difficult for interviewers to conduct in-person interview (Berg, 2001). Although ideally all interviews would have been conducted in person, previous research has revealed that there are not significant differences in interviews conducted in-person as compared to those conducted over the phone (Sturges and Hanrahan, 2004).

Prior to the start of each in-person interview, participants were asked to read a letter of consent (Appendix C). For the telephone interviews, I emailed the letter of consent to participants prior to the interview date. I answered any questions participants had about the study before beginning the interviews, which were audio recorded. Audio files collected from the telephone and in-person interviews were transcribed verbatim by a professional transcription service. To protect participant confidentiality, all identifying information was removed from transcripts prior to analysis. Data were saved on a protected computer and all files were deleted from the audio recorder.

**Data analysis.** I used QSR NVivo 10, a qualitative software program, to organize and manage data. Findings from Phase I (i.e., the content analysis) informed the codes used to identify descriptive themes in interview data, allowing me to identify an initial set of codes a priori in the creation of a preliminary codebook. Initial codes were also based on the study's research questions. Thus, I began with a provisional coding approach,

which is appropriate for qualitative studies that build on other research or when researchers already know what they want to study (Creswell, 2007; Miles, Huberman & Saldana, 2014; Saldana, 2012). Saldana (2012) stressed that researchers must exercise caution with this coding approach, as sometimes when a researcher goes looking for something specific, they find it. To help guard against that, I viewed pre-established categories as flexible, refining them as needed so that the categories fit the data, not vice versa.

To increase the level of objectivity achieved in the coding process, my dissertation chair assisted with checking the clarity of categories once an initial coding of one of the transcripts is complete. My chair independently coded the transcript using the coding categories I identified based on data from the same transcript and also made recommendations for additional codes. I then checked to see to what extent we coded the transcripts similarly according to coding categories and subcategories. Based on that process, I modified codes, which continued to evolve throughout the data analysis. After the codebook was finalized, NVivo was used to facilitate an axial coding process through which I identified thematic relationships among categories and subcategories (Strauss & Corbin, 1998). Selective coding was used to integrate and synthesize categories derived from the analysis in the development of core categories (Corbin & Strauss, 1998). I then compared themes from the qualitative data with results of the content analysis to identify similarities and differences between stakeholders' recollections and perceptions of coverage and actual coverage (Specific Aim 4: RQ14). The University of South Carolina's Institutional Review Board (IRB) approved the study.

# CHAPTER 4

## Results

### 4.1 Manuscript 1

### Framing the 2014 West Virginia Elk River Chemical Spill: A Mixed-Methods Study Examining Media Coverage of a Public Health Disaster[1]

[1] Thomas, T, Friedman, DB, Tanner, A, Brandt, HM, & Spencer, SM. Article Status – Submitted to *Science Communication.*

**Abstract**

This study examined how news media framed West Virginia's 2014 Elk River Chemical Spill, an industrial disaster that began a national discussion about chemical safety. A content analysis of media in conjunction with in-depth stakeholder interviews was conducted to explore how audiences interpreted and evaluated disaster coverage. Both content analysis and interview findings highlighted media's reliance on the attribution of responsibility frame, which dominated overall media coverage, although the dominance of particular frames differed according to media channel and time period. Results suggest that media played an important role in the passage of the state's Aboveground Storage Tank Act.

## Introduction

During a disaster, the media are primary transmitters of crisis and risk communication (CDC, 2014a; Glik, 2007). In addition to providing the public with the information they need to take self-protective action, the media influence how people and communities respond to disasters (Clayton, Koehn, & Grover, 2013). One way the media do this is by helping individuals determine how much importance to attach to an event and to the issues that it raises, potentially affecting public agendas and disaster policies (Barnes et al., 2008; Birkland, 1997, 2006).

Through framing, the media also influence the public's understanding of causes and solutions related to an issue or problem (de Vries, 2004; Entman, 1993; Liu, 2009; Seeger, Sellnow, & Ulmer, 2003). A particularly important function of the framing process is to identify systematic faults such as failed or absent policies (De Vries, 2004), which may help determine solutions and identify the parties with the power to act on

those solutions. As a result, the identification of causes plays a critical role in setting policy agendas (Baumgartner & Jones, 1993; Birkland, 1997).

Through an examination of media coverage of disasters, Birkland (1997) developed a theory based on *focusing events*, "sudden, unpredictable events," such as disasters that influence the social policy-making process by helping to clarify and narrow policy options (p. 1). Although not all focusing events lead to true policy change, Birkland (2006) suggested that it is likely that they increase awareness of disaster-related issues within the policy-making system. By changing the public's perception about the likelihood that certain events could occur, disasters may highlight the inadequacy of current policies and the need for policy change (Birkland, 2006). Birkland & Lawrence (2009) suggested that as a result, both *social policy learning* and *instrumental policy learning* occur. While social policy learning involves acquiring new information about problems, their causes, and their potential solutions, instrumental policy learning concerns "learning whether and to what extent existing policy instruments—laws, regulations, norms, standard operating procedures—successfully achieve their goals" (p. 1421). Although Birkland and Lawrence (2009) focused primarily on agenda setting, framing also appears to play a role in the policy learning process, especially pertaining to how people identify and evaluate current and proposed policies.

The current study viewed West Virginia's Elk River Chemical Spill as a focusing event, as it raised several important policy-related questions at the state and federal level. The incident occurred on January 9, 2014, when 10,000 gallons of the coal-processing chemical 4-methylcyclohexanemethanol (MCHM) escaped from a ruptured storage tank at Freedom Industries and spilled into the Elk River (Board, 2014; West Virginia

Department of Health & Human Resources [WVDHHR], 2014). The spill occurred just 1.5 miles upstream from the state's largest water intake, resulting in a do-not-use order for 300,000 residents that lasted up to 10 days (Osnos, 2014; WVDHHR, 2014). The incident illuminated the need for more stringent regulation of chemical storage sites and ultimately resulted in the unanimous passage of Senate Bill 373, the Aboveground Storage Tank Act, which required state officials to register and inspect all aboveground storage tanks in the state (West Virginia Department of Environmental Protection, 2015; West Virginia Legislature, 2014).

Given the public's reliance on media during public crises (Glik, 2007), how the media framed the spill potentially influenced the ways in which the public interpreted what caused it and solutions for preventing such events in the future. Understanding how media framed causes of and solutions to the spill is particularly important given the location of the incident in West Virginia's Chemical Valley, a region vulnerable to industrial disasters due to its high concentration of chemical plants (Cantrell, 2004; Parker, 2014; United Press International, 1985). By examining how media framed coverage and how audiences interpreted that coverage, this study explored the role media potentially played in influencing the event's policy-related outcomes. More specifically, the study used a mixed methods approach, combining a content analysis of media coverage and in-depth interviews with stakeholders involved in responding to the spill, to explore connections between actual media coverage and stakeholders' interpretations of coverage. This is an innovative approach to framing research, as framing studies have commonly examined content only (e.g., Barnes et al., 2008; de Vreese, Peter, & Semetko, 2001; McGinty, Webster, Jarlenski, & Barry, 2014; McKeever, 2012; Semetko &

Valkenburg, 2000), focusing on a descriptive frame analysis rather than examining connections between media and audience frames. Less descriptive approaches that include non-content analytical methods are needed to advance framing theory, particularly as it relates to interactions between media and audience frames (Matthes, 2009; Scheufele, 1999). While research on media frames is primarily concerned with how issues are presented and covered by media, research focusing on audience frames focuses on how audiences interpret issues and events (de Vreese et al., 2001). Through the coupling of content analysis and in-depth interviews, this study contributes to the current body of framing literature by broadening our understanding of how audiences process and assess media frames.

**Media Framing of Disasters**

Framing is the most widely used theory in mass communication research (Matthes, 2009; Weaver, 2007). At its most basic level, framing theory suggests that the media can influence how audiences feel about an issue (Scheufele, 1999). Framing research often explores the relationship between policy issues in news coverage and the public's perceptions and opinions regarding those issues (Boydstun & Glazier, 2013; de Vreese & Boomgaarden, 2003; Foster, Tanner, Kim, & Kim, 2014; Iannarino, Veil, & Cotton, 2015; Iyengar, 1991; Iyengar, 1996; Kim, Tanner, Foster, & 2014). Although there is no single definition of framing within the field of media studies, Matthes (2009) discovered through a systematic review of 131 framing studies that Entman's (1993) definition was the most frequently cited. According to Entman (1993), framing is the mechanism by which the media selects certain aspects of a perceived reality and makes them more salient to the receiving audience. Those selected frames "promote a particular

problem definition, causal interpretation, moral evaluation, and/or treatment recommendations" (Entman, 1993, p. 52).

In their coverage of an event, media producers (e.g., reporters, editors) select frames by emphasizing certain aspects of the event and selecting what elements of a story to include and exclude (Birkland, 1997). Birkland and Lawrence (2009) suggested that the framing process and selection of frames is most apparent when an issue or event is controversial. In those situations, various individuals and groups including interest groups, politicians, and journalists often focus in on and sometimes promote particular frames (Andsager, 2000; Birkland & Lawrence, 2009; Pan & Kosicki, 1993; Scheufele & Tewksbury, 2007). Regardless of whether frames are selected intentionally or unintentionally, framing is an essential tool used by media producers to simplify complex issues for mass consumption within limited boundaries of time and space (Scheufele & Tewksbury, 2007).

Research has suggested that certain frames may be more dominant in disaster coverage compared to regular news coverage. The use of particular frames, however, appears to vary by disaster type, stage, and time period (Chyi & McCombs, 2004; Houston et al., 2012; Muschert, 2009). In their examination of news coverage of the most severe U.S. natural disasters occurring between 2000 and 2010, Houston et al. (2012) found that an environmental frame (which captured death and destruction) was the most dominant frame in initial coverage, with the human interest frame becoming the most dominant two months post-event. Further, in the context of a manmade disaster, Kuttschreuter and colleagues (2011) found that disaster coverage of a fireworks facility explosion changed over time, with frames focusing on conflict and responsibility

becoming more dominant during peaks in newspaper coverage. Researchers noting changes in frames over time have attributed this to frame changing (Chyi & McCombs, 2004), a strategy used to keep a story alive through "salience maintenance" (Muschert & Carr, 2006, p. 749). Frame changing, however, may occur more organically, with certain frames becoming more appropriate for specific phases of an event. For example, Adam, Allan and Carter (1999) suggested reframing of issues occurs according to three phases of an event: 1) the normalcy phase, 2) investigation phase, and 3) the restoration phase, with frames changing to align with the current phase. This is just one example of how researchers have defined the stages of disasters and the responding role of media.

Media coverage of disasters also may vary depending on a news organization's values. Through an examination of print media coverage of the West Virginia Buffalo Creek Mine Disaster of 1972, Colistra (2010) discovered that media frames depended on the political leanings of newspapers and, more specifically, between a historically pro-coal, conservative newspaper and a pro-union, progressive newspaper. A content analysis of coverage revealed that the progressive newspaper was more likely than the conservative newspaper to use the conflict/attribution of responsibility frame, which focused on causes of the disaster and who was at fault. Research has also identified differences between national and local media coverage of disasters. In an examination of Hurricane Katrina coverage, Barnes et al. (2008) found that national print media were more likely to advocate for government responses, including policy change, to disaster-related problems when compared to local print media.

Finally, sources also have the power to influence how the media presents causes of and solutions to disaster-related problems. Previous research suggests that sources are

more likely to assign blame than to praise the government, particularly at the federal level (Salwen, 1995), with government sources more likely than other sources to offer government solutions (Priest, Walkers, & Templin, 1991). Although sources do sometimes offer solutions to problems related to disasters, research has found that media coverage is more likely to cover causes (Smith, Cho, Gielen, & Vernick, 2006; Walters & Hornig, 1993). Ewart and McLean (2015) suggested that the media's focus on who is to blame for a disaster ultimately affects their ability to facilitate a conversation about solutions related to the prevention of future disasters.

## Research Purpose and Questions

This two-part study used a mixed methods approach to 1) understand how media framed coverage of the Elk River Chemical Spill and 2) assess stakeholder perceptions of this coverage. For Part I, a content analysis of print, television, and online media stories was conducted. Multiple media were included in the study based on a community emergency response assessment that revealed the top sources for spill-related information were television (85.4%), (40.3%), newspapers (47.4%), and the Internet (36.3%) (CDC, 2014b). The following research questions guided the content analysis:

**RQ1:** What were the dominant frames in media coverage of the spill?

**RQ2:** How did frames change over time? How did they vary by media channel?

**RQ3:** How did media present causes of and solutions to the spill? How did causes and solutions presented by local print media compare to those presented by national print media?

For Part II, researchers conducted in-depth interviews with stakeholders representing diverse groups and organizations (e.g., Kanawha–Charleston Health

Department, West Virginia Department of Environmental Protection, West Virginia Poison Center) who were involved in disaster management and response. The following research questions guided the qualitative analysis:

**RQ4:** What were stakeholders' perceptions of the media's presentation of causes and solutions based on their recollections of disaster coverage?

**RQ5:** What were stakeholders' perceptions of the type of coverage the disaster received from national and local media?

## Method

### Overview

This mixed-methods approach was comprised of a quantitative content analysis of media coverage followed by semi-structured interviews with stakeholders. While content analysis is useful for describing media coverage (Wakefield & Elliot, 2003), this study included a qualitative interview component to help us to understand how audiences interpret and make sense of disaster coverage. Interviews with stakeholders provided an opportunity to learn more about the type of coverage the spill received and their views on the reasons for that type of coverage, potentially helping us to better understand factors influencing the frame-building (how frames emerge) and frame-setting processes (how media shape audiences' interpretations of issues) (de Vreese, 2005; Zhou & Moy, 2007).

### Part I: Content analysis of news coverage

**Sample.** Media coverage of the Elk River Chemical Spill was examined over a 24-day timespan that was conceived in two distinct time periods. Time Period I began on January 9, 2014, when the spill was discovered and West Virginia American Water (WVAW) issued a do-not-use water order, and ended on January 20, 2014, the day the

official state of emergency ended (FEMA, 2014; WVDHHR, 2014). Time Period II was from January 21 to February 1, 2014, 12 days after the official state of emergency had ended. The study's time frame was chosen because the most intensive media coverage of a disaster typically occurs within weeks of an event (Birkland, 1997). To examine a broad representation of media, the study included a purposively selected sample of local and national newspapers, major and cable television networks, and online news sites representing an assortment of liberal, conservative, and moderate media outlets (Pew Research Center, 2014b).

***Print media.*** *The Wall Street Journal* and *The New York Times* were selected as the two national newspapers because they are among the top five circulating daily newspapers in the U.S. (Alliance for Audited Media, 2014). The *Charleston Gazette* and *Charleston Daily Mail* were selected to represent local newspapers because of their proximity to the spill and because they are among the top newspapers circulating daily in West Virginia (Mondo Times, 2015). Newspaper stories were retrieved using *LexisNexis* and *Factiva* databases. Search terms included "West Virginia" in combination with one or more of the following: "Elk River," "water," "Freedom Industries," "chemical spill," "chemical leak," and "MCHM." After excluding articles not explicitly focused on the spill, the sample included 413 stories: *The Wall Street Journal* (*n*=18); *The New York Times* (*n*=13); the *Charleston Gazette* (*n*=221); and the *Charleston Daily Mail* (*n*=161).

***Television news.*** Three broadcast news networks (ABC, CBS, and NBC) and two cable news channels (CNN and Fox News) were selected to provide a broad look at coverage. Using the search terms mentioned above, television news transcripts were retrieved using *LexisNexis* database. After excluding duplicates and transcripts without an

explicit focus on the spill, the search resulted in 172 transcripts: ABC (*n*=15), CBS (*n*=23), NBC (*n*=21), CNN (*n*=109), and Fox News (*n*=4). Due to feasibility issues related to locating and retrieving transcripts from local stations, local television stories were not included in the study.

***Online news.*** HuffingtonPost.com and CNN.com were selected as the online news sources, as they are both listed within the top five most popular online sources according to the top online measurement firms: comScore, Nielsen, and Experian Hitwise (Sasseen, Olmstead, & Mitchell, 2013). Also, in addition to being easily searchable, HuffingtonPost.com and CNN.com represent two different types of online news sites. HuffingtonPost.com is a news aggregator site, retrieving articles from many sources. In contrast, CNN.com is a focused-provider news site, providing news from a limited number of sources. Including each type of online news site was deemed important as Hurley and Tewsbsury (2012) found differences in the types of sources and content that aggregator and focused-provider news sites provided regarding the same issue.

Using the terms from above to conduct a search in *LexisNexis*, 16 stories from CNN.com were retrieved. Although *LexisNexis* provides access to stories published on Huffingtonpost.com, it is difficult to distinguish news stories from blog posts. Because this study was only interested in news stories, as blogs are more commonly categorized as social media (Kaplan & Haenlein, 2010), the search engine provided on Huffingtonpost.com was used to identify articles, as it provided an option to filter search results by news or by blogs. Thirty news stories met the inclusion criteria.

