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#Zika #Olympics: The Use of Dialogue in Tweets
Regarding the Zika Virus and the 2016 Rio Olympics

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JAMES MADISON UNIVERSITY

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Partial fulfillment of the requirements

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Abstract

Previous research has observed the use of social media by health organizations; however, few studies have addressed how health organizations use these media to build relationships with publics. This thesis addresses this gap by applying Kent and Taylor's (2002) dialogic tenets to Twitter messages regarding the 2015-2016 Zika virus epidemic and the 2016 Rio Olympics. First a pilot study used a quantitative survey to find that individuals were using online media to seek information about Zika, and that the public generally had high threat salience toward the virus. Next, social network analyzer Netlytic was used to collect Tweets that mentioned both "Zika" and "Olympics" between August 5th and August 7th, 2016, during the Olympic Games. Data analysis and a qualitative content analysis found that health organizations were not engaged in the conversations regarding Zika during the Olympics on Twitter, and did not effectively employ the tenets of dialogue. Health organizations can potentially raise their level of dialogue with publics by interacting more with users on the Twitter platform. This thesis extends the literature surrounding dialogic theory, social media use, and health communication practices of public health organizations.

CHAPTER 1: RATIONALE

The 2016 Rio Olympics were the source of a great deal of media attention that had little to do with the athletics of the event. Outlets from around the world raised concerns over whether Brazil's struggling economy could support a sporting event of that magnitude, reported on the potentially excessive use of Brazilian state police, debated the safety of the event, and perhaps most strikingly, discussed health concerns for athletes, reporters, and visitors in the wake of the 2015-2016 Zika virus outbreak (Barbara, 2016).

Concern over the Zika virus increased dramatically toward the end of 2015 due to multiple reported cases of maternal-fetal transmission of the virus, particularly in Brazil where the outbreak began (Petersen, Staples, Meaney-Delman, Fischer, Ellington, Callaghan, & Jamieson, 2016). Although the virus itself typically only causes mild illness for those infected (CDC, 2016; Hayes, 2009), the disease can be extremely dangerous for pregnant mothers (Petersen et al., 2016). This was the case in Brazil, where over 2,000 infants born from Zika-infected mothers were reportedly diagnosed with microcephaly, a condition where babies are born with an abnormally small head that typically leads to later developmental abnormalities (Sun, 2016; Petersen et al., 2016).

With growing media attention of the disease and the 2016 Rio Olympics, as well as a number of reported cases of Zika appearing in the United States (CDC, 2016), public perceptions of the threat of Zika were likely high. Rising salience of the threat necessitated information distribution from health organizations, such as the Centers for Disease Control and Prevention (CDC), which urged individuals and particularly pregnant mothers to postpone travel to areas with high numbers of reported cases of Zika (Petersen et al., 2016).

This thesis argues that distribution of health information from health organizations should only be the first step in reducing public salience of threats such as that created by the 2015-2016 Zika virus epidemic. To better address public concerns over disease outbreaks and epidemics, health organizations need to engage in ethical, meaningful dialogic communication with publics. Messages that build dialogue lead to ethical relationships between organizations and publics, which for health organizations can mean better informed and safer publics. This is made more possible with the continued popularity of interactive media, such as the microblogging platform Twitter.

Previous research has studied the use of health communication in social media (e.g. Hajli, Featherman, & Love, 2015; Feng & Xie, 2015; Wartella, Rideout, Montague, Beaudoin-Ryan, & Lauricella, 2016), including the use of Twitter by health organizations (e.g. Jiang et al., 2014; Park et al., 2016); however, there is a severe lack of research on the use of dialogic principles in the communication of health organizations. A clearer understanding of the principles of dialogue are important for health organizations to understand and apply, especially during public health crises, as more dialogue builds trusts and stronger communication ties with publics.

To better understand if and how messages from health organizations build dialogue, Kent and Taylor's (2002) tenets of the dialogic theory were used. This theory from the field of public relations aims to promote ethical relationships between organizations and publics through messages that build dialogue (Kent 2013; Kent & Taylor, 2002). Kent and Taylor's (2002) five tenets provide practitioners with specific goals for messages to be dialogic, and provide researchers a way to more easily operationalize whether messages are in fact dialogic. Using these tenets to understand

messages between organizations and publics is particularly important now as organizations and publics move toward interactive communicative technologies and media online.

Before this thesis, a pilot study was conducted collecting information regarding individual's online health information seeking behaviors and threat salience toward the Zika virus. The main study first used the social network and data analyzing software platform Netlytic to collect and assess Twitter posts (Tweets) that pertained to Zika and the 2016 Rio Olympics, focusing on the degree to which the health organizations interacted with and responded to other users. Next, a sample of the tweets were analyzed through a content analysis to assess whether Kent and Taylor's (2002) five dialogic principles were employed by organizations to communicate about the Zika virus during the Olympics.

This thesis extends the literature of health communication and social media, as well as fills a gap in the dialogic theory literature in regards to health communication, by using Kent and Taylor's (2002) dialogic tenets as a frame to understand the use of communication by health organizations during a public health threat. This thesis will assess the current and potential use of Twitter by health organizations to build dialogue during a public health crisis through interactive social media, and suggestion better practices for these groups.

CHAPTER 2: LITERATURE REVIEW

The Zika Virus

Zika, or ZIKV, is a virus in the flavivirus genus family that includes yellow fever, dengue fever, the West Nile virus, and Japanese encephalitis viruses (Hayes, 2009).

Although the first human case of Zika was not reported until 1954, the disease takes its name from its original discovery in 1947 from a rhesus monkey in the Zika Forest in Uganda (Hayes, 2009). The virus is typically spread through mosquitoes, and usually only results in mild symptoms, such as fever, rash, joint pain, red eyes, and sometimes muscle pain and headaches for those infected (CDC, 2016; Hayes, 2009).

Despite typically mild symptoms for most individuals, the disease can be extremely dangerous for pregnant women who can transmit the virus to their infants, likely causing microcephaly in those infants (Petersen et al., 2016). With the current lack of a vaccine to prevent the Zika virus and no medical treatment beyond allowing the symptoms to pass (CDC, 2016), individuals, particularly pregnant women and women who were planning to become pregnant, became increasingly concerned of the disease.

The disease received heavy attention in American media in 2015 following the outbreak of Zika and subsequent cases of microcephaly in Brazil (Petersen et al., 2016). Although the disease spread to much of the Americas, Brazil was hit the hardest, likely due to the wet and humid climate of the Amazon Rainforest, deforestation that created large mosquito breeding grounds, economic issues that slowed mosquito eradication campaigns, and the population's lack of resistance to the disease which was relatively new to the region (Vittor, 2016).

The spread of Zika and the resulting number of infants born with microcephaly became particularly problematic in the months leading up to the 2016 Rio Olympics, with increasing public concern for athletes traveling to Brazil. Some athletes even refused to attend the Olympics for fear of catching the virus, including American cyclist Tejay van Garderen, Australian golfer Marc Leishman, and South African golfer Charl Schwartzel (Davis, 2016). The media coverage of the 2015-2016 Zika virus epidemic, especially in relation to the 2016 Rio Olympics, can be interpreted as an example of the media tracking, and potentially over-reporting, on an epidemic outbreak.

The Media & Epidemic Outbreaks

The past few decades have seen numerous examples of American media heavily reporting on disease outbreaks and other public health threats. Some recent examples include the 2009 H1N1 'Swine Flu' pandemic (Zhang, Kong, & Chang, 2015), the 2011-2012 New Delhi Metallo-beta-lactamase-1 (NDM-1) superbug (Mason & Wright, 2015), and most recently the Ebola outbreaks in 2015 (Boscarino & Adams, 2015). The coverage of the Zika epidemic is an additional example of heavy media coverage of a disease.

Media researchers analyzing this phenomenon have found potential drawbacks and benefits to media consumers. On one hand, researchers claim the excessive media coverage during each result in media false alarms that produce warning fatigue, desensitized publics, loss of expert credibility, general amplification of public uncertainty (Mason & Wright, 2015), and in some cases a panic among publics (Zhang et al., 2015). On the other hand, frequent media exposure to disease can be beneficial to publics by

increasing perceived knowledge of epidemics, and increased preventative measures taken (Zhang et al., 2015).

