

HEALTH POLICY RESPONSES AND NEWS MEDIA COVERAGE OF AN
EMERGING OUTBREAK: THE CASE OF EBOLA

by
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Dissertation Abstract

The Ebola outbreak of 2014-2015 and the resulting media and policy responses provide an important case for studying dreaded communicable diseases and other public health emergencies that will test public health policy development and emergency communication. This research examined public health response policies to the Ebola outbreak as well as media messages about these policies and risks from Ebola. Federal guidance and state policies determining how to manage individuals within the U.S. who may have been exposed to Ebola were systematically identified and analyzed. In addition, the volume of news coverage and content of U.S.-focused news stories about Ebola was analyzed for risk-related messages that were judged to potentially increase or decrease perception of risk and policy-related messages about the Ebola response. Policies on quarantine, movement restrictions, exposure categories, and monitoring varied. A number of states enacted more aggressive policies than were called for in guidance from the Centers for Disease Control and Prevention (CDC). Examination of news coverage showed that the volume of stories about Ebola rapidly increased following diagnosis of the Ebola case in Dallas in September 2014. Furthermore, all policy-related messages studied showed significant increases in frequency after this date, with the exception of messages related to isolation, which showed a significant decrease. Overall, 96% of news stories contained one or more risk-elevating messages, with messages about foreigners or travelers bringing Ebola to the U.S. (72%), those describing the disease causing deaths (66%), and those about a potential U.S. outbreak/people in the U.S. contracting Ebola (35%) appearing most frequently. In addition, 82% of news stories contained at least one or more policy-related message, with those about isolation (47%) and quarantine (40%)

appearing most frequently. Findings provide greater understanding of the interplay between news media coverage of emerging risks and theories on risk perception as well as how the news media covers policies to manage emerging disease threats. This research may help public health practitioners and policymakers anticipate what policies could be implemented in response to future infectious disease threats and to understand and improve the messaging landscape around infectious disease risks and policies.

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Introduction

Problem Statement

New diseases have emerged regularly in the human population for millennia and will continue to emerge for the foreseeable future. This problem will be aggravated as human communities expand and encroach further on natural habitats and come into greater contact with wildlife reservoirs of zoonotic disease.¹ When emerging diseases strike, public health policymakers need to establish policies to respond and potentially control an outbreak. Further, the risks associated with the disease and the potential policy solutions need to be communicated to the public. Success or failure of public health intervention depends on a coordinated public health response and successful communication about the disease and response policies. The Ebola outbreak of 2014-2015 and the resulting media and policy responses provide an important case that can be studied to increase understanding of these issues and gain valuable lessons for improving risk communication and policy response in the future.

The Ebola Outbreak

Ebola Virus Disease is a highly and rapidly fatal disease, which causes fever, fatigue, loss of appetite, vomiting, diarrhea, headache, abdominal pain, and unexplained bleeding.² The Ebola outbreak focused on in this research began in Guinea in late 2013 and rapidly spread through several countries in West Africa, eventually becoming the largest Ebola outbreak on record.^{3,4} As the outbreak expanded, medical intervention from aid

organizations increased, and the likelihood that Americans assisting in fighting the outbreak in West Africa would become exposed and acquire the disease increased as well. In early August 2014, the infection of two American aid workers was confirmed and they were repatriated to the U.S.⁵ In addition, the expanding outbreak also increased the potential for individuals infected with Ebola in West Africa to travel to the U.S. and develop symptoms after their arrival. On September 30, 2014, the previously unknown importation of Ebola was confirmed when a traveler from Liberia was diagnosed with Ebola in Dallas, Texas.⁶

The outbreak and concern about possible spread of Ebola in the U.S. triggered an intense reaction among the American public and policy-makers. Public health policies, some based on scientific knowledge about the disease and grounded in an evidence base more than others, were developed to increase efforts to prevent possible disease spread.⁷ Media coverage also began to focus on the outbreak and public polling showed widespread fear among Americans that they, or someone they knew, would become infected with Ebola.⁸ These events raised questions about the range of policies that were implemented in response to this outbreak and what lessons could be drawn from them for anticipating response to the next infectious disease threat. Additionally, little is known about how news media coverage of the Ebola outbreak could have influenced risk perception by the public. Also unknown is the public's potential exposure to messages about Ebola policy options via the news media.

Conceptual Model

Dearing and Rogers' agenda setting process model (Figure 1) was used to provide the context in which to examine news media messages about Ebola risks and policies as well as U.S. Ebola policies themselves.⁹ This model describes how the media can impact public health policy through the news media's effects on the public's issue agenda, which in turn helps to set policy. Accordingly, this dissertation investigated aspects of two domains of the model, the media agenda and the policy agenda. Specifically, research focused on the messages being used in media coverage of Ebola risk and policy response options as well as the final policies put in place to respond to the outbreak. Additionally, for specific research focused on risk perception, this model was compared to Kasperson's conceptual framework for the social amplification of risk and found to be compatible.¹⁰

Research Goal

The goal of this research was to enable a greater understanding of what policies could be implemented in response to future infectious disease threats and to provide important information to improve messaging around risks and policies in future outbreaks of emerging disease.

Specific Aims and Research Questions

The specific aims of this research study were to:

Specific Aim 1: Describe the array of state policies implemented for people returning from Ebola affected countries.

Research Question 1.1: What were the different specifications and requirements included in state policies for people who may have been exposed to Ebola?

Research Question 1.2: How do the specifications and requirements included in state policies for people who may have been exposed to Ebola differ from official CDC guidance?

Specific Aim 2: Examine the volume and content of specific messages related to risk included in U.S. news media coverage of the Ebola outbreak.

Research Question 2.1: What is the volume of news stories about Ebola?

Research Question 2.2: What is the relative frequency of use of different risk messages in the Ebola dialogue?

Research Question 2.3: How do frequently used Ebola message frames align with risk perception theory?

Research Question 2.4: How do news source types differ in their use of messages about Ebola risk?

Specific Aim 3: Examine the content of specific Ebola policy messages included in news media coverage of the Ebola outbreak.

Research Question 3.1: What is the relative frequency of use of different messages about policy responses in news coverage about Ebola?

Research Question 3.2: How do news source types differ in their use of messages about Ebola response policies?

Research Question 3.3: How do news sources with conservative or liberal ideologies differ in their use of messages about potential policy responses?

Research Question 3.4: How do messages about policy responses differ before and after critical events in the outbreak?

Background and Literature Review

Agenda Setting, Framing, and Target Populations

Agenda setting is one important way that the news media can influence public perception of an issue. McCombs and Shaw suggest that the news media may determine what the important issues of the time are or, in other words, what the public should think about.¹¹ In their foundational study, they showed that voters' views of the most important election issues correlated with what the media had identified as most important, or the media's "composite definition of what is important."¹¹ Individuals often make judgments on issues based on the "accessibility" of information easily available and retrievable from their memory, which can be affected by the news media.¹² As a result, the news media is able to influence the salience, or personal relevance, of attitudes toward different issues. This, in turn, helps to determine which issues the public considers important.¹¹ According to Dearing and Rogers' agenda setting process model, which was used to conceptualize this research, this process plays a role in public health policy via the news media's effects on the public's issue agenda, and the issues that the public thinks are important then help to set policy.⁹ In the case of Ebola, the agenda setting function of the news media likely raised the profile of the Ebola outbreak and indicated to the public what aspects of the outbreak, such as quarantine efforts, were important.

News media framing helps to determine how the public should think about an issue. Importantly, it is also a key link between elite opinion leaders and the public.¹³ Entman has defined framing as the process of selecting "some aspects of a perceived reality and

mak[ing] them more salient...in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and or treatment recommendation.”¹⁴ Chong and Druckman note that, through framing, an issue can be presented via one of a number of different perspectives. These different message frames, or ways that an issue is presented and conceptualized, can influence public perception of an issue.¹⁵ When members of the public are exposed to a message frame, it can change how an issue is understood. Competition also plays a role in the impact that message frames have on those who are exposed to them. Opposing message frames can compete against each other, with stronger frames that more often resonate with individual’s values having greater influence than weaker frames.¹⁶ Further, as individuals are exposed to a given message frame with greater frequency, it may be more likely to influence opinion.¹⁵ However, when competitive frames are received at the same time, they can cancel each other out.¹⁶ The outcome of competition between message frames may then play a role in determining which policies gain greater support among the public.¹⁷ Consequently, through message framing, the news media likely helped to influence public views on Ebola and Ebola response policies.

News coverage can also influence attitudes about the groups that are affected by public policies, such as those put in place in the Ebola outbreak. Schneider and Ingram note that the construction of these “target populations” can influence policy choices.¹⁸ Policies most often benefit populations that are positively constructed, or considered “deserving,” and politically powerful.¹⁸ During the Ebola outbreak, most response policies governed the activities of a very limited group of potentially exposed people who traveled to the

U.S. from West Africa, were involved in the domestic Ebola response, or had close relations with an Ebola patient. Many of these individuals could have been positively characterized as selfless heroes who risked their lives to prevent a devastating disease from spreading across the globe or, alternatively, negatively characterized as self-centered, irresponsible individuals who possessed little consideration of the danger they posed to their communities. The news media construction and portrayal of this target population likely influenced public and policymaker attitudes about the effects of potential policies, contributing to policy development and support for the Ebola policies.

Risk Perception Theory

Risk can generally be defined as the combination of the severity of consequences and the probability or uncertainty of those consequences.¹⁹ However, the social understanding of risk is shaped by more than the outcome of the quantitative assessment of absolute risk. Risk perception, which is a subjective judgment influenced by cultural, social, and individual responses, also plays a role in how people comprehend risk and influences decisions on how individuals may protect themselves and their families and decide what policies to support.^{20,21,22}

As noted by Kaspersen et al., people receive messages about risk through information systems that can amplify or dampen perception of risk.¹⁰ One important factor in the shaping of risk perception is the information volume received through these systems. As signals about risk travel through information systems, they are processed by “amplification stations” which can increase or decrease the intensity of these signals. In

addition, these stations, which include the news media, can selectively filter risk signals that travel through them to the public.¹⁰ These theories about risk perception integrate well with existing theories on agenda setting and framing, showing how amplification stations such as the news media shape the information that the public receives about risks and, as a result, can influence opinions on how severe a risk is perceived to be. In the case of Ebola, the news media may have prioritized and filtered signals about this risk, which would have played a role in the formation of attitudes about Ebola, target populations, and the policy actions necessary to address the Ebola threat.

In addition, some risks may be perceived as greater than others due to a number of different aspects of the risk itself. Slovic provides a conceptualization of risk perception with two factors that scale how unknown a risk is and how dreaded a risk is.²⁰ These factors are made up of a number of characteristics. Risks that are considered greatly unknown often have one or more of the following characteristics: they are not observable, unknown to those exposed, delayed in effect, new, and unknown to science. Risks that are considered to be highly dreaded feature characteristics that are uncontrollable, catastrophic, fatal, not equitable, high risk to future generations, not easily reduced, increasing in risk, and involuntary.²⁰ A risk that has many unknown and dreaded characteristics will be perceived as higher risk than one that is more well known with fewer dreaded characteristics. For instance, people often perceive nuclear energy to be very high risk but do not assign similarly high risks to the consumption of alcoholic beverages, which experts judge to be a much higher risk in day-to-day life.²⁰ However, people are much more familiar with alcoholic beverages, which have a more immediate

effect, are controllable, and voluntarily ingested. In contrast, nuclear power could potentially present risks from radiation that are delayed, unobservable, uncontrollable, involuntary, catastrophic, fatal, and dangerous to future generations. As a result, the latter is perceived to be higher risk than the former. News media coverage may communicate some of these characteristics of a risk over others, which may, in turn, influence how severe a risk is perceived to be. In the case of the Ebola outbreak, communication of some Ebola characteristics, such as the often fatal consequences of infection, may have influenced public attitudes and perceptions about risks related to Ebola.

The Ebola Outbreak

The Ebola outbreak started on December 26, 2013 in a small remote village in Guinea.²³ An 18-month-old boy likely came in contact with an Ebola infected animal and developed the disease, infecting his immediate family. Ebola spread for several months, often to caregivers of infected individuals and attendees of funerals, without being identified as Ebola. Finally, after the disease had spread to several cities, it was identified as Ebola on March 21, 2014.²³ Ebola continued to spread in West Africa and quickly grew into the largest Ebola outbreak on record. On August 8, 2014, the World Health Organization (WHO) declared it a Public Health Emergency of International Concern (PHEIC).⁴

International medical assistance teams had mobilized before the outbreak had been identified as Ebola and response intensified in the following months.²³ However, medical caregivers were among those most vulnerable to infection with Ebola, due to their close

proximity to blood and body fluids that are most infective in late stages of the illness.²⁴ Several missionaries who cared for infected individuals became infected themselves and were repatriated to their home countries. Two such individuals were Americans Dr. Kent Brantly and Nancy Writebol.⁵ These individuals were diagnosed with Ebola in West Africa and returned to the United States for treatment on August 2nd and 5th, respectively.²⁵ A number of other individuals diagnosed overseas were returned to the United States in the following months.

Cases continued to grow in West Africa, increasing the chances of the importation of unidentified cases of Ebola to the U.S. On September 30, 2014, the Texas State Department of Health Services confirmed that the unintentional importation of Ebola into the U.S. had occurred. A Liberian man, Thomas Eric Duncan, who was visiting Dallas, Texas, had fallen ill after his arrival in the U.S. and, after being sent home from the hospital once, returned and subsequently tested positive for Ebola virus.⁶ Errors in the management of this case contributed to the potential exposure of a large number of healthcare workers. Consequently, on October 11 and 15, two nurses who had cared for Mr. Duncan were also confirmed as having been infected with Ebola.⁶ One additional case of Ebola was diagnosed in the U.S. on October 23. In this case, the patient was a doctor who had recently returned from treating Ebola patients in Guinea. He had been monitoring his health and reported his potential infection at an early stage of his illness. He was admitted to a hospital in New York City where no further cases occurred.²⁶ On the day after the New York Case was diagnosed, a nurse returning from treating Ebola patients in Sierra Leone arrived in New Jersey and was quarantined in accordance

with policies put in place by the governor of New Jersey.²⁷ She contested the legal basis of her quarantine, and it was later overturned by the chief judge of the Maine District Court (where she resided and was transferred).²⁸ (Table 1)

Ebola continued to spread in West Africa and was only gradually brought under control. The WHO declared that all known chains of transmission had been stopped on January 14, 2016.²⁹ However, a number of subsequent cases have occurred and may continue to occur, potentially due to the ability of the Ebola virus to remain in survivors in immunologically privileged parts of the body, such as the testes, and be transmitted through activities that put individuals into contact with infected body fluids, such as sexual intercourse.^{30,31}

Ebola Policy Responses in the United States

Prior to the outbreak, specific federal and state guidelines designed to manage individuals who may have been exposed to Ebola had not been developed. There are a number of tools that can be employed by public health practitioners to reduce the potential for communicable diseases to spread. These include restrictions placed on the type of community interactions an exposed person may have. For example, extensive restrictions can be placed on an individual through quarantine, which is the separation and restriction of movement of people who have been exposed to a disease but are not symptomatic. In addition, public health authorities may monitor people who may have been exposed to a disease for potential signs and symptoms of disease development. Further, public health practitioners may isolate individuals who are known to be infected with a disease from

others who are not infected. Medical countermeasures such as vaccines can also be deployed to combat an outbreak if available.

During the Ebola outbreak, the CDC provided federal guidance, and states developed a range of policies to manage individuals who may have become exposed to Ebola.^{7,32,33,34}

The public received information about these policies through a variety of channels, including the media. One of the central features of CDC's policy guidance was the creation of different levels of restrictions for individuals based on their level of Ebola risk. These restrictions included different levels of movement restrictions, which are limitations on where and how people may travel. The CDC rejected the use of quarantine³⁵; however this public health tool was widely discussed in policy circles and in the media.^{36,37} The CDC also recommended that state and local public health agencies monitor potentially exposed individuals to check for symptoms that could signal the development of the disease.³² In addition to these movement restrictions and monitoring requirements, individuals traveling to the U.S. from the affected West African countries were screened for symptoms of Ebola and asked to complete a questionnaire about potential Ebola exposure incidents they may have had.³⁸

News Media Coverage of the Ebola Outbreak

Prior studies have examined news media coverage of infectious disease outbreaks.^{39,40,41}

Additional efforts have been made to determine if analyses of news media and social media can serve as an effective means of syndromic surveillance.^{42,43,44} However, to date,

few studies have investigated news content in the case of the most recent outbreak of Ebola.^{37,45}

News media coverage of the Ebola outbreak was extensive, highlighting the news media's role in infectious disease outbreaks. During the Ebola outbreak, there was elevated public interest in Ebola, as shown by high volumes of internet searches and tweets about the virus.⁴⁶ This was, at least in some part, driven by the news media.^{47,48} In addition, prior studies suggest that U.S. media coverage of Ebola was driven by several key events.⁴⁹ A news media analysis of the topics covered in articles about Ebola in three different U.S. newspapers showed that the most common topic of news coverage was cases in the U.S.⁴⁵ In addition, about one fifth of news articles also covered the rising death toll of the virus.⁴⁵ These topics may have been important factors in raising the public profile of and perceptions of risk about the outbreak.

Although existing surveys of public knowledge and perceptions of risk from Ebola have not been causally linked to news media accounts of the disease, a number of researchers have highlighted the potential connection between news media coverage of the Ebola outbreak and heightened perception of risk from Ebola.^{50,51} In the case of the Ebola outbreak, the news media has also been characterized as sensationalizing the outbreak, and unnecessarily alarming the public.^{52,53} To place this study in context, the Ebola outbreak resulted in high levels of concern among the public, although this changed over the course of the outbreak. In August 2014, 39% of survey respondents in a Harvard School of Public Health poll were concerned about the potential spread of Ebola in the

U.S., increasing to 65% of respondents in a Washington Post-ABC news poll by mid-October 2014 and dropping to 19% of respondents in a poll conducted by RTI international by December 2014.^{8,50,54} However, it is difficult to know if news media coverage increased public concern or public concern increased news coverage of risks. Additionally, despite the high volume of news coverage about Ebola, public polling showed widespread misinformation about how Ebola spreads. For example, 85% of survey respondents believed that the sneeze or cough of a symptomatic person could transmit the disease to another person (Ebola is only spread through contact with infected blood and body fluids) and 48% of respondents believed that a person could transmit the virus before symptoms of the disease appeared.⁵⁵ Furthermore, public polling showed that, at the time of the outbreak, 71% of respondents supported mandatory quarantines for Ebola health workers.⁵⁶

Methods

This research focused on public health response policies to the Ebola outbreak as well as media messages about these policies and risks from Ebola. Federal guidance and state policies determining how to manage individuals within the U.S. who may have been exposed to Ebola were systematically identified and analyzed. In addition, the volume of news coverage and content of U.S.-focused news stories about Ebola was analyzed for risk-related messages that were judged to potentially increase or decrease perception of risk and policy-related messages about the Ebola response.

Aim 1

In order to investigate CDC Ebola guidance and Ebola policies put forth by the 50 U.S. state governments and the District of Columbia, documents describing policies, requirements, and restrictions for individuals considered at risk for Ebola were systematically identified and analyzed. These documents were published between October 1, 2014 and March 30, 2015, which encompasses the time period covering early responses to Ebola and the following 6 months. The nature of these policies, requirements, and restrictions was subsequently described.

Aim 1 Data Collection

Documents describing state policies for individuals considered at risk for Ebola, as well as the requirements and restrictions that they may be subject to, were systematically identified and reviewed. Records were obtained by searching the websites of state health departments, state governors' offices, and official state websites (e.g., Alaska.gov) for each of the 50 U.S. states and the District of Columbia. Searches were conducted using the term "ebola" between February 1, 2015 and April 2, 2015. Sources of information were, for the most part, easily accessible using traditional search methods. In situations where a state's governor changed during the outbreak, the archived website for the prior governor was used to search for Ebola policies when available. Press release archives for the previously mentioned websites were also reviewed using the term "ebola" to capture documents that may not have been identified through the original search process. On three occasions, a source referenced a relevant but previously unidentified document, and a second search was undertaken to include it. The National Council of State Legislatures website was also used to search for documents, although no additional relevant documents were uncovered. Finally, the *Interim Table of State Ebola Screening and Monitoring Policies for Asymptomatic Individuals*, which was developed by the CDC, was used to ensure that all documents identified by CDC's Office for State, Tribal, Local, and Territorial Support, Public Health Law Program & Office of the Associate Director for Policy were reviewed for inclusion in the present analysis.⁵⁷

Documents were included in the analysis if they mentioned quarantine or monitoring policies relative to Ebola; included movement restrictions specific to Ebola; or described executive orders pertaining to these issues and Ebola. Monitoring policies include required communication between the monitored individual and public health officials about potential signs of disease, and/or direct observation by public health officials. Movement restrictions are limitations on where and how people may travel. Quarantine entails separating asymptomatic people who may have been exposed to a disease from those who have not been exposed and often limits a person to a single locale.³² If the term “quarantine” was used to describe state policy, these states were categorized as using quarantine, regardless of whether quarantines were mandatory or voluntary or whether they were used on a case-by-case basis.

Documents were excluded if they pertained to other aspects of the Ebola outbreak (e.g., waste management, pets, food safety); were solely focused on first responder, hospital/medical, laboratory or personal protective equipment (PPE) protocols; outlined school or emergency response plans; or were general information updates or screening tools. Video transcripts, password-protected documents, and county- or city-level documents were not included. In total, 139 documents were included in this analysis (Appendix 1).

Aim 1 Data Analysis

Data were abstracted from identified documents using a Microsoft Excel-based electronic data collection form. The form contained categories for the type of document reviewed, date published/modified, source of document, quarantine policy, isolation policy, exposure categories, restriction of movement, daily monitoring, and legal justification (Appendix 2). The form contained open text sections to include specific details of policies within these categories. Data extraction was completed between February 1, 2015 and April 2, 2015, during the data collection process, under the oversight of my dissertation committee. Questions were resolved through consultation and consensus among members of my dissertation committee and documents were reviewed for quality control purposes in May and June 2015.

For the information that was abstracted, a qualitative analysis was undertaken to identify recurring themes and unique outliers. Each focus area, such as quarantine, monitoring, or movement restrictions, was analyzed for similarities to and differences from published CDC guidelines.

Aims 2 and 3

The volume of news coverage and content of U.S.-focused news stories about Ebola from major, English-language, U.S. sources published between July 1, 2014 and November 30, 2014 were reviewed and analyzed. This period encompasses the month before the first

case of Ebola arrived in the U.S. through two weeks following the last Ebola death on U.S. soil. These stories were examined for risk-related messages that were judged to potentially increase or decrease perception of risk and policy-related messages.