**Measures and reliability.** A codebook was developed based on the research questions of interest and previous research focused on media framing of disasters

(Huckstep, 2009; Kuttschreuter et al., 2011). Two coders analyzed a 10% ($n$=155) stratified sample of stories to establish intercoder reliability. The overall Cohen's kappa statistic for the coding sheet was .72 (range=.57–1.0), indicating "substantial agreement" based on guidelines developed by Landis and Koch (1977).

***Volume and scope.*** Codes were developed to examine general information including media outlet; story date; author; geographic focus (e.g., local and/or national); story type (e.g., news or editorial/opinion); reference to previous industrial disasters in the state; and use of "Chemical Valley," which suggests the story emphasized the environmental and historical context in which the spill occurred ($k$=.88).

***News frames.*** The study employed a deductive approach to deriving generic and issue-based frames (Calderon et al., 2007; Matthes, 2009; McGinty et al., 2014). Generic frames included Semetko and Valkenburg's (2000) five news frames: 1) attribution of responsibility (i.e., implies a particular individual, group, or organization is responsible for the disaster and its consequences); 2) human interest (i.e., presents the human emotional aspect of an event), 3) conflict (i.e., conflicts between individuals, groups, or organizations); 4) economic consequences (i.e., includes information related to the financial consequences of a disaster); and 5) morality frame (i.e., includes reference to religious tenants or moral prescriptions). Semetko and Valkenburg's (2000) 20-item instrument used to identify the five news frames was included in the codebook. Cohen's kappa indicated substantial agreement among frames: attribution of responsibility ($k$=.71); human interest ($k$=.67); conflict ($k$=.69); economic consequences ($k$=.67); and morality ($k$=.60).

***Causes & Solutions.*** The items comprising the attribution of responsibility frame largely captured causes of and solutions to the spill (Semetko & Valkenburg, 2000). For example, one item asked if the story suggested that some level of the government was responsible for the problem (i.e., the spill). Another item asked if the story suggested solutions to the problem (i.e., the spill). As a complement to those items, issue-specific codes were created to capture information related to the particular individuals and groups who were responsible for the accident as well as codes pertaining to government responsibility. Codes were also developed to determine the presence or absence of solutions related to the immediate effects of the spill and to the prevention of similar incidents in the future. Finally, codes were included to identify a governmental "call to action" (Huckstep, 2009). Cohen's kappa was .71 for this category.

***Sources.*** To determine if there were differences in the types of coverage causes and solutions to the spill received, coders examined whether sources (e.g., state government official, nonprofit representative, for-profit representative) were cited in news stories. Cohen's kappa was .72 for this category.

**Data analysis.** Data were analyzed using IBM SPSS Statistics 20 (IBM Corp., 2011). The unit of analysis was an individual news story. Images, graphics, or other visual elements were not included as part of the content analysis. One item from the codebook falling under the attribution responsibility frame ("Does the story suggest the problem requires urgent action?") was omitted from the analysis based on Semetko and Valkenburg's (2000) findings from a principal component analysis that revealed the item did not cluster with other items. To identify the most dominant news frames in coverage, a percentage used score was calculated as a standardized score for each frame.

**Part II: Stakeholder Interviews**

**Sample.** A purposive sample of 11 stakeholders was recruited to participate in the study. Participants were screened to verify that they met inclusion criteria: 1) 18 years of age or older; 2) able to complete the interview in spoken English; and 3) were involved in managing or responding to the chemical spill through the distribution of information or resources during the crisis. The sample included two state government officials; two local government officials; one medical doctor who led an emergency response organization; one environmental scientist who specialized in water safety; and five individuals who led nonprofits and citizen-action groups focused on health, safety, and the environment.

**Recruitment.** A local and state public health official served as informants, identifying an initial group of stakeholders who played an active role in managing or responding to the chemical spill and sending an email invitation to them about participation in the study. Stakeholders interested in participating contacted the primary author for more information and to confirm eligibility. Using a snowball sampling strategy (Biernacki & Wardorf, 1981), those choosing to participate in interviews were asked to recommend others for participation.

**Data collection.** An open-ended, semi-structured interview guide was developed to gather stakeholder recollections of and views on media coverage. Aligning with the major categories included in the content analysis codebook, interview questions covered two broad topic areas: 1) views on the role media played in the days following the discovery of the chemical spill (e.g., What do you recall about the type of local media coverage the spill received? What themes did you observe in national coverage?); and 2) perceptions of media's presentation of causes and solutions related to the spill (e.g., How

did the media explain what caused the spill? How did media portrayals of solutions compare when considering local and national coverage?). A semi-structured approach was selected to ensure consistency among the topics covered during each interview (Corbin & Strauss, 2015).

Seven of the 11 interviews were conducted in person. The final four interviews were conducted over the phone due to geographic challenges, a common reason for conducting telephone interviews (Berg, 2001). Previous research suggests there are not significant differences in interviews conducted in-person as compared to those conducted over the phone (Sturges and Harnrahan, 2004). Interviews, averaging 36 minutes in length, were audio-recorded and transcribed by a professional transcription service.

**Data analysis.** QSR NVivo 10 was used to organize and manage qualitative data. Upon an initial review of transcripts, two researchers worked together to develop and define coding categories, with one researcher then coding all transcripts and conducting the analysis. The data were analyzed using constant-comparative principles, employing open coding followed by an axial coding process through which thematic relationships were identified among categories and subcategories (Glaser & Strauss, 1967; Strauss & Corbin, 1998; Corbin & Strauss, 2015). Selective coding was used as a final step to integrate and synthesize categories derived from the analysis (Corbin & Strauss, 1998).

## Results

### Part I: Content Analysis Findings

A total of 631 stories met the study's inclusion criteria. Stories focused largely on issues at the local level, (*n*=582, 92.2%). The majority were news stories (*n*=529, 83.8%), compared to 102 (16.2%) editorial or opinion stories. Only 26 (4.1%) stories referred to

previous industrial disasters in the state, and only 10 (1.6%) stories used "Chemical Valley" to describe the region in which the incident occurred.

**Dominant news frames.** To determine dominant frames in coverage, editorials were removed from the analysis. Table 4.1 provides the frequencies and percentages for the news framing variables, illustrating that news stories commonly covered how people were affected by the spill as well as solutions to consequences of the spill. Descriptive statistics revealed that the attribution of responsibility frame was the most commonly used news frame in overall coverage ($M$=.31 $SD$=.28), followed by the human interest frame ($M$=.29, $SD$=.29), conflict ($M$=.20, $SD$=.26), economic consequences ($M$=.17, $SD$=.30), and morality frames ($M$=.05, $SD$=.15).

The order of frames, however, changed when looking at the two time periods separately. Table 4.2 reflects differences in the dominance of frames between the two time periods, showing that human interest was the most dominant frame in Time Period I and attribution of responsibility was the most dominant frame in Time Period II. Further, a series of independent t-tests revealed that Time Period I coverage was more likely to include both the human interest frame, $t(371.21)=6.58$, $p$=.0005 and the morality frame $t(461.91)=2.342$, $p$=.02. In contrast, Time Period II was more likely to include the economic consequences frame, $t(254.15)=-3.220$, $p$=.001.

To determine differences in the use of particular news frames across media channels, a Welch's ANOVA was conducted as the homogeneity of variance assumption was not met for conducting a one-way ANOVA. The results showed statistically significant differences in the use of all frames with the exception of the morality frame, which was used minimally in all coverage.

***Attribution of responsibility.*** There was a statistically significant difference between media channels as determined by a Welch's ANOVA $F(2, 113.12)=9.39$, $p = .0005$). A Games-Howell post-hoc test revealed that the attribution of responsibility frame was used significantly more in online coverage than in print coverage (.18, 95% CI (.06 to .30), $p=.001$). Further, television coverage was more likely to use the attribution of responsibility frame when compared to print coverage (.08, 95% CI (.01 to .14), $p=.01$). There were no significant differences between television and online media use of this frame.

***Human interest.*** There was a statistically significant difference in the use of the human interest frame between media channels, Welch's $F(2, 110.04)=23.648$, $p = .0005$). Similar to results for the attribution of responsibility frame, the human interest frame was used more frequently in online coverage than in print coverage (.21, 95% CI (.07 to .35), $p=.002$. Television coverage was also more likely to use this frame than print coverage (.17, 95% CI (.11 to .23), $p=.0005$). There was not a difference between television and online use of this frame.

***Conflict.*** There was a statistically significant difference in the use of the conflict frame between media channels, Welch's $F(2, 115.33)=11.57$, $p = .0005$), with a post-hoc test revealing that this frame was used more in online coverage than in print coverage (.19, 95% CI (.08 to .30), $p=.0005$) and television coverage (.23, 95% CI (.11 to .34), $p=.0005$). There was not a significant difference in the use of this frame between print and television coverage.

***Economic consequences.*** There was also a statistically significant difference in the use of the economic consequences frame between media channels, Welch's $F(2,$

142.03)=18.52, $p$ = .0005). This frame was used more in print coverage than in television (.15, 95% CI (.08 to .2092), $p$=.0005) and online coverage (.14, 95% CI (.06 to .22), $p$=.0005). There was not a significant difference in the use of this frame between online and television coverage.

**Presentation of causes and solutions.** The study examined how media presented causes of the incident and solutions to problems related to the spill. Differences between local and national coverage of causes and solutions were also assessed. Because local television news was not included in the sample, the study compared only local print and national print coverage.

***Causes.*** Of the 529 stories, 200 (37.8%) stories named a specific individual or entity as being responsible for causing the spill. Of those, 196 (98%) blamed Freedom Industries (the company that owned the faulty storage tank) either as solely or partially responsible for causing the spill. The second most commonly named entity, though substantially less frequently, was the West Virginia Department of Environmental Protection ($n$=14, 7%), followed by West Virginia American Water ($n$=9, 4.5%).

In total, 76 (14.4%) stories suggested that some level of government contributed to factors causing the spill. Of the stories suggesting the government was responsible for causing the spill, 61 (80.1%) suggested that the state government was responsible, compared to 22 (29.9%) suggesting that the federal government was responsible and 11 (14.5%) suggesting the local government was responsible. Stories with government sources were significantly more likely to suggest some level of government was responsible for the spill (81.6%) compared to stories without government sources (18.4%), ($\chi^2(1)$=23.0, $p$=.0005). Stories published during Time Period II were also more

likely to hold the government accountable for causing the spill (17.3%) when compared to those published in Time Period I (2.5%), ($\chi^2(1)=8.01$, $p=.005$). Further, a Fisher's Exact test revealed that a higher proportion of national news stories suggested that the government was at least partially responsible for causing the spill ($n=7$, 24.1%) compared to local news stories ($n=21$, 7.4%), $p=.007$.

***Solutions.*** In total, 251 (47.4%) stories covered solutions either to immediate problems resulting from the spill (e.g., water distribution, water testing, cleanup) or to solutions for preventing similar incidents in the future (e.g., policy creation). Of the 209 (38.5%) stories covering immediate solutions, the majority focused on solutions relying on the federal government ($n=97$, 46.4%), followed by the state government ($n=88$, 42.1%), for-profit organizations including Freedom Industries ($n=83$, 39.7%), the local government ($n=51$, 24.4%), non-profit organizations, private citizens ($n=25$, 12.0%), and other groups or entities such as researchers or churches ($n=14$, 6.7%). Stories that cited government sources were more likely to cover immediate solutions (74.5%) compared to stories without government sources (46.7%), ($\chi^2(1)=15.3$, $p=.0005$).

Of the 88 (16.6%) news stories providing coverage of solutions centered on preventing similar incidents in the future, the majority relied on the state government (n=85, 96.6%), followed by the federal government ($n=23$, 26.1%), local government ($n=7$, 1.3%), and for-profit organizations including Freedom Industries ($n=7$, 1.3%). National media stories (83.3%) were more likely than local media stories (17.0%) to cover solutions related to the prevention of future spills that relied on the federal government ($p=.002$). While there were no differences found when comparing the inclusion of immediate solutions between time periods, stories published during Time

Period II were more likely to include solutions focused on preventing future disasters (25.6%) compared to stories published in Time Period I (12.6%), ($\chi^2(1)=13.81$, $p=.0005$). The inclusion of government sources had no effect on the likelihood that the story would include solutions focused on prevention.

***Call to action.*** Of all 529 stories, 82 (15.5%) included a call to action for a government response, with stories published during Time Period II most likely to include a call to action, $\chi^2(1)=7.56$, $p=.006$. Similar to the results regarding solutions to preventing disasters in the future, the majority of stories including a call to action focused on the state government (n=80, 97.6%), followed by the federal ($n=21$, 25.6%) and local ($n=5$, 6.1%) government. A Fisher's Exact test indicated that a higher proportion of national news stories included a call to action focused specifically on the federal government (83.0%) compared to local news stories (13.7%), $p=.001$.

**Part II: Interview Findings**

Eleven interviews were conducted with stakeholders representing government, emergency response, and public health organizations. Eight of the stakeholders were women and three were men, all of whom were involved in responding to the spill. Several themes emerged from the information stakeholders provided during interviews. Major themes are discussed below and include *the blame game*; *root v. surface causes**;*** *national v. local coverage of causes; what solutions?; and policy solutions.*

**The blame game.** When participants were asked how media framed causes of the spill, many participants used the word blame to describe coverage. One participant explained, "There was just a lot of blame in the beginning." Participants commonly stated that Freedom Industries received the most blame, particularly in initial coverage of the

incident. One participant stated: "I think the crisis was really, I think, pretty squarely blamed on Freedom Industries and their leaky tanks."

Although most participants said that media coverage placed blame on Freedom Industries, they also explained that blame was often not centered on just one individual or entity. One participated stated:

> People in the community were pointing the blame at different places, too, and I think the media either influenced that or there was some interplay there. Some people were blaming the water company. Some were blaming the regulators or the political leaders, where it's a combination of all of that.

Many participants said that the media named three entities as being responsible for some aspect of the spill: Freedom Industries, the West Virginia Department of Environmental Protection (WVDEP), and West Virginia American Water (WVAW). A participant explained:

> The blame, that's what I would say in a presentation, that it's really a combination of Freedom [Industries], West Virginia American [Water], the regulatory agencies, and on top of that it's the state leaders that have kind of perpetuated this whole war on coal mentality, that regulations and EPA are evil. It's kind of allowed these industries like Freedom Industries that serve the coal industry to really be let off the hook and turn a blind eye toward them. So there's a lot of blame to go around, and I think that the media covered all those aspects of it.

Participants frequently discussed how coverage of causes changed over time. One participant explained how the media initially focused on Freedom Industries' role in causing the spill but then began questioning who else might have been responsible:

> Immediately following the spill and through local television media it was, 'here are these rogue operators.' I think they did mention that DEP hadn't been onsite, but it was here these guys have had bankruptcies and they've been charged with criminal complaints and they're just bad guys, which was such a small piece of everything. The print journalism did a better job at starting to look at the entirety, like DEP played a large role. The water company, there was some digging – not enough.

Other participants also mentioned that there had been a lack of coverage related to WVAW's role in the disaster. For example, one participant said, "But the water company is a story, in my mind, that's yet to be broken." Similarly, another participant said:

> In the rush of everything that happened, I don't think anyone was really looking at West Virginia American Water's part. It was, like, that's a long story, you know what I mean, and no one had really been looking at it.

**Coverage of root v. surface causes.** When discussing news coverage of what caused the spill, many participants expressed criticism. Reflecting upon coverage of causes, one participant said, "The media likes to make assumptions about things, and it's kind of hard sometimes to report in a 30 second sound bite a very complex issue." Another participant said:

> I don't think they really did a good job of outlining what have we, as a society, done with regulations that allow that to happen. And the yin and yang of, businesses do what they want to do versus public safety. As a public, what have we allowed because we don't want regulation? I don't think there was a lot of looking at that piece.

Although most participants were critical of the media's lack of coverage focusing on the complex economic, environmental, and political issues that led to the spill, many participants acknowledged that particular journalists, reporters, and media outlets provided better coverage of root causes than others. Overall, participants expressed that print media went deeper in coverage of the event. Critical of television coverage, one participant said, "The television stations did not at all look at the backstory. Why had DEP not been down there? What about this culture of lax regulation that leads to these kind of things?"

Similarly, another participant stated, "It seemed like they were relying a lot on official word. There wasn't a lot of investigative journalism going on, except for at the papers. The papers were doing a better job." When praising stories done by the print media, nearly every participant referred to the investigative work done by a particular journalist, Ken Ward, at the *Charleston Gazette*. One participant said:

> When I look at Ken Ward's work, he digs deep into the systemic issues and the causes and the history, more the investigative background stuff. I remember watching the network television news station and it was, I guess, more of the community safety aspect.

**National v. local coverage of causes.** When comparing local and national media coverage, many participants said that national media were more likely to cover systematic issues related to the spill. One participant said, "The national media – in my view – probably focused more on the this is what happens in a state that's controlled by the agencies that it's supposed to regulate." Similarly, another participant said, "National media, some of them did a better job on the root causes."