Media reporting during epidemics is important to understand for health organizations, as the media often turns to them for expertise during public health crises. Additionally, media coverage often leads to increased health information seeking by publics, either from additional media or directly from health organizations themselves.

Health Information Seeking Online

Understanding why and how individuals seek information regarding diseases and outbreaks is important to understand for health organizations, as individuals are now acquiring a large portion of their health information from online sources (Centola & Rijt, 2014; Hou & Shim, 2010; Jha et al., 2016; Medlock et al., 2015; Xiao et al., 2014). This includes social media platforms (Hajli et al., 2015; Feng & Xie, 2015; Wartella et al., 2016), such as Twitter (Juang et al., 2014; Van der Goot et al., 2013). In fact, many individuals report trusting information they find online more than information found through traditional media (Hou & Shim, 2010), because traditional communication channels have lost credibility with individuals seeking health information (Hajli et al., 2015).

Compared to traditional media, Internet sources of health information allow users to easily access up-to-date information, and let providers and health organizations disseminate health information to a much broader audience for a fraction of the cost (Feng & Xie, 2015; Park, Reber, & Chon, 2016; Thackeray, Neiger, Smith, & Van Wagenen, 2012). Along with information dissemination, the Internet also gives users and organizations the ability to interact, connect, and collaborate with publics (Feng & Xie,

2015; Cline & Haynes, 2001). Additionally individuals can seek information regarding more specific health issues (Feng & Xie, 2015), and organizations can better tailor information to fit specific audience needs (Cline & Haynes, 2001).

Information obtained online can also impact individual's health care outcomes (Xiao et al., 2014), influencing them to make more informed health choices (Jha et al., 2016), to directly change behavior (Wartella et al., 2016), or to seek out further professional medical advice (Jha et al., 2016). For example, Feng and Xie (2015) found that individuals who use social media (SNS) to seek health information were also more likely to search for additional health-related information regarding specific medical problems, medical treatment, or healthcare systems like doctors and hospitals.

Despite these benefits afforded by using the Internet, online health information seeking does have a number of potential drawbacks. These include the net-gap created when sections of the population do not have access to online information, and questions on the quality and credibility of information received online (Cline & Haynes, 2001; Feng & Xie, 2015; Hajli et al., 2015; Jiang et al., 2014; Park et al., 2016). For example, Feng and Xie (2015) found significant disparities in the use of social networking services (SNS) health information seeking in relation to socioeconomic and demographic factors, pointing to a digital divide of unequal access to SNS among different social and ethnic groups.

And while the Internet has amassed a huge amount of health information (Feng & Xie, 2015), the shortage of professional gatekeepers and editors to evaluate message credibility has resulted in information that can be incomplete, or fraudulent (Jiang et al., 2014), creating concerns from the consumers who seek this information (Cline & Haynes,

2001). Lastly, online health information can be bogged down with overly technical language, a problem exacerbated by the lack of information-evaluative skills by users (Cline & Haynes, 2001).

Health Information Seeking on Twitter

While the Internet provides a number of different access points for receiving information, such as organization websites, online discussion boards, and e-Health communities (Hajli et al., 2015), contacting peers or medical experts directly (Xu, Chiu, Chen, & Mukherjee, 2015), smartphone applications (Pandey, Hasa, Dubey, & Sarangi, 2013), and even online games and wearable technologies (Wartella et al., 2016), one of the most popular means remains to be social media platforms (SNS; Feng & Xie, 2015; Jha et al., 2016). Of the various platforms, Twitter is both a popular and interesting point of study in its ability to disseminate information and potential to encourage interactivity among organizations and users (Park et al., 2016; Van der Goot, Tanev, & Linge, 2013; Xu et al., 2014).

Twitter is a microblogging service that allows users to publish posts (or ‘tweets’) about any topic within a 140-character limit, follow other users, and share other users’ tweets (Kwak, Lee, Park, & Moon, 2010). Along with information dissemination, Twitter is open access, allows users to easily read and exchange information, and can be used to link to additional outside sources of information (Jiang et al., 2014; Park et al., 2016; Van der Goot, 2013). Likewise, Twitter can be used to post and exchange health information (Jiang et al., 2014; Park et al., 2016).

Though Twitter is a great way to disseminate short tidbits of information, the 140-character limit can limit the power and validity of individual tweets (Jiang et al., 2014;

Van der Goot, 2013). One possible risk of these short posts is the greater likelihood of information being incomplete or lacking supporting arguments (Jiang et al., 2014). Additionally, though Twitter may provide the opportunity for health organizations to engage with publics through dialogue, it may be further hindered from doing so because of the space limit of each tweet.

This can be especially problematic during epidemic outbreaks when individuals may require more specific questions answered beyond information being disseminated at them. For example, while Van der Goot et al. (2014) found that tweets could be useful in linking to other sources of information, individual tweets themselves were often of limited value in disease tracking. Regardless, though the practice may need improvement, health organizations like the CDC and WHO can use Twitter to alert the public about epidemic outbreaks (Thackeray et al., 2012; Xu et al., 2014).

Despite limitations to Twitter as a platform due to the small character limit and general reliance on information dissemination rather than engagement (Jiang et al., 2014; Van der Goot, 2013), the platform is important to study for its ubiquitous nature in generating, shifting, and potentially framing important public topics of discussion like the Zika outbreaks. As a platform that easily allows organizations to respond to user messages, Twitter may be utilized to build dialogue with publics. This thesis explores whether tweets from health organizations were utilizing the dialogic tenets (Kent & Taylor, 2002) in interactions (or lack of interactions) with publics during the 2016 Rio Olympics.

Dialogic Theory

Deriving from the field of public relations, the dialogic theory is a valuable tool in the study of communication between an organization and its publics (Kent & Taylor, 2002), particularly as organizations and publics move toward interactive communicative technologies and media online. This theory can be thought of as an ethical framework of establishing meaningful connections between organizations and publics (Kent & Taylor, 2002), or “the interpersonal conversational technique based on respect and trust, and as an approach, or orientation, toward others” (Kent, 2013, p. 257). Dialogic communication is a negotiated exchange of ideas and opinions from clients to stakeholders intended to build meaningful relationships between the two (Kent, 2002, 2013; Kent & Taylor, 1998); more than simply one-way messages from a corporation to consumers (Kent & Taylor, 2002).

Historically, the concept of “dialogue” or dialectic dates back to ancient Greece and the Socratic method for uncovering truth and finding knowledge (Kent, 2013). Interest in the concept of dialogue in relation to communication and public relations became prominent following Grunig and Hunt’s seminal work *Managing Public Relations* (1984) (Kent, 2013), which created the four models of public relations that have since dominated the field. In particular, the *two-way symmetrical model* has emerged as a relevant and useful model of understanding communication between organizations and publics. The field’s modern understanding of the term dialogue, however, derives mostly from the clarifying work of Kent and Taylor (1998; 2002). In particular, Kent and Taylor’s (2002) operationalization of dialogic theory provided

practitioners a way to measure whether organizations were in fact using dialogue in communication with publics.

The Dialogic Tenets

Dialogue and the dialogic theory involve five major tenets that separate it from two-way talk (Kent, 2013; Kent & Taylor, 2002). These include (1) mutuality, or the recognition of shared goals and interests between a company and its publics, (2) proximity (originally called “propinquity”), or the spontaneity and honesty of interactions between companies and their publics, (3) empathy, or the supportiveness and confirmation of public goals and interests, (4) risk, or the willingness of businesses to interact with publics on the public’s terms, and (5) commitment, or the extent to which an organization gives itself over to ethical dialogue, interpretation, and understanding in its interactions with publics (Kent, 2013; Kent & Taylor, 2002).