Source Selection

A total of 13 news sources (9 print, 3 television, and 1 blog) were used to analyze Ebola coverage. The final selection of news media sources included the following newspapers: *Atlanta Journal Constitution*, *Chicago Tribune*, *Fort Worth Star Telegram*, *New York Daily News*, *New York Times*, *Orange County Register*, *Portland Press Herald*, *USA Today*, and *Washington Post*; transcripts from the following television news programs: CNN Situation Room, Fox Special Report, and NBC Nightly News; and the Huffington Post blog. News source selection strategy was designed to achieve a sample meeting the following criteria: 1) geographic variation, with at least one news source from each of the four U.S. census regions; 2) liberal or conservative ideological variation; 3) representation of news sources based in localities that experienced Ebola cases or controversies (e.g., the highly publicized quarantine of the Maine-based nurse when she returned to the U.S.); and 4) variation in type of news source (print, TV, blog). (Table 2). We selected the highest circulation/viewership news sources available in LexisNexis, ProQuest, or Newsbank meeting these criteria.^{58,59} Selection criteria were not mutually exclusive and several news sources fell within multiple selection categories.

Classification of conservative or liberal ideology was based on endorsement of Democratic or Republican candidates in the 2012 presidential election and viewer clustering around specific news sources according to data collected by Pew Research Center.^{60,61} Television news sources were selected to provide a potential comparison of information presented to readers or viewers.⁶² Examples of both network (NBC Nightly News) and cable television news (CNN Situation Room, Fox Special Report) were included. Although television news sources were headquartered in cities that had experienced Ebola cases, they are nationally produced and focused and were therefore not classified as containing local coverage. Initially, *Dallas Morning News* was included rather than the *Fort Worth Star-Telegram* but online databases returned only blog results for this newspaper. As a result, *Dallas Morning News* was dropped and replaced with the *Fort Worth Star-Telegram*.

Search Strategy

Searches among the 13 news sources for the term “Ebola” in the LexisNexis, ProQuest, and NewsBank online archives yielded 3,296 news stories. These news stories were evaluated to determine if they met exclusion criteria. The content analysis focused on policy-related messages appearing in Ebola-related news stories with a U.S. focus (i.e., included discussion of Ebola coming to or in the U.S.). As a result, stories with exclusively international coverage that did not place Ebola in a U.S. context (n=428) were included in our analysis of news volume but excluded from the final content analysis, which focused on identifying risk-related and policy-related messages about

Ebola in the U.S. context. Stories shorter than 100 words as well as items classified as advice columns; book reviews; calendar/event reports; corrections; duplicates; indexes; introductions/lead ins; items that mentioned Ebola only in passing; letters to the editor; obituaries; and solely business/stock focused were also excluded. After applying these exclusion criteria, 1,262 news stories and opinion pieces (editorial or opinion-editorial pieces) and 159 blog posts remained, and were used in the content analysis.

Content Analysis and Measures

To identify messages for inclusion in the coding instrument, an informal news media scan (i.e., a nonsystematic review of the policy themes and themes that could impact perception of risks from Ebola circulating in news media articles at the time) was used to identify common messages about Ebola. An initial 45-item coding instrument of Ebola-related messages was developed. This included 14 items relevant to risk perception and 31 items related to policy messages. The instrument's list of Ebola-related messages was also reviewed by two infectious disease and public health experts affiliated with the University of Pittsburgh Medical Center (UPMC) Center for Health Security to identify any further risk-related messages about Ebola that they may have observed in their professional roles.

Two coders then piloted the instrument on 50 articles and 10 transcripts from the study time period that appeared in two news sources not included in the study sample (*Wall Street Journal*, *CBS Evening News*). The results from the pilot phase, along with advice

from the infectious disease and public health experts, directed refinement of the coding instrument.

A number of items related to type of message source (n=15) were among those eliminated from the instrument, due to difficulties interpreting this aspect of news stories and in coding these types of items. Three policy topics – travel bans, quarantine, and isolation – were originally included only as containing either supportive or oppositional messages. However, results from the piloting phase led to the addition of an item that included any mention of travel bans or quarantine (i.e., opposing, supporting, or neutral) and sub-items were included in the coding instrument to specify supporting and oppositional messages for these topics. Messages mentioning isolation were combined into a single item specifying any mention of isolation, because supporting and opposing viewpoints were not found during our pilot phase and the topic was not a subject of policy debate in the same manner that quarantine or travel bans were.

The final coding instrument used for this research contained 30 items, including story word count, date of publication, 14 risk-related Ebola messages, 13 policy-related Ebola messages, and one message about fear that was later eliminated from the analysis. (Appendices 3 and 4)

The 14 risk-related messages were mapped onto factors drawn from the risk perception literature that have been shown to increase or decrease audiences' perception of a risk's severity. (Tables 3 and 4) Nine of the identified Ebola-related messages contained

characteristics that could increase perception of risk according to the risk perception framework published by Slovic.²⁰ (Table 3). Throughout this dissertation, these messages are referred to as “risk-elevating” messages. Five of the identified messages contained characteristics that could decrease perception of risk, according to Slovic. (Table 4). These messages are referred to as “risk-minimizing messages.” (See Appendix 5 for example risk-related messages)

The 13 policy-related messages focused on travel bans in general; support for travel bans; opposition to travel bans; quarantine in general; support for quarantine; opposition to quarantine; isolation; dividing potentially exposed persons into groups based on level of Ebola risk; requirements to enter the U.S. (e.g. passport checks, temperature readings); public health monitoring; poor/slow response from government; poor personal protective equipment (PPE), standards, or training (i.e., lack of preparedness); and confusion (i.e., about policies, standards, or requirements related to U.S. Ebola response). (See Appendix 6 for example policy-related messages)

The same two coders then independently coded a random sample of 15 percent (n=216) of the news stories in the study sample to assess interrater reliability for each dichotomous yes/no item. All policy-related items had kappa values of 0.69 or higher and therefore met conventional standards for adequate reliability.⁶³ (See Appendix 4 for final kappa and percent agreement for all policy related variables). The majority of risk-related items met conventional standards for adequate reliability. Four items had kappa statistics slightly below this threshold (kappa = 0.63, 0.64, 0.67 and 0.67) but high raw percent

agreement (94%, 90%, 94% and 90%, respectively; see Appendix 3 for final kappa and percent agreement for all risk related variables) and were also included.⁶³ One item, a message mentioning fear, was determined not to fit thematically into either analysis completed for aims 2 and 3 and was eliminated.

Data Analysis

The content of print and television news stories about the Ebola outbreak was assessed by calculating the proportion of stories that mentioned each Ebola-related message over the study period. Chi-squared tests were used to test differences in the proportion of print and televisions news stories mentioning each Ebola-related message in new sources based in localities that faced an Ebola case or controversy versus news sources in localities that did not; conservative versus liberal news sources; and news source type (television, print, blog). Chi-squared tests were also used to compare the proportion of policy-related messages appearing in news stories published before and after key dates in the Ebola outbreak.

Distinctive characteristics of the Huffington Post blog (e.g., unique story types, potential differences from other internet news sources) may have skewed the main news story sample. As a result, a separate analysis was completed that included this news source. In this separate analysis, the content of all news stories, including those in the Huffington Post blog, was analyzed by calculating the proportion of stories that mentioned each Ebola-related message. The Huffington post blog was then compared to television and print news using chi-squared tests. Data analysis was completed using Stata 12.1.⁶⁴

IRB

The Johns Hopkins Bloomberg School of Public Health Institutional Review Board determined this study was not human subjects research. Therefore, this study was exempt from IRB oversight (Appendix 7).

Paper 1

Manuscript 1

U.S. State-Level Policy Responses to the Ebola Outbreak, 2014-2015

Abstract

The 2014-2015 Ebola epidemic in West Africa raised concerns about the potential occurrence of an Ebola outbreak in the United States. The federal government and individual states developed guidance and policies to determine how to manage individuals within the U.S. who may have been exposed to Ebola. 139 documents describing state policies for individuals considered at risk for Ebola and the requirements, as well as restrictions these individuals may be subject to, were systematically identified and analyzed. A wide range of policy responses and variations on quarantine, movement restrictions, exposure categories, and monitoring were found. While the majority of states reflected CDC guidance, some states enacted aggressive quarantine policies and movement restrictions, developed unique categorization strategies, and established more frequent monitoring procedures. Findings may help public health practitioners and policymakers anticipate what policies could be implemented in response to future infectious disease threats.

Introduction

The Ebola outbreak that began in December 2013 was associated with widespread disease transmission in Liberia, Guinea, and Sierra Leone and raised concerns about Ebola's potential spread to the United States.^{3,65} The disease's high case fatality rate and rapid growth in Africa highlighted the seriousness of the outbreak as a possible threat to the U.S.² As individuals were brought to the U.S. for medical treatment and two hospital-based transmissions occurred at a Dallas hospital, the specter of domestic spread of Ebola spurred American policymakers into action.^{35,66} Although the U.S. Centers for Disease Control and Prevention (CDC) provided federal guidance, (updated November 16, November 18, and December 24, 2014 and discontinued for Liberia September 21, 2015), on how to manage individuals who may have been exposed to Ebola,³² many states created their own policies to address the outbreak, establishing a range of different requirements for travelers returning from affected countries and others potentially exposed to the virus.

The federal government and individual states have laws that provide the legal basis for isolation and quarantine orders.⁶⁷ Individual states can also declare a state of "disaster" or "emergency." In addition, 26 states can declare a "public health emergency."⁶⁸ These declarations can temporarily change the legal environment to allow increased response capabilities and legal waivers of potential barriers to the public health response.^{68,69} Although these laws and declarations can provide the basic underpinning of response to

an infectious disease outbreak, specific policies were also developed by many states to detail how to manage those with potential Ebola exposure.

On September 30, 2014, the Texas State Department of Health Services confirmed that a Liberian man, who was visiting Dallas, Texas, had tested positive for Ebola virus.⁶

Although individuals with known Ebola infection had previously been flown to the U.S. to receive treatment, these cases had been previously diagnosed internationally while this was the first case of Ebola diagnosed in the U.S. Subsequently, on October 11 and 15, two Dallas-based nurses who had treated the Liberian patient were also confirmed as having been infected with Ebola. One of these individuals had flown on a commercial airliner after her exposure to Ebola but prior to her diagnosis.⁶ Additionally, on October 23, a doctor, who had recently returned from treating Ebola patients in Guinea, was admitted to a hospital in New York City with Ebola.²⁶

On October 24, a nurse returning from treating Ebola patients in Sierra Leone, but who had no symptoms of Ebola (therefore not at high risk according to CDC guidance), arrived in New Jersey and was quickly quarantined in compliance with policies announced that day by the governors of New Jersey and New York.²⁷ Although her quarantine was later overturned by the chief judge of the Maine District Court (where the nurse resided and was transferred),²⁸ this incident highlighted the controversial nature of some state-level infectious disease policies, especially when they differed from CDC guidance – which did not recommend quarantine. Other instances, such as Louisiana banning travelers who had been to Ebola-affected countries from attending medical and

public health conferences, also showed how some state-level policies differed from scientific evidence.⁷⁰ Although the CDC issued guidance based on available research and scientific understanding of Ebola in an effort to create a national standard, states could and often did release their own policies to create more stringent requirements.³⁴

The objective of this research is to describe the CDC Ebola guidance and identify and analyze the Ebola policies put forth by the 50 state governments and the District of Columbia from October 1, 2014 through March 30, 2015. This period encompasses early responses to Ebola and the following 6 months. Analysis of these policies may provide insight into future policy actions by state governments in response to infectious disease outbreaks. Understanding the array of different state-level Ebola policies may help public health practitioners and policymakers know which policies can or may be implemented in response to the next infectious disease threat.

Methods

Documents describing state policies for individuals considered at risk for Ebola, as well as the requirements and restrictions that they may be subject to, were systematically identified and reviewed. Records were obtained by searching the websites of state health departments, state governors' offices, and official state websites (e.g., Alaska.gov) for each of the 50 U.S. states and the District of Columbia. Searches were conducted using the term "ebola" between February 1, 2015 and April 2, 2015. Sources of information were, for the most part, easily accessible using traditional search methods. Press release

archives for the previously mentioned websites were also reviewed using the term “ebola” to capture documents that may not have been identified through the original search process. On three occasions, a source referenced a relevant but previously unidentified document, and a second search was undertaken to include it. The National Council of State Legislatures website was also used to search for documents, although no additional relevant documents were uncovered. Finally, the *Interim Table of State Ebola Screening and Monitoring Policies for Asymptomatic Individuals*, which was developed by the CDC, was used to ensure that all documents identified by CDC’s Office for State, Tribal, Local, and Territorial Support, Public Health Law Program & Office of the Associate Director for Policy were reviewed for inclusion in the present analysis.⁵⁷

Documents were included in the analysis if they mentioned quarantine or monitoring policies relative to Ebola; included movement restrictions specific to Ebola; or described executive orders pertaining to these issues and Ebola. Monitoring policies include required communication between the monitored individual and public health officials about potential signs of disease, and/or direct observation by public health officials. Movement restrictions are limitations on where and how people may travel. Quarantine entails separating asymptomatic people who may have been exposed to a disease from those who have not been exposed and often limits a person to a single locale.³² If the term “quarantine” was used to describe state policy, these states were categorized as using quarantine, regardless of whether quarantines were mandatory or voluntary or whether they were used on a case-by-case basis.

Documents were excluded if they pertained to other aspects of the Ebola outbreak (e.g., waste management, pets, food safety); were solely focused on first responder, hospital/medical, laboratory or personal protective equipment (PPE) protocols; outlined school or emergency response plans; or were general information updates or screening tools. Video transcripts, password protected documents, and county- or city-level documents were not included. In total, 139 documents were included in this analysis (Appendix 1).

Data were abstracted from identified documents using a Microsoft Excel-based electronic data collection form. The form contained categories for the type of document reviewed, date published/modified, source of document, quarantine policy, isolation policy, exposure categories, restriction of movement, daily monitoring, and legal justification (Appendix 2). I completed data extraction between February 1, 2015 and April 2, 2015, during the data collection process, under the oversight of my dissertation committee. Questions were resolved through consultation and consensus with my dissertation committee and I reviewed documents for quality control purposes in May and June 2015.

For the information that was abstracted, a qualitative analysis was undertaken to identify recurring themes and unique outliers. Each focus area, such as quarantine, monitoring, or movement restrictions, was analyzed for similarities to and differences from published CDC guidelines.

Results

Many state policies for individuals potentially exposed to Ebola reflected CDC guidance (Table 5). Some states implemented policies that were highly consistent with CDC guidance. Others followed CDC guidance in select areas, such as exposure categories, but differed in other areas. However, a few states produced unique policies, significantly different from CDC guidance for all components. Overall, a wide range of policy responses and variations on quarantine, movement restrictions, exposure categories, and monitoring were found (Table 6).

Timing and source of policies

Most documents describing state Ebola policies were originally published in October 2014, with updates occurring during the following months. Updated CDC guidance was published on October 27, 2014 and many states published their policies in the following days. Documents describing policies for 46 states and the District of Columbia were published, posted, or updated on or following this date. For the remaining four states, posted policies were found on undated websites.

The documents examined for this study were issued by a variety of entities. Besides the CDC, policies were most often issued by state public health agencies, leaders of state public health agencies, state epidemiologists, governors, and infectious disease/Ebola task forces. Policies were also issued in a variety of ways. Some states issued formal

reports and guidance, while others issued press releases, executive orders, or health orders. Every state provided some guidance on policies for people who may have been exposed to Ebola, although some policies were issued in a more formal way than others. Some states, such as Alabama, posted a few paragraphs on an Ebola-focused public health website. Other states, such as New York, issued detailed health orders.

Executive orders, such as those issued in Arizona and Texas, were used to establish the task forces that later developed final Ebola guidelines. Executive orders and health directives were also used to stipulate specific public health actions. In Florida, an executive order specified daily in-person temperature checks for all travelers returning from Ebola-affected countries and quarantine for all high risk travelers. In New York, the health commissioner signed an order that specified risk groups, quarantine policies, and daily monitoring requirements. Executive orders were also issued to declare a public health emergency, such as in Connecticut, to provide public health authorities with emergency powers.

Exposure categories

Most states (n=40) based their Ebola exposure categories on CDC guidance with high, some, low, and no identifiable risk levels (Tables 5 and 6). States occasionally made limited adjustments to specifications for each exposure category but for the most part these were minor. There were, however, a number of exceptions and a few states developed unique exposure categories or lumped all returning travelers into one or a few

exposure categories (Table 6). For instance, Georgia created three exposure categories: high risk travelers, low risk travelers, and medical personnel treating patients in the U.S. Ohio developed unique exposure categories by dividing its highest exposure category into “A” and “B” groups. The “A” group included bodily fluid contact without PPE and the “B” group included health care workers (HCW) or travelers with uncertain contact who had been in countries impacted by Ebola in the last 21 days. Exposure categories were then used to specify certain public health actions and restrictions.

Ebola policies diverged with regard to a general focus on all potentially exposed persons or specific groups such as travelers, HCWs, or others. For instance, CDC guidance and many state policies laid out directives that covered many scenarios through which a person might be exposed to Ebola. In contrast, other states, such as New Jersey, focused on travelers. Often, these states contained or were near airports that were receiving travelers from West African countries affected by Ebola. Other states, such as Texas, had guidance documents that were similar to CDC guidance but also issued specific guidance to subgroups such as HCWs who had treated an Ebola patient in Dallas, laboratory workers, and air travelers.

Movement restrictions

Movement restrictions for individuals potentially exposed to Ebola were most often based on exposure category. CDC guidance specified that those in the high risk category should be excluded from public conveyances, public spaces, congregate gatherings, and

workplaces. However, non-congregate public activities that allowed 3 feet of space between the individual and others, such as jogging, could be allowed. Movement restrictions for those with some risk would be determined by public health authorities, while the low risk and no identifiable risk exposure groups were not subject to any restrictions.

Generally, states also used exposure categories to specify restrictions for different groups (Table 5). Noteworthy differences arose as some states (n=7) assigned more stringent restrictions to lower exposure categories or a broader range of people (Table 6). For instance, Ohio specified that travelers from countries with widespread Ebola outbreaks were not permitted to leave the U.S. even if they reported no exposure to Ebola victims because continued monitoring could not be ensured. In contrast, Idaho policy indicated that individuals who were not included in its high risk group would be permitted to participate in their usual daily activities.

Quarantine

CDC guidance does not specify that individuals with any level of Ebola exposure should be quarantined (Table 6).³⁵ In fact, the CDC guidance mentions the word “quarantine” only twice, and these mentions are in a section that defines the concept. However, for the highest exposure category, it does specify movement restrictions that significantly limit public activities and may have been interpreted by some states as quarantine. The CDC guidance also specifies that a health order may be used to ensure compliance with

restrictions, although it does not specify the type of health order (e.g., quarantine or travel restrictions). Some states, such as Minnesota, were consistent with CDC guidance and explained why quarantine was not being used. Other states, such as Hawaii and Arizona, referred to the CDC guidance but also specified quarantine for persons in their highest exposure category.

In contrast, a number of states included quarantine as a key aspect of their Ebola response. For instance, as mentioned above, Louisiana specified voluntary quarantine regardless of exposure category. Illinois specified mandatory quarantine for those at high risk and specified that these individuals may not leave their housing for 21 days following high risk exposure. Maine's policy also included quarantine for all travelers who had direct contact with or treated Ebola patients. However, this policy was successfully challenged in court by the Maine-based nurse who had been quarantined in New Jersey.²⁸ Although 30 states promoted the use of quarantine, policies regarding quarantine often specified the use of voluntary quarantine or signed quarantine agreements. For example, Kentucky encouraged high risk individuals to sign a quarantine agreement, although if the individual refused, officials could seek a quarantine order.

Monitoring requirements

Active and direct active monitoring were included as a component of the public health response, at both the state and federal levels, for potentially exposed persons in the U.S. Active monitoring includes interaction between individuals being monitored and public

health workers to check daily for potential symptoms. For programs of active monitoring, regular communication is required, but this does not have to be in person or face to face. In contrast, direct active monitoring requires active monitoring through direct observation.³² Although not every interaction with public health professionals must be in person, at least one interaction should be directly observed in person, or occasionally over Skype each day.

All states utilized monitoring in their Ebola policies. In general, guidance documents called for an individual who is undergoing monitoring to be checked for fever twice a day. However, some states, such as Maryland, called for more frequent checks, in this instance, four temperature checks per day for individuals in its high risk exposure category and its some risk exposure category (Table 6).

The CDC called for direct active monitoring of those in its high risk exposure category as well as its some risk exposure category. Additionally, the CDC called for direct active monitoring for U.S.-based Ebola HCWs and air travelers who sat within 3 feet of a traveler with Ebola, who were otherwise part of the low risk exposure category. For all others in the low risk category, CDC called for active monitoring. State Ebola policies either called for a similar monitoring scheme or extended direct active monitoring to a wider range of people (Table 5). For example, in Indiana, all returning travelers from countries with widespread Ebola were required to participate in direct active monitoring.

Discussion

The variation in Ebola policy responses demonstrates how the federal and state governments interacted to develop policies in the face of an emerging outbreak that caused significant concern in the public and political spheres. While the World Health Organization (WHO) provided information on travel and transport risk, this guidance had an international focus.⁷¹ For the most part, states based their policies on CDC guidance. However, some states such as Louisiana and New Jersey seemingly developed independent guidance. Here we discuss potential rationales for the differences noted in this analysis but note that each state likely faced its own unique blend of issues that combined to influence the policies put in place to respond to Ebola. Given that CDC guidance was based on available research, more strict policies were likely unnecessary to protect the health of the public and may have unnecessarily infringed on civil liberties. However, states' ability to act independently may have had the benefit of developing policies that were responsive to local threats and concerns.

One factor that may have influenced variation in state policies is the location at which travelers from West Africa typically enter the U.S. Before the outbreak, 94% of travelers from Sierra Leone, Guinea, and Liberia traveled through JFK, Washington-Dulles, Newark Liberty, Chicago-O'Hare, and Hartsfield-Jackson Atlanta International airports. Beginning on October 21, 2014, new rules required all travelers from these West African nations to fly into one of these five airports.⁷² The concentration of travelers from West Africa may have spurred the states that these airports were located in or near – New

York, Washington DC, Maryland, New Jersey, Illinois, and Georgia – to develop policies on their own to combat the potential threat of importation of Ebola via air travel into their states. These states, with the exception of Maryland, developed Ebola policies that were often more restrictive than CDC’s guidance.