Participants often provided specific examples of articles, media outlets, or reporters when discussing coverage. One participant, who also thought the national media had covered systemic issues related to the incident more adequately than the local media had, said:

> *The New Yorker* did a big article, and I thought that was really well done. Evan Osnos spent, I think, two weeks here. He got into the bigger context of what I started off talking about, this anti-regulatory attitude and political corruption, arguably, that has played into this lax enforcement in West Virginia. To provide that context in, I think, the bigger national conversation around the tension between economic development and natural resource development and regulation in environmental protection was playing out in this example.

Other participants agreed that national coverage of the incident helped to fuel a political and social response to the incident. One participant said, "I think the national media helped get a larger response that would not have happened otherwise." Although participants gave credit to national media for helping to heighten the awareness of systematic issues related to the spill, they commonly stated it was local media and local reporters who were there for the long haul. One participant said, "The national media scratched the surface of it, they kind of hit the high points, and they're here for a little while, and they're gone." Similarly, a participant discussing her organization's media strategy said:

> We were trying to figure out, as part of our strategy for wanting meaningful change to come out of this, how do we keep the national media attention? It's hard, depending on what's happening in that news cycle or what else is

happening. I forget, there was a plane that disappeared that took over. But the local stayed with it, and still, a year later, stayed with it.

Participants credited local media's continued coverage with ensuring that change occurred. One participant said, "I think the local media really drove the DEP investigation because they were concerned about the way companies get handled." Many participants speculated that the reason the local media coverage was strong and continued after the initial days of the incident was because journalists were living through the disaster, making the issues they covered more personal. One participant said:

> They were being affected, too. Everybody, all the reporters and their families, were being affected, too. So, it became a personal connection and an interesting personal relationship with the media because they had the same concerns we did, and you felt that. You felt some of the outrageousness of it from the media, too, which was interesting and breaking down those barriers of media versus the audience. It was like we were all in it together.

**What solutions?** When participants were asked about media coverage of solutions, they largely expressed criticism. Summarizing coverage of solutions, one participant simply stated, "Not enough." Participants commonly offered explanations as to why solutions were not covered by media. One participant said with sarcasm:

> That's not news. They're not going to cover that, it's too far away from the incident and you can't create a sensational moment out of that in a 30-second sound bite. Solutions? The media reporting solutions to problems?

Speculating on the role on the reasons why media did not cover solutions, another participants said:

> It's interesting to talk with some of the journalists because I hear their role isn't always to push solutions or to advocate for anything. It's really to lay out the facts and let the people come to their own conclusions.

Although most participants commented on the general lack of solutions presented by the media, multiple participants acknowledged the local media's coverage of solutions, again referring to a particular journalist for his coverage of the incident. Commenting on differences in coverage of solutions, one participant said, "Ken Ward does a lot related to that aspect of it. The national media, I would say again, I don't really remember them getting into any level of detail on that." Another participant said:

> Now there is the local paper – the *Gazette* – here in Charleston has a reporter that follows things in more detail than most and he will be engaged in the cleanup and all of those things. He's reported on that stuff all along but that's the only media outlet that cares or will do that.

**Policy solutions.** When considering how the media presented solutions, many participants mentioned the extensive coverage Senate Bill 373, known locally as the "spill bill," had received from local media (West Virginia Legislator, 2014). Reflecting on that coverage, one participant said, "I think the conversation shifted pretty quickly, as well, to like the legislative session and Senate Bill 373, which got, you know, very strong coverage in both the *Gazette* and the *Daily Mail*, and it was good coverage." Reflecting on the passage of the bill, another participant said, "I think a tremendous amount of progress was made because of the timing of this event, the role of the media, and the fact that the legislature was here."

## Discussion and Conclusion

This is the first study to systematically analyze media coverage of the 2014 Elk River Chemical Spill, providing insight into how media frame human-initiated, industrial disasters and media's role in influencing disaster-related policy outcomes. This is also one of only a few framing studies to conduct a content analysis of media in conjunction with in-depth interviews (also see Jacobson, 2014; Wakefield & Elliot, 2003), exploring the relationship between media and audience frames. Because understanding how media's presentation of information affects how audiences perceive an event, issue, or problem is central to framing theory (Stacks & Salwen, 2014), there is a need for integrated framing approaches such as this that go beyond providing a descriptive account of media frames by examining how audiences interact with those frames (de Vreese, 2005; Matthes, 2009; Scheufele, 1999).

West Virginia's anti-regulation history and economic reliance on the coal and chemical industries made this a particularly interesting disaster to study when focusing on attribution of responsibility, which includes disaster-related causes and solutions (Osnos, 2014; Sararelli et al., 2014). Attribution of responsibility was the most dominant frame in coverage regardless of source, corresponding to stakeholders' recollections of the predominance of blame in coverage. This finding is not surprising since people are motivated to look for explanations when disasters occur, as placing blame on someone or some entity helps the public regain a feeling of control and a belief that future disasters can be prevented (Arceneaux & Stein, 2006). Previous studies have also found that attribution of responsibility is an important and often dominant frame in media coverage (e.g., Arceneaux & Stein, 2006; Ben-Porath & Shaker, 2010; Collistra, 2010; Semetko &

Valkenburg, 2000). Depending on a particular media outlet's organizational values or stylistic approach, however, they may be more or less likely to use the attribution of responsibility frame in coverage (Colistra, 2010; Semetko & Valkenburg, 2000).

When comparing coverage across traditional media channels, this study also found differences in the use of the attribution of responsibility frame as well as other frames. Online coverage was most likely to include the attribution of responsibility frame in coverage, which may relate to the fact that online stories were acquired from national media outlets that are more liberal leaning on the political spectrum (Pew Research Center, 2014a), perhaps making them more likely to place blame on elected officials, question the state's anti-regulation history, and support policy-related solutions. Online media were also more likely to include the human interest and conflict frames, suggesting that this media channel's more frequent use of frames in general may be partially explained by its breadth of coverage compared to other media, particularly television.

Although stakeholders did not frequently discuss online news coverage, they did often speak about the differences between print and television media, noting that print journalists provided more comprehensive coverage of the incident. Differences are likely the result of television news routines, the visual nature of television, and time constraints of televised media (Driedger, 2007; Leask, Hooker, & King, 2010; Tanner, Friedman, Barr, & Koskan, 2008; Tanner, Friedman, Koskan, & Barr, 2009; Tanner, Friedman, & Zheng, 2015; Wanta, 1997). Further demonstrating their media savvy, stakeholders were generally aware of how these aspects of media production influenced journalists' selection of frames using words and phrases such as "sound bites" and "the 24-hour news cycle" when describing factors that likely influenced disaster coverage.

Differences in the use of frames across media channels may also result from variations in the types of stories that each channel typically tells, as content analysis findings indicated that while the attribution of responsibility frame was the most commonly used frame in print coverage, human interest was the most commonly used frame in television coverage. Previous research also focusing on media coverage of an incident of public drinking water contamination found that television was more to likely to include emotional story content themes while newspapers were more likely to provide thorough analysis and commentary (Driedger, 2007). Although stakeholders in this study questioned the quality of television coverage the spill received, the general public still considered it their preferred source as well as the most reliable source for information about the spill (CDC, 2014b), suggesting the this media channel provided the public the type of information they wanted and expected from this channel during the water crisis.

This study found that frames not only differed according to media channel but also according to the time period of coverage, similar to previous research findings demonstrating that disaster frames change over time (Chyi & McCombs, 2004; Houston et al., 2012; Kuttschreuter et al., 2011; Muschert, 2009). Stories published in Time Period I were more likely to include the human interest frame, focusing coverage on how people were coping with the immediate impacts of the spill. In contrast, stories published in Time Period II when the state of emergency was no longer in effect, were more likely to include the economic frame. This was likely because business, community, and personal costs could not be calculated until the do-no-use order was lifted. Another factor that may have increased use of the economic frame, particularly in newspaper coverage, was

Freedom Industries' bankruptcy filing on January 17, 2014 (USBC, 2015), which became a major topic in coverage throughout Time Period II.

Although media coverage of causes and solutions ultimately relates to attribution of responsibility, this study examined causes and solutions separately in order to make comparisons between them, as those who are deemed responsible for causing a disaster are not necessarily those who are considered responsible for solutions related to that particular disaster (Bucher, 1957). Focusing first on coverage of causes, content analysis and interview findings both indicated that media pointed the blame at three entities: Freedom Industries, WVDEP, and WVAW. Although government is commonly the subject of blame when a disaster occurs (Arceneaux & Stein, 2006), Freedom Industries received the large majority of the blame, particularly in initial coverage. Only 14.4% of all media stories suggested that some level of government was at least partially responsible for the spill, with the majority of those stories placing the blame on the state government. Both content analysis and interview findings also suggested that the government's role in causing the spill increased in Time Period II. This was likely associated with increased coverage of solutions relating to the prevention of similar incidents, which relied largely on state-level environmental policies, as building a case for the creation of new policies would involve highlighting inadequacies in current state policies that allowed the spill to occur. The increase in coverage of solutions in Time Period II is consistent with another recent framing study that found policy solutions were most likely to receive coverage two weeks following a crisis than during other time periods (McGinty et al., 2014).

Although stakeholders were generally critical of the media's coverage of solutions, they often praised the substantial coverage Senate Bill 373 received from local media. The timing of the spill on day two of the 2014 legislative session, when lawmakers were meeting in the State Capitol, likely influenced the breadth and depth in coverage the bill received. In turn, by bringing attention to the spill and raising questions about government responsibility, media coverage of the spill appears to have played an important role in the state government's unanimous passage of the Senate Bill 373 two months after the spill occurred.

Through the use of a multi-method, integrated framing approach, this study adds to framing literature by providing insight into how audiences, particularly those paying substantial attention to coverage, interpret and evaluate media frames. The clear parallels between content analysis and interview findings suggest that well-informed stakeholders recalled and perceived media coverage with great accuracy even if they were critical of how media presented disaster-related topics and issues. While this study focused on how a stakeholder audience perceived and assessed media coverage, future research may use qualitative methods in conjunction with content analysis to examine connections between media frames and a general audience's interpretations of those frames, as framing effects may be stronger for stakeholders who are paying closer attention to media coverage of particular issues or events (Scheufele & Tewksbury, 2007).

**Limitations**

This study has several limitations. First, while the newspaper sample included both local and national media stories, the television and online news samples included only national stories. Therefore, it was only possible to compare local and national print

coverage of the incident when looking at news frames. It is recommended that future research explore differences in local and national coverage of disasters, examining print as well as television coverage. Additionally, the content analysis component of this study also included only textual components of media. Because videos and photographs may provide additional information regarding media framing, it is also suggested that future research considers how visual depictions frame coverage of disasters. Finally, although consideration was given to selecting a balance of liberal and conservative media sources, the two online sources included were both more liberal leaning (Pew Research Center, 2014b), which may have influenced coverage, particularly related to causes and solutions to the spill since liberal and conservative opinions on environmental regulations generally differ (Konisky, Milyo, & Richardson, 2008; Pew Research Center, 2014a).

With respect to the qualitative component, conducting interviews immediately following the time period of interest would have been optimal, as that would have ensured that participants' recollections were limited to the initial days of media coverage. An unintentional discovery related to this limitation, however, was learning that even a year after the event occurred participants' recollections of coverage were similar to actual coverage. It is also important to note that the interview findings are not generalizable to media coverage of other disasters (Creswell, 2003); however, generalizability is typically not the goal of qualitative research nor was it the goal of the interview component of this study (Corbin & Strauss, 2015; Creswell, 2003; Maxwell, 2013).

**Conclusion**

This study used an integrated framing approach to not only describe media coverage of the 2014 Elk River Chemical Spill in West Virginia but to also explore

connections between actual media coverage and stakeholders perceptions of that coverage. Results revealed that interview and content analysis findings were largely consistent, suggesting that a well-informed stakeholder audience can accurately recall and identify frames used in media coverage. This demonstrates the powerful and lasting effects media frames have on audiences.

Results also suggested that media played an important role in shaping policy-related outcomes of the spill through the dominant use of the attribution of responsibility frame. Even though media coverage largely placed responsibility on Freedom Industries for causing the spill, coverage of solutions held the state government accountable for responding to the incident and preventing future spills. Due to the emphasis placed on the need for stricter environmental policies, media helped begin a discussion at the state and national level about the need to strengthen the regulation of aboveground storage tanks, influencing the state government to take action through the passage of Senate Bill 373. Unfortunately, one year later, after the media coverage of the incident had diminished and the spotlight on West Virginia had faded, the state scaled back regulations by repealing parts of the Aboveground Storage Tank Act with the passage of Senate Bill 423 (Marra, 2015; Office of the Governor, 2015). This demonstrates a need for public health experts and advocates to keep pressuring elected officials, even when the cameras are off and the reporters go home.

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**Table 4.1:** Inclusion of Framing Variables Frequencies and Percentages (n=529)

| Frame | Frequency | Percentage |
|---|---|---|
| **Human Interest** | | |
| Human Example | 163 | 25.8 |
| Personal Vignettes | 142 | 22.5 |
| Individuals Affected | 387 | 61.3 |
| Private Lives | 97 | 15.4 |
| Visual Information/Metaphors Generate Feelings | 45 | 7.1 |
| **Conflict** | | |
| Disagreement Between Parties | 76 | 12 |
| Parties Criticize Another | 247 | 39.1 |
| Two or More Sides to Problem | 214 | 33.9 |
| Winners and Losers Mentioned | 21 | 3.3 |
| **Attribution of Responsibility** | | |
| Government Can Alleviate Problem | 145 | 23.0 |
| Government Responsible | 108 | 17.1 |
| * *Local* | *19* | *3.0* |
| * *National* | *88* | *13.9* |
| * *Federal* | *28* | *4.4* |
| Solutions to Problem | 325 | 51.5 |
| * *Solutions Relate Immediate Problems* | *221* | *35.0* |
| * *Solutions Relate Future Problems* | *133* | *21.1* |
| Particular Individual/Group is Responsible | 254 | 40.3 |
| Urgent Action Needed | 66 | 10.5 |
| **Economic Consequences** | | |
| Financial Losses or Gains | 153 | 24.2 |
| Cost/Degree of Expenses | 77 | 12.2 |
| Consequences of Particular Course of Action | 90 | 14.3 |
| **Morality** | | |
| Moral Message | 56 | 8.9 |
| Religious Language/Reference to Morality | 16 | 2.5 |
| Social Prescriptions | 48 | 7.6 |

*Indicates variables not included on the original scale (Semetko & Valkenburg, 2000).

**Table 4.2:** News Frame's Standardized Means by Time Period

| | Time Period I (n=365) | | Time Period II (n=164) | |
|---|---|---|---|---|
| Frame | *M* | *SD* | *M* | *SD* |
| Attribution of responsibility | .32 | .29 | .29 | .27 |
| Human Interest | .34 | .30 | .17 | .25 |
| Conflict | .20 | .27 | .22 | .28 |
| Economic consequences | .14 | .27 | .24 | .35 |
| Morality | .06 | .17 | .03 | .11 |

4.2 Manuscript 2

Uncharted Waters: Communicating Health Risks During the 2014 West Virginia Water Crisis[2]

[2] Thomas, T, Friedman, DB, Brandt, HM, Spencer, SM, & Tanner A. Article Status – Submitted to *Journal of Health Communication*.

**Abstract**

This study is among the first to examine how health risks are communicated through traditional and social media during a public health crisis. Using an innovative research approach, the study combined a content analysis with in-depth interviews to examine and understand how stakeholders perceived media coverage after a chemical spill contaminated the drinking water of 300,000 West Virginia residents. A content analysis of print, television, and online media stories and tweets revealed that health risk information was largely absent from crisis coverage. Although traditional media stories were significantly more likely to include health information compared to tweets, public health sources were underutilized in traditional media coverage. Instead, traditional media favored the use of government sources outside the public health field, which stakeholders suggested was problematic due to a public distrust of officials and official information during the crisis. Results also indicated that Twitter was not a common or reliable source for health information but was important in the spread of other types of information. Ultimately, the study highlights a need for more deliberate media coverage of health risks and provides insight into how Twitter is used to spread crisis information.

## Introduction

On January 9, 2014, 10,000 gallons of a chemical mixture leaked from a storage tank at Freedom Industries and spilled into West Virginia's Elk River (Board, 2014; West Virginia Department of Health and Human Resources [WVDHHR], 2014). The spill occurred 1.5 miles upstream from the state's largest water intake, which provides drinking water for 300,000 residents (Roger, 2014). In response, the local water utility issued a do-not-use order, lasting for up to 10 days in some communities (Gerken, 2015).

The long-term health impacts of chemical exposure were unknown, and emergency planners had no plan for responding to the spill (Manuel, 2014). The incident, commonly referred to as the "West Virginia water crisis" (Gerken, 2015), highlighted an immediate need for improved emergency communication (Manuel, 2014). This study examined how health risks were communicated through traditional and social media during the water crisis to identify opportunities for improving health communication during future crises.