Mutuality can be further defined as “an acknowledgement that an organization and its publics are inextricably tied together,” and is characterized by “inclusion or collaborative orientation” (Kent & Taylor, 2002, p. 25). Propinquity can be further defined as when “publics are consulted in matters that influence them and are willing and able to articulate their demands to organizations,” and is characterized by “engagement” (Kent & Taylor, 2002, p. 26). Empathy is defined as when a company is “building an atmosphere or support and trust” and is characterized by “supportiveness” (Kent & Taylor, 2002, p. 27). The definition of risk can be expanded upon by adding that companies take these risks “despite the possibility of unpredictable outcomes to the relationship,” and is characterized by “vulnerability and growth” (Kent & Taylor, 2002, p. 28). Lastly, commitment is characterized by “genuineness, honesty, and commitment”

(Kent & Taylor, 2002, p. 29). Each of these concepts of dialogue are imperative to achieving a true ethical conversation and require more than publically posting content (Kent, 2013).

The Dialogic Theory and Online Communication

Kent and Taylor's (1998) seminal work on dialogue and public relations was focused primarily on how websites could be used to build dialogue with publics, emphasizing that websites must be easy to use, have valuable information, and most importantly provide an opportunity for publics to interact with organizations (Kent & Taylor, 1998). In contrast, the researchers later proclaimed that true dialogue could only be achieved through face-to-face interaction between organizations and publics (Kent & Taylor, 2002), likely as there appeared to be a gap between what practitioners thought was possible and actual relationship-building being accomplished through organization websites (McAllister-Spooner, 2009).

Despite earlier findings that organizational websites typically do not incorporate dialogic functions well (McAllister-Spooner, 2009), recent technology like social media have introduced new capabilities for users to interact and build relationships, making these platforms far more important for businesses to understand and utilize (Kim, Chun, Kwak, & Nam, 2014). Along with dissemination of information, the Internet gives users and organizations the ability to interact, connect, and collaborate (Feng & Xie, 2015; Cline & Haynes, 2001), which when used correctly can create open and discussion-based messages (Kaul, 2013; Kim et al., 2014). Because anyone with a computer and Internet connection can "post", "tweet", and comment on each other's messages, organizations can now create the direct two-way communication advocated by Grunig and Hunt (1984)

with a larger number of individuals. In this regard, the dialogic theory can fit with the Twitter platform, and Kent and Taylor's (2002) dialogic tenets can be theoretically applied to messages from health organizations.

Even with the communication opportunities made possible with the Internet, two-way communication on its own does not constitute dialogue, despite findings that research in the field of dialogue often equates the two terms (McAllister-Spooner, 2009; Theunissen & Wan Noordin, 2012). As stated above, many organizations demonstrate a limited use of dialogue (McAllister-Spooner, 2009), often talking *at* publics (one-way communication) rather than with them (Kent, 2013; Kim et al., 2014). In addition, research on dialogue and social media often erroneously equate social media engagement with "holding one's attention" rather than actual interaction (Taylor & Kent, 2014, p. 386); however, it takes more than posting on Twitter to constitute as interactive communication, let alone dialogic communication.

For example, health organizations that could benefit from greater connection to publics, especially during epidemics and other outbreaks, often struggle to take full advantage of the interactive potential of online social platforms (Jha et al., 2016; Park et al., 2016). Many times, this is the result of lack of financial resources and staffing (Park et al., 2016), as the interactive features of social media platforms all require the allocation of trained human resources to rapidly respond to publics (Kim et al., 2014). In addition, there can be several technical or infrastructural issues that can hinder the dialogic use of these social technologies (Kim et al., 2014). Understanding the benefits and challenges to creating dialogue through online media is important for health organizations communicating to publics during public health crises.

Research Questions

The Zika virus was a prominent source of media attention preceding and during the 2016 Rio Olympics. Health organizations like the CDC and WHO took to social media platforms like Twitter to address these concerns. This thesis analyzes the online communication that occurred on Twitter during the 2016 Rio Olympics to discover whether health organizations engaged in a high level of dialogic interactivity with publics, and whether health organizations utilized the tenets of the dialogic theory (Kent & Taylor, 2002) as a means to better engage with publics.

RQ1: Do Twitter posts by health organizations (measured by number of posts) demonstrate dialogic communication through high levels of reciprocity and centralization (measured through Netlytic)?

RQ2: Do Twitter posts by health organizations demonstrate dialogic communication through the utilization of Kent and Taylor's (2002) tenets of dialogue?

RQ2a: Do Twitter posts by health organizations demonstrate mutuality?

RQ2b: Do Twitter posts by health organizations demonstrate propinquity?

RQ2c: Do Twitter posts by health organizations demonstrate empathy?

RQ2d: Do Twitter posts by health organizations demonstrate risk?

RQ2e: Do Twitter posts by health organizations demonstrate commitment?

CHAPTER 3: PILOT STUDY

Prior to the current thesis research, a pilot study was conducted to find whether individuals were using Twitter to find information about Zika, whether this information was coming from health organizations, and the impact information seeking had on the publics' perceived salience of the threat toward the virus. Although research on epidemic outbreaks and communication often focus on the information disseminated from mass media and public reactions to these messages, this pilot study is focused first, on *how* individuals seek out health information online (e.g. Twitter), and second, on the impact this information seeking has on their perceived threat salience toward a public health crisis (e.g. Zika).

Literature Review

Media Coverage and Health Information Seeking

As stated in Chapter 2, traditionally health information regarding public health risks came from mass media (Jiang et al., 2014). Media exposure to a public health crisis can be problematic if coverage is excessive, or beneficial if perceived salience of a health threat leads to increased preventative measures taken (Mason & Wright, 2015; Zhang et al., 2015). One preventative measure publics can take is health information seeking, which can reduce salience of a threat to beneficial levels (Xiao et al., 2014; Zhang et al., 2015). While media outlets still play a major role in information dissemination, the Internet has impacted the way individuals are able to seek health information (Centola & Rijt, 2014; Hou & Shim, 2010; Jha, Lin, & Savoia, 2016; Medlock, Eslami, Askari, Arts, Sent, de Rooij, & Abu-Hanna, 2015; Xiao et al., 2014). Twitter is an example of a

popular social media platform that can potentially be used for health information dissemination and seeking (Jiang et al., 2014; Park et al., 2016).

Additionally, the Internet allows health organizations to communicate more directly with publics during a health crisis, such as through Twitter. Effective health and risk communication is important for health organizations to understand, as it can reduce or limit adverse population reactions to epidemic outbreaks, including fear reduction, greater trust between individuals and health organizations, decreased spread of misinformation, and promotion of self-protecting measures (Boscarino & Adams, 2015; Zhang, King, & Chang, 2015).

Perceived Threat Salience

As stated above, perceived threat salience toward a public health crisis can impact whether and how individuals seek health information. Recognizing the propensity for media to sometimes over cover public health threats, it is likely the media coverage of the Zika virus epidemic surrounding the Olympic caused an increase in perceived threat salience for the general population. Perceived salience of a threat, such as the Zika virus, is an important variable for health organizations to understand and utilize during public health crises, as it may impact how publics interpret and react to health messages they may find online and through social media (Hastall & Knobloch-Westerwick, 2012).

Health organizations often attempt to communicate effectively by using ‘threat messages’ when talking about disease outbreaks. Communication messages are considered a threat message when they warn of danger, which can be measured as an individual’s perceived severity and likelihood of that risk, or level of threat (Basil & Witte, 2012). The severity of the threat message refers to the level of emphasize on how

serious a threat a potential health risk is to an individual (Hastall & Knobloch-Westerwick, 2012).

Research Questions

The literature notes that media can cause an increase in public salience toward a health threat during epidemic outbreaks (Mason & Wright, 2015; Zhang et al., 2015), that individuals do seek health information online through social media platforms like Twitter (Park et al., 2016; Thackeray et al., 2012; Xu et al., 2014), and that health information seeking can reduce salience toward the threat (Xiao et al., 2014; Zhang et al., 2015). This pilot study applies these findings to health organizations' use of Twitter during the 2015-2016 Zika virus epidemic and the 2016 Rio Olympics. Additionally, this pilot finds whether online health information seeking behavior alleviates threat salience toward epidemic outbreaks, specifically the Zika virus epidemic of 2015-2016. The pilot study was guided by the following research questions and hypothesis:

RQ1: Are individuals seeking information about the Zika virus online?