Politics may have also played a contributing role in the development of State Ebola policies.³³ The emergence of cases of Ebola in the U.S. occurred shortly before Election Day in 2014, when several gubernatorial seats were being contested. For example, the governor of New York, a state that announced a more aggressive quarantine policy, was up for re-election. Additionally, presidential politics may have also led to pressure to establish more aggressive policy responses in a number of states. For instance, the governors of some states with the most aggressive Ebola policies, such as New Jersey and Louisiana, later announced presidential bids for 2016.

Location of Ebola cases in the U.S. may have also impacted the development of state policies for individuals who were potentially exposed to Ebola, possibly leading to more aggressive responses. The first case diagnosed in the U.S. occurred in Texas and two additional cases also developed there. Given the different groups of people potentially exposed during the response to these cases, Texas provided specific guidance for several subcategories that may have been exposed. Additionally, while the state’s overall guidance generally reflected CDC guidance, quarantine was required for those in Texas’s high risk exposure category, perhaps in response to public concerns over Ebola cases in Texas. Another case was diagnosed in New York, which also developed its own

somewhat more aggressive quarantine policies. Finally, although no case was diagnosed in Ohio, one of the Dallas nurses who was later diagnosed with Ebola traveled to Ohio. Ohio then also introduced a more aggressive quarantine approach. In contrast, although more specific guidance may have been expected in Nebraska, where several Americans who had been diagnosed in West Africa were transported for care, only monitoring information was identified. However, this may be related to the fact that cases in this state were previously diagnosed and had been brought into the state for treatment in an established and high level isolation facility.

Use of quarantine was one of the most controversial areas in which CDC guidance and some state policies differed. The Ebola outbreak made the balance between the potential risk to the public and infringement on personal freedoms difficult because levels of potential exposure and risk were variable, as was the appropriate level of quarantine, if any.⁷³ CDC avoided the term “quarantine” in describing federal guidance in an effort to reduce barriers for people volunteering to respond to the outbreak in West Africa.⁷⁴ In several instances, state policies cited CDC guidance or noted that a state was following CDC guidance and then discussed quarantine for the state’s highest risk exposure category. The voluntary restrictions specified in CDC guidance could easily be interpreted by states as describing quarantine because they included controlled movement and restrictions from public places, congregate gatherings, and workplaces. This subtle difference in policy may not have made an impact on the implementation of movement restrictions, given that many individuals may have voluntarily accepted staying at home, but it did create the opportunity for confusion. Additionally, voluntary quarantine

agreements were often supported by an option to pursue mandatory compliance with quarantine and other public health measures if individuals were not willing to comply with the voluntary agreements, suggesting that, in reality, individuals had little choice in the matter.

Limitations

Study results should be considered in the context of several limitations. Despite a systematic approach, some documents may not have been captured through the search process. For example, two websites had technical anomalies that limited key word searches. State policies may have changed during the study period, and although searches of website archives were undertaken to address this limitation, some past policies or differences in implementation of policies may not be reflected in this analysis.

Additionally, eleven state governors changed during the study period and the websites of previous governors went offline. However, the search of state websites should have provided redundancy to reduce the number of documents that may have been missed. The study focused solely on state and federal policies and did not include potentially unique policies established at a more local level. Additionally, the study did not address implementation of Ebola policies by state and local health departments, and in-depth case studies of implementation practices may be an important area of future research. Finally, the study methodology does not reflect the internal deliberations and rationales that may have shaped state Ebola policies. Additional research, including interviews of state health officials, may help to shed light on the development of future infectious disease policies.

Conclusion

States adopted a wide range of policy responses on quarantine, movement restrictions, exposure categorization, and monitoring that were developed in reaction to the 2014-2015 Ebola outbreak. Although CDC provided science-based federal guidance for states that created sufficient protections for the public, many states developed their own policies to manage individuals who had potentially been exposed to Ebola. Some state-level policies were highly restrictive, attempting to eliminate any possible risk of exposure to the public. Other policies were more measured and allowed greater freedom of movement for potentially exposed individuals. The flexibility of individual states to create different policies can lead to both benefits and challenges. Importantly, states have the opportunity to respond to unique threats and local concerns and develop specific policies that address issues not faced by other states. However, in the case of Ebola, the ability to go beyond federal guidelines allowed for policies that lacked a scientific basis. In future events, federal and state policymakers and practitioners should collaborate to gain a science-based understanding of actual risks and formulate policies that are able to effectively address those risks. Findings from this research may help public health practitioners and policymakers anticipate what policies can or may be implemented in response to future infectious disease threats. Practitioners and policymakers should anticipate deviations from evidence-based federal guidance, particularly in states influenced by localized infectious disease events.

Paper 2

Manuscript 2

News Media Messages about Ebola and Their Implications for Risk Perception in the United States

News Media Messages about Ebola and Their Implications for Risk Perception in the United States

Abstract

The Ebola outbreak of 2014-15 generated high levels of media coverage and highlighted the role that the news media plays in communication about disease risks. Research has shown that the news media can influence public attitudes and perception of risk. The volume and content of U.S.-focused news stories (n=1,421) about Ebola from 13 print, television, and blog news sources from July 1, 2014 through November 30, 2014 was analyzed for 14 risk-related messages that were judged to potentially increase or decrease perception of risk. Volume of news coverage rose greatly following diagnosis of the Ebola case in Dallas in September 2014. One or more risk-elevating messages were found in 96% of news stories analyzed. The most frequent messages were those about people bringing Ebola to the U.S. (72% of news stories), those describing the disease causing deaths (66% of news stories), and those about a potential U.S. outbreak/people in the U.S. contracting Ebola (35% of news stories). Differences in message frequency were found among types of news sources (print, television, and blog), news sources with conservative or liberal ideology, and news sources located in or away from an area that experienced an Ebola case or controversy. Results offer insight into the interplay between news media coverage of emerging risks and theories on risk perception, and may help decision-makers to influence news content on infectious disease risks and improve future messaging.

Background

The Ebola outbreak of 2014-15 began in West Africa and grew into the largest Ebola outbreak on record.⁴ The disease is transmitted via contact with bodily fluids and is highly lethal, a fact frequently cited in news media reports about the outbreak.^{2,45} The outbreak generated a large amount of news media coverage and spurred discussion of the news media's role in providing information about risks to the public.^{48,50,52} Research shows that the news media can influence what people know about a topic and how they perceive it.¹³ For instance, news coverage is known to influence the public's attitudes and policy preferences, as well as political engagement.^{13,75,76} News coverage can also convey messages about risks, as it did during the Ebola outbreak, and the way risks are discussed and communicated can impact how people perceive risk.^{20,21,22} During the Ebola outbreak, news media exposure likely helped to drive widespread public interest about Ebola.^{48,49} Yet, little is known about the message content of news media coverage of the Ebola outbreak or how this coverage may align with theories about the public's perception of risk.

Two important ways that the news media can influence public perception of an issue are agenda setting, which influences what the public should think about, and framing, which suggests how the public should think about an issue. In agenda setting, the news media influences the salience, or personal relevance, of attitudes toward different issues and affects which issues the public considers important.¹¹ In framing, an issue is presented through one of a number of different perspectives, and these different frames – or ways an issue is presented and conceptualized – can influence public perception.¹⁵ Exposure to

a message frame can change how an issue is understood. In addition, the more frequently the public is exposed to a message frame, the more likely a given frame is to influence opinion.¹⁵ Consequently, the news media likely helped to raise the public profile of Ebola, indicate what aspects of the outbreak were important, and influence public views on Ebola.

The messages and frames used to communicate about risks can influence how people understand and perceive risk, influence decisions on how to protect themselves and their families from risks, and decide what policies to support.^{20,21,22} The social experience of risk is molded by more than a simple calculation of absolute risk. Instead, risk perception is a subjective judgment of risk influenced by cultural, social, and individual responses to a risk.²⁰ As noted by Kasperson et al., the information systems through which people receive messages about risk and the characteristics of public response shape perception of risk via “social amplification of risk,” and can be influenced by several attributes, such as information volume.¹⁰ Signals about risk are processed by “amplification stations,” which include the news media, and can lead to the increase or decrease in intensity – as well as selective filtration – of these signals.¹⁰ Additionally, communicating some aspects of a risk over others may influence how severe a risk is perceived to be. Slovic expressed how a risk that is not observable, unknown to those exposed, unknown to science, new, with delayed effects, uncontrollable, dreaded, catastrophic, fatal, not easily reduced, increasing, or involuntary may be perceived as more severe than a risk that does not have these characteristics.²⁰ Accordingly, news media coverage of the Ebola outbreak likely influenced public attitudes and perceptions about risks related to Ebola.

The objective of this research was to analyze the volume and content of specific messages related to risk included in U.S. news media coverage of the Ebola outbreak from July 1, 2014 through November 30, 2014. The analysis also includes an examination of how these messages map on to established literature about risk perception theory. This outbreak provides an important case for studying emerging outbreaks and other public health emergencies that will require communication of risk in the future. Results offer insight into the interplay between news media coverage of emerging risks and theories on risk perception, and may help decision-makers to influence news content on infectious disease risks and improve future messaging.

Methods

To evaluate news media coverage of the Ebola outbreak and its implications for risk perception by the public, we analyzed news stories from major English-language, U.S. sources focused on the Ebola outbreak published between July 1, 2014 and November 30, 2014. This period encompasses the month before the first case of Ebola arrived in the U.S. through two weeks following the last Ebola death on U.S. soil. Additionally, one national news-oriented blog was analyzed to provide a limited comparison between an Internet news source and traditional news sources.

We analyzed Ebola coverage in 13 total news sources (9 print, 3 television, and 1 blog). The final selection of news media sources included the following newspapers: *Atlanta Journal Constitution*, *Chicago Tribune*, *Fort Worth Star Telegram*, *New York Daily*

News, *New York Times*, *Orange County Register*, *Portland Press Herald*, *USA Today*, and *Washington Post*; transcripts from the following television news programs: CNN Situation Room, Fox Special Report, and NBC Nightly News; and the Huffington Post blog. Our news source selection strategy was designed to achieve a sample meeting the following *a priori* criteria: 1) geographic variation, with at least one news source from each of the four U.S. census regions; 2) liberal or conservative ideological variation; 3) representation of news sources based in localities that experienced Ebola cases or controversies (e.g., the highly publicized quarantine of the Maine-based nurse when she returned to the U.S.); and 4) variation in type of news source (print, TV, blog). (Table 2). We selected the highest circulation/viewership news sources available in LexisNexis, ProQuest, or Newsbank meeting these criteria.^{58,59} Selection criteria were not mutually exclusive; thus, several news sources fell within multiple selection categories.

Classification of conservative or liberal ideology was based on endorsement of Democratic or Republican candidates in the 2012 presidential election and viewer clustering around specific news sources according to data collected by Pew Research Center.^{60,61} Television news sources were selected to provide a potential comparison of information presented to readers or viewers.⁶² Examples of both network (NBC Nightly News) and cable television news (CNN Situation Room, Fox Special Report) were included. Although television news sources were headquartered in cities that had experienced Ebola cases, they are nationally produced and focused and were therefore not classified as containing local coverage.

Search Strategy

News media stories were collected through a search of LexisNexis, ProQuest, and NewsBank online archives using the search term “Ebola.” The search yielded 3,296 news stories, which I scanned to determine if they met inclusion criteria. The primary inclusion criterion was that news stories focus on U.S.-related Ebola issues. Stories that provided exclusively international coverage and did not place Ebola in a U.S. context (n=428) were included in our analysis of news volume but excluded from the final content analysis, which focused on identifying risk-related messages about Ebola in the U.S. context. Stories shorter than 100 words; items classified as corrections; book reviews; letters to the editor; solely business/stock focused; obituaries; duplicates; indexes; introductions/lead ins; calendar/event reports; advice columns; and items that mentioned Ebola only in passing were excluded from the study sample. The final analytic sample for the content analysis included 1,262 news stories and opinion pieces (editorial or opinion-editorial pieces) from print and television news sources and 159 blog postings.

Content Analysis and Measures

To identify risk-related messages for inclusion in the coding instrument, an informal news media scan (i.e., a review of the themes that could impact perception of risks from Ebola, circulating in news media articles at the time) was used to identify common risk-related messages about Ebola. An initial 14-item coding instrument of messages relevant to risk perception was developed by myself and a member of my dissertation committee. The instrument’s list of Ebola-related messages was also reviewed by two infectious disease and public health experts affiliated with the University of Pittsburgh Medical

Center (UPMC) Center for Health Security to identify any further risk-related messages about Ebola that they may have observed in their professional roles. These messages were then mapped onto factors drawn from the risk perception literature that have been shown to increase or decrease audiences' perception of a risk's severity. (Tables 3 and 4)

Nine of the identified Ebola-related messages contained characteristics that could increase perception of risk according to the risk perception framework published by Slovic.²⁰ (Table 3). Throughout this paper, we refer to these as “risk-elevating” messages. Five of the identified messages contained characteristics that could decrease perception of risk, according to Slovic. (Table 4). We refer to these as “risk-minimizing messages.”

With a colleague, I piloted the instrument on 50 articles and 10 transcripts from the study time period that appeared in two news sources not included in the study sample (*Wall Street Journal*, *CBS Evening News*). The coding instrument was then refined based on pilot results and advice from the infectious disease and public health experts we consulted. The final coding instrument used for this research contained 16 items, including story word count, date of publication, and 14 risk-related Ebola messages. (Appendix 3).

Along with a colleague, I then independently coded a random sample of 15 percent (n=216) of the news stories in the study sample to assess interrater reliability for each dichotomous yes/no item. The majority of items met conventional standards for adequate reliability with kappa values of 0.69 or higher.⁶³ Four items had kappa statistics slightly

below this threshold ($\kappa = 0.63, 0.64, 0.67$ and 0.67) but high raw percent agreement (94%, 90%, 94% and 90%, respectively; see Appendix A for final κ and percent agreement for all variables), and were therefore also included.

Data Analysis

The content of news stories about the Ebola outbreak was assessed by calculating the proportion of television and print news stories that mentioned each Ebola-related message over the study period. Chi-squared tests were used to test differences in the proportion of news stories mentioning each Ebola-related message in news sources based in localities that faced an Ebola case or controversy versus news sources in localities that did not; conservative versus liberal news sources; and news source type (television, print, blog). Because distinctive characteristics of the Huffington Post blog (e.g., unique story types, potential differences from other internet news sources) may have skewed the main news story sample, a separate analysis was completed that included this news source. In this separate analysis, the content of all news stories, including those in the Huffington Post blog, was analyzed by calculating the proportion of stories that mentioned each Ebola-related message. The Huffington post blog was then compared to television and print news using chi-squared tests. Data analysis was completed using Stata 12.1.⁶³

Results

A total of 1,849 news stories and editorials were included in the analysis of news volume. After the analysis of news volume was completed, the articles that did not focus on Ebola in the U.S. context ($n=428$) were excluded and the remaining articles ($n=1,421$, 77%) were used in the content analysis. Of the 1,421 domestically-focused Ebola stories,

1,109 (78%) were print news, 153 (11%) were television news, and 159 (11%) were blog postings. The volume of U.S.-focused news coverage of the Ebola outbreak showed a small peak after the first individual diagnosed overseas arrived in the U.S. on August 2, 2014, and a much larger peak after the Dallas case was diagnosed on September 30, 2014 (Figure 2; see Table 1 for important dates in the Ebola outbreak). Compared to the volume of news coverage of the Ebola outbreak in the U.S., the volume of news coverage that was solely internationally focused – with no coverage of Ebola coming to or in the U.S. – was much less and did not show similar peaks. Trends in the number of news stories mentioning specific risk-related messages about Ebola were also examined. The frequency of these messages varied over time but did not differ from the trends in the volume of Ebola-focused news stories described above.

Comparison of Messages that May Increase or Decrease Perception of Risk

Overall, 96% of the print and television news stories that covered Ebola in a U.S. context included one or more risk-elevating messages and 55% of stories contained one or more risk-minimizing messages. Fifty-three percent of news stories contained both types of messages and 42% contained only messages that could increase perception of risk. Two percent of news stories contained only risk-minimizing messages while another 2% contained neither type of message. Additionally, when directly opposed messages about ability to stop transmission or limit the outbreak in the U.S. were compared, news stories with messages affirming this ability (20%) were more frequent than news stories with messages suggesting that U.S. transmission or a U.S. outbreak could not be stopped (7%). (See Appendix 5 for examples of each type of message).

The three most common risk-elevating messages found in print and television news stories were messages about foreigners or travelers bringing Ebola to the U.S. (72% of news stories), those describing the disease causing deaths (66% of news stories), and messages about a potential U.S. outbreak/people in the U.S. contracting Ebola (35% of news stories). In contrast, messages about science not understanding Ebola (e.g., previous knowledge about the disease was wrong or expert advice was incorrect; 8% of news stories), messages about the inability to stop Ebola in the U.S. (7% of news stories), and messages about terrorism or use of Ebola as a bioweapon (1% of news stories) each appeared in less than 10% of news stories.

The most frequent risk-minimizing messages found in print and television news stories were those describing scientific knowledge about Ebola (e.g., transmission dynamics or other known aspects of the disease; 32% of news stories), messages about low risks (e.g., low risk of Ebola coming to the U.S.; low risk of someone transmitting the disease; low risks of school children acquiring Ebola; 28% of news stories), and positive messages about the ability to stop transmission/limit the outbreak in the U.S. (20% of news stories).

The least frequent risk-minimizing message concerned lower death rates from Ebola in the U.S. (5% of news stories). (Table 7)

Differences by Type of News Source

A number of risk-related messages differed when comparing news sources stratified by whether or not an Ebola case or controversy occurred in the locality in which the news source is based and also when comparing news sources stratified by political ideology. News sources that included coverage of local Ebola cases or controversies (*Atlanta Journal Constitution, Fort Worth Star-Telegram, New York Daily News, New York Times, and Portland Press Herald*) mentioned four risk-related messages significantly less often than news sources that were not in areas with local Ebola cases or controversies (*Chicago Tribune, CNN Situation Room, Fox Special Report, NBC Nightly News, Orange County Register, USA Today, and Washington Post*). These included three risk-elevating messages (i.e., lack of/limited availability of countermeasures to stop Ebola ($p<0.001$); inability to stop transmission/outbreak in the U.S. ($p<0.01$); growth of the Ebola epidemic ($p<0.001$)) and one risk-minimizing message (i.e., positive ability to stop transmission/outbreak in the U.S. ($p<0.01$)). (Table 7) When comparing message frequency in conservative news sources (*Fort Worth Star Telegram, Fox Special Report, and New York Daily News*) to message frequency in liberal news sources (*Chicago Tribune, New York Times, and Washington Post*), there were significant differences in the proportion of news stories mentioning these same messages, with the exception of negative messages about the ability to stop transmission/outbreak in the U.S. Liberal sources mentioned two risk-elevating messages (i.e., lack of/limited availability of countermeasures to stop Ebola ($p<0.01$); growth of the Ebola epidemic ($p<0.001$)) significantly more often than conservative sources. In contrast, liberal sources mentioned

one risk-minimizing message (i.e., positive ability to stop transmission/outbreak in the U.S. ($p < 0.01$)) less often than conservative sources.

When compared in this analysis, television news mentioned eight risk-related messages significantly more often than print news. (Table 8) Among risk-elevating messages, these differences were statistically significant for: growth of the Ebola epidemic ($p < 0.001$); science not understanding Ebola ($p < 0.05$); incubation period ($p < 0.05$); and foreigners or travelers bringing the disease to the U.S. ($p < 0.05$). Among risk-minimizing messages, differences in frequency of coverage among print and television news sources were statistically significant for: lower Ebola death rates in the U.S. ($p < 0.001$); positive message about ability to stop Ebola transmission/outbreak ($p < 0.01$); low risks ($p < 0.001$); and how to prevent spread of Ebola ($p < 0.05$).

The Huffington post blog, which was included in a secondary content analysis, was compared to television and print news. When the proportion of news stories with each Ebola-related message was compared, significant differences appeared for seven risk-related messages. (Table 8)

Discussion

The volume of news coverage over time suggests that the diagnosis of an Ebola case in Dallas and subsequent cases diagnosed in the U.S. were important time points in the escalation of news coverage of the Ebola outbreak. This is particularly interesting

considering that the Ebola outbreak had already reached historic levels internationally months earlier.⁴ Although the volume of international coverage was evaluated to account for articles solely focused on international aspects of the Ebola outbreak, these news stories did not appear in high volume even before coverage focused on Ebola in the U.S. spiked. As noted in other reports,^{50,77} the time period following the U.S. midterm elections reflects a large reduction in Ebola news volume. One potential explanation for this change in news volume is the inclusion of the Ebola outbreak and Ebola response as a campaign issue late in the election cycle, which drew to a close after Election Day. However, alternative explanations, such as the lack of newly diagnosed cases in the U.S., may also explain waning media interest.

The high frequency of risk-elevating messages in news media coverage may have contributed to increased public concern about Ebola in the U.S., which was much greater than the situation warranted. Nearly all news stories analyzed contained at least one message that could increase perceived Ebola risks while only slightly more than half of news stories contained risk-minimizing messages. As a result, consumers of the news media would have been exposed to risk-elevating messages more often than risk-minimizing messages, which may have increased their perception of risk from Ebola. Although many factors can alter how effective a message frame is (e.g., strength of frame, salience of frame), the frequency of exposure to risk-related messages can alter public perception and contribute to the social amplification of risk.^{10,15} Even in cases of balanced coverage, reassuring messages may be less able to counter messages that increase perception of risk.¹⁰

The news media has been blamed for sensationalizing the limited Ebola outbreak in the U.S., and unnecessarily alarming the public.^{52,53} Although the volume of news coverage may have influenced public attention given to the Ebola outbreak, the content of news stories does not necessarily support the idea that the news media was reporting news about Ebola in a hyperbolic or irresponsible manner. Comparison of opposing messages, such as the ability to stop transmission or the outbreak in the U.S., which was more frequently mentioned than the inability to stop Ebola in the U.S., suggests that some concerns about Ebola may have resulted from the nature of the risk itself, rather than irresponsible news media coverage of the outbreak. Additionally, the messages that were most inflammatory – such as messages about science not understanding the disease, the inability to stop Ebola in the U.S., and messages about terrorism or use of Ebola as a bioweapon – were mentioned less frequently than nearly all of the other messages analyzed.

Although this study's methodology does not allow for causal inference between the content of the news media coverage of Ebola and reported public polling about Ebola, comparison with public polling may provide context for the interpretation of these results. For instance, results about Ebola news volume roughly reflect levels of concern about Ebola. In August, 39% of survey respondents were concerned about the potential spread of Ebola in the U.S. This percentage rose to 65% by mid-October 2014 and dropped to 19% by December 2014.^{8,50,54} News media coverage could have increased public concern or public concern could have increased news coverage of risks.