During a disaster, the media are primary transmitters of crisis and risk communication (CDC, 2014a; Glik, 2007). Combining elements of crisis and risk communication, Crisis and Emergency Risk Communication (CERC) provides people with the information needed to make the best decisions about their safety and wellbeing within a narrow time frame (CDC, 2014a; Reynolds & Seeger, 2005). Nationwide, public health experts are prioritizing the improvement of CERC during emergencies. One national example is Healthy People 2020's objective to "increase the proportion of crisis and emergency risk messages intended to protect the public's health that demonstrate the use of best practices" (U.S. Department of Health & Human Services [HHS], 2011). This includes news stories that explain known and unknown threats to human health as well as what actions individuals can take to reduce personal health threats. Traditionally, news media's primary role has been to report news, not convey risk and crisis information. Communicating this type of information may lead to journalists working more closely with health experts when covering crisis events, as previous research suggests that journalists rely heavily on expert sources when covering complex health and medical topics (Tanner, 2004; Tanner & Friedman, 2011).

Although traditional media are the primary sources of emergency information,

social media are not far behind (American Red Cross, 2012). With nearly one in five people seeking emergency information on social media (American Red Cross, 2012), emergency managers must know how to integrate these communication tools into emergency response plans. To inform the development of best practices, multiple research teams have examined social media to discover how emergency managers and the public use these tools to communicate during crises (e.g., Chew & Eysenbach, 2010; Freberg, Saling, Vidoloff, & Eosco, 2013; Gurman & Ellenberger, 2015; Kim & Liu, 2012; Lachlan, Spence, & Lin, 2014; Liu & Kim, 2011; Sutton, League, Sellow, & Sellow, 2015; Spence, Lachlan, Lin, & del Greco, 2015). This study explores the use of social media to communicate health information during a crisis during which one in three households relied on social media as a source of crisis-related information (CDC, 2014b). This study also considers social media's role in spreading mobilizing information, which may cue audiences to take particular actions (Lemert, 1981). Although previous research suggests that traditional media have a limited capacity to transmit mobilizing information due to journalistic norms of objectivity (Hoffman, 2006; Tanner, Friedman, Koskan & Barr, 2009), social media, which do not share these same norms, may serve as important tools for activism by encouraging people to engage in civic and political activities (Valenzuela, 2013).

## Research Purpose and Objectives

This two-phase study explored how media communicated health risks in crisis coverage and how health risks can be better communicated in the future. More specifically, the study had three objectives: 1) to examine how news media communicated health risk information in crisis coverage; 2) to explore the role Twitter

played in the spread of crisis-related information; and 3) to understand how stakeholders' assessed media's role in the communication of health risks.

## Methods

Phase I included a content analysis of news media coverage and tweets focusing on the spill, followed by Phase II, which consisted of in-depth interviews with stakeholders involved in responding to the crisis. This approach allowed researchers to identify the types of information included in—as well as omitted from—media coverage and understand how stakeholders viewed and assessed opportunities for improving coverage.

### Phase I: Content Analysis of News Media Stories and Tweets

**Sample.** Print, television, and online media coverage of the spill was examined. Specifically, the news content utilized for this analysis was published between January 9, 2014, when the spill was discovered and the do-not-use order went into effect, and February 1, 2014, 12 days after the official state of emergency had ended, for a total of 24 days (FEMA, 2014). The sample included 1,505 stories and tweets.

***Print media.*** *The Wall Street Journal* and *The New York Times* were selected as the national newspapers because they are among the top circulating U.S. newspapers (Pew Research Center, 2014). *Charleston Gazette* and *Charleston Daily Mail* were included as the local newspapers due to their proximity to the spill and high circulation rates compared to other state newspapers (ANR, 2011). Newspaper stories were retrieved using *LexisNexis* and *Factiva* databases. Search terms included "West Virginia" in combination with one or more of the following: "Elk River," "water," "Freedom Industries," "chemical spill," "chemical leak," and "MCHM." After excluding articles

that did not focus on the spill, the sample included 413 stories: *The Wall Street Journal* (*n*=18); *The New York Times* (*n*=13); the *Charleston Gazette* (*n*=221); and the *Charleston Daily Mail* (*n*=161).

***Television news.*** The sample included transcripts from three broadcast news networks (ABC, CBS, and NBC) and two cable news channels (CNN and Fox News). Using the search terms above, transcripts were retrieved using *LexisNexis*. After excluding unrelated transcripts, the sample included 172 transcripts: ABC (*n*=15), CBS (*n*=23), NBC (*n*=21), CNN (*n*=109), and Fox News (*n*=4). Due to feasibility challenges, local television stories were not included in the study. This approach is common in media content analyses using television news content (Foster, Tanner, Kim, & Kim, 2014; Kim, Tanner, Foster, & Kim, 2014).

***Online news.*** Ranked among the most popular online sources, HuffingtonPost.com and CNN.com were selected for the study (Sasseen, Olmstead, & Mitchell, 2013). Also, in addition to being easily searchable, HuffingtonPost.com, a news aggregator site, and CNN.com, a focused-provider news site, represented two different types of online news sites. The inclusion of both types is important, as previous research found that news aggregator and focused-provider news sites included different types of sources and content when covering the same issue (Hurley & Tewsbury, 2012). Using search terms above, 16 CNN.com stories were retrieved from *LexisNexis*. The HuffingtonPost.com search was conducted using the site's search engine, which provided an option to filter results by news or blogs. Only news stories were included in the sample since blogs are more closely related to social media (Kaplan & Haenlein, 2010). Thirty stories met inclusion criteria.

***Twitter.*** Twitter was selected as the social platform since it is publicly searchable and previous research found that it is the leading (in terms of volume) and most effective (in terms of crisis content) social media platform used during disasters (Freberg et al., 2013; Sung & Hwang, 2014). Only tweets including #wvwatercrisis were included in the analysis, a sampling strategy used by other researchers examining tweets in a crisis setting (Genes, Chary, & Chason, 2014; Merry, 2013). This hashtag was the most frequently used in crisis-related tweets according to tweetarchivist.com, a service that allows users to search for tweets by hashtag, location, or keyword.

Using Twitter's search engine, 3995 tweets were retrieved for the sample. Although previous studies have used a 5% to 10% random sample of tweets when analyzing tweets in a crisis context (Binder, 2012; Mollema et al., 2015; Scanfeld, Scanfeld, & Larson, 2009), this study included a 20% random sample of tweets (n=800) in the analysis to ensure a sufficient sample size. NCapture, an add-on feature for QSR NVivo 10, was used to save a static file of all tweets containing the hashtag #wvwatercrisis. After excluding two indecipherable tweets, 798 tweets were included in the analysis.

**Measures and reliability.** A codebook was developed based on previous research that examined coverage of health issues and risks (Cohen et al., 2008; Harris et al., 2014). Two coders analyzed a 10% stratified sample of stories to establish intercoder reliability. The overall Cohen's kappa statistic for the coding sheet was 0.7 (range=0.6–1.0), indicating "substantial agreement" based on guidelines developed by Landis and Koch (1977).

***Volume and scope.*** Codes were developed to examine general information including publication date and story type (i.e., news or opinion/editorial) for traditional media. Codes used to examine the scope of tweets were platform specific and included date; user type (e.g., government office, public individual); inclusion of a URL and, if so, type (e.g., link to media outlet, government website); number of retweets; and primary purpose (e.g., announce a meeting, provide health risk information) ($k$=0.8).

***Health risk information.*** Codes were developed to identify the types of health information included in stories and tweets including symptoms (e.g., rash, nausea); preventive information (e.g., not bathing in tap water); treatment information (e.g., calling poison control); and uncertainty of health risks (e.g., long-term health outcomes are unknown) ($k$=0.7).

***Media sources.*** Individuals providing direct or indirect quotes used in news stories were coded according to source type (e.g., public health officials, government officials outside public health, laypersons) ($k$=0.7). Only the first three sources included in a traditional news story were coded.

**Data analysis.** Data were analyzed using IBM SPSS Statistics 20 (IBM Corp., 2011). The unit of analysis was an individual news story. Visual elements were not included in the analysis.

**Phase II: Stakeholder Interviews**

**Sample.** A purposive sample of 11 stakeholders was recruited to participate in interviews. Participants were screened to confirm that they were 1) 18 years of age or older; 2) able to complete the interview in spoken English, and 3) played an active role in responding to the crisis. The sample included two state government officials; two local

government officials; one medical doctor; one environmental scientist; and five leaders of organizations or groups focused on health, safety, and the environment.

**Recruitment.** Local and state public health officials served as informants, identifying an initial group of stakeholders and sending an email invitation about participation in the study. Stakeholders interested in participating contacted the primary author for more information and to ensure eligibility. Using a snowball sampling strategy (Biernacki & Wardorf, 1981), those participating in interviews were asked to recommend others for participation.

**Data collection & analysis.** A semi-structured interview guide was used to help ensure consistency among the topics covered during each interview (Corbin & Strauss, 2015). Questions centered on the ways in which various media communicated health-related information during the water crisis (e.g., What do you recall about how health risks were communicated by the media?) and how health information could be better communicated in future crises (e.g., How do you think health risks and concerns could have been better communicated to the public?).

Seven of the 11 interviews were conducted in person while the remaining four were conducted via phone due to geographic challenges, a common reason for conducting telephone interviews (Berg, 2001). Previous research suggests that there are not significant differences between interviews conducted in-person and those conducted over the phone (Sturges and Harnrahan, 2004). All interviews, averaging 36 minutes, were audio-recorded and professionally transcribed. Upon an initial review of transcripts, two researchers worked together to develop and define coding categories, with one researcher then coding all transcripts and conducting the analysis. QSR NVivo 10 was

used to facilitate an axial coding process through which thematic relationships were identified among categories and subcategories (Strauss & Corbin, 1998).

## Results

### Phase I: Media Coverage

**General information.** After excluding 74 stories and two tweets that did not explicitly relate to the crisis, 1,429 news stories and tweets were included in the analysis, including 631 (44.2%) traditional media stories and 798 (55.8%) tweets. Of the 631 traditional media stories, 529 (83.8%) were news stories and 102 (16.2%) were opinion/editorial stories.

The most frequent Twitter user was an individual without any explicit group affiliation ($n$=508, 63.7%), followed by a media representative ($n$=137, 17.2%), nonprofit organization or representative ($n$=92, 11.5%), government agency or representative ($n$=25, 3.1%), for-profit organization or representative ($n$=13, 1.6%), and other ($n$=23, 2.8%). The most common purpose of tweets was to provide general information about the spill (e.g., where and how the spill occurred, location of water distribution centers) ($n$=400, 50.1%). Table 4.3 includes other common purposes along with sample tweets. Although not always their primary purpose, 71 (8.9%) tweets contained specific mobilizing information such as asking others to sign an electronic petition or contact their state representative.

**Health risk information.** The majority of stories and tweets did not contain health information ($n$=1,164, 81.5%), compared to 265 (18.5%) containing health information. Traditional media stories were significantly more likely to include health information ($n$=203, 32.2%) compared to tweets ($n$= 59, 7.4%), ($\chi^2(1)=144.5$, $p$=.0005).

There were significant differences among traditional media with respect to their likelihood to report health information, ($\chi^2(2)=51.4$, $p=.0005$), with print stories less likely to report health information ($n=95$, 23.0%) than television ($n=85$, 49.4%) or online ($n=26$, 56.5%) stories. Of stories and tweets including health information, the most commonly included type of information related to the uncertainty of health risks and outcomes ($n=117$, 44.2%). Table 4.4 includes types of health information in coverage by media channel.

**Media sources.** Information sources were analyzed for traditional media, as sources were not typically included in tweets. The most commonly cited source was government officials ($n=280$, 44.4%), not including public health officials, which were analyzed separately. Stories typically cited government officials at the state level ($n=213$, 33.8%), followed by officials at the local ($n=64$, 10.1%) and federal ($n=46$, 7.3%) levels. There were statistically significant differences in the frequency of government sources among traditional media ($\chi^2(2)=6.8$, p=.034). Online media stories (n=26, 56.5%) were most likely to include government sources, compared to print (n=190, 44.1%) and television ($n=64$, 37.2%) stories.

Of the 631 traditional news stories, 53 (8.4%) included public health officials or experts as sources. There was a statistically significant difference in the frequency of public health sources among traditional media ($\chi^2(2)=13.8$, p=.001). Online media stories ($n=10$, 21.7%) were most likely to include public health sources, compared to print ($n=35$, 8.1%) and television ($n=8$, 4.7%) stories. Stories that cited public health sources were more likely to include health information than stories without public health sources, ($\chi^2(1)=45.5$, p=.0005). Table 4.5 presents sources by media channel.

***Twitter's role in the dissemination of traditional news.*** The majority of tweets contained a URL (i.e., link) ($n$=531, 66.5%), and of those, 285 (53.7%) provided a link to a media outlet's webpage. Tweets not containing a link were more likely to be retweeted than tweets that did contain a hyperlink, a statistically significant difference of 3.8 ± .7 [mean ± standard error], $t(330.0)=5.8$, $p$=.0005. Similarly, tweets that did not contain a link to a media outlet's webpage were more likely to be retweeted than those that did contain a link to a media outlet's webpage, a statistically significant difference of 3.0 ± .5, $t(375.8)=6.4$, $p$=.0005.

**Phase II: Stakeholder Interviews**

**Breaking the story.** Most participants said social media was their primary source of information about the spill and focused predominantly on social media when discussing the spread of crisis information. Many participants first learned about the spill from social media. While some participants learned from friends' Facebook posts or tweets, others learned from social media posts by organizations involved in the crisis. One participant stated:

> My first exposure to all of the news about it was through social media, and I think pretty much that whole first day was following social media. I follow the water company on Facebook, so I saw that they posted something midday that said that there had been a chemical leaked into the river but it was okay.

Participants frequently gave social media credit for breaking the story, often commenting on the speed at which information spread through social media compared to traditional media channels. One participant said:

> I think probably a lot of people were relying on television coverage actually, and it seemed to me a little behind. The story, as far as I'm concerned, was breaking on social media way before it was breaking in the news.

Reflecting on the importance of social media in the spread of information, another participant said, "I think it was really helpful to keep people apprised of what was going on. I think that if they were on social media, they were finding out things more quickly." In addition to commenting on the speed of information, participants also commonly referred to the ease of gathering information through social media. One participant explained:

> Social media played a huge part because the posting of articles of all types of information that was coming out around the clock. It just made it so easy. Instead of you just sitting there by yourself, trying to look up and read all this information.

**The many roles of social media.** When asked about social media's role in the spread of crisis information, participants commonly said that it played a significant role. One participant said, "I think social media played a huge role. It really helped people to learn the facts, both in terms of spreading – quickly spreading information from the government agencies and the water company." In addition to providing the public with general news and updates, participants commonly mentioned three other roles that social media played during the crisis: 1) connecting people with resources, 2) mobilizing citizens, and 3) public health monitoring. In each of these cases, social media served as a tool to accomplish a specific goal. One participant recalled:

> It also helped connect people to resources that they needed—helped connect people to water. So the West Virginia Clean Water Hub formed basically as a Facebook group to try to help people find a place where they could say 'hey, I need water,' and they could help make sure that the water got there if it wasn't being supplied properly.

Many participants discussed how groups used social media to mobilize residents to take action. When reflecting upon common themes observed in social media, a participant said, "I guess another theme was the legislative session and people sort of self-organizing to contact legislators about Senate Bill 373," a bill that would strengthen the regulation of aboveground storage tanks. Another participant said:

> I think social media helped a lot in terms of the different advocates, in terms of the different NGO groups that were collaborating and trying to advocate for safe drinking water. I think that was one of their primary points of contact and gathering people together.

Participants commenting on the role of social media from a public health perspective frequently discussed using social media to monitor public concerns and misinformation. One participant said:

> We were using social media in the sense of digital surveillance, to utilize that information to respond adequately, in a timely fashion to the event. For example, we would constantly be monitoring what was going on in social media, so we could actually know what some of the needs were in the community, in addition to what we were aware of.

**Official sources of limited information in traditional media.** Participants largely expressed criticism when discussing how traditional media communicated health information. Many participants, however, did not hold journalists or reporters accountable but instead blamed unreliable sources of information. One participant said:

> I don't say the media did a poor job. It was the officials who didn't have the answers. It was amazing, and I think the media was amazed with us of the lack of information there was about this chemical and the health effects.

Public trust was eroded by the conflicting health information officials shared through media. Nearly all participants referred to media reports warning pregnant women not to drink the water, which were issued a few days after the public had been told the water was safe. A participant recalling that incident said:

> The CDC said it was safe, and then two days later they said, 'Well, except for pregnant women.' They had just told the population that it was okay to drink the water and then they come back and say, 'But if you're pregnant you probably shouldn't.'