RQ2: Are individuals seeking information about the Zika virus from health organizations on Twitter?

RQ3: Do individuals perceive the Zika virus as a salient threat?

H1: Individuals who seek information through health organizations on Twitter will have a decreased level of perceived threat valence toward the Zika virus

Methodology

Participants

A convenience sample of participants was gathered from a large public Mid-Atlantic university. This was accomplished through a system that simplifies the process

of getting a large number of participants by requiring the students in general studies communication classes to either participate in a certain number of upper-level research experiments to receive class credit, or complete an alternative assignment. As all first-year students must take this course, the sample represents a broad cross section of students.

A total of 328 participants agreed to take the survey. Participants who did not complete all test items were removed before analysis, leaving a total of 317 participants. The majority of participants were female, Caucasian, first-year students. 23.66% of the participants identified their gender as male ($n = 75$), 76.06% of participants identified their gender as female ($n = 241$), and one participant ($n = 1$) declined to answer. When asked to identify their academic year, 94.95% identified as freshman ($n = 301$), 3.79% identified as sophomores ($n = 12$), 0.32% identified as junior ($n = 1$), and 0.95% identified as seniors ($n = 3$). Regarding race and ethnicity, 80.44% identified as white or Caucasian ($n = 255$), 5.99% identified as Hispanic or Latino/a ($n = 19$), 5.26% identified as black or African American ($n = 17$), 4.73% identified as Asian or Pacific Islander ($n = 15$), 2.25% identified as other ($n = 8$), and two declined to answer ($n = 2$).

Procedure

This pilot was approved by the university's Institutional Review Board (IRB), an independent ethics committee that reviews and monitors all studies involving human subjects (Appendix A). Evidence for or against the research question was collected from a quantitative survey research design to discover whether individuals sought information about the Zika virus online, and whether this impacted their perceived threat salience to the disease. Participants were asked to answer a series of Likert-scale questions to

measure online health information seeking habits and attitudes, attitudes about the Zika virus, self-efficacy of health information, perceived importance of health information, and a risk behavior diagnosis scale regarding threat salience to the Zika virus. Basic demographic data was then collected.

Measures

To measure these variables, participants took two five-point Likert-type scales adapted and modified from the Health Information National Trends Survey (HINTS) (National Cancer Institute, 2015), and the Risk Behavior Diagnosis Scale (Witte, McKeon, Cameron, & Berkowitz, 1995). With these tests, participants were asked to rate the degree to which they agree or disagree with the given statements between ‘Strongly Agree’ and ‘Strongly Disagree’, or ‘Almost Never’ and ‘Very Often’ depending on the statement.

Health Information National Trends Survey (HINTS). The Health Information National Trends Survey (henceforth referred to as ‘HINTS’; National Cancer Institute, 2015) was originally conceived during a 1998 conference on risk communication and cancer, where professionals from a number of medical and social science fields addressed the lack of population level data on the subject (Nelson et al., 2004). Research from this conference encouraged the National Cancer Institute to develop a survey to collect baseline and follow-up data to assess cancer information needs, particularly of specific population sub-groups (Nelson et al., 2004). The survey was first conducted in 2002-2003, and is now distributed biannually to track trends in the public’s rapidly changing use of new communication technology (Nelson, et al., 2004).

Data collected from HINTS have been used in numerous studies on information seeking behaviors of individuals within the context of cancer (Rutten, Squiers, & Hesse, 2006; Wigfall, Friedman, 2016). In fact, in their meta-analysis, Wigfall and Friedman (2016) found 274 titles utilizing data from HINTS.

Although HINTS was developed specifically to assess information seeking trends related to cancer (Nelson et al., 2004), many questions from the survey address information seeking online. To collect and analyze online information seeking behaviors and attitudes, these questions related to online health information seeking were taken and modified to address the Zika virus (Appendix B). The general Zika online information seeking subscale consisted of 3 items ($\alpha = .784$), and the Twitter Zika online information seeking subscale consisted of 2 items ($\alpha = .683$). The low reliability for the online information seeking subscale is potentially the result of the small number of items in the scale, as well as the fact that the scale was not originally intended to measure Twitter use and was modified to do so.

Risk Behavior Diagnosis Scale. Using the Extended Parallel Process Model (EPPM; Witte, 1992) as a framework, Witt et al. (1995) designed the 12-item Risk Behavior Diagnosis Scale (RBDS) to help determine which types of health risk messages would be more appropriate for a given individual or audience. This is based on the assumption within EPPM that states that when an individual is faced with a health threat, they will either control the danger or control their fear about the danger (Witte, 1992; Witte et al., 1995). Evidence of validation for the scale was later provided by Witte (1996).

Though originally conceived to address HIV/AIDS prevention messages, the scale was developed from the start with the intention that researchers could plug any health threat and recommended response into the Likert-scale statements (Witte et al., 1995). For example, the first statement is listed as “[*Recommended response*] is effective in preventing [*health threat*]” (Witte et al., 1995, p. 3). These statements were adapted for the current research by replacing the recommended response with ‘Access to clear health information’, and replacing the health threat with ‘Zika virus spread’ (Appendix C).

The 12 statements of RBDS are divided into two sections of six questions that measure Self-Efficacy (SEff) and Perceived Severity of the threat (Sthreat) respectively (Witte et al., 1995). Scores from the Sthreat portion are then subtracted from the SEff for the raw RBDS score. Positive scores indicate that danger control processes dominate, meaning a threat is necessary along a high efficacy message to motivate an individual (Witte et al., 1995). Negative scores indicate that fear control processes dominate, meaning only efficacy messages are needed for individual motivation (Witte et al., 1995). Together these variables represent risk behavior, although they can also be measured separately as an indicator of the perceived salience of a threat, particularly the Sthreat score. For this pilot, all three scores were presented as individual markers of risk behavior to Zika, self-efficacy of response to Zika, and perceived salience of the threat of the Zika virus. The perceived severity of the threat (Sthreat) subscale consisted of 6 items ($\alpha = .665$). This low reliability can potentially be explained by the modification of the scale to fit the context of Zika virus. Additionally, the reliability scales could be explained by differing participant opinions of how much information can improve safety from the Zika threat.

Results

Research question one asked whether individuals were seeking information about the Zika virus online. Descriptive statistics were run on a HINTS subscale measuring online information seeking regarding the Zika virus (*Zik_ISsub*). Analysis found that participants were slightly more likely than average to seek information regarding the Zika virus online ($M = 1.03$, $SD = 0.06$).

Research question two asked whether individuals were seeking information about the Zika virus from Twitter. In general individuals were less likely than average to seek information about the Zika virus from Twitter, especially as compared to seeking information about the disease online in general ($M = 2.14$, $SD = 1.07$, $SE = 0.06$).

Research question three asked whether individuals perceived the Zika virus to be a salient threat. Descriptive statistics were run on the subscale of the adapted Risk Behavior Diagnosis Scale that specifically measured individual perceptions of the severity of the threat of Zika virus (*SThreat*). The sample indicated that individuals had a high level of perceived threat severity to the Zika virus ($M = 4.55$, $SD = 1.28$).

Hypothesis one predicted that individuals who seek information through Twitter will have a decreased level of perceived threat valence towards the Zika virus. A single linear regression was calculated to predict perceived Zika threat severity based on total Zika information seeking (online and Twitter). A significant regression equation was found, $R^2 = .092$, $F(1, 315) = 31.91$, $p < .000$. In other words, 9% of the variance in perceptions of Zika threat severity can be explained by Zika information seeking. Participant's perceived Zika threat severity is equal to $3.47 + 0.41$. Perceived Zika threat severity increased .41 for each increasing unit of total Zika information seeking.