Additionally, despite the large number of news stories covering Ebola, poll respondents were often misinformed about how the disease was spread, with 85% of respondents indicating that a person was likely to get Ebola via the sneeze or cough of a symptomatic person and 48% noting that a person could transmit the virus before symptoms appeared.⁵⁵ In our analysis, only 32% of news stories included scientific knowledge such as how the disease is spread. It is possible that more in-depth and frequent coverage of scientific aspects of a public health threat (and disease contagion pathways in particular) could help prevent these types of misperceptions in the future.

The news media are often required to strike a delicate balance between raising awareness and causing unnecessary alarm. Results show that some risk-related messages appeared more or less frequently when considering news sources' political ideology and news source type. Several of the messages that were seen significantly more frequently in liberal news sources may have been related to increasing awareness of specific issues, such as medical countermeasure development efforts and the large-scale growth of the Ebola epidemic. This analysis also supports previous research showing that print and television news sources provide different information to readers and viewers.⁶² Results show that television news was more intense in the frequency of risk-related message use overall. Nearly all of the risk-related messages examined in this study appeared more frequently in television news than print news. In contrast, the blog that was analyzed mentioned all risk-related messages less frequently. This suggests that members of the public may differ in their perceptions of the Ebola risk depending on which type of news they consume.

Limitations

Study results should be considered in the context of several limitations. First, the sample did not include talk radio transcripts, social media, local television, or a range of internet-only news sources through which many Americans receive at least some news. Thus, potential variation in messages provided by these sources could have led to differences in risk perception by listeners of, viewers of, and participants in these forms of news media. Additionally, the coding process utilized specific interpretations of messages that may have been understood differently by other readers or viewers. Further, four items in the coding instrument had kappa statistics slightly below conventional reliability standards but were included in the analysis because of high raw percent agreement. Also, some messages that influenced risk perception may have been unintentionally omitted from the coding instrument. Moreover, the final set of messages included a greater number of risk-elevating messages than risk-minimizing messages. Although the process used to create and evaluate the coding instrument should have accounted for any other risk-elevating or risk-minimizing messages used frequently in news media coverage about Ebola, this imbalance may have influenced our analysis of the overall frequency of each of these two types of messages. Further, this analysis may not fully explain trends in news coverage, which may have been influenced by the existence or lack of existence of competing issues in the news cycle. Finally, this study does not allow for the assessment of how many people were exposed to specific messages in the news media or provide a direct measurement of the influence these messages had on actual risk perception during the Ebola outbreak. This is a promising area for future research.

Conclusion

The Ebola outbreak of 2014-15 provides an important case for studying emerging outbreaks and other public health emergencies that will require communication of risk in the future, and highlighted the role that the news media plays in communication about disease risks. The outbreak resulted in a large volume of news coverage, particularly in October 2014. Nearly all news stories in our sample contained at least one or more risk-elevating message(s). Although these findings cannot be definitively tied to public opinions about the Ebola outbreak, previous research has shown that the news media can influence public opinion.^{13,75,76} In the case of the Ebola outbreak, high levels of concern about the spread of the disease and misunderstandings about the nature and transmission of the disease may have impacted policy decisions about how to manage the outbreak. Findings offer insight into the interplay between theories on risk perception and news media coverage of emerging risks. Results may help decision-makers and leaders to influence news content on infectious disease risks and improve policy messaging in the future.

Paper 3

Manuscript 3

News Media Coverage of U.S. Ebola Policies: Implications for Communication During
Future Infectious Disease Threats

News Media Coverage of U.S. Ebola Policies: Implications for Communication During Future Infectious Disease Threats

Abstract

The Ebola outbreak of 2014-2015 raised concerns about the disease's potential spread in the U.S. and received significant news media coverage. Prior research has shown that news media coverage of policy options can influence public opinion regarding those policies, as well as public attitudes toward the broader social issues and target populations addressed by such policies. To assess news media coverage of Ebola policies, the content of U.S.-focused news stories (n=1,421) published between July 1, 2014 and November 30, 2014 from 13 print, television, and blog news sources was analyzed for 13 policy-related messages. Eight-two percent of news stories mentioned one or more policy-related messages. The most frequently appearing policy messages overall were those about isolation (47% of news stories) and quarantine (40% of news stories). The least frequently mentioned policy message described dividing potentially exposed persons into distinct groups based on their level of Ebola risk in order to set different levels of restrictions (5%). Message frequency differed depending on whether news sources were located in an area that experienced an Ebola case or controversy, by news sources' political ideological perspective, and by type of news source (print, television, and blog). All policy-related messages showed significant increases in frequency after the first case of Ebola was diagnosed in the U.S. in Dallas on September 30, 2014, with the exception of messages related to isolation, which showed a significant decrease. Results offer insight into how the news media covers policies to manage emerging disease

threats, which may help public health practitioners and policymakers to understand and influence news content about future infectious disease policy.

Background

The Ebola outbreak of 2014-2015 grew from a single case in Guinea in December 2012 into the largest Ebola outbreak on record, and raised concerns about Ebola's potential spread to the United States.^{3,4,65} The high case fatality rate for those infected with the disease and rapid spread of the outbreak in West Africa highlighted its seriousness as a possible threat to the health of the U.S. population.² These and other sobering details about Ebola were frequently cited in news media reports about the outbreak and prompted U.S. policymakers to introduce policies to control the potential spread of Ebola in the U.S.^{35,45,66}

Specific federal and state guidelines for managing the potential community spread of Ebola in the U.S. did not exist prior to the outbreak. Public health practitioners possess an array of tools to help reduce the potential spread of communicable diseases in general, including restricting the types of community interactions an exposed person may have through, for example, quarantine (i.e., the separation and restriction of movement of people who have been exposed to a disease but are not symptomatic); monitoring people for the potential development of disease; isolation (i.e., the separation of those known to be infected with a disease from others not infected); and provision of medical countermeasures (e.g., influenza vaccine). During the Ebola outbreak, the U.S. Centers for Disease Control and Prevention (CDC) provided federal guidance, and states developed a range of policies to manage individuals who may have been exposed to Ebola.^{7,32,33} The CDC and most states created different levels of restrictions for

individuals based on their level of Ebola risk, including movement restrictions (i.e., limitations on where and how people may travel). Although the CDC rejected use of quarantine in its guidance, several states chose to impose quarantines on some individuals. Public health departments also monitored those who were potentially exposed to Ebola to check for symptoms.⁷ Travelers arriving in the U.S. from affected West African countries were screened for symptoms such as fever and asked to complete a questionnaire about exposure.³⁸ These policy responses were communicated to the public through a variety of channels, including the media, but little is known about the specific policy content of news media coverage of Ebola.

The news media can influence public perception in a variety of ways and has been shown to influence the public's knowledge, attitudes, and policy choices.^{13,75,76} Whether and how the news media covers different policy options can influence attitudes and support for policies in response to potential public health threats such as Ebola. One important way that the news media can influence policy is through agenda setting, which shapes what issues the public considers important.^{9,11,78} Another critical area of news media influence comes from message framing, or presenting one of the different ways an issue can be conceptualized, which indicates how the public should think about an issue and the policies that are appropriate responses.^{9,15} Different message frames can compete against each other, with stronger, more persuasive frames outcompeting weaker frames.¹⁷ In addition, more frequent frames often have greater influence than infrequent frames.¹⁶ However, when competitive frames are received at the same time, they can cancel each

other out.¹⁶ In the policy realm, the outcome of competition between frames can influence which policies gain greater support among the public.¹⁷

Coverage of policies can also influence attitudes about the target populations of these policies (i.e., groups who are affected by public policies), which in turn influences policy choices.¹⁸ For instance, in the case of Ebola, most response policies governed the activities of a very limited group of potentially exposed people – such as doctors and nurses involved in the response – who could have been portrayed either as selfless heroes risking their lives to protect the world from a devastating disease or, alternatively, as irresponsible self-interested individuals who had little consideration for the danger they posed to others. The way this target population was portrayed, often via the news media, likely influenced public and policymaker attitudes about those whom policies would affect and contributed to the policy development process and the final policies that were put in place for Ebola. Given the role that the news media plays in agenda setting, framing, and construction of target populations, the news media likely influenced public perception of Ebola and helped to shape policies created in response to the outbreak.⁹ Ebola response policies were then communicated back to the public via the news media, which further shaped public opinion about Ebola and Ebola policies. The large amount of news media coverage generated in response to the Ebola outbreak also highlighted the news media's role in infectious disease outbreaks and likely helped to drive widespread public interest in Ebola.^{48,49,50,52}

The objective of this research is to analyze the frequency of specific Ebola policy messages included in U.S. news media coverage of the Ebola outbreak from July 1, 2014 through November 30, 2014. This outbreak provides an important case for studying emerging outbreaks and other public health emergencies that will require public health practitioners to issue and communicate about disease management policies. Results could offer insight into how the news media covers policies to manage emerging disease threats, which may help public health practitioners and policymakers to understand and encourage appropriate communication of infectious disease policy.

Methods

I measured mentions of Ebola policy responses in print, television, and Internet news stories. The analysis was limited to stories published in major (i.e., widely or regionally recognized) U.S. English-language news sources between July 1, 2014, one month before the first case of Ebola arrived in the U.S., and November 30, 2014, two weeks after the final Ebola death in the U.S.

The analysis included 13 news sources selected to create a sample with the following *a priori* criteria, which were not mutually exclusive: 1) geographic diversity, with representation from each of the four U.S. census regions; 2) ideological variation (i.e., liberal and conservative)^{60,61}; 3) representation of news sources located in areas with Ebola cases or controversies (e.g., the diagnosis of an Ebola case in New York and the

quarantine of the Maine-based nurse upon her return to the U.S.)^a; and 4) diversity in news medium (print, television, blog). Multiple selection categories applied to several news sources. Ideological classification for a particular news source was determined using 2012 presidential candidate endorsement and viewer clustering (drawn from data collected by Pew Research Center). Among the sources meeting these criteria, the sample was reduced to the highest circulation/viewership news sources available in LexisNexis, ProQuest, or Newsbank (i.e., major news sources for this research).^{58,59} The final sample of news sources included articles from nine newspapers: *Atlanta Journal Constitution* (Southwest region, local Ebola case), *Chicago Tribune* (Midwest region, liberal), *Fort Worth Star Telegram* (South region, conservative), *New York Daily News* (Northeast region, conservative, local Ebola case), *New York Times* (national newspaper, liberal, local Ebola case), *Orange County Register* (West region), *Portland Press Herald* (Northeast region, local Ebola controversy), *USA Today* (national newspaper), and *Washington Post* (national newspaper); transcripts from three television news programs: CNN Situation Room (cable television news), Fox Special Report (cable television news), and NBC Nightly News (network television news); and one blog: the Huffington Post.

Search Strategy

Searches among the 13 news sources for the term “Ebola” in the LexisNexis, ProQuest, and NewsBank online archives yielded 3,296 news stories. I evaluated these news stories

^a Television news sources, which are nationally produced, were not classified as sources based in localities that experienced Ebola cases or controversies even though they were headquartered in cities that had experienced Ebola cases.

to determine if they met exclusion criteria. The content analysis focused on policy-related messages appearing in Ebola-related news stories with a U.S. focus (i.e., included discussion of Ebola coming to or in the U.S.). As a result, stories with exclusively international coverage that did not place Ebola in a U.S. context (n=428) were excluded from the final content analysis. I also excluded stories shorter than 100 words as well as items classified as advice columns; book reviews; calendar/event reports; corrections; duplicates; indexes; introductions/lead ins; items that mentioned Ebola only in passing; letters to the editor; obituaries; and solely business/stock focused. After applying these exclusion criteria, 1,262 news stories and opinion pieces (editorial or opinion-editorial pieces) and 159 blog posts remained, and were used in the content analysis.

Content Analysis and Measures

An initial 31-item coding instrument of messages about types of policies considered/implemented in the U.S. for Ebola was developed based on an informal news media scan (i.e., a non-systematic evaluation of the policy-relevant themes found in news stories that had been published at the time). Two infectious disease and public health experts affiliated with the University of Pittsburgh Medical Center (UPMC) Center for Health Security were then asked to review the instrument and to identify additional policy-related messages about Ebola. The instrument was then piloted by my colleague and me on 60 news stories that appeared in two news sources (*Wall Street Journal*, *CBS Evening News*) from the study time period that were not included in our final sample. The

results from the pilot phase, along with advice from the infectious disease and public health experts, directed refinement of the coding instrument.

A number of items related to type of message source (n=15) were among those eliminated from the instrument, due to difficulties interpreting this aspect of news stories and in coding these types of items. Three policy topics – travel bans, quarantine, and isolation – were originally included only as containing either supportive or oppositional messages. However, results from the piloting phase led to the addition of an item that included any mention of travel bans or quarantine (i.e., opposing, supporting, or neutral) and sub-items were included in the coding instrument to specify supporting and oppositional messages for these topics. Messages mentioning isolation were combined into a single item specifying any mention of isolation, because supporting and opposing viewpoints were not found during our pilot phase and the topic was not a subject of policy debate in the same manner that quarantine or travel bans were.

The final coding instrument used in this analysis contained 15 items: 13 policy-related Ebola messages, story word count, and date of publication. These policy-related messages focused on travel bans in general; support for travel bans; opposition to travel bans; quarantine in general; support for quarantine; opposition to quarantine; isolation; dividing potentially exposed persons into groups based on level of Ebola risk; requirements to enter the U.S. (e.g., passport checks, temperature readings); public health monitoring; poor/slow response from government; poor personal protective equipment (PPE), standards, or training (i.e., lack of preparedness); and confusion about policy

guidelines/implementation. My colleague and I assessed interrater reliability for each dichotomous yes/no item by independently coding a random sample of 15 percent (n=216) of the study sample. All items had kappa values of 0.69 or higher and therefore met conventional standards for adequate reliability.⁶³ (Appendix 4).

Data Analysis

To evaluate the content of news stories about the Ebola outbreak, I assessed the proportion of television and print news stories from the study period that mentioned each policy-related message about Ebola. Differences in the proportion of news stories mentioning each Ebola-related policy message were tested using chi-squared tests. Statistical comparisons using chi-squared tests were conducted to assess differences in policy messages between news sources located in or away from an area that faced an Ebola case or controversy; conservative or liberal news sources; and print or television news sources. We also used chi-squared tests to compare the proportion of messages appearing in news stories published before and after key dates in the Ebola outbreak. The Huffington Post blog was excluded from the original content analysis due to potentially distinctive characteristics including unique story types and potential differences from other internet news sources. Because these characteristics may have skewed the main news story sample, a second analysis was undertaken including this news source. In this separate analysis, we evaluated the content of all news stories, including those in the Huffington Post blog, by calculating the proportion of stories that mentioned each Ebola-

related policy message. Television and print news sources were then compared to the Huffington Post blog using chi-squared tests. Data were analyzed with Stata 12.1.⁶⁴

Results

This analysis included 1,421 news stories focused on the Ebola outbreak in a U.S. context. Of these stories, 1,109 (78%) were print news, 153 (11%) were television news, and 159 (11%) were blog posts. Of the 1,262 print and television news stories included in the main content analysis, 82% contained at least one of the policy-related messages we analyzed. (See Appendix 6 for examples of each type of message). The policy-relevant messages that appeared most often in Ebola-related news coverage were those mentioning quarantine (40% of news stories) and isolation (47% of news stories). The least frequently mentioned policy-related message described dividing potentially exposed persons into distinct groups based on their level of Ebola risk (5%). Messages supporting travel bans appeared in the same proportion of Ebola-related news stories as messages opposing travel bans (9%) and 5% of Ebola-related news stories contained both of these messages. Messages supporting (13%) and opposing (12%) quarantines also appeared in similar proportions of news stories, with 9% of news stories containing both messages. Messages blaming aspects of the Ebola outbreak on slow or poor response from the U.S. government or poor PPE (Personal Protective Equipment), standards, and training (i.e., lack of preparedness) were mentioned in 20% and 21% of Ebola-related news stories, respectively. (Table 9)

Differences in frequency of message by news source type

The proportion of policy-related messages in news sources that included coverage of local Ebola cases or controversies (*Atlanta Journal Constitution, Fort Worth Star-Telegram, New York Daily News, New York Times, and Portland Press Herald*) was compared to the proportion of policy-related messages in news sources that were not in areas with local Ebola cases or controversies (*Chicago Tribune, CNN Situation Room, Fox Special Report, NBC Nightly News, Orange County Register, USA Today, and Washington Post*). Four policy-related messages appeared in a significantly greater proportion of nationally produced news sources or those without an Ebola case or controversy in the locality where the news source is based. These messages included those with any mention of travel bans ($p < 0.001$); messages in support of travel bans ($p < 0.01$); messages in opposition to travel bans ($p < 0.001$); and messages about requirements to enter the U.S. (e.g., passport checks and temperature readings; $p < 0.01$). (Table 9) We also compared Ebola-related message frequency in news sources stratified by conservative (*Fort Worth Star Telegram, Fox Special Report and New York Daily News*) or liberal (*Chicago Tribune, New York Times, and Washington Post*) political ideology. Liberal news sources included messages with any mention of travel bans ($p < 0.05$) and those opposing travel bans ($p < 0.05$) significantly more often than conservative sources. (Table 9)

The proportion of television news stories mentioning policy-related messages was greater across all Ebola-related policy messages when compared to print news stories. This

difference was significant for: messages mentioning isolation ($p < 0.01$); requirements to enter the U.S. ($p < 0.001$); public health monitoring ($p < 0.001$); slow or poor response from the U.S. government ($p < 0.001$); and poor PPE, standards, or training ($p < 0.001$). We also compared the Huffington post blog, which was not included in the main sample, to television and print news to examine whether this Internet news source provided different policy-related messages than other traditional news mediums. The proportion of 8 of the 13 Ebola policy-related messages of interest appearing in this source was significantly lower than in print and television news. (Table 10)

Message use over time

All policy-related messages about the Ebola outbreak showed a statistically significant increase ($p < 0.001$) after the first case of Ebola was diagnosed in the U.S. in Dallas on September 30, 2014, with the exception of messages related to isolation, which showed a significant decrease ($p < 0.05$). (Table 11)

Discussion

The relatively low frequency of some messages about policies important to the Ebola response highlights the difficulty that public health agencies and policymakers face in communicating about public health policies. For example, the policy of assigning different levels of risk to individuals potentially exposed to Ebola was a key aspect of CDC and state-level Ebola policy and formed the basis for different risk-based

restrictions and requirements for potentially exposed persons. Yet relatively few news stories included any mention of this policy. In contrast, quarantine – an activity not recommended by the CDC but occasionally used by a number of states and promoted by a number of politicians – appeared in a much greater proportion of news stories. Also, although our research methodology does not allow us to assess a causal relationship between news media coverage and public opinion, it is interesting to note that polling at the time showed that 71% of Americans supported mandatory quarantines for Ebola health workers.⁵⁶ Our results may reflect the heightened newsworthiness of a controversial topic, which would have increased news coverage of quarantine, and raised public exposure to quarantine as a potential public health response. In contrast, more measured and universally acceptable responses may receive less media coverage and, as a result, the public may be less familiar with policies more widely embraced by the public health community. These differences in the frequency of some policy-relevant messages may also reflect challenges faced by the science community in effectively communicating, often via the media, to the public about science-based decision-making.⁷⁹

Another potential explanation for greater frequency of messages about quarantine could be confusion among the news media about the difference between isolation and quarantine. For example, at times isolation may have been mistakenly used interchangeably with quarantine, even though they are distinct activities.⁸⁰ For instance, some news stories might have described the quarantine of an asymptomatic person exposed to Ebola as “isolation,” even though this description is inaccurate. However,

messages about isolation appeared in an even greater proportion of news stories and so, regardless of potential confusion surrounding the proper use of each term, news coverage of these concepts remained high. As a result, American consumers of the news media were more likely to be exposed to the concepts of quarantine and isolation than any other policy intervention, although they may not have understood the distinction between the two. This may have led to an oversimplification of what the public health response to Ebola entailed.

The proportion of supportive and oppositional messages about travel bans was similar, suggesting that news coverage presented these different messages in a fairly balanced manner. Messages supporting or opposing quarantine also seemed to show balanced representation in news coverage. The inclusion of messages opposing travel bans and quarantines could be considered a limited success in public health messaging about policy decisions, since many public health officials opposed travel bans and quarantines for asymptomatic individuals. Although messages supporting quarantine and travel bans were still mentioned in news stories, the use of opposing message frames promoted by public health officials shows that these messages were part of the policy discussion in the news media. Of note, liberal news sources were significantly more likely to include messages opposing travel bans than conservative sources, suggesting greater penetration of government policy messages about Ebola in liberal news sources.

Messages critical of the government response to Ebola, a lack of preparedness, and confusion about policies appeared in some news stories but did not represent the most

frequently covered Ebola policy-related messages. These messages were not significantly different between liberal and conservative sources. Instead, television coverage included more messages criticizing the U.S. government than print news coverage. Although the impact of these messages cannot be determined from this study, it is useful to note that these policy-related messages appeared in the news media at a time when members of the public expressed lack of trust in government officials. Polls of public opinion on the Ebola outbreak showed that only 31% of the public reported that they trusted U.S. health officials to share complete and accurate information about Ebola while 40% did not trust information from the CDC about the Ebola outbreak.⁵⁵

The proportion of nearly all policy-related messages appearing in news stories increased following the diagnosis of the Dallas case, suggesting that news coverage of Ebola changed significantly after this event. Prior to the diagnosis of the Dallas case, the only policy-related message that appeared in a large proportion of news stories concerned isolation. After diagnosis of the Dallas case, all policy messages other than those about isolation saw a significant increase, which highlights the importance of the first domestically diagnosed case as an opportunity to promote response policies. However, this finding also highlights the risk of delaying the development and communication of potential policies until a landmark event occurs. If public health policymakers do not introduce science-based policies in a timely manner, then other, less desirable policies may dominate the news media dialogue. Although a single case does not generally indicate a public health emergency, it may signal a need for increased communication with the public. Clear and consistent communication about policies that are being

implemented as a crisis is developing – but before these types of landmark events, such as the first domestic diagnosis of a case, occur – is important. At the same time, policies should be communicated in the context of transparency about what is not known and what may change, without over-reassuring the public, to build trust and public support for evidence-based policies.