In their discussions about the public's district of officials, participants frequently referred to a "disconnect" between their lived experience during the spill and reports of safety. One participant explained:

> There was a real disconnect in what people were hearing from their elected officials through the media and what they were experiencing. We were smelling water, nobody wanted to drink it, it didn't feel safe, and yet we were starting to hear, I can't even remember, one part per million or whatever number they made up.

Participants commonly discussed how poor communication of health risks and safety ultimately led to the public's distrust of government officials. One participant stated:

> I think the state government or at least elements in the state government, like Commissioner Tierney and Governor Tomblin, kind of made this mistake of trying to act with more certainty or present more certainty than was really warranted by the amount of information available to them. I think that that also really eroded public trust because, again, it's like how can you tell me that this is safe when it clearly, you know, smells bad?

Participants also described disconnects between officials and the public when referring to individuals concerned about chemical exposure. For example, speaking of a state public health official, one participant said, "She is infamous for telling people in terms of the complaints about different things, 'Well, it's flu season.'" Several other participants shared similar comments that suggested officials had nonchalantly disregarded reports of symptoms considered related to the spill.

In their discussions about trust, participants frequently stressed the importance of complete transparence when communicating health risks. One participant said, "I think the communication really should've been more honest about what we did and didn't know about the chemical and even if the answer was 'well we really don't know much of anything.'" Most participants mentioned that there was one trusted official – Dr. Rahul Gupta, the Executive Director of the Kanawha Charleston Health department. Referring to him, one participant said, "Doctor Gupta kind of emerged as the most trusted public official during the water crisis and most of what he was saying was 'we don't know.'"

**Unreliable information and the rumor mill on social media.** Although participants were mostly positive in their responses to social media's role in spreading crisis information, many participants discussed challenges of communicating health information through social media. Reflecting upon the communication of health risks, one participant said, "I don't remember anything on social media that seemed reliable. So yeah, and then I also remember some various rumors running wild on Facebook about different possible health impacts but none of that was very well substantiated." Speaking about the types of information shared online, one participant said:

> In the very beginning people suddenly became the best researchers in the world. They found the MSDS sheets [Material Safety Data Sheets], and they were communicating the risk because nobody else was providing the information. When in actuality they were providing the wrong information.

Many participants connected their discussion of misinformation on social media to the importance of public health stakeholders using social media to not only monitor but also respond to public conversations. Referring to a colleague, a participant said:

> One of her roles in an event is to monitor media and social media because we need to know what the public's hearing so that we can formulate responses when they call, or get a heads-up on what they're concerned about or what they've heard so that if it's inaccurate, we can address that in a better way.

**Recommendations for the future.** When asked how health risks could be better communicated during future emergencies, participants focused predominantly on social media, stressing that disaster response agencies must include social media in emergency response plans. One participant said, "Social media may be able to play a more active and

better role if most agencies are actively using it. If you have a tool and you're not using a tool, it's not gonna serve the purpose."

Another recurrent theme was the importance of having trained staff to manage social media. One participant said, "If you're large enough, you can afford to have individuals, perhaps separate from traditional media, that are doing nothing but monitoring and surveying digital media–social media." Participants frequently acknowledged that having a social media page and designated staff is not enough, as staff also need to know how to effectively use social media to communicate with the public. One participant stated:

> I think it's very important that when we engage social media as a system, we must be prepared to engage in it bidirectional and understand the importance of social media, in its ability to get your message out, but also, as I said, understanding the needs of the community.

Several participants also emphasized the importance of not waiting until a crisis occurs to begin developing a relationship with the public through social media. One participant said, "I think that the prior relationship piece is very important in order to build that confidence and trust."

## Discussion and Conclusion

This study was among the first to empirically examine how health risks have been communicated through traditional and social media in a crisis setting. It is also one of only a few studies to combine media content analysis with in-depth interviews, offering a comprehensive look at health information in crisis coverage and how stakeholders perceived that coverage. While content analysis was important for describing media

coverage of health information, stakeholder interviews were particularly helpful in identifying strengths and weaknesses in coverage as well as opportunities for improvement. Table 4.6 provides recommendations for future communication based on the integration of content analysis and interview findings.

Findings underscore a need for more deliberate media coverage of health risks, as less than one fifth of stories and tweets included health information. Traditional media were more likely than tweets to include health information, and, unsurprisingly, stories citing public health sources were most likely to include health information. Still, less than 10% of stories included a public health source, perhaps indicating a lack of in-depth health news coverage and certainly highlighting a need for media to work more closely with public health experts. Previous research analyzing traditional media coverage of a crisis event also highlighted a need for journalists to work more closely with public health professionals as sources (Cohen et al., 2008). Since this research found that the public were less trusting of state and federal government officials, media may particularly benefit from working with health experts from local health departments and nongovernmental organizations specializing in emergency response.

Stakeholders' recollections regarding the mixed messages they received from government officials, both from within and from outside public health, suggested poor collaboration and integration among agencies providing information. The confusion caused by mixed and changing messages contributed to an erosion of trust between the public and officials, which was exacerbated by a lack of transparency from officials and perceived absence of empathy for residents expressing health concerns. Interview

findings support prior observations that the principles of and best practices in CERC were not implemented (Manuel, 2014).

Although interview findings suggest that Twitter may not be a reliable source of health information, it played a significant role in the spread of other types of information. Nearly two-thirds of tweets contained an URL, with the majority of those URLs linking audiences to traditional news sources, similar to trends found by other researchers (Binder, 2012; Chew & Eysenbach, 2010; Yi, Choi, & Kim, 2015). Content analysis findings, however, indicated that the inclusion of a URL (i.e., link) did not increase retweets, even when analyzing those specifically directing users to a traditional news source, which is unlike previous research findings (Bhattacharya, Srinivasan, & Polgreen, 2014; Suh, Hong, Pirolli, & Chi, 2010;). This may suggest that individuals were using Twitter to gather and spread types of information that were not distributed through traditional media and may relate to the public's distrust of "official" information. This study also suggests that social media provides residents with a venue to engage in community action, a topic future research should explore in more depth.

A major limitation of this study was including only national television stories. It is likely that local television likely included broader coverage of the disaster including health risk information. Another significant limitation relates to the sampling strategy used for Twitter. Including only tweets containing #wvwatercrisis limited researchers to a relatively small subset of tweets. Because this study and previous research has predominantly focused on Twitter, future research may explore how Facebook is used in crisis settings. Finally, interview findings are not generalizable to media coverage of or social media use during other crisis events (Corbin & Strauss, 2015; Creswell, 2003).

Despite these limitations, this study highlights some of the challenges of communicating during public crises, which are often, by nature, replete with unknowns. One clear way the media can improve their coverage is to seek out public health sources at the earliest stages of the crisis event. Because trust is an essential component of effective crisis and emergency risk communication, public health professionals need to begin building trust before a crisis occurs. They can do this is by increasing their social media presence now. Then when a crisis occurs, they can continue communicating directly with the public through social media as they proactively work with each other as a multiagency team and collaboratively with journalists to disseminate information through traditional media channels.

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**Table 4.3:** Primary Tweet Purpose by Frequency and Percent

| Purpose | Frequency/Percent | Sample Tweet |
|---|---|---|
| Provide general information | 400 (50.1) | "WVSU is a water distribution site today. A water tank is located at parking lot C on campus. Must bring your own containers." |
| Express opinion | 159 (19.9) | "It's time we all stand up and demand better than incompetency & mediocrity in this crisis." |
| Share personal story | 74 (9.3) | "Haven't used my tap water for anything but flushing my toilet and 'flushing' my house in 9 days." |
| Provide health risk information | 71 (8.9) | "11 people seen at hospitals related to #WVWaterCrisis. 544 total since Jan 9. Hospitalizations-stable at 26, all released." |
| Mobilize or organize the public | 51 (6.4) | "Take a second and sign this petition for the people of #wv." |
| Announce meeting or event | 36 (4.5) | "They'll be another town hall Wednesday at The Clay Center, doors open at 4:30 p.m., event starts at 5:30 p.m." |
| Seek advice related to the crisis | 7 (.9) | "Where can I recycle used water bottles?" |
| Total | 798 (100) | |

**Table 4.4.** Frequencies and Percentages of Health Information by Media Channel

| Attribute | Print (n=413) | Online (n=46) | TV (n=172) | Twitter (n=798) | All (n=1429) |
|---|---|---|---|---|---|
| Reference to the uncertainty of health risks | 53 (12.8) | 22 (47.8) | 39 (22.7) | 3 (.4) | 117 (8.2) |
| General stories about community or individual health | 31 (7.5) | 11 (23.9) | 43 (25.0) | 16 (2.0) | 101 (7.1) |
| Preventative information | 19 (4.6) | 6 (13.0) | 26 (15.1) | 48 (6.0) | 99 (6.9) |
| Information about health risks for pregnant women | 31 (7.5) | 6 (13.0) | 21 (12.2) | 8 (1.0) | 66 (4.6) |
| Information about symptoms health risks general populations | 23 (5.6) | 12 (26.1) | 22 (12.8) | 3 (.4) | 60 (4.2) |
| Treatment information | 4 (1.0) | 3 (6.5) | 1 (.6) | 5 (.6) | 13 (.9) |
| Information about health risks for infants and children | 5 (1.2) | 1 (2.2) | 1 (.6) | 1 (.1) | 8 (.6) |

**Table 4.5.** Comparing Frequencies and Percentages of Sources by Media Channel

| Source | Print n=413 | Online n=46 | TV n=172 | All n=631 | Fisher's Exact Test |
|---|---|---|---|---|---|
| Federal Public Health Representative/Office | 5 (1.2) | 1 (2.2) | 1 (.6) | 7 (1.1) | *p*=.426 |
| State Public Health Representative/Office | 16 (3.9) | 8 (17.4) | 2 (1.2) | 26 (4.1) | *p*=.0005* |
| Local Public Health Representative/Office | 17 (4.1) | 2 (4.4) | 5 (2.9) | 24 (3.8) | *p*=.740 |
| Local Government Representative/Office | 42 (10.2) | 2 (4.4) | 20 (11.6) | 64 (10.1) | *p*=.371 |
| State Government Representative/Office | 143 (34.6) | 22 (47.8) | 48 (27.9) | 213 (33.8) | *p*=.034* |
| Federal Government Representative/Office | 31 (7.5) | 8 (17.4) | 7 (4.1) | 46 (7.3) | *p*=.012* |
| FEMA Representative | 2 (.5) | 0 (0) | 0 (0) | 2 (.3) | *p*=1.0 |
| Interest Group/ Representative | 11 (2.7) | 4 (8.7) | 5 (2.9) | 20 (3.2) | *p*=.110 |
| Medical Doctor | 0 (0) | 0 (0) | 1 (.6) | 1 (.2) | *p*=.345 |
| Other Medical Professional | 4 (1.0) | 0 (0) | 0 (0) | 4 (.6) | *p*=.502 |
| Nonprofit Representative | 29 (7.0) | 7 (15.2) | 4 (2.3) | 40 (6.3) | *p*=.003* |
| Private Company Representative | 61 (14.8) | 13 (28.3) | 30 (17.4) | 104 (16.5) | *p*=.070 |
| Academic Researcher | 22 (5.3) | 2 (4.4) | 6 (3.5) | 31 (4.9) | *p*=.513 |
| Layperson | 55 (13.3) | 16 (34.8) | 57 (33.1) | 128 (20.3) | *p*=.0005* |
| Other | 52 (12.6) | 6 (13.0) | 19 (11.0) | 77 (12.2) | *p*=.776 |

*Asterisk indicates significant finding at *p*=.05.

**Table 4.6.** Recommendations for Future Communication Based on Study Findings

| | Media Content | Stakeholder Perceptions | Recommendations |
|---|---|---|---|
| *Health information* | Majority did not contain health-related information. | Critical of health coverage but blamed information sources, not media producers. | Increase health information particularly related to health risks and treatment. |
| | Traditional media significantly more likely than tweets to include health information; television and online media most likely. | Social media not common or reliable source of health information. | Implement best practices in CERC: be first, be right, be credible, express empathy, promote action, show respect (CDC, 2014a). |
| | Uncertainty of health risks most commonly reported health information. | Mixed messages, lack of empathy, and lack of transparency related to safety eroded trust. | Increase organizational use of social media to provide non-crisis health information. |
| *Sources of information* | Government officials most cited sources. | Lack of trusted official sources, particularly at state level. | Increase number of public health sources, particularly nongovernmental health sources, accessed and cited in media stories. |
| | Large majority did not contain public health sources. | | |
| | Stories with public health sources most likely to include health information. | Social media offered official and unofficial sources of information. | Increase unofficial sources (e.g., laypersons) cited in coverage, providing multiple perspectives. |
| *Social media* | Majority of tweets contained a URL, half of which were to a media outlet's webpage. | Social media key role in breaking the story due to ease and speed of accessing information. | Increase organizational social media use during crises and integrate social media into crisis response plans. |
| | An URL did not increase retweet rates. | Mobilized citizens and connected people with resources. | Enhance integration of traditional and social media. |
| | Most common tweet purposes: share general information, an opinion, or personal story. | Used for monitoring public concerns and misinformation. | Designate trained staff to monitor and respond to public health concerns on social media. |

# CHAPTER 5

## Discussion

The overall goal of this research was to identify dominant frames in media coverage of the Elk River chemical spill and understand how stakeholders involved in responding to the crisis perceived coverage. I was particularly interested in examining how media framed causes and solutions given the state's historical economic dependence on the chemical and coal industries and recent experience with industrial accidents (Parker, 2014). I was also interested in understanding how media communicated health risks and what role social media in particular played in the spread of crisis information. This chapter summarizes research findings and highlights study limitations, strengths, and implications for future research.

### Summary of Findings

**Specific aim 1.** To assess media coverage of the 2014 Elk River chemical spill in the days immediately following the incident. Coverage in local and national newspapers, network and cable television news, online news, and social media will be examined.

***RQ1.*** What was the volume and scope of media coverage about the spill?

The media content analysis included 631 traditional media stories and a 20% sample of tweets (n=798) published between January 9 and February 1, 2014. Traditional news media stories and tweets focused predominantly on the spill's local rather than national implications, which is consistent with previous research analyzing disaster media coverage (Houston et al., 2012). Despite the Kanawha River Valley's history of industrial

accidents, only 26 traditional media stories and three tweets referenced a prior accident.

Focusing specifically on Twitter, only 15% of tweets included a photograph or image. The most frequent user was an individual without any explicit group affiliation followed by a representative of a news media outlet, with 4 of 5 tweets posted by one of these user types. Government representatives and representatives of private companies were the least likely users to post tweets containing the #wvwatercrisis, suggesting that they were working with more traditional channels to distribute crisis information. The primary purpose of the majority (50.1%) of tweets was to provide general information about the spill such as how and when it occurred, which communities were affected, and how authorities were addressing the spill, similar to the types of information found on news media. The second most common purpose of tweets was to express a personal opinion about the spill (19.9%) such as criticizing a particular person or group for their response to the spill. Significantly fewer tweets had a primary purpose to share a personal experience or story (9.3%); provide health information (8.9%); mobilize citizens to take a specific social or political action (6.4%); announce a meeting or community forum (4.5%); or ask a question requesting information, instructions, or advice related to the spill (1%).

***RQ2.*** What were the dominant frames in media coverage of the chemical spill and how did these frames change over time?

The exploratory factor analysis (EFA) revealed that the five factors (or frames) explained 81% of the variance when including traditional and social media. The items however, did not group as expected based on previous research by Semetko and Valkenburg (2000). Although the five factors explained less variance (78%) when

including traditional media only, the items were more likely to load on one rather than multiple factors. Results suggest that these five news frames may be more appropriate for analyzing general news rather than disaster coverage. See Table 5.1 for EFA results.

**Table 5.1. Exploratory Factor Analysis Results**

| Frame/Items | Factor Loadings | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| *Attribution of responsibility (α=.54)* | | | | | |
| Government has ability to alleviate problem | .697 | | | | |
| Government responsible for the issues/problem | .743 | | | | |
| Solution to the problem/issue | NA | NA | NA | NA | NA |
| An individual group responsible for issue/problem | NA | NA | NA | NA | NA |
| *Human interest (α=.75)* | | | | | |
| Human example on the issue | | .846 | | | |
| Adjectives or personal vignettes that generate feelings | | .794 | | | |
| Individuals and groups affected by issue/problem | | .749 | | | |
| Personal or private lives of actors | | .861 | | | |
| Visual information that generates feelings | | .710 | | | |
| *Conflict (α=.61)* | | | | | |
| Disagreement between parties | .585 | | | | |
| Parties criticize each other | .747 | | | | |
| Two ore more sides to problem/issue | .709 | | | | |
| Reference to winners and losers | | | | .731 | |
| *Economic (α=.75)* | | | | | |
| Financial losses or gains now or in future | | | .944 | | |
| Cost/degree of expense involved | | | .894 | | |
| Economic consequences of pursuing course of action | | | .807 | | |
| *Morality (α=.55)* | | | | | |
| Moral message | .671 | | | | -.533 |
| Reference to morality, God, other religious tenets | | | | .623 | |
| Social prescriptions about how to behave | .616 | | | | |

When including traditional and social media, attribution of responsibility was the most frequently used frame, followed by human interest, conflict, economic, and morality frames. When traditional media stories and tweets were analyzed separately, the rank order of frames did not change in either case. Previous studies have also found that attribution of responsibility is an important and often dominant frame in news as well as crisis media coverage (An & Gower, 2009; Arceneaux & Stein, 2006; Ben-Porath & Shaker, 2010; Collistra, 2010; Semetko & Valkenburg, 2000).