Discussion

Understanding the ways publics engage with social media platforms in the pursuit of health information is important for the health organizations to understand. This is especially true when it comes to disease epidemics that receive heavy media attention, such as the Zika virus, when public perceptions of threat severity of the disease are high. This pilot study looked at whether individuals were in fact using Twitter to gather information about the Zika virus, whether they had high perceived levels of threat severity to the disease, and whether finding information on Twitter was related to individual threat perceptions of the virus.

Research question one asked whether individuals in general were seeking information about the Zika virus online. This is important to analyze separately from seeking information specifically from Twitter, as the Internet provides numerous channels for finding information. Descriptive statistics indicate that individuals in general were seeking information about the virus online at a higher than average rate. Though higher than average, these numbers were not as drastic as expected. This may be explained with the younger age of the participant pool, who may not have been engaged with the traditional media channels that focused heavily on the virus. This may also be explained with the timeframe of the survey, which took place when the epidemic was waning, months after the heavy media rotation surrounding the 2016 Rio Olympics.

Research question two more specifically sought out whether individuals were seeking information about the Zika virus from health organizations on Twitter. Results from these descriptive statistics indicated low levels of information seeking from Twitter as compared to information seeking online. Similar to research question one, this may be

explained in part by the younger participant pool who were not engaged in the virus media attention, or the timeframe of the survey distribution. In addition, it is possible participants do not ‘follow’ health organizations on Twitter, such as the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO), who share this information; even if they saw shared Tweets from these organizations from other individuals who do follow these organizations. Finally, individuals may not see Twitter as a reputable source of news, even if information is coming from health organizations, turning instead to other Internet sources.

Research question three asked whether individuals perceived the Zika virus as a salient threat. Using a subscale from the Witte et al.’s (1995) Risk Behavior Diagnosis Scale that looks specifically at perceived severity of a health risk, it was found that participants had surprisingly high levels of perceived severity to the disease. This in some ways contradicts the low levels of online health information seeking, as the literature found that higher levels of perceived threat would lead to more information seeking (Zhang et al., 2015). This also contrasts the explanation that the participant pool was not engaged with the disease, as a higher perceived threat salience to Zika would likely be linked to being exposed to more media attention (Zhang et al., 2015). In this regard, it is possible individuals were receiving information about the disease in general from media other than Twitter, but were not taking the initiative to learn more about the disease.

Lastly, hypothesis one proposed that there would be a relationship between individuals seeking health information regarding Zika on Twitter and their perceived threat salience towards the virus. More specifically, the hypothesis predicted that individuals who seek more information regarding Zika would have decreased levels of

perceived threat severity to the virus. A single linear regression found a relatively small but highly significant relationship. This is potentially the result of lower reliability scores for the HINTS and Risk Diagnosis scales; however, this may regardless help explain the earlier findings that found that individuals reported high levels of perceived threat salience to Zika but relatively lower levels of seeking Zika health information online, and even lower levels of seeking information from Twitter. Had individuals sought and found more information about the disease, such as that the disease is relatively harmless to all but pregnant women and causes only mild symptoms (CDC, 2016; Hayes, 2009; Petersen et al., 2016), they may have reported lower levels of perceived threat severity to the disease.

Together, these findings demonstrate that while individuals do seek information online about disease epidemics, particularly those heavily covered in media such as the Zika virus, Twitter remains an underused platform for information seeking. This pilot study adds to previous findings that heavy media coverage increase perceived threat toward an epidemic (Boscarino & Adams, 2015; Mason & Wright, 2015; Zhang et al., 2015), provides insight into health communication practices on social media, and gives more backing to the case that information seeking is important in lowering perceptions of threat severity to a disease.

Limitations

This pilot study had a few limitations. A central limitation in the study was the lack of scales that relate specifically to online health information seeking through Twitter. Though the scales used to find online health information seeking behaviors regarding Zika were modified from the popular and well used HINTS (2015) scale, which

does have a component related to online health information seeking, the scale had to be heavily modified to relate to Twitter and Zika. Stemming from this, the subscales dealing directly with Twitter information seeking and Zika had a relatively small number of items, potentially leading to lower levels of reliability as compared to the original HINTS. The lower reliability levels for each scale were in themselves another limitation to this study. Lower reliability for the scales may in fact be another explanation to the lower than expected mean scores for each scale.

In addition, no questions were asked about alternative forms of health information seeking (television, radio, online newspapers), limiting the ability to directly compare participant use of Twitter to find information about Zika in relation to their general information seeking about the disease. The timeframe in which the survey was distributed is also a limitation of the study, as media attention for the disease had already been waning months in the after the 2016 Rio Olympics, and the disease was becoming more under control in parts of South America and Brazil.

Another potential issue was the homogenous sample frame of largely young, white females from a mid-Atlantic school. As a younger sample, it is possible participants were not as engaged with the virus as individuals who more typically watch the traditional media that was heavily focusing on the disease. In addition, the location of the university in which participants were pulled was far from areas where the disease was found, potentially impacting perceptions of disease threat.

Future Research

Research in the field of online health communication and disease epidemics should continue looking at ways that Twitter is or potentially can be a valuable source of

information for individuals. This can be accomplished through the development of a more specific scale to measure attitudes and behaviors toward the medium. Along with this, additional variables can be studied for their relationships to online health information seeking, such as level of trust in information, self-efficacy in preventing disease, and the impact of two-way communication between health organizations and publics.

Additional research should also be conducted with different populations in different locations. It is likely individuals closer to areas impacted more heavily by a disease epidemic would respond differently than individuals further removed from the threat. For example, this research on Zika virus health information seeking could be conducted in Florida where a small number of cases of Zika have been reported.

Data collected from this participant pool can also be used for additional tests to determine relationships between various types of health information seeking, self-efficacy toward preventing Zika, perceived importance of health information, and other online health information seeking behavior variables.

CHAPTER 4: METHODOLOGY

To best answer the questions posed for the main study, this thesis was split into two parts: 1) a data analysis of the reciprocity and centralization scores of health organizations on Twitter, and (2) a quantitative content analysis to assess whether tweets from health organizations utilized Kent and Taylor's (2002) dialogic tenets in online communication.

Study 1: Data Analysis: Netlytic

The use of dialogue by health organizations in social media communication regarding the Zika virus during the 2016 Rio Olympics was first explored through a data analysis of Twitter posts ('tweets') collected during this time frame, with a focus on the Tweets posted by health organizations. Units of analysis for this data analysis are the tweets collected using the social media analysis software Netlytic that mentioned both the key terms "Zika" and "Olympics" during the timeframe of data collection.

Leading Health Organizations

Although numerous health organizations use social media to disseminate information, and possibly interact with publics, two of the largest represented on Twitter are the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO). The CDC, a federal agency of the United States Department of health and Human Services, is the leading national public health institute in the United States (CDC, 2016). As the name implies, the organization is focused on public safety through the control and prevention of diseases, as well as injury and issues of disability (CDC, 2016, web).

Like the CDC, the WHO also strives to combat diseases, though on a much larger scale, with working offices in more than 150 countries worldwide (WHO, 2016, web).

The WHO works directly with a government as it sets health objectives, and supports national health policies and strategies (WHO, 2016, web). Both the CDC and WHO are active on social media such as Twitter (Jha et al., 2015; Thackery et al., 2012; Xu et al, 2014), and as such were potentially a large player in the dissemination of information regarding Zika during the outbreaks and around the time of the 2016 Rio Olympics (i.e., Part et al., 2016).

Data Collection Method: Netlytic

Many social media websites provide users with easy ways to quickly analyze information about their accounts, posts, followers, and more. For example, Facebook Analytics allows organizations to easily attain demographic data on followers, check the ‘reach’ of posts (i.e. the number of people who saw these posts on their feeds), and even begin using some psychographic information gathered from what publics follow on Facebook to target advertisements. Third-party social media analyzing platforms, such as Netlytic, can also provide organizations and researchers with more advanced tools for analyzing.