Limitations

This research has several limitations. A number of different types of news sources, through which many Americans receive news, such as talk radio transcripts, social media, local television, and internet-only news sources, were not included in the analysis. These sources may have provided a different message profile to listeners, viewers, and participants and, as a result, influenced perception of risk about Ebola differently. Additionally, the process of coding news stories for each item in the coding instrument used specific interpretations of messages that may not have been understood by other readers or viewers in precisely the same way. Some policy-related messages may have been unintentionally omitted from the coding instrument; however, the piloting process and review by experts should have reduced the potential that frequently used messages were overlooked. Also, trends in news coverage could also be influenced by the existence or lack of competing issues in the news cycle. Finally, this study does not assess public exposure to policy-related messages in the news media or provide a direct measurement

of the influence these messages had on public understanding and acceptance of these policies.

Conclusion

As was required in the Ebola outbreak of 2014-2015, future disease outbreaks will involve the communication of public health and infectious disease response policies. The Ebola outbreak generated high levels of media coverage, which can influence the public's knowledge, perceptions, attitudes, and policy preferences, as well as political engagement.^{13,75,76} Findings highlight the difficulty that public health agencies and policymakers face in communicating public health policies for unfamiliar, fear-provoking threats. Central features of Ebola response policies received relatively little news media coverage compared to other features, such as quarantine, which made up only a limited part of policies used to control the potential spread of Ebola. The frequency of policy-related messages changed significantly following the first case of Ebola diagnosed in the U.S. This emphasizes the importance of the first domestically diagnosed case in an emerging disease outbreak as an opportunity to introduce and promote appropriate response policies; if this opportunity is missed, it could create a communication vacuum to be filled by those promoting policies contrary to public health interests. This research into how the news media covers policies to manage public health threats may help public health practitioners and policymakers to influence news content about infectious disease policy in future disease outbreaks by communicating policies in a timely manner,

anticipating the heightened attention given to controversial issues, and crafting messages that will succeed in a competitive news media environment.

Discussion and Policy Implications

Limitations

This research has several limitations that should be noted. Data collection for aim 1 was limited by a number of factors: key word searches of two websites were stymied by technical anomalies; state policies may have changed during the study period for aim 1, resulting in the removal of old policies from websites; and eleven state governors changed during the study period for aim 1, causing the websites of previous governors to go offline. As a result, despite a systematic approach to data collection for aim 1, some documents may not have been captured through the search process. However, a number of safeguards were put in place to minimize this risk. For instance, searches of state websites, which offered redundancy in the posting of state public health policies, and searches of website archives, which included previously posted policies, should have reduced the number of documents that may have been missed.

Aim 1 was also limited in scope. This research was focused on state and federal policies and did not attempt to include any policies that may have been established at a more local level. Additionally, aim 1 provided an analysis of the policies as posted, but did not attempt to address how these policies were put in place by state and local health departments or if they were modified in practice. Finally, aim 1 did not examine the process by which states developed Ebola response policies, which limited analysis of why policies may have differed between states.

The second and third aims of this research utilized the same methodological approach, and as a result, some similar limitations apply to both aims. The coding process for aims 2 and 3 may have limited content analysis and measures. This process utilized specific interpretations of messages mutually understood by my colleague and me, but other readers and viewers may have interpreted these messages differently. Furthermore, some messages may not have been included in the coding instrument used for aims 2 and 3. However, the use of two coders, the piloting process, and the review of coding items by subject matter experts should have reduced the potential for our understanding of messages to be misaligned with general interpretations and for frequently used messages to be overlooked.

A number of additional limitations apply specifically to the content analysis and measures for aim 2. Four messages used in aim 2 did not meet conventional reliability standards for interrater reliability and had kappa statistics slightly below 0.69. However, these messages were included in the analysis because of high raw percent agreement between my colleague and me. Also, the number of risk-elevating messages included in the final coding instrument was greater than the number of risk-minimizing messages, which may have influenced analysis of the overall frequency of each of these two types of messages. However, as noted above, the piloting and external review process that was used to create and evaluate the coding instrument should have accounted for any other risk-elevating or risk-minimizing messages used frequently in news media coverage about Ebola.

The scope for aims 2 and 3 was also limited. News sources for the news media analysis did not include talk radio transcripts, social media, local television, or a range of internet-only news sources. Many Americans receive at least some news through these sources, which could have varied in the messages they provided and led to differences in risk perception not accounted for by this study. Further, this analysis did not investigate the existence or lack of existence of competing issues in the news cycle, which may have influenced trends in news coverage. Finally, aims 2 and 3 did not directly assess public exposure to specific messages in the news media (i.e., how many people read or viewed certain messages) or provide a direct measurement (through polling) of the influence these messages had on public risk perception or policy acceptance during the Ebola outbreak.

Strengths

Disease outbreaks that require nationwide response are rare, and so the opportunity to comparatively study different state-level responses, especially to a dreaded disease such as Ebola, is unique. This research describes nationwide policy responses to this recent emerging disease outbreak in a comprehensive way that is unique to the literature. Aim 1 employed a systematic search methodology to identify documents describing state policies for individuals considered at risk for Ebola, as well as the requirements and restrictions that they may be subject to. These documents were then systematically analyzed and described to provide a comprehensive view of state Ebola policies and an evaluation of how they compared to CDC guidance. This research translates a disparate and disjointed array of state policies into a comprehensive evaluation of Ebola policies across the federal government, 50 U.S. states, and the District of Columbia, allowing policymakers and practitioners to better understand the policies that may be put in place in a future infectious disease outbreak.

Beyond the opportunity to investigate potential policy responses to an outbreak of a dreaded infectious disease, the Ebola outbreak also allowed for the investigation of media coverage of risk-related and policy-related messages about a newly emerging disease. Both aims 2 and 3 were systematic investigations of media coverage of the Ebola outbreak, using a large sample of news articles (3,296 articles were originally examined for inclusion and exclusion criteria and 1,421 were coded for message content) published throughout and beyond the entire time period in which active cases of Ebola existed in

the U.S. The large sample size and wide time frame allowed for a more comprehensive investigation of the messages used in news media coverage of the outbreak. This research used a larger number of news media sources than other examinations of news media coverage of the Ebola outbreak,^{37,45} which allowed for a more balanced investigation of news coverage.

Aim 2 utilized a quantitative news media content analysis methodology to evaluate U.S.-focused news stories for risk-related messages that were judged to potentially increase or decrease perception of risk. This research was unique in its combination of risk perception theory with a quantitative analysis of news messages about Ebola in a wide array of news sources. The results from this research provide a greater understanding of the way public health risks from a disease are communicated in the news media and will likely be applicable in future disease outbreaks. This study also provides an opportunity to understand how specific public health messages about risk were used in the media during the Ebola outbreak and information on how risk perception during the outbreak may have been influenced through media coverage.

Aim 3 also used a quantitative news media content analysis methodology in order to evaluate U.S.-focused news stories for policy-related messages. This research provided a unique understanding of how policies for Ebola response were represented in the news media. Specifically, this research allows for a greater understanding of which policies were most strongly represented in news media coverage of the outbreak and which policies were underrepresented, providing important information for better

communication in future infectious disease outbreaks. Results from all three aims may improve communication and policy formation during infectious disease events and can immediately be applied to growing concerns regarding Zika, the most recent infectious disease outbreak that has required a response from public health policymakers and communicators.

Policy Implications

Emerging infectious diseases that capture the attention of the public and the media are not a new phenomenon and the Ebola case is unlikely to be the last. For instance, the ongoing outbreak of the Zika virus in the Americas has already garnered significant attention from the press and in policy circles, with the White House recently requesting \$1.9 billion from Congress to address this threat.⁸¹ Although Zika and Ebola have different profiles with regard to their implications for risk perception theory, Zika also possesses characteristics – such as its potential threat to future generations via the birth defects that have been attributed to it²⁰ – that potentially heighten risk perception. This research identifies important implications for policy development and emergency communication during infectious disease outbreaks.

Policy Development

Recommendation 1.1: Practitioners and policymakers should anticipate deviations from evidence-based federal guidance, particularly in states influenced by localized infectious disease events.

Study results from aim 1 show a wide range of state-level policy responses to Ebola and variations on quarantine, movement restrictions, exposure categories, and monitoring. Most state policies reflected CDC guidance. However, states have the ability to act independently from federal recommendations and some states developed their own policies with more aggressive quarantine and movement restrictions, established unique

strategies to categorize people who may have been exposed to Ebola, and set more frequent monitoring procedures than were called for in federal guidance. Local factors, such as Ebola cases in specific U.S. regions and the location of international airports, may have played a role the development of state policies, possibly leading to more aggressive responses. Federal and state policymakers should anticipate that not all states will follow federal guidance in the development of infectious disease response policies in the future and provide adequate information to states that may wish to develop their own policies, in order to ensure that these policies are appropriate.

***Recommendation 1.2:** Federal policymakers should increase efforts to communicate with state policymakers about the scientific rationale for federal guidance in order to improve nationwide responses to infectious disease.*

The ability of individual states to create different public health policies allows states to respond to unique threats and local concerns by developing policies that address state-specific issues. However, during the Ebola outbreak, the ability to go beyond federal guidelines led to the creation of some policies that had little basis in science. CDC guidance was based on available research, suggesting that more strict policies were unnecessary. In future disease outbreak events, federal and state public health officials should work to establish a mutual science-based understanding of actual risks in order to formulate policies that are able to effectively address those risks. Federal policymakers, including CDC officials and others from responding agencies, such as the U.S. Food and Drug Administration (FDA) and the Assistant Secretary for Preparedness and Response

(ASPR), should develop and improve upon communication channels with state public health policymakers and emphasize the scientific evidence supporting federal guidelines. Although some communication efforts were put in place during the Ebola response, given the wide range of policy responses, these were clearly not enough.

***Recommendation 1.3:** Public health officials should expect political intervention in the response to high profile infectious disease outbreaks and be prepared to respond to political pressure with fact-based policy interventions.*

The potential role that politics played in the development of Ebola outbreak response policies highlights the potential for political pressures to impact a response to a future disease outbreak. The first cases of Ebola to be diagnosed in the U.S. occurred shortly before the midterm elections in 2014, which included elections for several gubernatorial seats. The election may have spurred some governors to act more aggressively in response to the outbreak than they may have in other circumstances. For instance, New York, a state that announced a more aggressive quarantine policy, was holding gubernatorial elections in which the incumbent governor was running for re-election. Presidential politics may have also influenced some governors to establish more aggressive responses to the Ebola outbreak. For example, the governors of New Jersey and Louisiana – two states with aggressive Ebola policies – later announced that they planned to run for president in the 2016 election. Furthermore, the results of aim 2 show a reduction in news volume that coincided with the 2014 midterm elections, which may also suggest that the Ebola outbreak and response was a campaign issue late in the

election cycle and was less relevant to political leaders after Election Day. The timing of outbreaks in relation to the U.S. election cycle is beyond the control of public health policymakers and practitioners. However, public health officials who are prepared to respond to political requests for information and pressure to act with fact-based policy suggestions and rationales may be more likely to sway political decision-making in the direction of science-based policy. Additionally, public health officials must be prepared to formulate a science-based strategy for the cessation of public health response policies in order to move public health agencies and the public forward after the outbreak has subsided.

Communicating Risks

Recommendation 2.1: *Public health officials and communicators should understand that some risks might more easily trigger increases in risk perception and make efforts to understand what risk characteristics contribute most significantly to heightened perception of risk.*

The news media has been blamed for unnecessarily alarming the public through sensationalized coverage of the Ebola outbreak in the U.S.^{52,53} Results from aim 2 show a high frequency of potentially risk-elevating messages in news media coverage of the Ebola outbreak, which may have contributed to unnecessarily high levels of public concern about Ebola in the U.S. For example, at least one message that could increase perceived Ebola risks appeared in nearly all news stories analyzed. In contrast, risk-minimizing messages appeared in slightly more than half of news stories. As a result, the

public may have been exposed to risk-elevating messages more frequently than risk-minimizing messages, potentially increasing perceived risks from Ebola. However, further results from aim 2 describing the content of news stories do not necessarily support the idea that major news outlets were covering Ebola in a hyperbolic or irresponsible manner. When the frequency of opposing messages, such as the ability or inability to stop transmission of the outbreak in the U.S., were compared, messages affirming the ability to stop transmission of the outbreak appeared more often.

Additionally, results from aim 2 show that the messages that were most inflammatory – such as messages about science not understanding the disease, the inability to stop Ebola in the U.S., and terrorism or use of Ebola as a bioweapon – were mentioned less frequently than nearly all other messages included in the analysis. This may suggest that some concerns about Ebola may have resulted from the nature of the risk itself, which included features that heighten perception of risk, rather than irresponsible news media coverage of the outbreak.

Although the news media plays an important role in public risk perception, and may emphasize some messages that elevate risk perception over others, some characteristics of a risk may naturally increase risk perception. Public health officials and communicators should have a baseline understanding of risk characteristics that are most likely to increase perception of risk.

Recommendation 2.2: *Officials should anticipate heightened public and media response to events likely to trigger higher risk perception and message accordingly.*

Although science-based considerations of risks from Ebola showed that most Americans should not be concerned about acquiring Ebola, both news media attention and public perception of risk from Ebola were high. Results from aim 2 showed that the volume of U.S.-focused news coverage of the Ebola outbreak experienced a large peak after the Dallas case was diagnosed on September 30, 2014. Although it is unclear if news volume was related to public concerns, in mid-October 2014, 65% of respondents to a Washington Post-ABC News poll were concerned about the potential spread of Ebola in the U.S.⁸ Real or not, public health officials must take public concerns about risks seriously and increase communication efforts accordingly. Using knowledge of the types of threats that may trigger increased perception of risk (recommendation 2.1), officials can anticipate when heightened communication responses may be necessary. Public concerns about risk should not be dismissed as uneducated opinions but, instead, used as an opportunity to communicate more effectively by using empathetic communications that acknowledge feelings of vulnerability and fear.⁸² In the case of Ebola, members of the public had an unnecessarily high perception of risk from Ebola. However, although not justifiable based on quantitative risk analysis, these concerns reflect broad issues, misperceptions, and lack of knowledge about Ebola that would be best addressed through compassionate and respectful communication efforts that do not dismiss public fears out of hand.

Recommendation 2.3: *Officials should increase efforts to communicate the scientific aspects of a public health threat such as Ebola.*

Despite the high volume of news stories about Ebola, public polling showed that respondents were often misinformed about disease transmission, with 85% of respondents indicating that a symptomatic person could spread Ebola by sneezing or coughing and 48% noting that an asymptomatic person could spread the disease.⁵⁵ Results from aim 2 show that only 32% of news stories included information about how Ebola spreads. In addition, although the coding process used in aim 3 could not account for confusion within the news media about the difference between isolation and quarantine, my colleague and I noticed many instances in which the terms “quarantine” and “isolation” were incorrectly used in an interchangeable manner, even though they are distinct activities. For example, some news stories described the quarantine of an asymptomatic person exposed to Ebola as “isolation,” even though “isolation” only refers to the separation of an individual diagnosed with a disease from others who have not been diagnosed. Still, messages about isolation and quarantine appeared in a large proportion of news stories about Ebola. News media audiences were more likely to be exposed to the concepts of quarantine and isolation than any other policy intervention. However, interchangeable use of these two distinct terms may have led to an oversimplification of potential public health responses to Ebola. Public health officials and communicators should emphasize important science-based facts about Ebola, such as information about transmission and control measures, in their communication via the news media. More in-depth and frequent coverage of scientific aspects of a public health

threat may help to prevent these types of misperceptions in a future infectious disease outbreak.

Communicating Public Health Policies

Recommendation 3.1: *Public health officials and communicators should implement clear and consistent communication efforts about public health policies from the beginning of a crisis, and quickly seize opportunities to actively communicate when landmark events draw attention to public health policies.*

Results from aim 2 show a drastic increase in news volume following the first domestic diagnosis of an Ebola case in Dallas. Further, results from aim 3 show that nearly all policy-related messages appearing in news stories increased following this date, suggesting a significant change in news coverage after this event. These findings highlight the importance of this event and others like it, which may occur in future outbreaks, as an opportunity to promote public health response policies. However, these findings also emphasize the potential risk of being unprepared with potential policy solutions and of delaying the communication efforts when such an event occurs. Less desirable policies and messages contrary to public health interests may dominate news coverage if public health policy-makers do not communicate science-based policies in a timely manner and, instead, allow a communication vacuum to form.

Additional analyses that were conducted but not included in the final manuscript for aim 3 showed that – when limiting the study’s time period to only after the diagnosis of the

Liberian visitor in Dallas – the proportion of news stories mentioning travel bans was significantly higher prior to the diagnosis of a physician and quarantine of a nurse who had both recently returned from West Africa than in the time period following these events. In contrast, the proportion of news stories mentioning quarantine was significantly higher following these events than before. These differences highlight the importance of landmark events in shaping the policy discussion in the news media. In the case of travel bans, this effect, combined with the finding from aim 3 that discussion of travel bans significantly increased after the diagnosis in Dallas, suggests that this event was predominantly responsible for the message change. And, indeed, it is not surprising that the importation of Ebola by a foreigner would spur discussions of a travel ban. Conversely, the quarantine finding suggests that the increase in quarantine messages found previously can be largely attributed to the October events (i.e., the diagnosis of a physician and quarantine of a nurse who had both recently returned from West Africa), which again aligns with intuition, in this case that the controversy around the potential quarantine of returning medical workers could increase coverage of this intervention. It is important that policymakers and communicators are aware of these types of events, which will shift public discussion and attention, and communicate accordingly.

As a crisis begins to develop, policymakers should actively communicate in a clear and consistent manner about policies that are being implemented. Actively communicating in advance of landmark events, such as the first domestic diagnosis of Ebola, and continuing to communicate during the event, reduces the opportunity for competing messages to dominate the public dialogue. Communications should be transparent about what is

known and what may change, without over-reassuring members of the public, in order to build trust between officials and members of the public and to gain public support for evidence-based policies.

***Recommendation 3.2:** Public health policymakers and those communicating about public health policies should anticipate the newsworthiness of controversial issues, which may supersede important public health messages, and be prepared to defend and emphasize important policy positions.*

Some policy messages that were important to the Ebola response appeared in relatively fewer news stories than other messages that were more peripheral to the actual response but were highly controversial. For example, CDC Ebola guidance and many state-level policies utilized the practice of assigning different levels of risk to individuals potentially exposed to Ebola. This formed the basis for different risk-based restrictions and requirements for potentially exposed persons. Contrary to its importance in the policy response to the outbreak, relatively few news stories included any mention of this policy. A striking contrast can be drawn from study results showing frequent discussion of quarantine. This practice was not recommended by the CDC, though it was occasionally used by a number of states and promoted by some politicians. However, messages about quarantine appeared in a much greater proportion of news stories than the practice of categorizing individuals based on exposure risk. The controversial nature of quarantine efforts may have heightened newsworthiness and increased news coverage of this topic,

increasing public exposure to quarantine as a potential public health response. In contrast, policy responses that are less controversial, more measured, and universally accepted may be less newsworthy and receive reduced media coverage. As a result, the public's exposure to different policy options may lead to the development of a skewed understanding of appropriate public health response, since news audiences may be less familiar with policies that are accepted by the majority of the public health community. Public health policymakers and communicators should be prepared to highlight the most important aspects of public health response policies while, at the same time, be prepared to defend their positions on less central but more controversial policies.

Conclusion

Infectious diseases that emerge and capture the attention of the news media and public are not isolated events and will continue to occur over time. Although the first Ebola case to be diagnosed in the U.S. occurred less than two years ago, a new infectious disease, Zika, has already become a topic of interest to the public and news media. When these types of infectious disease events occur, public health policymakers and communicators need to respond with effective policies and communication efforts. The ability of public health to effectively protect the health of the public depends on the development of a coordinated public health response and communication of important information about the disease and what should and can be done to combat it.

The capacity for states to act independently in developing infectious disease response policies can provide important opportunities to respond to unique local conditions. However, in the case of Ebola, results from aim 1 show that states developed a wide range of policy responses and variations on quarantine, movement restrictions, exposure categories, and monitoring, some of which were not backed by scientific evidence. These findings highlight the importance of coordination between federal and state partners in developing a comprehensive understanding of the scientific rationale for specific policy responses.

Findings from aims 2 and 3 highlight the difficulty that public health officials face in communicating in the midst of unfamiliar, fear-provoking threats. Importantly for risk

perception, nearly all news stories contained at least one or more risk-elevating message(s). Results from aim 2 also highlight the importance of the relationship between risk perception and news media coverage of emerging risks, emphasizing the potential of news media coverage to increase perception of risk. Public views about potential risks from Ebola may have ultimately played a role in the formation of policy to manage the outbreak. In the future, it will be important for public health officials to understand how different aspects of a risk may influence risk perception and message accordingly. Furthermore, results from aim 3 show that important public health components of Ebola response policies received relatively little news media coverage compared to other more controversial topics, such as quarantine. Accordingly, public health communicators should be prepared to defend and emphasize important policy positions.

The Ebola outbreak resulted in a large volume of news coverage, particularly following the first case of Ebola diagnosed in the U.S. The frequency of policy-related messages also changed after this event, emphasizing the importance of this type of occasion in an emerging disease outbreak as an opportunity to introduce and promote appropriate response policies. These findings highlight the importance of providing key messages at the right time during periods of heightened public health concern. If opportunities to communicate as news volume and policy messages increase are squandered, public health communicators may miss their chance to promote policies that support public health interests.

The Ebola outbreak of 2014-2015 provides an important case study to improve understanding of media and policy responses to emerging infectious disease events and gain valuable lessons for improving policy development, risk communication, and communication about infectious disease response policies in future disease outbreaks. Findings from this research may help public health practitioners and policymakers anticipate what policies can or may be implemented in response to future infectious disease threats. Additionally, results may help decision-makers and leaders to influence news content on infectious disease risks and improve policy messaging in the future.