As expected based on previous research focused on media coverage of crises and disasters (Brunken, 2006; Chyi & McCombs, 2004; Houston et al., 2012; Kuttschreuter et al., 2011; Muschert, 2009), the dominance of particular frames changed according to time period. Coverage during Time Period I, when the state of emergency was in effect, was significantly more likely to use the human interest frame, which was the most frequently used frame in coverage during this time period. In contrast, coverage during Time Period II, the 12 days that followed the state of emergency, most frequently included the attribution of responsibility frame, followed by the economic frame, which was used significantly more in coverage during this time period than during Time Period I. These finding contribute to our understanding of frame changing, suggesting that initial coverage may focus more on how a crisis affects individuals and communities while coverage further out when a sense of normalcy is restored may focus more on who should be held accountable and the economic costs associated with the event. This may be particularly true for coverage of industrial crises that do not result in death or major destruction, as media coverage is dependent on the specific type and nature of a crisis (Houston et al., 2012).

***RQ3.*** How did media present causes and solutions related to the incident and the prevention of similar events?

Media coverage of causes as well as solutions is important because it has the power to influence how the public perceives what causes a disaster and ultimately what actions are needed to ensure they do not occur in the future (Entman, 1993; Van Gorp, 2007). However, this study found that the large majority of stories and tweets did not include a discussion of causes and solutions related to the spill, consistent with previous research examining media disaster coverage (Cohen et al., 2008; Houston et al., 2012). Of all media stories and tweets, 21.6% placed the responsibility for causing the spill on a specific individual or entity, with the large majority of those stories stating that Freedom Industries or Gary Southern, the company's president, was responsible for the spill. Together, only 2.3% stories specifically indicated that West Virginia American Water (WVAW) or the West Virginia Department of Environmental Protection (WVDEP) was at least partially responsible for the spill. When examining government responsibility more broadly, 8.4% of news stories and 1.5% of tweets suggested that some level of government was at least partially responsible for the spill, with the large majority holding the state government responsible followed by the federal government. This would have included stories that referred to lax or absent environmental policies at the state or federal level.

In total, 16.9% of stories and tweets provided solutions related to immediate problems or issues resulting from the spill. Fewer, however, provided solutions related to the prevention of similar accidents, with only 8.6% including a long-term solution. The most notable difference found in coverage of solutions was that immediate solutions

typically relied on federal government action while solutions to preventing future incidents relied on state government action. Differences were also found according to time period, with stories published during Time Period II more likely to include solutions focused on preventing future incidents than those published during Time Period I. Stories published during Time Period II were also more likely to include a call to action directed at the state government. These findings suggest that during the initial days of the crisis, there was a reliance on those outside of the state to address the immediate outcomes of the spill, particularly the lack of drinking water, while an emphasis was placed on the state government's role in protecting residents from future spills after immediate threats appeared to have diminished.

While this study found that solutions concerning prevention relied heavily on state government action, Barnes and colleagues (2008) found that the federal government was most frequently identified as the entity responsible for responding to the disaster in Hurricane Katrina coverage. This dissimilarity in results likely relates to differences in the scale (in terms of number of people affected) and the gravity of the event (in terms of death and destruction) between the two crises, with Hurricane Katrina perceived as warranting a national response.

***RQ4.*** What tone was used in the print media's description of governmental responses to the incident?

The majority of stories were neutral in tone related to the government's disaster preparedness and response, which may relate to traditional journalistic norms and ethics related to objectivity, neutrality, and unbiased reporting (Ward, 2009). The only stories that were more frequently negative in tone were those covering the state government's

disaster preparedness. This finding also was unlike what Barnes and colleagues (2008) discovered in their examination of Hurricane Katrina coverage, as they found that tone was primarily neutral in stories covering local and state government accountability while stories focusing on federal government accountability were primarily negative. This may further suggest that media coverage of disasters with more catastrophic outcomes may be more critical of the federal government's role in causing and responding to the incident compared to disasters with less devastating immediate outcomes.

***RQ5.*** How did media communicate health risks related to the incident?

The large majority of stories and tweets did not contain health information (81.5%), with traditional media stories significantly more likely than tweets to include health information. When focusing on traditional media coverage, print stories were less likely than television or online news stories to contain health information. Of stories and tweets providing health information, the most commonly included type of information related to the uncertainty of health risks and outcomes, followed by general stories about individual or community health, health risks for pregnant women, and health risks for general populations. The least common types of health information included were treatment information, health risks for children, and preventive information. These findings are similar to those of Cohen and colleagues (2008) that also revealed health information (including health risks) were largely absent from media coverage of a public health disaster. Previous research suggests this may relate to journalists' tendency to focus coverage on what is new and known about a disaster rather than on health risks and outcomes, which are often complex and replete with uncertainty (Lowrey et al., 2007).

***RQ6.*** What individuals, groups, or organizations were the commonly cited sources of information included in media coverage?

Sources were analyzed for traditional media only, as sources were rarely included in tweets. The most common source of information was government officials, particularly at the state level, with online news stories being more likely to include government sources compared to print and television new stories. Journalists' reliance on government sources in crisis and disaster coverage is not unusual (Lee & Basnyat, 2013; Walters & Hornig, 1993). During public health crises in particular, the public counts on government sources, particularly those representing federal public health agencies, to provide them with credible and reliable crisis information (Anthony, Sellnow, & Miller, 2013). However, this study found that only 8.4% of news stories included a public health source, with online media relying on public health sources more than other media did. The underutilization of public health sources ultimately appeared to influence the type of coverage health topics received, as stories that included public health sources were significantly more likely to include health information when compared to stories not including these sources. Previous research has also suggested that an underutilization of health sources during a public crisis resulted in a lack of media attention to health issues and concerns (Cohen et al., 2008). Although research has explored how public health experts and journalists can better work together to provide information about health risks during disasters (Lowery et al., 2007), there is still a need for research that offers practical solutions to the challenges that prevent these groups from working together more closely.

***RQ7.*** What role did Twitter play in the spread of online news through transmission and retransmission ("retweets") of messages including hyperlinks?

Similar to previous research findings, the content analysis revealed that the majority of tweets contained a URL and that they most commonly contained a news media website URL (Binder, 2012; Chew & Eysenbach, 2010; Yi, Choi, & Kim, 2015). Tweets containing a URL in general or a news media website URL specifically were significantly less likely to be retweeted than tweets without a URL. Previous research has found the opposite to be true when analyzing retweet rates outside of a crisis context (Bhattacharya et al., 2014; Suh et al., 2010), suggesting that users' retweet behaviors are different during crises than in everyday use.

**Specific aim 2.** To compare coverage of the 2014 Elk River chemical spill across media channels and sources.

***RQ8.*** How did dominant media frames vary by media channel?

Significant differences were found in the use of all frames across media channels. Online media stories were significantly more likely to use the attribution of responsibility, human interest, and conflict frames compared to other media. Further, television news stories were more likely to include these three frames when compared to newspaper stories and tweets. Unlike these results, newspapers were more likely than all other media channels to include the economic consequences frame. When considering the morality frame, the only significant difference in its use among media channels was between newspaper stories and tweets, with newspaper stories most likely to include this frame. The generally low use of all five news frames in tweets likely relates to their 140-charter limit since a clear frame was less apparent in one- to two-sentence statements as

compared to longer media stories that convey significantly more information. This observation may suggest that issue-specific frames are more appropriate than generic news frames in the analysis of tweets. Ultimately, the differences found in the use of frames suggest that crisis coverage is dependent upon media channel and that audiences may prefer some channels to others according to the type of coverage (e.g., human interest stories v. economic recovery stories) they expect to receive from media.

***RQ9.*** How did causes and solutions presented by local print media compare to solutions presented by national print media?

National newspaper stories were significantly more likely to suggest that the government was at least partially responsible for the spill when compared to local newspaper stories. Significant differences were also found in coverage of solutions, with national stories more likely than local stories to present solutions to preventing incidents in the future that relied on the federal government. Similarly, when examining stories that included a call to action, national stories were more likely than local stories to include a call to action focused on the federal government. No other significant differences between national and local print coverage of causes and solutions were found. These findings suggest that national media may be more implicitly concerned with the national implications of the spill since federal level actions would extend beyond West Virginia's borders.

***RQ10.*** How did tone in coverage of the government's response to the incident compare between local print and national print media?

There were no significant differences in tone between national and local print media coverage of government preparedness and response. This suggests that local and

national media were similar in their coverage of the government's preparedness and response. This is unlike previous research studying the use of tone in disaster coverage that found national newspapers were more positive in tone than local newspapers (Brunken, 2006), further demonstrating that media coverage of largely dependent on the specific disaster type and context.

**Specific aim 3.** To understand how community, government, and nonprofit stakeholders view the incident and media coverage of the water crisis.

***RQ11.*** What value do stakeholders see in the role news media and social media played in the spread of information following the incident?

Participants commonly spoke about traditional and social media separately, highlighting the different role each type of media played in the spread of information. In their discussions of traditional media, participants commonly praised local media coverage, particularly newspaper coverage. Many participants stated that local reporters were more invested than national reporters since they were, too, experiencing the consequences of the spill first-hand. Participants also frequently commented that local coverage of the spill was some of the best journalism they had seen done by area journalists. Nearly all participants praised local newspaper journalist Ken Ward for his investigative work with the *Charleston Gazette*, and many participants also commended local news anchor Kallie Cart for her willingness to raise difficult questions.

In general, participants were most critical of national media coverage. Although many participants recognized national media's role in bringing national and even international attention to the spill, participants commonly criticized the media for their short-lived coverage of the event due to a sensationalist news bias. Many participants

were also critical of television coverage, commenting on its lack of depth in coverage and suggesting that television reporters played less of an investigative role than newspaper reporters, with a few exceptions.

It was apparent that participants particularly valued the role social media played throughout the crisis. Nearly all participants stated that they had first learned about the spill through social media from both official and unofficial sources. Many participants also used social media as their primary source of crisis-related information since it was often more timely and more easily accessed than traditional media. Additionally, several participants discussed how their friends and families outside of West Virginia followed the crisis using social media since they did not have access to local media delivered through traditional media channels.

In addition to using social media to stay abreast of the situation, participants commonly referred to three other roles social media played during the crisis: 1) connecting people with resources to help them cope with the effects of the spill; 2) mobilizing citizens by cueing them to participate in political or civic action in response to the crisis; and 3) and providing public health and other emergency responders with a tool for monitoring public conversations about the spill. When participants made recommendations for future crisis communication strategies, they focused particularly on how social could be used for public health monitoring and surveillance. Participants also stressed the importance of including social media in emergency response plans, having trained and dedicated staff to manage social media, and using social to create a bidirectional dialogue with the public. Several of the recommendations participants

offered concerning ways to improve crisis communication aligned with existing best practices in social media and crisis communication (Veil et al., 2011).

***RQ12.*** What are stakeholders' views on the media's presentation of causes and solutions related to the incident based on their recollections of media coverage?

Participants generally focused on newspaper and television coverage in their discussions about causes and solutions related to the spill, frequently comparing newspaper and television coverage and discussing differences in national and local coverage. When focusing on media coverage of causes, most participants used the word blame to describe coverage. Although they agreed that media coverage clearly placed blame on Freedom Industries, most participants stated that WVAW and WVDEP were also at least partially responsible for the spill.

Participants commonly mentioned that the subject of blame or presentation of causes changed over time, with initial coverage focusing mostly on Freedom Industries' role in causing the incident and later coverage touching on WVAW's and WVDEP's connections to the spill. Many participants were critical of media's lack of in-depth into the root causes of the spill, acknowledging that the issue went deeper than blaming a company for a faulty storage tank. They often questioned why media stories had not focused more on the state's lax environmental regulations and the state and federal governments' lack of oversight. Participants agreed that national media were more likely than local media to cover deeper systematic issues related to the spill and that the national media's more comprehensive coverage of causes helped fuel a political response at the state level.

In contrast to the media's coverage of causes, which participants suggested was extensive, solutions were largely absent from coverage according to participants. This is similar to previous research suggesting that media are more likely to cover causes rather than solutions in disaster coverage (Ewart & McLean, 2015; Smith et al., 2006; Walters & Hornig, 1993). Although participants offered different explanations for this gap in coverage, the majority commented that solutions were not covered because they did not incite controversy or were not sensational enough to warrant the 30-second sound bite. When solutions were covered, participants commonly stated that it was in later coverage. They also frequently commented that unlike the presentation of causes, local media were more likely than national media to provide coverage of solutions, particularly those related to Senate Bill 373, which they agreed was the primary solution included in coverage.

***RQ13.*** What are stakeholders' views on the ways in which the media communicated health risks related to the incident based on their recollections of news media coverage?

When participants were asked about the major themes in media coverage, many of them said that issues related to community safety, including health risks, were the most dominant themes in traditional media coverage. Still, participants were largely critical of the way in which health information was communicated through traditional news media, particularly as it related to journalists' reliance on official sources of information including government officials and agencies. Participants viewed media's reliance on official sources as problematic because the public was largely skeptical of official information due to the combination of mixed messages, a perceived disconnection

between reported safety and the lived experiences of those affected, and a lack of transparency in communications, all of which are at odds with best practices in crisis communication (Covello, 2003; Seeger, 2006).

In contrast to traditional media, participants did not consider community safety or health-related information as major themes in crisis-related social media content. Although participants were mostly positive in their responses regarding social media's role in the spread of crisis information, many participants acknowledged the challenges of using social media to communicate health information. They were particularly concerned with the spread of rumors and misinformation pertaining to health via social media, with nearly all participants providing an example of a social media post that included incorrect health information. Based on those observations, participants largely agreed that social media was not a reliable source of health information.

Participants frequently spoke about the challenges of using social media to communicate health information as opportunities, recommending that public health officials and other emergency responders use social media to monitor public conversations to understand widespread concerns and misconceptions about health threats during crises. Many participants talked about their own experience using social media during the crisis as a monitoring tool, tailoring public responses that were relevant to public concerns expressed online. Many participants also discussed the importance of using social media during future crises to communicate health information but acknowledged that doing this effectively would require a trained staff focused specifically on social media (Freberg et al., 2013; Utz et al., 2013). They also recommended that public health organizations and agencies begin developing a

relationship with the public through social before a crisis occurs, working specifically on building trust, as participants stressed that the particular channel of media does not matter if audiences do not trust the sources of information. Consistent with previous research, this research suggests that perceptions of a honesty and openness as well as perceptions of concern and care increase trust and credibility in sources (Peter, Covello, & McCallum, 1997).

**Specific aim 4:** To determine how stakeholders' recollections and perceptions of media coverage compared to dominant frames identified in Aim 1.

***RQ14:*** How did stakeholders' recollections of media coverage differ from the dominant messages and frames found in Specific Aim 1?

Content analysis and stakeholder interview results often complemented each other, offering a deeper understanding of the major frames and themes in coverage. Focusing on scope, the content analysis revealed that there were significantly more crisis-related stories published in local papers than in national papers during the time of interest, which may explain why a common theme in interview data related to stakeholders' perceived view on the fleeting nature of national media coverage, a commonly stated criticism of national coverage of the crisis. When examining media, the content analysis showed that the attribution of responsibility frame was the most dominant frame in overall coverage. Although interview data also suggested that issues related to causal responsibility dominated coverage, particularly early on, it did not indicate that solutions were commonly included in coverage, with the exception of Senate Bill 373. This may be related to the fact that although the content analysis indicated that 47% of news stories covered solutions in general, only 16.6% focused specifically on

solutions to preventing similar incidents in the future. In their discussions of solutions, participants were more focused on long-term solutions to preventing similar incidents, not immediate solutions such where to find drinking water, which would explain why they perceived a lack in coverage of solutions.

Similar to content analysis results that found Freedom Industries was the most commonly named individual or entity as being responsible for the spill, interview data also suggested that media placed the majority of blame on Freedom Industries. Both content analysis and interview data suggested that WVAW's and WVDEP's role in causing the spill received some media coverage but it was considerably less than coverage focusing on Freedom Industries' role. Both types of data also indicated that there was minimal coverage of the local, state, or federal government's role in causing the spill. Content analysis findings suggested that national media were significantly more likely than local media to place blame on the government, similar to stakeholder perceptions that national media were most likely to cover systematic causes including the state's history of lax environmental regulations, which implicitly relates to the government's responsibility in causing the still. Previous research has also suggested that national media may be particularly inclined to stray from journalistic norms of objectivity to assume a privileged position of pointing blame toward government authorities in disaster coverage (Littlefield & Quenette, 2007).