Netlytic is a community-supported text and social networks analyzer that can be used to automatically collect and summarize various online conversations on social media sites, such as Twitter (Netlytic, web date). This is accomplished through three steps. First, Netlytic captures data from social media sites with the use of keywords or phrases (Netlytic, web date). This allows for the user to quickly and easily collect a large sample size of social media posts regarding a specific topic. Second, Netlytic allows users to use built-in algorithms to analyze the data to find trends and emerging themes (Netlytic, web date). Two examples of built-in analytics that were used in this thesis are

reciprocity and centralization scores, which are discussed in further detail below. Finally, Netlytic can build visualizations of the data (Netlytic, web date). These graphs generated through Netlytic visually represent the connections and clusters (or nodes) between social media users in regard to the keywords chosen. These three functions of the software can be highly valuable to researchers who work with social media communication analysis, quickly collecting large datasets and finding trends within this data.

For this thesis, a data collection effort was conducted through Netlytic during the time of the 2016 Rio Olympics. The result was a dataset collecting all tweets that mentioned both the terms “Zika” and “Olympics” between the dates of August 5th and August 7th, 2016 ($n = 9,041$). After collecting this sample of social media posts, these datasets were analyzed for reciprocity and centralization scores.

Measures: Reciprocity and Centralization

Reciprocity and centralization scores are two outputs from Netlytic data analysis that are valuable in demonstrating and quantifying a crucial first step in building dialogue between organizations and publics: interaction (Kent & Taylor, 1998). Reciprocity is a score that represents the amount of two-way communication (or reciprocal ties) in relation to the total number of links (or overall ties) between different Twitter users in the specific network being observed. In other words, how many times users respond to messages compared to how many messages are posted. Higher reciprocity scores indicate more individuals participating in two-way communication, while lower scores indicate that conversations are more one-sided (Netlytic, web).

Centralization is a measure of how closely clustered user communication is in nodes. In other words, are conversations taking place between smaller amounts of people

or spread across multiple users? Higher centralization scores suggest that there are a few central participants who dominate the flow of information in the networks (such as a health organization), while lower scores indicate information flowing more between multiple participants (Netlytic, web).

Although these scores do not directly relate to the dialogic theory as a whole, these can be used as an indication of health organization's' use of specific tenets of the theory (Kent & Taylor, 2002). In particular, reciprocity and centralization scores relate to the tenets of proximity and risk. As stated above, proximity is defined as the spontaneity and honesty of interactions between companies and their publics, or when “publics are consulted in matters that influence them and are willing and able to articulate their demands to organizations” (Kent & Taylor, 2002, p. 26). Proximity is characterized by “engagement” (Kent and Taylor, 2002), which in a social media setting most closely assigns to organizations responding to user posts and questions. This is particularly important in reducing fears of public health crises like the Zika outbreaks.

Risk is the willingness of businesses to interact with publics on their terms “despite the possibility of unpredictable outcomes to the relationship” (Kent & Taylor, 2002, p. 28). Risk is characterized by “vulnerability and growth” (Kent & Taylor, 2002), which likewise is highly applicable to a social media setting as spontaneous interaction with publics brings a certain level of uncertainty alongside the opportunity to engage publics. Although they only relate to two of the dialogic tenets, reciprocity and centralization together can be thought of as one means to quantify the level of dialogue between organizations and publics on Twitter. Because of this, this thesis uses these

scores as a means to help quantify the level of dialogue demonstrated in the use of Twitter by health organizations regarding Zika during the 2016 Rio Olympics.

Study 2: Quantitative Content Analysis of Dialogic Tenets

To further answer the research questions, this thesis used a quantitative content analysis of Twitter Posts ('tweets') that referenced the 2015-2016 Zika Virus epidemic during the time of the 2016 Rio Olympics. Tweets selected as units of analysis were carefully read and coded based on the codebook detailed below. Strict organization of the data and careful analysis of the collected data were used to ensure high quality of results.

Quantitative Content Analysis

Content analysis is a research method that takes data from a phenomenon and condenses them to provide further knowledge, insights, and representations of the concept in a way that is replicable and valid (Elo & Kyngäs, 2008). A quantitative content analysis uses systematic assignment of communication content into categories according to rules, and analyzes relationships involving those categories using statistical methods (Riff, Lacy, & Fico, 2014). Typically, a quantitative content analysis involves drawing a representative sample of content, and uses trained coders to apply categories rules designed to measure or reflect differences in content (Riff, Lacy, & Rico, 2014). Collected data are then able to be analyzed for patterns or characteristics important in identifying relationships (Riff, Lacy, & Rico, 2014).

Through quantitative content analysis, this thesis collected information about the trends of these social media posts (e.g., how often are links, hashtags, or images used), and captured the use of dialogue in the social media posts between organizations and publics. The researcher and an additional coder applied the codebook (described below)

to analyze a sample ($n = 500$) of the total collected Tweets ($n = 9,041$). This content analysis provides information on whether health organizations use dialogue in their communication through social media in relation to disease outbreaks, such as the Zika virus epidemic.

Data Collection Method: Netlytic

As stated above, Netlytic is a social network data analyzer that collects large sets of data from social media platforms using key terms. With this software, data collection was conducted during the time of the 2016 Rio Olympics. The result was a sample of every Tweet that mentioned both the key terms “Zika” and “Olympics” between August 5th and August 7th, 2016 ($n = 9,041$). Of the total Tweets collected from Netlytic ($n = 9,041$), a random systematic sampling frame was used to select units of analysis for coding. This sampling frame was chosen to best capture a large section of the total database across the time frame of data collection. The researcher and a second coder focused on every tenth Twitter post until saturation of themes was reached ($n = 500$). This number is also higher than the determined needed sample size of at least 384 units of analysis (Neuendorf, 2002).

Codebook Construction

After the units of analysis were collected through the Netlytic software, a codebook was carefully constructed to help collect information on the social media posts and capture examples of Kent and Taylor’s (2002) tenets of the dialogic theory (Appendix D). The first part of the codebook asks basic information about the tweets, identifying information such as the general sentiment of the Tweets, whether the Tweet did in fact relate to Zika and the Olympics, and whether the messages included links, images, hashtags or

'mentions' of other users, as well as the number of each of these factors. These categories were further broken down to collect additional information, such as the type of websites the links appeared to lead to, how many hashtags were included, which health organizations were posting, and more. This provides information on how users and health organizations use social media messages, which can be valuable for understanding the type of information disseminated and whether individual posts were responses to users.

The second part of the codebook represents the five dialogic tenets (Kent & Taylor, 2002). Definitions, descriptions, and characterizations for each tenet were given, as well as practical examples of how these may be applied to tweets, which is describe below. After construction, the codebook was converted into Qualtrics, an online survey platform, to simplify the process of coding a large number of Tweets. An open-ended question for additional comments was included to capture any additional themes observed within the data not included in the codebook questions, such as humor or anger used within the Tweets.

Data Analysis Methods: The Tenets of the Dialogic Theory

The Twitter posts collected directly from health organizations were further analyzed regarding whether they had used the tenets of dialogue in communication with publics regarding the Zika virus. Although many organizations struggle to build true dialogue with publics (Jha et al., 2016; Park et al., 2016), it may still be possible for organizations to demonstrate the tenets of dialogic framework through online communication. If used correctly, social media can feasibly help build trust and empathetic understanding. In particular, organizations responding to comments and questions publicly may provide the opportunity to achieve the tenets of proximity and

risk, as well as possibly empathy, mutuality, and commitment (Kent & Taylor, 2002). By using a codebook to measure these tenets, this thesis measured the degree to which health organizations engaged in meaningful dialogue with publics in relation to public fears and questions about the Zika virus during the time of the 2016 Rio Olympics.

The pragmatic definitions and characterizations were written for each tenet in the codebook based on Kent and Taylor's (2002) work, listed above. For example, mutuality is characterized by inclusion and collaborative orientation, while empathy is characterized by supportiveness (Kent & Taylor, 2002). Within the codebook, the tenets were also given practical examples of how the tenets may apply to tweets. For example, a Tweet from a health organization directly responding to a user question would be coded for proximity, and a Tweet making clear that the health organization is addressing a user concern would be coded for risk. These definitions, characteristics, and examples were used to find whether the Twitter posts from health organizations did or did not embody the tenets of the dialogic theory.