Appendices

Tables

Table 1. Dates of major events during the Ebola outbreak

December 26, 2013: Ebola outbreak begins in Guinea ^{3,23}
March 23, 2014: Ebola outbreak reported by World Health Organization (WHO) ⁸³
August 2, 2014: First Ebola case arrives on U.S. soil ⁵
August 8, 2014: WHO declares the Ebola outbreak a Public Health Emergency of International Concern (PHEIC) ⁴
September 30, 2014: First Ebola case diagnosed in the U.S. in Dallas, TX ⁶
October 11, 2014: First healthcare worker (HCW) in Dallas diagnosed with Ebola ⁸⁴
October 15, 2014: Second HCW in Dallas diagnosed with Ebola ⁸⁴
October 23, 2014: Ebola case diagnosed in New York, NY ⁶⁶
October 24, 2014: Quarantine of nurse returning from Sierra Leone ⁶⁶

Table 2. News Media Sources

Print News Sources	Regional or National Newspaper ¹	Liberal or Conservative Ideology	Ebola Case or Controversy in the Locality in Which the News Source is Based
<i>Atlanta Journal Constitution</i>	South Region	- ²	Ebola Case
<i>Chicago Tribune</i>	Midwest Region	Liberal	-
<i>Fort Worth Star Telegram</i>	South Region	Conservative	Ebola Case
<i>New York Daily News</i>	Northeast Region	Conservative	Ebola Case
<i>New York Times</i>	National	Liberal	Ebola Case
<i>Orange County Register</i>	West Region	-	-
<i>Portland Press Herald</i>	Northeast Region	-	Ebola Controversy
<i>USA Today</i>	National	-	-
<i>Washington Post</i>	National	Liberal	-
TV News Sources			
CNN Situation Room	-	-	-
Fox Special Report	-	Conservative	-
NBC Nightly News	-	-	-
Blog News Source			
Huffington Post	(excluded from main analysis)		

1. Newspaper region was determined by location of news sources in U.S. census regions, with at least one source from each region. Newspapers with national distribution were considered “National.”

2. Dash indicates that this news source was not included in either category for this analysis

Table 3. Messages Potentially Increasing Perception of Risk

Message	Factors that increase risk perception (Slovic)
Lack of/limited availability of countermeasures	Disease is not controllable
Potential U.S. outbreak/people in the U.S. contracting Ebola	Disease is not controllable
Inability to stop transmission/outbreak in the U.S.	Disease is not controllable
Ebola causes deaths	Disease is fatal
Growth of the Ebola epidemic	Risk associated with disease is increasing
Science does not understand Ebola (e.g., previous knowledge about the disease was wrong or expert advice was incorrect)	Risk is unknown to science
Ebola's potential use in terrorism or as a biological weapon	Catastrophic and dread characteristic
Ebola has an incubation period	Delayed effect after exposure to the disease
Foreigners or travelers bringing Ebola to the U.S.	Disease is exotic and unknown

Table 4. Messages Potentially Decreasing Perception of Risk

Ebola-related message	Factors that decrease risk perception (Slovic)
Lower Ebola death rates in the U.S.	Disease may not be fatal
Ability to stop transmission/outbreak in the U.S.	Disease is controllable
How to prevent spread of Ebola	Risk can be reduced
Description of scientific knowledge about the disease (e.g., transmission dynamics or other known aspects of the disease)	Risk is known to science, observable, and known to those exposed
Low risks related to Ebola (e.g., low risk of the disease coming to the U.S., low risk of someone transmitting the disease, low risks of school children acquiring Ebola)	Indicate lowered risks associated with disease

Table 5. Comparison of state exposure categories, movement restrictions, quarantine, and monitoring with CDC guidance (October 2014 – March 2015)

	Exposure categories consistent with CDC? ^a	Movement restrictions consistent with CDC? ^b	Use of quarantine? ^c	More stringent monitoring than CDC?
AL	Yes	Yes	Potentially ^d	No
AK	Yes	Yes	Potentially	No
AZ	Yes	Yes	Yes	No
AR	Yes	Yes	- ^e	No
CA	Yes	Yes	Yes ^f	No
CO	Yes	Yes	-	No
CT	Yes	Yes	Yes	No
DE	Yes	Yes	Yes	No
DC	No	No	-	No
FL	No	-	Yes	Yes
GA	No	-	Yes	No
HI ^g	Yes	Yes	Potentially	No
ID	Yes	Yes	-	No
IL	Yes	Yes	Yes	No
IN	Yes	-	-	Yes
IA	Yes	No	Yes	No
KS	Yes	No ^h	Potentially	No
KY	Yes	Yes	Yes	No
LA	No	No	Yes	Yes
ME	No	-	Yes	No
MD	Yes	Yes	-	Yes
MA	Yes	-	-	No
MI	Yes	Yes	Yes	No
MN	Yes	Yes	No	No
MS	-	-	Yes	Yes ⁱ
MO ^j	-	-	-	No
MT	Yes	Yes	-	No
NE	-	-	-	No
NV	Yes	-	-	No
NH	Yes	Yes ^k	Yes	No
NJ	Yes	No	Yes	Yes
NM	Yes	Yes	Potentially ^l	No
NY	No ^m	No	Yes	Yes
NC	Yes	Yes	-	No
ND	Yes	-	-	No
OH	No	No	Yes	Yes
OK	Yes	Yes	Yes	No
OR	Yes	Yes	-	No
PA	Yes	Yes	-	No
RI	Yes	Yes	-	No
SC	Yes	Yes	-	No
SD	Yes	Yes	Potentially	No
TN	Yes	Yes	-	No
TX	Yes	Yes ⁿ	Yes	No
UT	Yes	Yes	-	No
VT	Yes	Yes	Potentially	No
VA	Yes	Yes	Yes	No

WA	Yes	Yes	Potentially	No
WV	Yes	Yes	-	No
WI	Yes	-	Potentially	No
WY	Yes	Yes	Potentially ^l	No

^a “Consistent with CDC” means that a policy was either identical or contained only a few small changes from published CDC guidance, which was on updated December 24, 2014.

^b States that included quarantine for their highest risk category but were otherwise consistent with CDC were categorized as “Yes” and quarantine use was noted in the subsequent column.

^c CDC specifies movement restrictions enforced “through orders as necessary” but does not use the term “quarantine.”

^d “Potentially” means that quarantine will be used at discretion of public health authorities, often to ensure restrictions and monitoring are adhered to.

^e - Means not specified

^f All travelers from areas of active transmission who had contact with an individual with confirmed Ebola were to be quarantined for 21 days, however, the requirements of the quarantine order were to conform with CDC guidance

^g CDC guidance was adapted for the state to conduct case-by-case risk assessments

^h Individuals with high and some risk are instructed to stay at home for 21 days

ⁱ All returning travelers from areas of active transmission “directly monitored”

^j Public Health website provides links to CDC documents but does not specifically endorse them

^k Individuals with some risk were asked to voluntarily self-quarantine but no legal action would be taken if they did not

^l Quarantine procedures outlined in guidance but not specifically called for

^m Exposure risk categories different from CDC but divide potentially exposed people in a similar manner

ⁿ Specific restrictions for potentially exposed subgroups such as health care workers who treated patients in Dallas, lab personnel, and air travelers

Table 6. CDC guidance for potential Ebola virus exposure and variation in state policies

	CDC Guidance (updated December 24, 2014)	Example State Policies that Differ from CDC guidance (October 2014 - March 2015)	
Ebola Virus Exposure Categorization	<p><u>4 Exposure categories for general exposure (broadly covers potentially exposed persons)</u></p> <p><i>High risk:</i> percutaneous or mucous membrane exposure, exposure to or processed body fluids without personal protective equipment (PPE) while infected person was symptomatic, direct contact with dead body in country with widespread transmission without PPE, cohabitated with and provided direct care to symptomatic Ebola victim</p> <p><i>Some risk:</i> direct contact with symptomatic Ebola victim or body fluids while wearing PPE, patient care in countries with widespread transmission, close contact (within 3 ft) with symptomatic Ebola victim</p> <p><i>Low risk:</i> in country with widespread transmission within last 21 days, direct contact with Ebola victim in early stage of disease, brief proximity with asymptomatic Ebola victim, direct contact using PPE in country without widespread transmission, traveled on aircraft with symptomatic Ebola victim</p> <p><i>No identifiable risk</i></p>	<p><u>Specific guidance for potentially exposed subgroups</u></p> <p>Use of CDC categories with addition of specific guidance for individual groups such as healthcare workers who treated the cases in Dallas, laboratory workers, and air travelers. (Texas)</p>	<p><u>Exposure categories focusing only on travelers</u></p> <ul style="list-style-type: none"> • All returning travelers from countries with widespread Ebola (Indiana; Louisiana) • Two categories – 1) travelers to affected countries in past 21 days; 2) travelers involved in Ebola patient care in past 21 days (Maine) • Three categories - 1) Direct contact that is high risk; 2) low risk direct contact; 3) no direct contact (New York)
		<p><u>General exposure categories different from CDC guidance</u></p> <p>Category 1A) Direct contact without PPE; Category 1B) health care worker (HCW) in country with widespread Ebola/travelers with uncertain exposure; Category 2) within 3 ft of infected person, traveler with no known exposure, US HCW with PPE; Category 3) brief proximity with symptomatic person; Category 4) in broad vicinity (Ohio)</p>	

Movement Restrictions	<p><u>Restrictions based on exposure category, no quarantine</u></p> <p><i>High risk:</i> Exclusion from public conveyances, public spaces, congregate gatherings, and workplaces. Non-congregate public activities may be allowed. Coordinate travel outside of jurisdiction, Federal Do Not Board applied.</p> <p><i>Some risk:</i> Health authority will determine appropriate restrictions including those above.</p> <p><i>Low risk and No risk:</i> No restrictions</p>	<p><u>Permission required for travel</u></p> <p>High and some risk groups require advance approval for movement outside residence (Kansas)</p>	<p><u>Limited travel</u></p> <p>No trips on public transportation lasting longer than 3 hours for all monitored individuals (Minnesota)</p>	<p><u>Movement restrictions for high risk only</u></p> <p>Non-high-risk individuals allowed participation in usual daily activities (Idaho)</p>
	<p><u>Remain within U.S.</u></p> <p>Includes travelers with no exposure (Ohio)</p>	<p><u>Case by case restrictions</u></p> <p>Determined on a case by case basis by local public health officials (Hawaii)</p>	<p><u>Essential errands allowed</u></p> <p>Some risk group allowed to shop for essential needs during off peak hours (Virginia)</p>	
Quarantine	<p><u>No quarantine</u></p> <p>However, movement restrictions may be ensured through a public health order if necessary.</p>	<p><u>Voluntary quarantine</u></p> <p>For individuals who came into direct contact with or treated Ebola-positive individuals (Maine)</p>	<p><u>Mandatory quarantine</u></p> <ul style="list-style-type: none"> • For individuals classified as high risk (New Hampshire) • For individuals classified as high risk and some risk (New Jersey) 	<p><u>All travelers</u></p> <p>Quarantine for all travelers returning from countries with widespread transmission (Louisiana)</p>
		<p><u>Two step process</u></p> <p>If voluntary quarantine for high risk exposure group not agreed to, a quarantine order will be issued (Virginia)</p>	<p><u>Public health determination</u></p> <p>At the discretion of public health authorities (Hawaii)</p>	

Monitoring	<p><u>Direct Active and Active Monitoring</u></p> <p><i>Direct active monitoring:</i> high risk, some risk, and subcategories of low risk (i.e., US-based Ebola HCW and air travelers within 3 feet of Ebola victim) directly observed once per day. Second follow-up by phone.</p> <p><i>Active monitoring:</i> daily reporting of two temperature checks for others in low risk category.</p>	<p><u>Direct active monitoring only</u></p> <p>All travelers from countries with widespread transmission (Indiana)</p>	<p><u>More frequent temperature checks</u></p> <p>Temperature check 4 times per day for high and some risk categories (Maryland)</p>	<p><u>Unannounced monitoring</u></p> <p>Unannounced visits to quarantine group (New York)</p>
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Table 7. Risk-Related News Media Messages about Ebola, July – November 2014

1. Sources included in all news stories include *Atlanta Journal Constitution*, *Chicago Tribune*, CNN Situation Room, *Fort Worth Star Telegram*, Fox Special Report, NBC Nightly News, *New York Daily News*, *New York Times*, *Orange County Register*, *Portland Press Herald*, *USA Today*, and *Washington Post*. Huffington Post Blog was excluded from this analysis.
2. New sources with an Ebola case or controversy in the locality include *Atlanta Journal Constitution*, *Fort Worth Star-Telegram*, *New York Daily News*, *New York Times*, and *Portland Press Herald*.
3. Nationally produced new sources or those without an Ebola case or controversy in the locality include *Chicago Tribune*, CNN Situation Room, Fox Special Report, NBC Nightly News, *Orange County Register*, *USA Today*, and *Washington Post*.
4. Conservative news sources include *Fort Worth Star Telegram*, Fox Special Report, and *New York Daily News*.
5. Liberal news sources include *Chicago Tribune*, *New York Times*, and *Washington Post*.
6. Chi-squared test *P<0.05, **P<0.01, ***P<0.001

<u>Message Mentioned in News Story</u>	Print and TV News Stories n=1262 ¹	Ebola Case or Controversy in the Locality in Which the News Source is Based n=655 ²	Nationally Produced News Sources or those without Ebola Case or Controversy in the Locality in Which the News Source is Based n=607 ³	Conservative news sources n=302 ⁴	Liberal News Sources n=595 ⁵
Messages that could increase perception of risk	Percent of News Stories with Message				
Lack of/limited availability of countermeasures to stop Ebola	17	13*** ⁶	21***	11**	19**
Ebola causes deaths	66	64	68	70	65
Potential U.S. outbreak/people in the U.S. contracting Ebola	35	33	36	35	33
Inability to stop transmission/outbreak in the U.S.	7	4**	9**	4	6
Growth of the Ebola epidemic	23	17***	30***	14***	26***
Science does not understand Ebola (e.g., previous knowledge about the disease was wrong or expert advice was incorrect)	8	8	8	7	9
Ebola's potential use in terrorism or as a biological weapon	1	1	1	1	1
Ebola has an incubation period	34	34	35	37	33
Foreigners or travelers bringing Ebola to the U.S.	72	71	74	72	70
Messages that could decrease perception of risk					
Lower Ebola death rates in the U.S.	5	4	6	3	4
Ability to stop transmission/outbreak in the U.S.	20	16**	24**	24**	17**
Low risks related to Ebola (e.g., low risk of the disease coming to the U.S., low risk of someone transmitting the disease, low risks of school children acquiring Ebola)	28	25	30	25	27
How to prevent spread of Ebola	12	12	13	12	10
Description of scientific knowledge about Ebola (e.g., transmission dynamics or other known aspects of the disease)	32	30	33	29	30

Table 8. Risk Related News Media Messages about Ebola in Print, Television, and Blog News Sources, July – November, 2014

1. Sources included in all news stories include *Atlanta Journal Constitution*, *Chicago Tribune*, CNN Situation Room, *Fort Worth Star Telegram*, Fox Special Report, Huffington Post blog, NBC Nightly News, *New York Daily News*, *New York Times*, *Orange County Register*, *Portland Press Herald*, *USA Today*, and *Washington Post*.
2. Print news sources include *Atlanta Journal Constitution*, *Chicago Tribune*, *Fort Worth Star-Telegram*, *New York Daily News*, *New York Times*, *Orange County Register*, *Portland Press Herald*, *USA Today*, and *Washington Post*.
3. TV news sources include *CNN Situation Room*, *Fox Special Report*, and *NBC Nightly News*
4. Blog news source is Huffington Post, compared to other types of news sources
5. Chi-squared test *P<0.05, **P<0.01, ***P<0.001

Message Mentioned in News Story	All news stories ¹ n=1421	Print News ² n=1109	TV News ³ n=153	Blog News ⁴ n=159
Messages that could increase perception of risk	Percent of News Stories with Message			
Lack of/limited availability of countermeasures to stop Ebola	17	17	20	11
Ebola causes deaths	64	66	65	48** *
Potential U.S. outbreak/people in the U.S. contracting Ebola	34	34	41	31
Inability to stop transmission/outbreak in the U.S.	6	6	7	6
Growth of the Ebola epidemic	22	21*** ⁵	36** *	12**
Science does not understand Ebola (e.g., previous knowledge about the disease was wrong or expert advice was incorrect)	8	7*	13*	6
Ebola's potential use in terrorism or as a biological weapon	1	1	1	1
Ebola has an incubation period	32	33*	43*	18** *
Foreigners or travelers bringing Ebola to the U.S.	72	71*	79*	68
Messages that could decrease perception of risk				
Lower Ebola death rates in the U.S.	4	4***	10** *	2
Ability to stop transmission/outbreak in the U.S.	18	18**	30**	7***
Low risks related to Ebola (e.g., low risk of the disease coming to the U.S., low risk of someone transmitting the disease, low risks of school children acquiring Ebola)	27	26***	42** *	18*
How to prevent spread of Ebola	12	11*	20*	5**
Description of scientific knowledge about Ebola (e.g., transmission dynamics or other known aspects of the disease)	30	31	35	19**

Table 9. Policy-related messages about Ebola in news stories, July – November 2014

Message Mentioned in News Story	Print and TV News Stories n=1,262 ¹	Ebola Case or Controversy in the Locality Where the News Source is Based n=655 ²	Nationally Produced News Sources or those without Ebola Case or Controversy in the Locality Where the News Source is Based n=607 ³	Conservative news sources n=302 ⁴	Liberal News Sources n=595 ⁵
Policy-related Messages	Percent of News Stories with Message				
Any mention of travel bans	14	11*** ⁶	18***	12*	17*
Support of travel bans	9	7**	12**	8	12
Opposition to travel bans	9	6***	12***	7*	12*
Any mention of quarantine	40	42	38	44	40
Support of quarantine	13	14	12	15	11
Opposition to quarantine	12	13	11	13	10
Isolation	47	45	49	44	47
Dividing potentially exposed persons into groups based on their level of Ebola risk	5	5	6	6	6
Requirements to enter the U.S. (e.g., passport checks, temperature readings)	21	17**	25**	16	20
Public health monitoring	34	33	34	34	33
Slow or poor response from the U.S. government	20	19	21	17	20
Poor PPE, standards, training (i.e., lack of preparedness)	21	19	22	23	19
Confusion (i.e., about policies, standards, or requirements related to U.S. Ebola response)	7	7	7	6	7

1. Sources of news stories are: *Atlanta Journal Constitution*, *Chicago Tribune*, CNN Situation Room, *Fort Worth Star Telegram*, Fox Special Report, NBC Nightly News, *New York Daily News*, *New York Times*, *Orange County Register*, *Portland Press Herald*, *USA Today*, and *Washington Post*. Huffington Post Blog was excluded from this analysis due to its potential to skew the main news story sample.

2. New sources with an Ebola case or controversy in the locality include *Atlanta Journal Constitution*, *Fort Worth Star-Telegram*, *New York Daily News*, *New York Times*, and *Portland Press Herald*.

3. Nationally produced new sources or those without an Ebola case or controversy in the locality include *Chicago Tribune*, CNN Situation Room, Fox Special Report, NBC Nightly News, *Orange County Register*, *USA Today*, and *Washington Post*.

4. Conservative news sources include *Fort Worth Star Telegram*, Fox Special Report, and *New York Daily News*.

5. Liberal news sources include *Chicago Tribune*, *New York Times*, and *Washington Post*.

6. Chi-squared test *P<0.05, **P<0.01, ***P<0.001.

Table 10. Policy-related messages about Ebola in print, television, and blog news sources, July – November 2014

Message Mentioned in News Story	All news stories ¹ n=1,421	Print News ² n=1,109	TV News ³ n=153	Blog News ⁴ n=159
Policy-related Messages	Percent of News Stories with Message			
Any mention of travel bans	14	13	18	14
Support of travel bans	10	9	11	11
Opposition to travel bans	9	8	12	8
Any mention of quarantine	38	40	43	25*** ⁵
Support of quarantine	12	13	16	8
Opposition to quarantine	11	11	14	6*
Isolation	44	45**	59**	25***
Dividing potentially exposed persons into groups based on their level of Ebola risk	5	5	6	0**
Requirements to enter the U.S. (e.g., passport checks, temperature readings)	19	18***	40***	8***
Public health monitoring	31	31***	51***	13***
Slow or poor response from the U.S. government	19	18***	34***	16
Poor PPE, standards, training (i.e., lack of preparedness)	19	19***	33***	9**
Confusion (i.e., about policies, standards, or requirements related to U.S. Ebola response)	6	6	10	1**

1. Sources included in all news stories include *Atlanta Journal Constitution*, *Chicago Tribune*, CNN Situation Room, *Fort Worth Star Telegram*, Fox Special Report, Huffington Post blog, NBC Nightly News, *New York Daily News*, *New York Times*, *Orange County Register*, *Portland Press Herald*, *USA Today*, and *Washington Post*.

2. Print news sources include: *Atlanta Journal Constitution*, *Chicago Tribune*, *Fort Worth Star-Telegram*, *New York Daily News*, *New York Times*, *Orange County Register*, *Portland Press Herald*, *USA Today*, and *Washington Post*.

3. TV news sources include: CNN Situation Room, Fox Special Report, and NBC Nightly News.

4. Blog news source is Huffington Post, compared to other types of news sources.

5. Chi-squared test *P<0.05, **P<0.01, ***P<0.001.

Table 11. Policy-related messages about Ebola during specific time periods, July – November 2014

<u>Message Mentioned in News Story</u>	News Stories Published Before September 30, 2014 n=249 ^{1,2}	News Stories Published After September 30, 2014 n=1,013
Policy-related Messages	Percent of News Stories with Message	
Mentions Travel bans	1*** ³	17***
Support of travel bans	0***	11***
Opposition to travel bans	1***	11***
Quarantine	19***	45***
Support of quarantine	1***	16***
Opposition to quarantine	0***	15***
Isolation	54*	45*
Dividing potentially exposed persons into groups based on their level of Ebola risk	0***	7***
Requirements to enter the U.S. (e.g., passport checks, temperature readings)	8***	24***
Public health monitoring	7***	40***
Slow or poor response from the U.S. government	2***	24***
Poor PPE, standards, training (i.e., lack of preparedness)	1***	26***
Confusion (i.e., about policies, standards, or requirements related to U.S. Ebola response)	0***	8***

1. The first U.S. case of Ebola was diagnosed on September 30, 2014.
2. Huffington Post Blog was excluded from this analysis due to its potential to skew the main news story sample.
3. Chi-squared test *P<0.05, **P<0.01, ***P<0.001.