Further, content analysis and interview findings suggested that although coverage focused on the attribution of responsibility, particularly related to who was accountable for the spill, coverage differed according to media channel. News media frames were used infrequently in tweets, suggesting that different types of crisis information were

found on social media than in traditional news coverage. The fact that crisis information on social and traditional media was different is unsurprising given the inherent differences between these media channels, but there were also differences found between traditional media channels. Stakeholders commonly discussed differences in newspaper and television coverage, commenting that newspapers provided more in-depth coverage. Content analysis findings also found differences in coverage between these media channels, with newspaper stories more likely to include the attribution of responsibility frame and television stories more likely to include the human interest frame. These findings are similar to those found by other research focusing on media coverage of a public health crisis that revealed television stories were more to likely to include emotional content themes while newspaper stories were more likely to provide thorough analysis and commentary (Driedger, 2007).

With respect to media coverage of health information, there were also many similarities between content analysis and interview findings, as both suggested that there was a general lack of reliable health information. When examining the presence of specific types of health information (e.g., personal stories about health, information about health risks for pregnant women, information about symptoms associated with chemical exposure), content analysis and interview results suggested that there was a particular lack of information regarding treatment, which would have included providing poison control's phone number or recommendations for contacting a medical professional. Although content analysis findings indicated that the most frequent type of health information related to the uncertainty of health risks, still only 18% of traditional news stories and less than 1% of tweets included a reference to uncertainties or unknowns

surrounding health risks. Similarly, a major theme in interview data was the lack of transparency about what was unknown about short- and long-term health risks in media coverage, which stakeholders suggested related to the media's dependence on public officials who were unwilling to admit what was unknown, ultimately contributing to the public's distrust of government officials and official information. The content analysis also demonstrated a reliance on official sources of information, particularly government agencies and officials outside public health.

**Study Limitations**

When interpreting study results, several limitations should be considered. Foremost, based on the EFA results, the five generic news frames may not provide the best framework for studying dominant frames in disaster coverage. This, however, was not apparent until after conducting the analysis. Additionally, this study was limited by the fact that it included only national television transcripts due to challenges with accessing local transcripts. As a result, this study only compared local and national newspaper coverage of the spill when examining news frames, causes and solutions, and tone. It is recommended that future research explore differences in local and national television coverage of disasters since people generally retrieve crisis information from television news (American Red Cross, 2012). The study also did not include an analysis of visual media components such as videos, photographs, and other graphics. Because visuals such as these may provide additional information regarding media framing, it is also suggested that future research considers how visual depictions frame coverage of the West Virginia water crisis and other similar disasters.

Related to the content analysis phase of this study, another potential limitation relates to the media selected for the sample. Although consideration was given to the balance of liberal and conservative publications, as a whole, the media sample may have still been liberal leaning. This may be particularly true of the two online sources selected for inclusion in the study, CNN.com and HuffingtonPost.com, both of which are left leaning on the political spectrum (Pew, 2014b). This may have influenced content analysis results, particularly those related to causes and solutions related to the spill since liberal and conservative opinions on environmental regulations often differ (Konisky, Milyo, & Richardson, 2008; Pew, 2014a).

Another significant limitation relates to the sampling strategy used for Twitter, which used a commonly used hashtag to build a sample of crisis-related tweets. In an examination of 1.5 million tweets, Yi, Choi, and Kim (2015) found that only 25% of tweets included at least one hashtag. Although #wvwatercrisis was the most popular hashtag used to communicate about the crisis, focusing only on tweets that contained this hashtag resulted in a small subset of tweets that may have been more likely to be posted by more skilled Twitter users. The study's focus on Twitter also limited our understanding of social media's role during crises since this is only one popular platform. When stakeholders discussed social media's role during the crisis, they commonly focused on both Twitter and Facebook, the two most dominant social media platforms (Pew, 2014c). This study and previous research has predominantly focused on Twitter, likely due to research challenges with studying Facebook due to the prevalence of private content. Future studies may explore strategies for conducting research using Facebook

and how Facebook and other popular social media platforms such as Instagram have been used in crisis settings.

With respect to the interview phase of this research, the use of non-random sampling procedures introduces the issue of selection bias and limits the study's generalizability (Creswell, 2003). Generalizability, however, is not typically the goal of qualitative research nor was it the goal of this study (Corbin & Strauss, 2015; Maxwell, 2013). Conducting interviews more than a year following the spill also presented limitations, as participants may have been able to more accurately recall initial media coverage of the event, which was the focus on this study. Given stakeholders' role in ongoing issues related to the spill, their responses may have been influenced by their current personal and political agenda.

The final limitation of this study relates to its time frame, focusing only on the first 24 days of media coverage. Examining media coverage over a longer period of time may have not provided deeper insight into media's communication of health risks, but it may have helped to better understand media's role in influencing policy outcomes. It would have been particularly interesting to compare media coverage of Senate Bill 373, which was passed in 2014 within weeks of the spill, with coverage of Senate Bill 423, which scaled back regulations one year later. Examining how major themes in coverage and media frames shifted over a 12- to 18-month time period may have also provided a deeper understanding of the media's role during the initial crisis stage as compared to in other crisis stages, enhancing our understanding of frame changing in a crisis context.

**Study Strengths & Implications for Future Research**

A key strength of this research was its inclusion of both social and traditional media, making it possible to compare how different media channels communicated health risks. Findings indicated that traditional media channels were more likely than social media to include this type of information. The inclusion of both social and traditional media also highlighted differences in the use of media frames according to media channel, as was demonstrated by the limited use of Semetko and Valkenburg's (2000) five news frames in tweets. Future research may further explore how the use of other generic frames may or may not be useful for examining social media and Twitter specifically.

The inclusion of social media in general was important to the study, as it provided an opportunity to explore a relatively new area of research focused on social media use during crisis situations. Research findings suggested that social media played a particularly important role in the spread of mobilizing information and unofficial information not made available through other media channels. Recently, researchers have explored the role of mobilizing information in online media (Bekkers et al., 2011; Tanner et al., 2009; Valenzuela, 2013); however, there is still a need to better understand social media's role in the spread of mobilizing information in crisis settings. Although this study suggests social media was used to promote political action and organize citizen groups, it did not explore the outcomes of this type of community organizing, an area of research that warrants further investigation. Also related to the spread of information on Twitter, this study found that the inclusion of a URL did not increase the likelihood that a tweet would be retweeted. This is unlike previous research findings suggesting that including a URL increased retweet rates in a non-crisis setting (Bhattacharya et al., 2014;

Suh et al., 2010), suggesting that during crises, users may share different types of information than they do outside of crises. Future research may examine what types of tweets are more commonly retweeted or shared during crises.

Another key strength of this research was the use of a mixed methods approach that combined a media content analysis with in-depth stakeholder interviews. By combining content analysis and non-content analytical approaches, this study provides insight into how audiences process media coverage and interpret media frames and how those processes and interpretations in turn influence how audiences process and interpret crisis events and crisis-related issues. As a result, this study helps to fill a gap in framing literature created by a focus on content analytical approaches that provide descriptive accounts of coverage but that do not examine how audiences interact with those frames (de Vreese, 2005; Matthes, 2009; Scheufele, 1999). This study found that content analysis and interview findings were largely complementary, providing additional support for each research phase's key findings and demonstrating that stakeholders can accurately recall and interpret major themes in media coverage. While this study focused on how a stakeholder audience perceived and assessed media coverage, future research may examine connections between media frames and general audiences' interpretations of those frames, as framing effects may be stronger for stakeholders who are more invested in and are giving closer attention particular issues (Scheufele & Tewskbury, 2007).

A final key strength of this study was its involvement of community partners. This was particularly important since I was working on the project from out of state. Community partners were involved in helping to define the direction of the research and

in the selection of research methods. They also assisted with recruitment and helped me establish credibility within their community, which was invaluable to the success of this project and helped me to recruit high-ranking leaders in both government and nongovernment positions. Although the involvement of community partners was a significant strength of this study, it also presented several challenges, discussed in more detail in the section below.

**Lessons Learned**

Although I learned many lessons throughout the dissertation process, the most significant lessons were those learned as the result of my biggest challenges and may be summarized by the adage: *If it seems too good to be true, it probably is.* This is particularly true of my experience working with NCapture, an QSR NVivo 10 add-on feature. When I heard about this tool and its ability to gather Tweets that include a particularly hashtag and import them into a NVivo as a dataset, I thought that I would be able to analyze thousands of tweets in the same amount of time that it would have taken me to analyze only a few hundred tweets using manual methods. Unfortunately, I learned that users are not able to use NCapture to capture historical tweets due to restrictions enforced by Twitter. Because I was committed to making NCapture work, I looked for a workaround and thought I found one, which involved spending multiple days "favoriting" every tweet that included the hastag #wvwatercrisis using my personal Twitter account. I tested a small sample consisting of 500 "favorited" tweets to see if I was able to capture and save them into an NVivo file, and I was successful. Bingo! Problem solved! Or so I thought. The only problem was that I had about 3,500 more tweets to favorite and then capture using the tool. I knew that would take about five days to complete due to Twitter

restrictions that only allow users to favorite so many tweets a day (a number that Twitter does not share with users). In respond to my excessive "favoriting," I received several disgruntled tweets from fellow Twitter users who did not appreciate me "favoriting" their posts, as they were sometimes receiving multiple notifications a day informing them that I had "favorited" a tweet. Still, I continued, even though I knew I was being a poor Twitter user. Ultimately, Twitter ended up winning after first ghost banning me and then suspending my account (which is still suspended today), which prevented me from ever capturing the nearly 4,000 "favorite" tweets and importing them into an NVivo data file. I was, however, able to capture my search results for #wvwatercrisis in a PDF using NCapture (and a new personal Twitter account). Having a PDF file of the tweets was still helpful, as it provided me with a static file from which to work as I examined every fifth tweet. Although my approach ended up being less efficient than it would have been if had been able to import tweets into NVivo, I still ended up with a similar outcome, and I got to experience what it's like being a rogue Twitter user in the process.

The other aspect of my research that led to important lessons learned related to my work with community partners. Although my partnership with local and state public health officials greatly strengthened my study by informing the direction of my research and helping me to establish credibility within the community, it also presented several challenges. Many of these challenges related to the fact that this research was number one on my list of priorities but was lower on everyone else's list. It was difficult for me to accept this fact, especially when deadlines for sending out invitations were missed, research-related emails and calls were not returned, and initial recruitment numbers were low. I ended up taking a more active role in recruitment than was originally discussed. I

also had to become more flexible in my approach, conducting my final four interviews over the phone after having a lower number of people attend in-person interviews than expected. Ultimately, I learned that community partners will want to help with research focused on their community because they also care about the research but that it is important not to allow them to overcommit, especially during initial conversations before the research has even begun. If it seems like they are volunteering to do too much, they probably are, and it is the researcher's responsibility to make sure everyone's role is manageable. I also think scheduling a series of regular meetings upfront, with specific dates and times, may have worked better than periodically trying to find times to discuss the research with partners. Because I am committed to community-based approaches to research, I am thankful for the experiences I received throughout this process and am grateful for the many community stakeholders who volunteered to help me along the way.

**Conclusion**

The research findings suggest that the media's focus on the attribution of responsibility may have helped drive the policy outcomes of the spill by focusing on the state government's role in causing the spill due to a lack of environmental regulations and highlighting the need for policies to regulate aboveground storage tanks. While initial coverage of the spill focused mostly on the human interest aspect of the spill, coverage following the end of the do-not-use order and state emergency focused more on the attribution of responsibility, providing increased coverage of the government's role in causing the spill and solutions concerning the prevention of future incidents. This suggests that the social policy and instrumental policy learning process occurs after order

is largely restored among the public and those affected begin looking for deeper explanations regarding why the incident occurred and how it could have been prevented (Birkland & Lawrence, 2009).

Research findings also stress the importance of providing timely, accurate, and consistent information about health risks and outcomes, as highlighted by the general lack of health information in media coverage and stakeholders' perceptions regarding the mixed and sometimes conflicting information the public received from officials. Although stakeholders largely did not hold the traditional media accountable for the poor communication of health risks, and instead placed blame on the actual information sources, media still was somewhat responsible since journalists relied overwhelmingly on government sources. This reliance was problematic since stakeholders suggested that the public was distrusting of government officials, particularly at the state and federal levels, and of official information in general. Although government public health officials are generally perceived as credible sources during public health emergencies (Anthony, Sellnow, & Miller, 2013; Freimuth, Musa, Hilyard, Crouse, & Kim, 2014; Pollard, 2003; Tanner & Friedman, 2011), this was not the case during the West Virginia water crisis, possibly because of the chemical and coal industries political connections, which may have made the public suspect of government sources, particularly at the state and federal level, in general. Regardless of the reasons for the public's lack of trust, the research highlights the importance of including diverse information sources from both inside and outside the government. During public health crises, journalists may particularly benefit from working more closely with health experts from local health departments since this and other recent research suggests that local public health officials are perceived as

trusted sources during local public health crises (Freimuth et al., 2014; Pollard, 2003). Public health experts and practitioners would also benefit from working more closely together to coordinate messages to ensure that messages are consistent, as consistency among messages as well as openness regarding what is known and unknown about a crisis event is essential to building trust and confidence (Wray et al., 2008).

Although social media was not considered a common or reliable source for health information, it still served in a prominent and important role during the crisis. First, it served as a way for people to easily obtain the most recent crisis information, both from official and unofficial sources, which was valuable due to a public distrust of official information. It also served an important function by providing users with a venue to exchange information, express opinions, and engage in community organizing activities. Public conversations taking place on social media ultimately informed the work of public health practitioners who assessed public needs, common beliefs, and misperceptions based on what users were sharing with each other on social media. Given the many important roles social media play during crises, social media will continue to provide individuals, groups, and organizations with opportunities to find new ways to use these powerful tools during future crisis events. Social and traditional media will remain complementary forms of communication during crises, as each of them plays a unique and important role in the dissemination of critical information.

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## APPENDIX A

## Coding Sheet

**Content Analysis of 2014 Elk River Chemical Spill Coverage: Coding Sheet**

Coder: 1=Tracey 2=Daniela 3=Graduate Assistant

Today's Date (YYYMMDD):

**What was the volume and scope of media coverage about the chemical spill?**

Media Source:
1=*The New York Times*
2=*The Wall Street Journal*
3=*Charleston Gazette*
4=*Charleston Daily Mail*
5=ABC
6=NBC
7=CBS
8=Fox News
9=CNN
10=Huffingtonpost.com
11=CNN.com
12=Twitter

Title/headline (First five words only and do not include for tweets.):

Story or tweet date, month and day (Use four digit code, e.g., January 9 is 0109.):

Author(s) as indicated by story, transcript, tweet, etc. (e.g., John Jones, Climate Reality):

Related to research topic: 0=unrelated 1=related

Story location if provided (e.g., Charleston):

Story length (total words):

*Code the following if coding newspaper article. Skip section if coding other media source.*

If newspaper, code article type (choose one): 1=News 2=Editorial/Opinion 3=Letter to editor

*Code the following if coding an online story. Skip section if coding other media source.*

If online source, provide URL:

*Code the following if coding tweet. Skip section if coding other media source.*

Provide code for Twitter user type:
a=Nonprofit organization or representative, specify:
b=For-profit organization or representative, specify:
c=Government agency or governmental representative, specify:
d=Media station, outlet, or representative, specify:
e=Public individual not associated with organization, agency, corporation, etc.
f=Other, specify:
g=Unknown

Provide number of retweets (e.g., 15):

Provide number of favorites (e.g., 30):

Provide number hashtags in post (e.g., 3):

List all hashtags included in post:

Does tweet provide information regarding health risks including general preventive information (e.g., do not brush teeth, do not drink water)? (1=yes, 0=no)

Does tweet provide treatment or health management information (e.g., who to call if you have had contact with water)? (1=yes, 0=no)

Does tweet contain mobilizing information (e.g., does tweet provide web link or phone number asking people to take some kind of action)? (1=yes, 0=no)

If YES, Describe the action are they asking people to do (e.g., sign petition, call poisoncontrol, email senator)?