Intercoder Reliability

To ensure reliability of the analysis and lessen potential bias of the codebook itself, two coders were used to finalize the measuring tool and interpret the data (Neuendorf, 2002). A major aspect of content analysis is establishing intercoder reliability, or the level of agreement between two or more human coders between repeated trials (Neuendorf, 2002). Though no official standard has been set for determining appropriate levels of intercoder reliability, commonly used statistical measures to represent intercoder reliability include Krippendorff's (1980) *alpha*, Cohen's *kappa* (Popping, 1988), and Scott's *Pi* (Neuendorf, 2002). Though they differ slightly in

execution, these measures in general work by analyzing the number of agreements between the coders in their analyses, or agreement percentage, and present the number on a scale between 0 and 1 (Neuendorf, 2002). The closer to 1 the output is, the more reliable the coding is said to be (Neuendorf, 2002). In general, outputs of these measures between .8 and .9 indicate good or excellent intercoder reliability (Ellis, 1994; Krippendorff, 1980; Neuendorf, 2002; Popping, 1988; Riffe, Lac, and Fico, 1998).

To ensure intercoder reliability, two rounds of 20 Tweets ($n = 40$) were coded by both coders. The first round of Tweets resulted in an agreement percentage of 86.9%, and a Krippendorff *alpha*, Cohen's *kappa*, and Scott's *pi* of 0.806 each, indicating excellent intercoder reliability. After this round, the coders discussed the codebook and coding process and began round two. Round two resulted in an agreement percentage of 91.9%, a Krippendorff's *alpha* and Cohen's *kappa* of 0.79, and a Scott's *pi* of 0.88, also indicating excellent intercoder reliability.

CHAPTER 5: RESULTS

Study 1: Data Analysis Results

Through social media analysis platform Netlytic, 9,041 Tweets containing both the terms “Zika” and “Olympics” were collected between August 5 and August 7, during the 2016 Rio Olympics in Brazil. Of this collection of Tweets, 7,921 were posted from unique users; the remainder were ‘Retweets,’ or Tweets that have been copied and shared from another user.

Of the top 10 users represented in the data, five represented news organizations or journalists: Zika_News, BlackLotusMedia, LIVE_COVERAGE, tomashbrooknpr, and AsiaPacNews. Only one of the top 10 users came from a medical profession: Docdhawad. The remaining three users were considered ‘other’ by the researcher: meta_guide_dj, luvinmysweetpea, Meta_guide_er, and Makotu_japon. None of the top ten users were from health organizations.

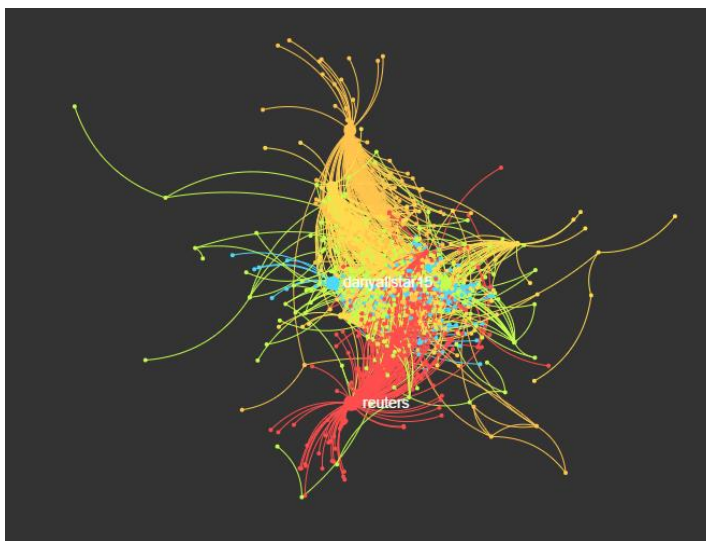


Figure 1 Netlytic output demonstrating the multiple clusters of 'mentions'

Through Netlytic, a network analysis was conducted on the use of mentions in the data, or Twitter posts that link to other Twitter users. The software gives various outputs

to help understand trends found within the data. Overall, a total number of 4418 nodes, or clusters of users, were found. There were 5,898 ties, or connections between Twitter users, found. The diameter of the output, representing the longest distance between two network participants was eight. This indicates a large network size. The reciprocity score from the output, or amount of two-way communication reciprocal ties in relation to the total number of overall ties, is 0.0173. This number represents the number of times users respond to messages compared to how many total messages are posted, with lower scores like this one indicating that individuals were less likely to respond to one another. The centralization score, or how closely clustered user communication in the nodes are, is 0.0188. This number represents how grouped or dispersed conversations are between users, with lower numbers like this one indicating more dispersion between greater numbers of users.

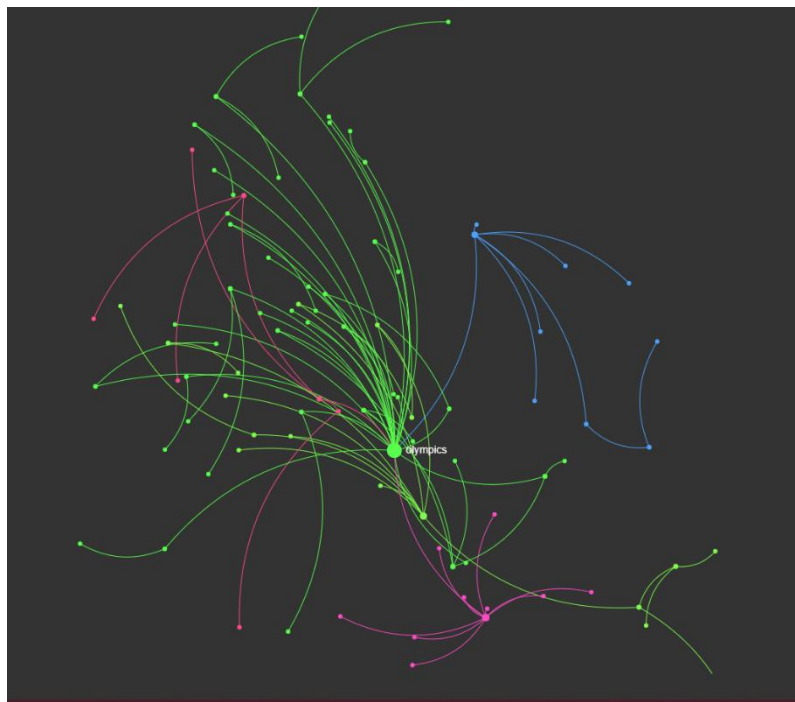


Figure 2 Netlytic output demonstrating the cluster of 'replies' found within the data

Netlytic also provides an analysis of replies found within the data, or trends found in relation to users replying to other users. A total number of 278 nodes, or clusters of users replying to each other's Tweets, were found. A total of 384 ties between Twitter users were found. The diameter of the data was found to be two, demonstrating a generally small size of network. The reciprocity score is 0.0052, and the centralization score is 0.0259.

Table 1

Netlytic outputs of mentions and replies compared

	Diameter	Reciprocity	Centralization	Total # of Nodes	Total # of reciprocal ties
Mentions	8	0.0173	0.0188	4418	5898
Replies	2	0.0052	0.0259	278	384

Study 2: Quantitative Content Analysis Results

From the 9,041 Tweets originally collected for the first study, every tenth Tweet of the first 5,000 was coded for a total of 500 Tweets. Coding was used to find trends in use of links, mentions, and hashtags, as well as the presence or absence of Kent and Taylor's (2002) five tenets of dialogue between health organizations and users regarding the Zika virus epidemic during the 2016 Rio Olympics. Tweets that were not in English (1.4% [$n = 7$]), including Tweets that were solely links with no text, were subsequently not coded for any remaining values.