Figures

Figure 1. Dearing and Rogers' Agenda Setting Process Model

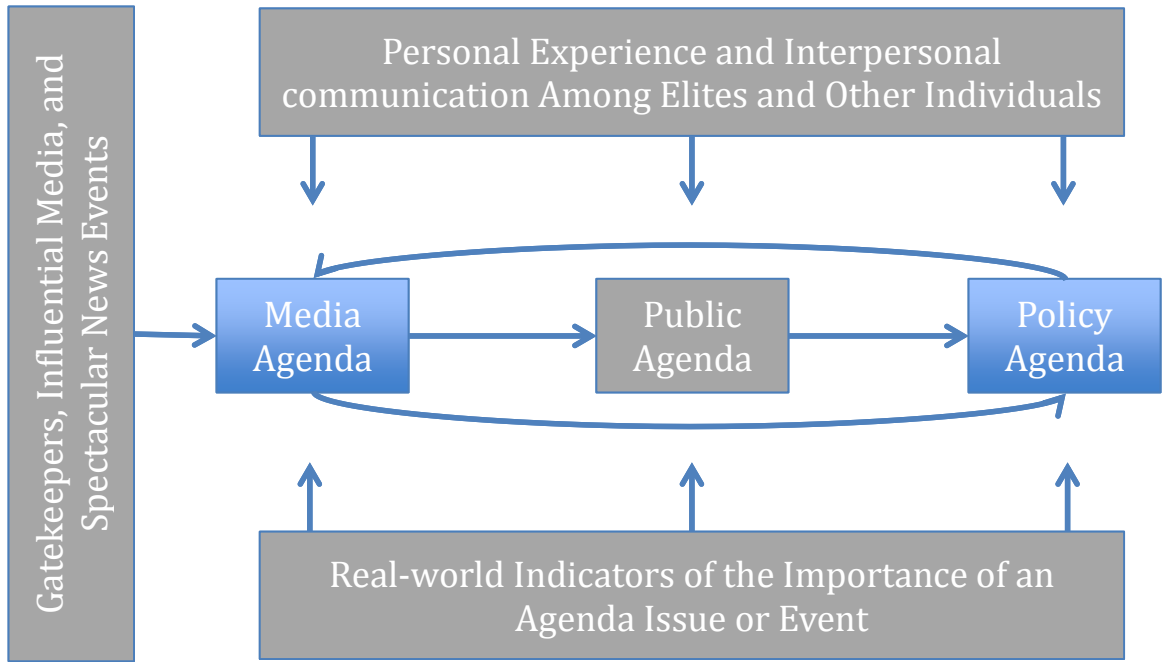
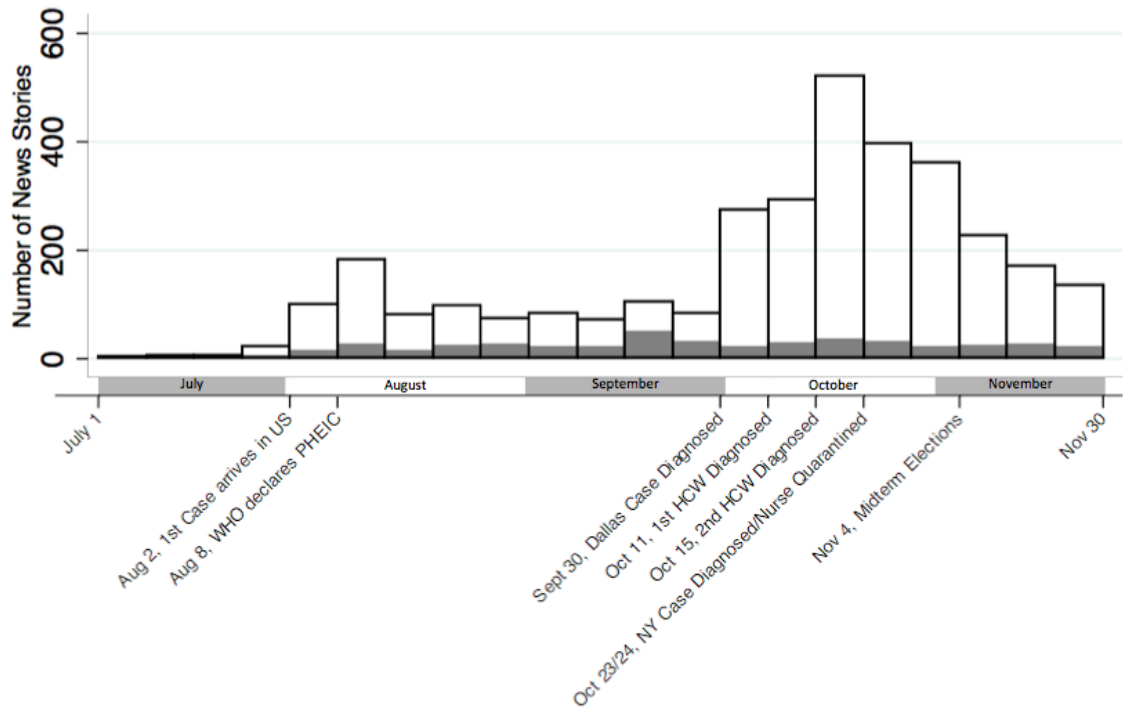


Figure 2. News Coverage of Ebola Comparing Stories about Ebola in the U.S. and Solely Internationally-Focused Stories About Ebola, July – November 2014



Timeline of Ebola Outbreak Events, 2014



Abbreviations: Public Health Emergency of International Concern (PHEIC), Health Care Worker (HCW), New York (NY)

Supplemental Materials

Appendix 1. Aim 1 List of Data Sources

Document ID	Link
CDC-1	http://www.cdc.gov/vhf/ebola/pdf/monitoring-and-movement.pdf
AL-1	http://www.adph.org/ebola/index.asp?id=6824
AK-1	http://www.epi.hss.state.ak.us/id/dod/ebola/EbolaResponsePlan.pdf
AZ-1	http://www.azdhs.gov/phs/oids/advisory-council/documents/gcidpr-preliminary-report.pdf
AZ-2	Executive order downloaded directly
AR-1	http://www.healthy.arkansas.gov/programsServices/communications/features/Pages/Ebola.aspx
AR-2	http://www.healthy.arkansas.gov/programsServices/communications/features/Documents/Ebola/EbolaMonitoringPlan.pdf
CA-1	http://www.cdph.ca.gov/Documents/Order_%20Ebola10292014.pdf
CA-2	http://www.cdph.ca.gov/Documents/EbolaCoverLetterGuidanceForms10292014.pdf
CA-4	http://www.cdph.ca.gov/programs/cder/Documents/CDPH%20Guidance%20for%20Monitoring%20Travelers%20(FINAL%20Revised%201-7-15).pdf
CO-1	https://www.colorado.gov/pacific/cdphe/news/ebolastmt2
CO-2	https://drive.google.com/folderview?id=0B0tmPQ67k3NVUVhPX3RYejRrVvk0&usp=sharing
CO-4	https://www.colorado.gov/pacific/cdphe/synthesis-cdc-guidance-local-public-health-agencies
CT-1	http://www.ct.gov/dph/cwp/view.asp?a=4721&q=560222
CT-2	http://www.governor.ct.gov/malloys/lib/malloys/2014.10.07_Declaration_of_Public_Health_Emergency.pdf
CT-3	http://www.governor.ct.gov/malloys/cwp/view.asp?A=4010&Q=555720
DE-1	http://dhss.delaware.gov/dhss/dms/files/ebolamonitoringfactsheet.pdf
DE-2	http://dhss.delaware.gov/dhss/pressreleases/2014/ebolaprevention-102914.html
DC-1	http://doh.dc.gov/sites/default/files/dc/sites/doh/publication/attachments/Returning_traveler_protocol_2014-11-20.pdf
DC-3	http://doh.dc.gov/sites/default/files/dc/sites/doh/page_content/attachments/Returned%20traveler%20protocol%202-09-15.pdf
FL-1	http://www.flgov.com/wp-content/uploads/2014/10/SKMBT_C35314102515490.pdf
FL-2	http://www.floridadisaster.org/eoc/PressReleases/10%2025%2014%20JIC%20UPDATE.pdf
FL-3	Document downloaded from health department website
GA-1	http://gov.georgia.gov/press-releases/2014-10-27/deal-issues-new-policy-travelers-ebola-affected-countries
GA-2	http://dph.georgia.gov/blog/2014-11-03/governor-nathan-deal-issues-new-policy-travelers-ebola-affected-countries
GA-3	http://gov.georgia.gov/sites/gov.georgia.gov/files/related_files/press_release/10.19.14.01.pdf
HI-1	http://health.hawaii.gov/docd/ebola/
HI-2	http://health.hawaii.gov/docd/files/2014/10/DOH-Ebola-Infographic-11212014-final.pdf
ID-1	http://healthandwelfare.idaho.gov/Default.aspx?Tabid=1475
ID-2	http://healthandwelfare.idaho.gov/Portals/46/Documents/Idaho%20Ebola%20Guidance%20Monitoring%20and%20Movement%20of%20Asymptomatic%20Persons%20Oct%2030%202014%20.pdf
IL-1	http://www.idph.state.il.us/ebola/10.24.14LHD_Monitoring_Travelers.pdf
IL-2	http://www.idph.state.il.us/public/press14/10.24.14_Governor_Directs_IDPH_to_Require_Quarantine_to_Protect_Against_Ebola.htm

IL-4	http://www.dph.illinois.gov/news/idph-issues-ebola-safety-guidance
IL-5	https://www.illinois.gov/Government/ExecOrders/Pages/2014_11.aspx
IN-1	http://www.state.in.us/isdh/files/Fall_2014_Newsletter.pdf
IN-2	http://www.in.gov/ActiveCalendar/EventList.aspx?fromdate=10/29/2014&todate=10/29/2014&display=Day&type=public&eventidn=191311&view=EventDetails&information_id=207361
IA-1	http://www.idph.state.ia.us/IDPHChannelsService/file.ashx?file=3E9242DF-7F89-445E-B392-2FEAFA8AD789
IA-2	http://www.idph.state.ia.us/EHI/Issue.aspx?issue=Ebola%20Outbreak&pg=Health%20Information%20for%20Medical%20Providers
KS -1	http://www.kdheks.gov/ebola/preparedness_plan/KDHE_Ebola_Preparedness_Plan.pdf
KY -1	http://healthalerts.ky.gov/Documents/At%20A%20Glance%20Ebola%20Guidance%20Final%2011%2010%2014.pdf
LA -1	http://new.dhh.louisiana.gov/assets/oph/Center-PHCH/Center-CH/infectious-epi/EpiManual/EbolaManual.pdf
LA -2	http://gohsep.la.gov/plans/2014_Louisiana_Ebola_Response_Plan_Annex.pdf
LA-3	http://www.gov.state.la.us/assets/docs/BJ%202014%20-%202013%20Travel%20to%20Areas%20Impacted%20by%20Ebola%20Virus%20Disease.pdf
LA-4	http://new.dhh.louisiana.gov/assets/oph/ebola/TravelGuidanceForm-Letter.pdf
ME-1	http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/zoonotic/ebola/documents/Maine-Ebola-Protocols-October-27.pdf
ME-2	http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/zoonotic/ebola/providers.shtml
MD - 1	http://dhmh.maryland.gov/newsroom1/Documents/Active%20Traveler%20Monitoring%20-slides%20FINAL%20102714.pdf
MD-2	http://dhmh.maryland.gov/newsroom1/Documents/Traveler%20Monitoring%20background%2010.27.14%20FINAL.pdf
MD-3	http://phpa.dhmh.maryland.gov/OIDEOR/SIPOR/Shared%20Documents/Ebola%20Directive%20and%20Order_Oct%202014.pdf
MD-4	http://dhmh.maryland.gov/newsroom1/pages/gov--o'malley-announces-policy-for-returning-travelers-from-countries-affected-by-the-ebola-outbreak.aspx
MA-1	http://www.mass.gov/eohhs/docs/dph/emergency-prep/ebola/plan-cdc-guidance-monitoring.pdf
MI-1	http://www.michigan.gov/documents/emergingdiseases/Michigan_EBOLA_Guidance_464829_7.pdf
MI-2	http://www.michigan.gov/documents/emergingdiseases/MI_Monitoring_of_Asymptomatic_Persons_473055_7.pdf
MI-3	http://www.michigan.gov/documents/emergingdiseases/TEAM_Protocol_V1-102414_472464_7.pdf?20141031085213
MN-1	http://www.health.state.mn.us/divs/idepc/diseases/vhf/monitoringriskcats.pdf
MN-2	http://www.health.state.mn.us/divs/idepc/diseases/vhf/monitoring.html
MN-3	http://www.health.state.mn.us/divs/idepc/diseases/vhf/monitoringfaq.pdf
MN-4	http://www.health.state.mn.us/news/pressrel/2014/ebola102714.html
MS-1	http://msdh.ms.gov/msdhsite/index.cfm/23,6059,386,661,pdf/EbolaResponsePlanningMSHAN-20141124-00107-ADV.pdf
MS-3	http://msdh.ms.gov/msdhsite/index.cfm/23,6024,386,661,pdf/HAN%20Advisory%20EVD%20Monitoring%20for%20Travlers%2Epdf
MO-1	http://health.mo.gov/emergencies/ert/alertsadvories/pdf/HU122414.pdf
MO-2	http://health.mo.gov/emergencies/ert/alertsadvories/pdf/HU102314.pdf
MT-1	http://dphhs.mt.gov/publichealth/cdepi/diseases/Ebola
MT-2	http://dphhs.mt.gov/Portals/85/publichealth/documents/CDEpi/Ebola/EbolaStateProtocols.pdf
MT-3	http://dphhs.mt.gov/Portals/85/publichealth/documents/CDEpi/Ebola/EbolaProtocolRelease.pdf

MT-4	http://dphhs.mt.gov/Portals/85/publichealth/documents/HAN/2014/HANUD2014-24.pdf
NE-1	http://dhhs.ne.gov/publichealth/Ebola/Pages/NESpecific.aspx
NV-1	http://www.health.nv.gov/Ebola/ActiveDirectMonitoringWebSite.pdf
NH-1	http://www.dhhs.nh.gov/dphs/cdcs/ebola/documents/isolationquarantine-interim.pdf
NH-2	http://www.dhhs.nh.gov/dphs/cdcs/ebola/documents/ebola-stateplan.pdf
NH-3	http://governor.nh.gov/media/news/2014/pr-2014-10-28-ebola-protocols.htm
NJ-1	http://www.state.nj.us/health/news/2014/approved/20141031b.html
NJ-2	http://www.state.nj.us/infobank/circular/eoccl64.pdf
NJ-3	http://www.state.nj.us/health/news/2014/approved/20141031b.html
NJ-4	http://www.state.nj.us/health/cd/vhf/documents/ebola_active_monitoring.pdf
NJ-5	http://www.state.nj.us/health/cd/vhf/documents/ebola_active_monitoring_add.pdf
NJ-6	http://www.state.nj.us/governor/news/news/552014/approved/20141024b.html
NJ-7	http://nj.gov/governor/news/news/552014/pdf/20141022a.pdf
NJ-8	http://www.state.nj.us/governor/news/news/552014/approved/20141026c.html
NM-1	http://nmhealth.org/publication/view/plan/953/
NY-1	http://www.health.ny.gov/diseases/communicable/ebola/docs/commissioner_order_2.pdf
NY-2	http://www.health.ny.gov/diseases/communicable/ebola/docs/screening_protocol_jfk.pdf
NY-3	http://www.governor.ny.gov/news/governor-cuomo-outlines-state-response-positive-test-ebola-patient-new-york-city
NY-4	http://www.health.ny.gov/press/releases/2014/2014-12-16_nys_ebola_monitoring.htm
NY-5	http://www.governor.ny.gov/news/governor-andrew-cuomo-and-governor-chris-christie-announce-additional-screening-protocols-ebola
NY-6	http://www.governor.ny.gov/news/new-york-state-releases-fact-sheet-state-screening-protocols-jfk-international-airport
NC-1	http://epi.publichealth.nc.gov/cd/lhds/manuals/cd/ebola/CDProgramAlert8EbolaUpdate_10302014.pdf
NC-2	http://www.ncdhhs.gov/ebola/pdfs/Risk_classification.pdf
ND-1	https://www.ndhan.gov/data/mrNews/Ebola%202014-10-29-Ebola%20Updates%20NR-v%20FINAL%20(2).pdf
ND-2	http://www.ndhealth.gov/pagecounters/ebola/ebolatravelermonitoringreport.pdf?v=635532269357105176
OH-1	http://www.odh.ohio.gov/~media/ODH/ASSETS/Files/ebola/Strengthened%20Traveler%20Protocols.ashx
OH-2	http://www.governor.ohio.gov/Portals/0/10.18.14%20ODH%20Revised%20Quarantine%20Protocols.pdf
OH-3	http://ema.ohio.gov/Documents/Releases/2014/20141016_ODH%20Quarantine%20Protocols.pdf
OH-4	http://ema.ohio.gov/Documents/Releases/2014/20141020_OhioDailyEbolaContactReport.pdf
OH-5	http://ema.ohio.gov/Documents/Releases/2014/20141031_Strengthened%20Ohio%20Health%20Monitoring-Quarantine%20Protocols.pdf
OK-1	http://www.ok.gov/health/Organization/Office_of_Communications/News_Releases/Situation_Updates/Surveillance_and_Preparedness_for_Ebola_Virus_Disease/EVD_Situation_Update_No_11.html
OR-1	https://public.health.oregon.gov/Preparedness/CurrentHazards/Events/EbolaResponse/Documents/Ebola-Monitoring-Plan.pdf
OR-2	https://public.health.oregon.gov/Preparedness/CurrentHazards/Events/EbolaResponse/Documents/Ebola-Monitoring-FAQ.pdf
OR-3	http://public.health.oregon.gov/Preparedness/CurrentHazards/Events/EbolaResponse/Documents/ebola-know-your-risk.pdf
PA-1	http://www.health.pa.gov/My%20Health/Diseases%20and%20Conditions/E-H/Pages/Ebola1124-7264.aspx#.VRA3_lzCH7V
PA-2	http://www.homelandsecurity.pa.gov/Documents/EMSIB%202014-003%20Ebola.pdf
RI-1	http://us2.campaign-archive2.com/?u=ece9b1661b3bf3b864a6894d1&id=727f242882

RI-2	http://www.ri.gov/press/view/23206
SC-1	http://www.scdhec.gov/Health/DiseasesandConditions/InfectiousDiseases/Ebola/EbolaStatement/
SD-1	http://doh.sd.gov/diseases/ebola.aspx
SD-2	http://doh.sd.gov/documents/diseases/10-29-14EbolaSlides.pdf
SD-3	http://news.sd.gov/newsitem.aspx?id=16909
TN-1	https://tnhan2.tn.gov/Documents/Ebola_Viral_Disease_(EVD)/TDH%20Interim%20Exposure,%20Monitoring,%20and%20Movement%20Definitions_Public_20141230.pdf
TX-1	http://gov.texas.gov/files/press-office/2014-10-31-TX-Task_Force_Recommendations.pdf
TX-2	https://www.dshs.state.tx.us/news/releases/20141001.aspx
TX-3	http://www.texasebola.org/pdfs/1505-Monitoring-Movement.pdf
TX-4	Presentation downloaded from health department website
TX-5	http://www.dshs.state.tx.us/news/releases/20141018.aspx
TX-6	http://www.lrl.state.tx.us/scanned/govdocs/Rick%20Perry/2014/RP-79.pdf
TX-8	Document downloaded from link in press release (TX-5)
TX-9	Document downloaded from link in press release (TX-5)
TX-10	Document downloaded from link in press release (TX-5)
TX-11	Document downloaded from link in press release (TX-5)
UT-1	http://health.utah.gov/epi/diseases/ebola/Monitoring_Movement_Guidance_FS.pdf
UT-2	http://health.utah.gov/epi/diseases/ebola/ebola_public_health_preparedness.pdf
UT-3	http://health.utah.gov/epi/diseases/ebola/plan.pdf
UT-4	http://www.health.utah.gov/epi/diseases/ebola/UDOH_Active%20Monitoring_EME_Protocol.pdf
VT-1	http://healthvermont.gov/advisory/2014/documents/20141107_ebola_hcw_monitoring.pdf
VT-2	http://www.vermont.gov/portal/government/article.php?news=5156
VA-1	http://www.vdh.virginia.gov/epidemiology/ebola/BasicAirportProtocol.htm
VA-2	http://vdfp.virginia.gov/pdf/ebola/DeclarationEbolaDiseaseasCommunicable.pdf
VA-3	https://www.vdh.virginia.gov/clinicians/pdf/EbolaVirusUpdate3.pdf
VA-4	http://www.vdh.virginia.gov/news/PressReleases/2014/102714ebola.htm
WA-1	http://www.doh.wa.gov/Portals/1/Documents/1000/EbolaQA_11-14.pdf
WA-2	Monitoring instructions downloaded from health department website
WA-3	Monitoring instructions downloaded from health department website
WA-4	http://www.doh.wa.gov/Portals/1/Documents/5100/420-132-Ebola-LHJ-MonitoringGuide.pdf
WV-1	http://www.dhhr.wv.gov/oeps/disease/zoonosis/other/ebola/documents/ebola-traveller-surveillance.pdf
WV-2	http://www.dhhr.wv.gov/oeps/disease/zoonosis/other/documents/ebola/ebola-public-faq.pdf
WV-3	http://www.dhhr.wv.gov/healthprep/Pages/cd-.aspx
WI-1	https://www.dhs.wisconsin.gov/disease/sitrep-11-20-14.pdf
WI-2	https://www.dhs.wisconsin.gov/publications/p0/p00903.pdf
WI-3	https://www.dhs.wisconsin.gov/disease/ebola-virus-disease-partnerinfo.htm
WY-1	Document downloaded from health department website

Appendix 2. Aim 1 Data Abstraction Fields

Document ID
Notes on source
Link
State
Type of document
Date Published
Date last modified
Who issued document
Number of days applicable
Quarantine policy
Use of voluntary quarantine agreement?
Isolation policy
Risk tiers
Restriction of movement
Daily monitoring
Legal Authority

Appendix 3. Aim 2 Coding Instrument

Basic Coding and Exclusions			
Domain		Coding Scheme	
Coder ID	1 – TKS 2 – CB		
Story unique ID			
Outlet	1 – USA Today		
	2 – New York Times		
	3 – Washington Post		
	4 – Orange County Register		
	5 – Atlanta Journal Constitution		
	6 – Fort Worth StarTelegram		
	7 – Portland Press Herald		
	8 – Chicago Tribune		
	9 – New York Daily News		
	10 – Huffington Post		
	11 – NBC Nightly News		
	12 – CNN Situation Room		
	13 – Fox Special Report		
Date	DD/MM		
Exclusion 1: Word count	1 – article <100 words 0 – article >=100 words		
Exclusion 2:	1 – Correction 2 – Book review 3 – Letter to the editor 4 – Solely business/stock 5 – Obituaries 6 – Duplicate 7 – Index only 8 – Introduction/lead in only 9 – Calendar/event report 10 – Advice column 11 – Mentioned in passing 12 – Other (fill in) 0 – News story, health/lifestyle, metro, op-ed/editorial		
Exclusion 3:	1 – International focus/no coverage US related Ebola issues 0 – Includes content about Ebola coming to/in the US		
Code Only for Included Stories			
Item		Coding Scheme	
Story word count			
Message		Raw Agreement (%)	Kappa Statistic
Message about lack of/ limited availability of countermeasures	1=yes 0=no	96	.84
Message about the disease causing deaths	1=yes	94	.85