What is the primary purpose of the tweet? (select one)

a) Express an opinion about the spill or issues related to the
b) Provide health risk information related to the spill (including preventive information)
c) Provide general information about the spill
d) Share general personal information situation/information
e) Reports signs and symptoms related to contact with contaminated water
f) Seek or ask for advice related to consequences of the spill
g) Announce upcoming event, meeting, or forum about the spill

h) Mobilize citizens to take action (e.g., sign petition, contact senator, attend meeting, etc.)
e) Miscellaneous/none of the above

Does tweet feature photography? (1=yes, 0=no):

Does tweet include an URL/external link (or multiple URLS)? (1=yes, 0=no)

IF YES, indicate source of URL/link by type (select more than one if applicable):
a=Government agency/department website, specific agency/department
b=Nonprofit organization website, specify organization
c=For-profit company website, specify company
d=Traditional media/news outlet, specify outlet:
e=Video-sharing website (e.g., YouTube, Vine.com)
f=Facebook
g=Photo-sharing website (e.g., Instagram)
h=Independent blog
i=Other
j=Unknown

*The following section applies to all media sources.*

Story refers to region as "Chemical Valley" (1=present, 0=absent):

Story refers to previous industrial accidents in the state (1=present, 0=absent):

Story focuses on implications of the spill at the local or state level (1=yes, 0=no):

Story focuses on implications of the spill at the national level (1=yes, 0=no):

**What were the dominant frames in media coverage of the chemical spill?** Questions based on Semetko & Valkenburg (2000), with the exception of italicized supplemental questions.

*Coder: Identify whether or not (1=present, 0=absent) the following subtopics are mentioned in the story, transcript, or tweet.*

**Attribution of Responsibility**
Does the story suggest that some level of the government has the ability to alleviate the problem? (For example, could federal policies have prevented the incident?)

Does the story suggest that some level of the government is responsible for the incident? (Does story place blame on a particular level of government or governmental office?)

*IF YES…*

*Did story suggest that the LOCAL government was responsible? (1=yes,0=no)*
*Did story suggest that the STATE government was responsible? (1=yes, 0=no)*
*Did story suggest that the FEDERAL government was responsible? (1=yes, 0=no)*

Does the story suggest solutions to the problem? (For example, does it provide suggestions or examples of what can be done to fix the current situation and prevent future incidents from occurring?)

Does the story suggest that an individual, group, or organization is responsible for the incident? (For example, does the article place blame on Freedom Industries, failed policies, or the water company?)

*Does the story place blame on the government, a particular official, a non-profit organization, or for-profit entity? (1=yes, 0=no)*

*IF YES, list the name(s) of the persons, agencies, organizations, etc. that are subject to that blame:*

Does the story suggest the problem requires urgent action? (Does the story suggest that there is an urgent need to address issues and problems related to the problem such as lack of available drinking water?)

**Human Interest**

Does the story provide a human example or "human face" on the issue? (Does the story give an example of at least one person's situation?)

Does the story employ adjectives or personal vignettes that generate feelings of outrage, empathy-caring, sympathy, or compassion? (Does the story include a personal story that sparks readers' emotions?)

Does the story emphasize how individuals and groups are affected by the incident? (Does the story stress how residents have had to adjust behaviors due to what has happened?)

Does the story go into the private or personal lives of the actors? (Does the story include an account of the issues a particular person has faced due to the incident?)

Does the story contain visual information that might generate feelings of outrage, empathy-caring, sympathy, or compassion? (Does the story use descriptions or metaphors to spark emotions?)

**Conflict**

Does the story reflect disagreement between parties, individuals, and/or groups? (Does the story suggest that individuals or groups differ in opinion or have different views regarding the incident?)

Does one party, individual, or group criticize another? (Does a particular group criticize a person such as the head of a for-profit company or state politician in the story?)

Does the story refer to two sides or to more than two sides of the incident or issues related to the incident? (Does the story offer different perspectives on the incident?)

Does the story refer to winners or losers? (Does the story portray a particular person or group coping and responding to the incident better than others?)

**Economic Impact**

Is there mention of financial losses or gains now or in the future? (Does the story make any reference to financials concerns in the present or future?)

Is there a mention of the cost/degree of expenses involved? (Does the story suggest specific dollar amounts that are needed or have been lost due to the incident?)

Is there reference to the economic consequences of pursuing or not pursuing a course of action? (Does the story mention potential costs or financial penalties related to addressing or not addressing issues causes by the spill?)

**Morality**

Does the story contain any moral messages? (Does the story express values or ethical issues such as the right to clean drinking water?)

Does the story make reference to morality, God, or other religious tenets?

Does the story offer specific social prescriptions about how to behave? (Does the story instruct people to act or conduct themselves in a particular way such as remaining cause or checking on neighbors?)

**How did story present solutions related to the incident and the prevention of similar events?** Questions informed by Huckstep (2009).

*The first set of statements relates to immediate solutions related to the spill. The second set refers to solutions as ways to prevent future spills.*

Solutions focusing on immediate affects of the spill (e.g., free water distribution), code 1=present, 0=absent

IF PRESENT, code 1=yes, 0=no…

1) Solutions relying on private citizens:

2) Solutions relying on action by nonprofits:
3) Solutions relying on corporate (for-profit) entities (e.g., West Virginia American Water, Freedom Industries):
4) Solutions relying on local government action (e.g., local policies):
5) Solutions relying on state government action (e.g., state policies):
6) Solutions relying on federal government action (e.g., federal policies):
7) Other:_____

*The following statements focus on solutions to prevent future spills.*

Solutions focusing on future prevention of similar incidents, code 1=present, 0=absent

IF PRESENT, code 1=yes, 0=no…

1) Solutions focusing on the prevention of similar incidents rely on private citizens.
2) Solutions relying on action by nonprofits.
3) Solutions relying on corporate (for-profit) entities (e.g., West Virginia American Water, Freedom Industries).
4) Solutions relying on local government action (e.g., local policies).
5) Solutions relying on state government action (e.g., state policies).
6) Solutions relying on federal government action (e.g., federal policies).
7) Solutions relying on other.
   ***If yes to #7, specify:_____

Does the story contain a call on the government to take a specific action (e.g., public policy) to prevent future incidents? (1=yes, 0=no)

IF YES…

1) Was the **local** government called on? (1=yes, 0=no)
2) Was the **state** government called on? (1=yes, 0=no)
3) Was the **federal** government called on? (1=yes, 0=no)

**What tone (i.e., positive, negative, neutral) was used in media's assessment of governmental response to the incident?** Questions adapted from Brunken (2006) and Kuttschreuter et al. (2011).

*Coders: Code tone using a 3-point ordinal scale: 1=positive, 2=neutral or mixed, 3=negative*

1) The story's portrayal of the **local** government's response to the spill:
2) The story's portrayal of the **state** government's response to the spill:
3) The story's portrayal of the **federal** government's response to the spill:
4) The story's portrayal of the **local** government's preparedness (awareness and attentiveness) to responding to the spill:

5) The story's portrayal of the **state** government's preparedness (awareness and attentiveness) to responding to the spill:
6) The story's portrayal of the **federal** government's preparedness (awareness and attentiveness) to responding to the spill:

*Coders: For following, code using 1=yes, 0=no.*

Story refers to incident (the spill) as an accident:

Story refers to incident (the spill) as a crime:

Story refers to the incident (the spill) as an injustice:

**How did media communicate health risks related to the incident?**

*Coder: Identify whether or not (1=present, 0=absent) the following subtopics are mentioned in the story.*

1) General public health stories (stories about individuals or community affected by symptoms or health risks related to the spill)
2) General information about health risks or symptoms (e.g., rash, nausea, unknown) related to the spill (stories including specific symptoms and discussion of short- or long-term health risks related to spill)
3) Information about health risks or symptoms specifically targeting pregnant women.
4) Information about health risks or symptoms specifically targeting children or infants.
5) Preventative information (e.g., not bathing in water or drinking water or inhaling fumes) in context of presenting illness (stories about ways to prevent health risks related to coming in contact with or drinking water)
6) Treatment information (e.g., who to call, where to go) if water is used or consumed (stories instructing people what to do)
7) Long-term health effects (e.g., examples of long-term medical conditions that may occur a year or more after exposure)
8) Uncertainty related to health risks (story includes reference to unknown health risks or outcomes to exposure)

**What individuals, groups, or organizations were the commonly referenced sources of information included in media coverage (e.g., interest group representatives, public health officials, residents, government officials)?**

*Coder: Identify who is the person/individual who is being indirectly or directly quoted in the story/tweet. An example of an indirect quote is The Director of the American Red Cross said that XYZ… An example of a direct quote is Carol Johnson, Director of the American Red Cross, said, "Do not drink water from…." You may select more than one source but ONLY CODE THE FIRST THREE sources.*

a=Representative of federal level governmental public health agency including Centers for Disease Control and Prevention, National Institutes of Health (NIH)
b=Representative of state health department (e.g., staff member of WVDHHR)
c=Representative of local health department (e.g., staff member of Kanawha Charleston Health Department)
d=Representative of national or local nonprofit organization (e.g., staff member of American Red Cross)
e=Representative of Federal Emergency Management Agency (FEMA)
f=Local politician or government official (e.g., major)
g=State politician or governmental official (e.g., governor)
h=Federal politician or government official (e.g., EPA representative, President Obama)
i=Interest group representative (e.g., member of WV Highlands Conservancy or Earthjustice)
j=Medical doctor
k=Other medical professional (e.g., nurse)
l=Representative of for-profit company (e.g., executive of Freedom Industries or WV American Water)
m=Academic researcher (e.g., environmental scientist, biologist)
n=Layperson (e.g., community resident)
o=Other: _____

*Coder: Identify where the different pieces of information for this story came from (i.e., reference from which the original information was obtained such as from an organization or entity). For example, when looking at the sentence, "American Red Cross tells us that XYZ…," d (a national nonprofit organization) is the information origin. You may select more than one reference but ONLY CODE THE FIRST THREE references.*

a=Federal public health agency or department
b=State public health agency or department
c=Local public health agency or department
d=National or local nonprofit organization
e=Federal Emergency Management Agency (FEMA)
f=Local political or governmental office
g=State political or governmental office (e.g., Governor's Office)
h=Federal political or government office (e.g., President's Office)
i=Interest group
j=Hospital
k=For-profit company (e.g., Freedom Industries)
l=Research/Educational Institution (e.g., WVU)
m=Layperson
n=Secondary reporting/other media outlet (e.g., website, book)
0=Other:_____

## APPENDIX B

### Interview Protocol

**Introduction** (5 minutes)

Hello. Thank you for agreeing to talk with me about the Elk River chemical spill. As you may recall from the letter I sent you, I am a doctoral student in the Department of Health Promotion, Education, and Behavior at the University of South Carolina. My dissertation is focusing on media coverage of the spill, and I just completed the first phase of my research, which involved examining news coverage from newspapers, television news, and online news and tweets posted on Twitter just after the incident occurred.

For the second phase of my research, I am talking with stakeholders such as you who played an active role in the management or response to the incident. I am particularly interested in finding out what your views are on how media covered the incident. What I learn from our discussion today will be used to make recommendations for communications during future disasters.

Your answers are confidential. I will not include your name, organization, or any identifying information that could identify you in any reports or manuscripts I write. I will destroy the notes, audio recordings, and transcripts after I complete the study and publish results.

Is it OK for me to begin recording now?

**Topic 1**

General information

(5 minutes)

1. To begin, please tell me about what you remember about those initial days after the incident.
    a. PROBE: What was your community like?
    b. PROBE: How did you find out about the incident?
    c. PROBE: What were your initial thoughts upon finding out about the spill?

**Topic 2**

The Role of Media

(15 minutes)

Now, I'd like to ask you a few questions about media's role during the incident. The first questions relate specifically to local news coverage.

2. What were the primary sources of local news during the event?
    a. PROBE: What local sources did you access?
    b. PROBE: What local media did you work with to share information?

3. What do you recall about the type of local coverage the spill received?
    a. PROBE: What type of coverage did the incident receive from local television news?
    b. PROBE: What type of coverage did the incident receive from local newspapers?

3. What themes did you observe in local coverage?
    a. PROBE: What types of messages or information were commonly included in local news coverage?

4. What role do you think local media played during the initial days of the incident?
    a. PROBE: What do you think were the priorities of local media during the incident as they related to covering the event?

Now I am going to ask you a few questions about national coverage of the event.

5. What types of national media covered the event?
    a. PROBE: What national sources did you access?
    b. PROBE: What national media did you work with to provide information about the spill?

6. What do you recall about national coverage of the event?
    a. PROBE: What type of national television news coverage did the incident receive?
    b. PROBE: What about national newspaper coverage?
    c. PROBE: What about online news coverage?

7. What themes did you observe in national coverage?
    a. PROBE: What types of messages or information were commonly included in national news coverage?
    b. PROBE: How did themes differ when comparing national to local coverage of the incident?

8. What role do you think national media played during the initial days of the incident?
   a. PROBE: What do you think were the priorities of national media during the incident as they related to covering the event?

The next question is about social media.

9. What role do you think social media played during the incident?
   a. PROBE: How did you or your organization use social media?
   b. PROBE: What types of information did you receive from social media?
   c. PROBE: What types of themes or trends in the types of information were shared?
   d. PROBE: How might have social media played a more significant role?

**Topic 3**

Media Presentation of Causes & Solutions

(10 minutes)

10. How did media explain what caused the spill?
   a. PROBE: What causes were commonly associated with a particular person, group, or entity?
   b. PROBE: How did portrayals related to cause compare when considering local and national media coverage?

11. What types of solutions to the problem or recommendations to prevent future spills were offered by media sources?
   a. PROBE: How did the media portray the government's role?
   b. PROBE: How did the media portray the water company's (i.e., West Virginia American Water) role?
   c. PROBE: How did the media portray Freedom Industries role?
   b. PROBE: How did portrayals related to solutions compare when considering local and national media coverage?

**Topic 4**

Media's Presentation of Health Risks

(10 minutes)

12. What do you recall about how health risks were communicated by media?
   a. PROBE: How did people report on or discuss the unknowns related to long-term health outcomes?
   b. PROBE: What do you recall about how people communicated about unknown health outcomes through social media?
   c. PROBE: How do you think health risks and concerns could have been better communicated to the public?

13. How do you think social media could be used in the future to communicate health risks?
   a. PROBE: What are the potential benefits to using social media?
   b. PROBE: What are the potential challenges?

**Wrap-Up** Those were all of my questions.

(5 minutes) Do you have any final thoughts about media coverage or use in response to the spill?

I also wanted to see if you know of others in the community who might be interested in participating in an interview with me.

Thank you very much for speaking with me.

**APPENDIX C**

**Participant Study Invitation**


May XX, 2015

Dear Participant,

Thank you for expressing interest in the study I am conducting for my dissertation that explores media coverage of the 2014 Elk River chemical spill. I am a doctoral candidate in the Arnold School of Public Health at the University of South Carolina (USC), and the title of my study is *Framing Risk, Responsibility, and Resolution: A Mixed-Methods Study Exploring Traditional and Social Media Coverage of the 2014 Elk River Chemical Spill*. This study focuses on media coverage of the chemical spill and the initial days of the West Virginia water crisis.

You are invited to participate in the interview component of the study because you played an active role in responding to the incident. You are not eligible for this study if you did not live in the region affected by the incident during the month in which it occurred. The information below explains what you will be asked to do if you decide to take part in the study. Please read it carefully and feel free to ask any questions before deciding if you would like to participate in the study.

If you decide to take part in the study, you will be asked to participate in one in-person interview that will last approximately 45 minutes. The interview will take place in a private conference room at the Kanawha-Charleston Health Department and will be audio recorded. Interview questions will cover four general topic areas: 1) general information about the incident; 2) your views on the role of media during and following the incident; 3) your perceptions of media's presentation of causes and solutions related to the chemical spill; and 4) your views on media's presentation of health risks related to the contamination of drinking water. All study activities will take place at a mutually agreed upon time.

Although there are no known risks associated with taking part in this research, you may feel uncomfortable answering some of the questions about your views on media coverage. Overall, you should not suffer any physical or emotional outcome from participating in this study. You may decline to answer any of the questions you do not want to answer and are free to withdraw from the study at any time. Lastly, there is a minimal risk that anonymity can be breached through study records, but we will do everything possible to keep your information protected.

The information you share will be used to make recommendations for communication strategies during disasters and may benefit your community in the event of future environmental disasters. There will be no costs to you taking part in this study (other than for your time), and you will not receive payment for taking part in the interview.

All personal identifying information will be kept strictly confidential and anonymous. A number (code) will be assigned to you at the beginning of the study and will be used on study records rather than your name. No one other than the researchers will be able to link the information you provide with your name or other personal identifying information. The results of the study may be published or presented at professional meetings, but your name and other personal identifying information will not be shared. All digital files will be password projected and stored on a password-protected computer. Any paper records will be kept in a locked filing cabinet.

In rare cases, a research study may be evaluated by an oversight agency such as the USC Institutional Review Board. If that occurs, records identifying you including the consent form may be reviewed in order to determine whether the study was properly carried out and your rights as a participant were protected.

If you have any questions about the study, please feel free to contact me at (859)302-4089 or thoma427@email.sc.edu. You may also contact Dr. Daniela Friedman (my faculty supervisor) at (803)576-5641 or dbfriedman@mailbox.sc.edu. If you have questions about your rights as a research participant, you may contact Lisa Marie Johnson, Institutional Review Board Manager, at the University of South Carolina's Office of Research Compliance at (803)777-7095 or lisaj@mailbox.sc.edu.

The choice to take part in or not to take part in this study is yours. Thank you for your time and consideration.

With kind regards,

Tracey Thomas