	0=no		
Message about lower death rates in the US	1=yes 0=no	98	.70
Message about a potential US outbreak/people in the US getting ebola	1=yes 0=no	87	.73
Message about ability to stop transmission in the US (positive)	1=yes 0=no	93	.77
Message about ability to stop transmission in the US (negative)	1=yes 0=no	94	.63
Message about growth of the epidemic	1=yes 0=no	89	.72
Message about low risks	1=yes 0=no	90	.76
Message about science not understanding the disease	1=yes 0=no	94	.67
Message about terrorism or potential use as a biological weapon	1=yes 0=no	100	.80
Message about how to prevent spread	1=yes 0=no	90	.64
Message about incubation period	1=yes 0=no	96	.90
Message describing science about the risks	1=yes 0=no	93	.83
Message about foreigners, travelers or borders (exotic)	1=yes 0=no	90	.67

Appendix 4. Aim 3 Coding Instrument

Basic Coding and Exclusions			
Domain		Coding Scheme	
Coder ID		1 – TKS 2 – CB	
Story unique ID			
Outlet		1 – USA Today	
		2 – New York Times	
		3 – Washington Post	
		4 – Orange County Register	
		5 – Atlanta Journal Constitution	
		6 – Fort Worth StarTelegram	
		7 – Portland Press Herald	
		8 – Chicago Tribune	
		9 – New York Daily News	
		10 – Huffington Post	
		11 – NBC Nightly News	
		12 – CNN Situation Room	
		13 – Fox Special Report	
Date		DD/MM	
Exclusion 1: Word count		1 – article <100 words 0 – article >=100 words	
Exclusion 2:		1 – Correction 2 – Book review 3 – Letter to the editor 4 – Solely business/stock 5 – Obituaries 6 – Duplicate 7 – Index only 8 – Introduction/lead in only 9 – Calendar/event report 10 – Advice column 11 – Mentioned in passing 12 – Other (fill in) 0 – News story, health/lifestyle, metro, op-ed/editorial	
Exclusion 3:		1 – International focus/no coverage US related Ebola issues 0 – Includes content about Ebola coming to/in the US	
Code Only for Included Stories			
Item		Coding Scheme	
Story word count			
Message		Raw Agreement (%)	Kappa Statistic
Message about confusion	1=yes 0=no	98	.85
Causal message about slow/poor response from	1=yes	91	.74

government	0=no		
Causal message about poor PPE, standards, training (lack of preparedness)	1=yes 0=no	94	.83
Message about travel bans	1=yes 0=no	99	.97
Message supporting travel bans	1=yes 0=no	97	.87
Message against travel bans	1=yes 0=no	99	.93
Message about quarantine	1=yes 0=no	95	.90
Message supporting quarantine	1=yes 0=no	96	.81
Message against quarantine	1=yes 0=no	100	1
Message about isolation	1=yes 0=no	94	.88
Message about dividing people into different risk groups	1=yes 0=no	98	.82
Message about requirements to enter the United States	1=yes 0=no	98	.94
Message about PH monitoring of people	1=yes 0=no	96	.92

Appendix 5. Aim 2 Example Messages

Message Types Potentially Increasing Perception of Risk	Example messages
Lack of/limited availability of countermeasures	“The maker of ZMapp has no more of the drug, which was made in small quantities because of its early stage of development.” – <i>USA Today</i> , 9/18/14
Potential U.S. outbreak/people in the U.S. contracting Ebola	<p>“The first diagnosed case of Ebola is sending chills through much of the U.S. tonight and despite official assurances, there are worries that patient zero in Dallas could be just the beginning.” – Fox Special Report, 10/1/14</p> <p>“We knew a second case could be a reality and we’ve been preparing for this possibility...” – <i>New York Daily News</i>, 10/13/14</p>
Inability to stop transmission/outbreak in the U.S.	<p>“Our public health system is not ready to deal with a challenge like Ebola if the situation takes a turn for the worst.” – <i>USA Today</i>, 10/2/14</p> <p>“...yet another day where there were more questions raised about whether the government really has a handle on this.” – Fox Special Report, 10/16/14</p>
Ebola causes deaths	<p>“Almost 1,000 people have died of Ebola since March.” – <i>New York Times</i>, 8/8/14</p> <p>“Thomas Eric Duncan, the Liberian man who was the first person to be diagnosed with the virus in [the] U.S. died on October 8th.” – Huffington Post, 10/16/14</p>
Growth of the Ebola epidemic	“The Ebola outbreak could last for years and spread to many more countries if it is not controlled quickly.” – <i>USA Today</i> , 9/17/14
Science does not understand Ebola (e.g., previous knowledge about the disease was wrong or expert advice was incorrect)	<p>“...The more this virus circulates in West Africa, Wolf, the greater chance it has of mutating...change in the virus to lead to possibly becoming...aerosol[ized].” – CNN Situation Room, 10/17/14</p> <p>“We don’t actually know with any great precision how Ebola is transmitted.” – Fox Special Report, 10/15/14</p> <p>“We have to rethink the way we address Ebola infection control, because even a single infection is unacceptable,” Thomas Frieden, director of the Centers for Disease Control and Prevention, said in a news conference.” – <i>Washington Post</i>, 10/13/14</p>
Ebola’s potential use in terrorism or as a biological weapon	“Are you worried that terrorist groups also try to use Ebola as a weapon against the U.S.? Have you heard anything on that essentially getting sympathetic

	infected people to specifically travel to the U.S. in the hopes of infecting others, is that a concern?” – Fox Special Report, 10/3/14
Ebola has an incubation period	“North Texas officially became Ebola-free on Friday when the last of 177 people being monitored because of their exposure moved out of the 21-day virus incubation period with no symptoms of sickness.” – <i>Fort Worth Star Telegram</i> , 11/7/14
Foreigners or travelers bringing Ebola to the U.S.	“Late this afternoon, Ashoka Mukpo boarded a plane in Monrovia, Liberia. After some nine hours in the air, he’ll land in Nebraska and be taken to the Nebraska Medical Center.” – NBC Nightly News, 10/5/14 “A man who flew from Liberia to Dallas in September was diagnosed with Ebola on Tuesday...” – <i>Washington Post</i> , 10/1/14
Message Types Potentially Decreasing Perception of Risk	
Lower Ebola death rates in the U.S.	“Two nurses who helped treat him, Nina Pham and Amber Vinson, later became ill and tested positive for Ebola. They received prompt, specialized treatment and survived...as serious as the threat was to Pham and Vinson, the numbers can be seen as encouraging.” – <i>Fort-Worth Star Telegram</i> , 11/7/14
Ability to stop transmission/outbreak in the U.S.	“We do not anticipate this will spread in the U.S...” – <i>New York Times</i> , 7/29/14 “In the U.S., we have a good health infrastructure and effective precautionary standards. Both greatly contribute to creating a formidable barrier against the spread of Ebola in the U.S.” – <i>Orange County Register</i> , 8/14/14
How to prevent spread of Ebola	“In Western hospitals, transmission is easily prevented with precautionary measures like face masks, gloves, protective gowns and isolation units.” – <i>Huffington Post</i> , 8/6/14
Description of scientific knowledge about the disease (e.g., transmission dynamics or other known aspects of the disease)	Ebola is spread only through direct contact with an infected person’s bodily fluids. People are not contagious until they begin showing symptoms.” – <i>Atlanta Journal Constitution</i> , 10/2/14
Low risks related to Ebola (e.g., low risk of the disease coming to the U.S., low risk of someone transmitting the disease, low risks of school children acquiring Ebola)	“The Centers for Disease Control and Prevention said there was no significant risk to the United States from the outbreak.” – <i>New York Times</i> , 8/1/14 “Carnival said the CDC had notified it that a passenger on the Carnival Magic was a lab supervisor at the hospital and deemed to be “very low risk.”” –

	<p><i>Chicago Tribune</i>, 10/18/14 “Schools Chancellor Carmen Fariña and city Health Commissioner Mary Bassett fired off a letter to school principals, laying out possible Ebola warning signs but emphasizing that the risk to staff and students is “very small.” – <i>New York Daily News</i>, 10/17/14</p>
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Appendix 6. Aim 3 Example Messages

<u>Message Types Mentioned in News Story</u>	Example messages
Any mention of travel bans	“It [the Department of Homeland Security] did not accede to demands for restrictions such as denying travelers from Ebola outbreak countries entry to the USA.” – <i>USA Today</i> , 10/22/14
Support of travel bans	“Even so, some members of Congress, mostly Republicans, have called for barring entry to all people who have been in the Ebola-stricken countries as a way to keep the virus out.” – <i>New York Times</i> , 10/17/14
Opposition to travel bans	“I’ll take the travel ban question first...right now, we believe those types of steps actually impede the response.” – CNN Situation Room, 10/3/14
Any mention of quarantine	“At University of Chicago Medicine, emergency department and urgent-care employees, along with other health care workers who volunteer to care for any Ebola patients, are receiving special training on quarantine procedures, according to a hospital statement.” – <i>Chicago Tribune</i> , 10/16/14
Support of quarantine	“The state health commissioner says the quarantine is a common sense approach and applies to anyone who had direct contact with [E]bola patients, since the disease may not surface for up to three weeks after exposure.” – Fox Special Report, 10/30/14
Opposition to quarantine	“Hickox says she has no Ebola symptoms, has tested negative for the virus, poses no public health threat and shouldn’t be quarantined.” – <i>USA Today</i> , 10/31/14
Isolation	“She began showing symptoms and checked into Texas Health Presbyterian the day after her flight, where she was isolated and diagnosed with Ebola. – Huffington Post, 10/16/14
Dividing potentially exposed persons into groups based on their level of Ebola risk	“The new federal guidelines separate people into four categories of risk. Those most at risk – people who have had direct contact with the Ebola virus...will be asked to stay home for 21 days.” – <i>New York Daily News</i> 10/28/14
Requirements to enter the U.S. (e.g., passport checks, temperature readings)	“Starting this weekend, New York’s JFK is screening all passengers arriving from Ebola stricken nations...” – NBC Nightly News, 10/12/14
Public health monitoring	“Some 50 people he may have come into contact with are being monitored.” – <i>New York Daily News</i> , 10/5/14
Slow or poor response from the U.S. government	“The federal Centers for Disease Control and Prevention has acknowledged that its response

	to the Dallas Ebola case was lacking and should have included sending specialized teams sooner.” – <i>Fort Worth Star-Telegram</i> , 11/7/14
Poor PPE, standards, training (i.e., lack of preparedness)	“Meanwhile, the National Nurses United union released a statement citing “steady reports from nurses at multiple hospitals who are alarmed at the inadequate preparation they see at their hospitals.”” – <i>Atlanta Journal-Constitution</i> , 10/14/16
Confusion (i.e., about policies, standards, or requirements related to U.S. Ebola response)	“There was – and still is – inconsistent information about how Ebola is spread and confusion about what to do with patients traveling to the U.S. from affected areas of West Africa...” – <i>Orange County Register</i> , 11/4/14

Appendix 7. Institutional Notice of Determination



FWA #00000287

Institutional Review Board Office

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NOT HUMAN SUBJECTS RESEARCH DETERMINATION NOTICE STUDENT PROJECTS

Date: January 9, 2015

To: Tara Kirk Sell

Re: **PhD Dissertation Student Project Title:** "Health policy responses to emerging outbreaks: News media coverage and potential health impacts in the case of Ebola"

The JHSPH IRB reviewed the IRB Office Determination Request Form for Primary Data Collection (received January 7, 2015) on **January 9, 2015**. We have determined that the proposed activity described in your request form involves subjects who are key informants and collects expert opinions and judgments designed to elicit information from them in their professional capacity about potential health impacts of a mandatory quarantine policy for individuals returning from Ebola affected countries. No personal or private information will be collected. Thus, the proposed activity does not qualify as human subjects research as defined by DHHS regulations 45 CFR 46.102, and does not require IRB oversight. We anticipate that you will follow ethical practices in your interactions with individuals in the community during the course of your project.

You are responsible for notifying the JHSPH IRB of any future changes that might involve human subjects and require IRB review.

If you have any questions regarding this determination, please contact the JHSPH IRB Office at (410) 955-3193 or via email at jhsph.irboffice@jhu.edu.

/teb

cc: Helaine Rutkow, PhD, JD
Faculty Advisor / Associate Professor
Department of Health Policy and Management

Thomas Burke, PhD
Faculty Advisor
Associate Dean for Public Health Practice and Training Professor
Department of Health Policy and Management
Department of Environmental Health Sciences

JHSPH IRB NHSR Determination Notice_Student Projects
V5, 18Sep2014

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Curriculum Vitae

TARA KIRK SELL
March 2016

Professional Contact

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Education

- Johns Hopkins Bloomberg School of Public Health (Baltimore, MD)
 - 2016 - Ph.D. Department of Health Policy and Management
Advisor: Lainie Rutkow, GPA: 4.0
 - Ph.D. Thesis – *Health Policy Responses and News Media Coverage of an Emerging Outbreak: The Case of Ebola*
- Stanford University (Palo Alto, CA)
 - 2005 – M.A. Anthropological Sciences, focus in Medical Anthropology,
Advisor: Ronald Barrett, GPA: 4.026
 - M.A. Thesis – *Reflections: Using H5N1 Avian Influenza to Investigate the Pandemic of 1918*
 - 2005 – B.A. Human Biology, focus in Humans and Infectious Diseases,
Advisor: Robert Siegel, GPA: 3.740

Professional Experience

- UPMC Center for Health Security (formerly Center for Biosecurity of UPMC), 10/09 – present
 - Current Position: Associate, 10/13-present
 - Conduct, manage and lead research projects to develop a greater understanding of potentially large-scale health events, including bioterrorism, nuclear terrorism, and large-scale pandemics. Responsibilities also include project management of medium to large research teams, the development of research proposals, and fundraising efforts to support research projects. Projects include qualitative and quantitative research analyses, development of policy recommendations, convening of working groups and conferences, and the publication of scientific articles.
 - Specific project areas included in past research efforts include: public health policy, strategic analysis of federal programs, federal budgeting, risk communication, community resilience, disaster preparedness, disease surveillance, outbreak response, nuclear consequence management, community

- engagement in public health emergency preparedness, and emerging disease prediction markets.
- Associate editor of *Health Security* (Formerly *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*)
- Previous Positions: Senior Analyst, 10/11 – 10/13; Analyst, 10/09 – 10/11
- Johns Hopkins Bloomberg School of Public Health, 9/12 – 4/16
 - Research Assistant - Study of News Reporting Frames for Stories on Background Check Laws for Gun Sales.
 - Teaching Assistant – Health Impact Assessment.
 - Teaching Assistant – Introduction to the Risk Sciences and Public Policy.
- Professional athlete, 5/04 – 1/09
 - Sponsored swimmer - sponsored by Speedo, Bank of America, and Toyota
 - Olympic Silver Medalist, former World Record Holder
 - Captain of 6 USA National Teams.
 - Athlete Correspondent for World Championship Sports Network
 - Swim Clinic Lead Instructor - Organizing and leading 50-200 person swim clinics nationwide for youth, adults, and elite swimmers.
 - Motivational and inspirational speaker for groups of 20-150
- San Mateo Mosquito Abatement District, 6/02 – 8/02
 - Position: Summer Lab Intern
 - Participated in monitoring local animal populations for diseases, such as West Nile Virus and Raccoon Roundworm. Collected live specimen for tests on mosquito and tick populations.

Publications (Peer Reviewed Journals)

20. Sell TK, McGinty EE, Pollack K, Smith KC, Burke TA, Rutkow L. US State-Level Policy Responses to the Ebola Outbreak, 2014-2015. *J Public Health Manag Pract.* 2016 Dec 15. [Epub ahead of print].
19. McGinty EE, Wolfson JA, Sell TK, Webster DW. Common Sense or Gun Control? Political Communication and News Media Framing of Firearm Sale Background Checks after Newtown. *J Health Polit Policy Law.* 2016 Feb;41(1):3-40.
18. Boddie C, Sell TK, Watson M. Federal Funding for Health Security in FY2016. *Health Security.* 2015;13(3):186-206. 2015 May-Jun;13(3):186-206.
17. Adalja A, Sell TK, Ravi S, Minton K, Morhard R. Emergency Preparedness in the 10-Mile Emergency Planning Zone Surrounding Nuclear Power Plants. *J Homel Secur Emerg.* 2014 Dec;12(1):81-100.
16. Boddie C, Sell TK, Watson M. Federal Funding for Health Security in FY2015. *Biosecur Bioterror.* 2014 July/Aug;12(4).
15. Sell TK, Watson M. Federal Agency Biodefense Funding, FY2013-FY2014. *Biosecur Bioterror.* 2013 Sept; 11(3): 196-216.
14. Schoch-Spana M, Sell TK, Morhard R. Local health department capacity for community engagement and its implications for disaster resilience. *Biosecur Bioterror.* 2013 Jun;11(2):118-29.

13. Sell TK, Franco C. Funding for nuclear consequence management-related programs: FY2012-FY2013. *Bio Secur Bioterror*. 2012 Dec;10(4):417-9.
12. Sell TK, Gilles K. Radiological disasters: what's the difference? *Bio Secur Bioterror*. 2012 Dec;10(4):412-6.
11. Sell TK, Gilles K, Franco C. Biodefense funding: changes from president's budget to congressional appropriations. *Bio Secur Bioterror*. 2012 Sep;10(3):321-7.
10. Franco C, Sell TK. Federal Agency Biodefense Funding, FY2012-FY2013. *Bio Secur Bioterror*. 2012 Jun;10(2):162-81.
9. Adalja AA, Sell TK, Bouri N, Franco C. Lessons Learned during Dengue Outbreaks in the United States, 2001-2011. *Emerg Infect Dis*. 2012 Apr;18(4):608-14.
8. Bouri N, Sell TK, Franco C, Adalja AA, Henderson DA, Hynes NA. Return of Epidemic Dengue in the United States: Implications for the Public Health Practitioner. *Public Health Rep*. 2012 May-June; 127(3):259-266.
7. Toner ES, Nuzzo JB, Watson M, Franco C, Sell TK, Cicero A, Inglesby TV. Biosurveillance Where It Happens: State and Local Capabilities and Needs. *Bio Secur Bioterror*. 2011 Dec;9(4):321-30.
6. Franco C, Sell TK. Federal Agency Biodefense Funding, FY2011-FY2012. *Bio Secur Bioterror*. 2011 Jun;9(2):117-37
5. Sell TK, Franco C, Ho ATY, Polgreen PM. Using a prediction market to forecast dengue fever activity in the U.S. [abstract]. *Emerg Health Threats J*. 2011; 4:s148
4. Sell TK. Understanding infectious disease surveillance: its uses, sources, and limitations. *Bio Secur Bioterror*. 2010 Dec;8(4):305-9
3. Rambhia KJ, Watson M, Sell TK, Waldhorn R, Toner E. Mass vaccination for the 2009 H1N1 pandemic: approaches, challenges, and recommendations. *Bio Secur Bioterror*. 2010 Dec;8(4):321-30.
2. Bouri N, Norwood A, Sell TK. Preparing to save lives and recover after a nuclear detonation: implications for U.S. policy. *Bio Secur Bioterror*. 2010 Sep;8(3):287-94.
1. Franco C, Sell TK. Federal Agency Biodefense Funding, FY2010-FY2011. *Bio Secur Bioterror*. 2010 Jun;8(2):129-49

Reports

2. Nuzzo JB, Wollner SB, Morhard RC, Sell TK, Cicero AJ, and Inglesby TV. When Good Food Goes Bad. Center for Biosecurity of UPMC. March 2013.
1. Schoch-Spana M, Norwood A, Sell TK, Morhard R. *Rad Resilient City: A Preparedness Checklist to Diminish Lives Lost from Radiation after a Nuclear Terrorist Attack*. Baltimore Maryland: Center for Biosecurity of UPMC; September, 2011.

Working Group memberships

- Member of the MCM Emergency Communication Working Group, 2014-2016.
- Member of the Nuc/Rad Communications Working Group. FEMA IND Response and Recovery Program, 2011- 2015.
- Member of the Nuclear Resilience Expert Advisory Group. Rad Resilient City Project, 2011.

Presentations

- *News Media Messages about Ebola and Their Implications for Risk Perception in the United States*. Poster presentation as the Johns Hopkins Bloomberg School of Public Health 2016 Delta Omega Poster Competition.
- *Rad Resilient City: A preparedness checklist to save lives after a nuclear detonation*. Poster Presentation at the Conference of Radiation Control Program Directors 2012 Annual Conference.
- *How Your City Can Survive a Nuclear Terrorist Attack*. Oral presentation at the 2012 Public Health Preparedness Summit.
- *Health Agency Infrastructure for Community Engagement in Public Health Emergency Preparedness*. Oral presentation at the 2011 Public Health Preparedness Summit.
- *Using Electronic Health Markets to Predict the Spread of Dengue*
 - Oral presentation International Meeting on Emerging Diseases and Surveillance, 2011
 - Poster presentation of preliminary results at the International Society for Disease Surveillance Conference, 2010.
- *Reflections: Using H5N1 Avian Influenza to Investigate the Pandemic of 1918* Poster Presentation at 2005 Parents' Weekend Symposium of Undergraduate Research in Progress at Stanford.

Awards and Achievements

- Sommer Scholar, Johns Hopkins Bloomberg School of Public Health, 2014-2016
- Sir Arthur Newsholme Research/Teaching Assistantship, Johns Hopkins Bloomberg School of Public Health, 2012-2014
- Rhodes Scholar finalist, 2005
- US Olympian and Silver Medalist, 2004
- World record holder (100 breaststroke short course meters), 2004 – 2006
- US National World Championship Team, 2003, 2005, 2007
 - Team Captain in 2005 and 2007, 4-time Silver Medalist, 2-time Bronze Medalist
- Stanford Varsity Swimming Team Member, 2000 – 2004
 - Team Captain from 2002 – 2004, 35-0 career record in the 100 breaststroke, 16-time All-American, 11-time NCAA Champion
- Honda/Broderick Cup winner, 2004 - Awarded to the Collegiate Woman Athlete of the Year, first Stanford athlete to receive the award.
- NCAA Top VIII recipient, 2004 - Awarded to the eight most outstanding student-athletes in the nation, spoke on behalf of the class at the induction ceremony
- Stanford AI Masters Award, 2004 - Stanford's highest athletic award for performance, leadership, and academic achievement
- John Arrillaga II Athletic Scholarship