The sentiments of each Tweet was coded as either 'positive' 'neutral' or 'negative.' Positive tweets were those supporting the Olympics, athletes, efforts to reduce Zika, and so on. 14.3% ($n = 72$) Tweets were coded as 'Positive.' The largest category,

neutral, were predominantly Tweets that only reported information, without any evaluation attached. This could include simply linking and describing an article, or reporting statistics about the Olympics or Zika. 48.3% ($n = 241$) Tweets were coded as ‘Neutral’. Negative Tweets were those that complained about aspects of the Olympics (such as how unsafe it was due to Zika). 37.4% ($n = 187$) Tweets were coded as ‘Negative’.

Table 2

Review of Tweet topics

Topic	Amount
About Zika	82.4% ($n = 412$)
Not about Zika	17.6% ($n = 88$)
About Olympics	97% ($n = 485$)
Not about Olympics	2.6% ($n = 13$)

Some variance in coding for sentiment arose when it came to Tweets that featured humor about Zika. ‘Zika jokes’ were often lighthearted in nature, and thus the sentiment may feel positive; however, as the content was still often pointing out problems with the Olympics, it was difficult to determine which category these messages fell into. Coding came down to whether the ‘humor’ of the joke outweighed the negative content. Large numbers of ‘negative’ Tweets also arose from complaints about specific athletes, most notably Hope Solo who received backlash for comments about the Zika virus that Brazilians found offensive. These Tweets were coded as neutral if they simply reported on the information, or negative if it was a complaint. Though they were tangentially related to Zika and the Olympics, though, they had little to do with health organizations.

Of the 500 coded Tweets, 82.4% ($n = 412$) were specifically about the Zika virus. Surprisingly, despite the search results specifically looking for Tweets about Zika, 17.6% ($n = 88$) were not about Zika. This can be explained by Tweets that ‘tag’ Zika without actually being related (trying to get more views by tagging a popular subject), or that Zika was mentioned in links which were not directly coded in this analysis. 97% ($n = 485$) Tweets were directly related to the Olympics, and only 2.6% ($n = 13$) did not directly mention the Olympics. Only 2% ($n = 10$) Tweets were from health organizations, the remaining 98% ($n = 490$).

Table 3

Use of links, hashtags and mentions in Tweets compared

	Tweets with	Tweets without	Related to Zika	Related to Olympics	Related to health org	Not related
Links	62.6% ($n = 313$)	37.4% ($n = 187$)	70.9% ($n = 222$)	94.9% ($n = 297$)	5.2% ($n = 16$)	3.6% ($n = 11$)
Hashtags	64.5% ($n = 322$)	35.5% ($n = 178$)	36.6% ($n = 118$)	75.4% ($n = 243$)	1.1% ($n = 4$)	25.7% ($n = 83$)
Mentions	54.6% ($n = 273$)	45.4% ($n = 227$)	n/a	n/a	5.2% ($n = 14$)	n/a

Because of the small character limit of Tweets, posts often include links to outside websites with more content. For example, posts can link to articles with information about Zika or the Olympics. 62.6% ($n = 313$) of the Tweets coded featured at least one link, while 37.4% ($n = 187$) did not feature a link.

Of the 313 Tweets that featured a link, 70.9% ($n = 222$) clearly linked to information about Zika, while 29.1% ($n = 91$) did not feature a link clearly leading to information about Zika. 94.9% ($n = 297$) clearly linked to information about the

Olympics, while 5.2% ($n = 16$) did not feature any links clearly leading to information about the Olympics. Only 5.2% ($n = 16$) clearly linked to a health organization website, while 94.8% ($n = 297$) did not clearly link to a health organization website. 3.6% ($n = 11$) of the Tweets that included at least one link did not have a link that clearly led to information about Zika, the Olympics, or a health organization.

Twitter posts often include hashtags (represented by the # symbol) as a way for users to quickly see all posts talking about the name ‘tagged’ topic. Of the 500 coded Tweets, 64.5% ($n = 322$) included at least one hashtag, while 35.5% ($n = 178$) did not feature any hashtags. The Tweets that did include a hashtag had on average 1.47 hashtags, ranging from 1 to 6 tags.

Of the Tweets that did include hashtags, 36.6% ($n = 118$) included at least one hashtag that related to the Zika virus, while 63.4% ($n = 204$) did not include any hashtags that related to Zika. 75.4% ($n = 243$) of the Tweets that included at least one hashtag had at least one that related to the Olympics, while 24.6% ($n = 79$) did not include any hashtags that related to the Olympics. Only 1.1% ($n = 4$) Tweets included at least one hashtag that references a health organization. Of the Tweets that did include hashtags, 25.7% ($n = 83$) included at least one hashtag that did not relate to Zika, the Olympics, or a health organization.

Tweets can link to other Twitter users with ‘mentions’ (represented by the @ symbol). This can result from “Retweeting,” or reposting another user’s Tweet, giving credit for another users’ content, or simply wanting to link to another relevant users’ account. Of the 500 coded Tweets, 54.6% ($n = 273$) included at least one mention, while 45.4% ($n = 227$) did not include any mentions. The Tweets that did include a mention on

average included 1.297 mentions, ranging from one to four mentions. Of the Tweets that did include a mention, only 5.2% ($n = 14$) included at least one mention to a health organization on Twitter, while the vast majority (94.8%, $n = 259$) did not mention a health organization.

Lastly, the Tweets were coded for the presence of absence of dialogue between health organizations and users, particularly in regard to the Zika virus. This was further operationalized through Kent and Taylor's (2002) five tenets of the dialogic theory. Unfortunately, of the 500 Tweets coded, only 1.8% ($n = 9$) included any example of dialogue between a health organizations and publics, while 98.2% ($n = 491$) did not include any reference to dialogue. This can be explained in part by the surprising lack of representation by health organizations in the data.

Table 4

Use of dialogue and dialogic tenets in Tweets

	Included Dialogue	Did not include dialogue
Total (out of 500)	1.8% ($n = 9$)	98.2% ($n = 491$)
Mutuality	11.11% ($n = 1$)	88.88% ($n = 8$)
Proximity	22.22% ($n = 2$)	77.77% ($n = 7$)
Empathy	66.66% ($n = 6$)	33.33% ($n = 3$)
Risk	22.22% ($n = 2$)	77.77% ($n = 7$)
Commitment	0% ($n = 0$)	100% ($n = 9$)

Of the nine Tweets that did include examples of dialogue, 11.11% ($n = 1$) included an example of mutuality, or the shared recognition of goals between an organization and its publics. 22.22% ($n = 2$) included an example of proximity, or the

spontaneity and honesty of interaction between an organization and its publics. 66.66% ($n = 6$) included an example of empathy, or the supportiveness and confirmation of public goals and interests by an organization. 22.22% ($n = 2$) included an example of risk, or the willingness of an organization to interact with publics on their terms. None of the tweets included an example of commitment, or the extent to which an organization gives itself over to ethical dialogue and understanding with publics.

CHAPTER 6: DISCUSSION

Overall, the results from this research found that health organizations were not a large part of the overall conversation surrounding Zika during the Olympics on Twitter. Despite health organizations being an authoritative voice in regard to public health threats, particularly for salient threats such as the Zika virus during the course of the Olympic Games, health organizations were not active. Surprisingly, of the health organizations that did participate, the majority were either health programs at colleges or universities, or health-centered media outlets, rather than the CDC or WHO. Furthermore, the small amount of messages coming from health organizations featured little dialogue, representing at most two of tenets of Kent and Taylor's (2002) tenets each.

Research Question One: Netlytic Outputs

The first research question asks whether posts from health organizations demonstrated dialogic communication as represented by the reciprocity and centralization scores given through Netlytic. Overall, the reciprocity scores were low in the analysis for Twitter replies and mentions. This indicates that, in general, Twitter users were not having direct conversations with other users. In other words, individuals were posting information and statements, but not responding to other users' information and statements. Without this type of interaction, the dialogic tenets cannot be fulfilled.

Likewise, the centralization scores were low in the analysis for Twitter replies and mentions, indicating the conversations were not clustered around users but rather dispersed between many "random" users. Had users with more 'followers,' such as health organizations, been a central point of contact between multiple users within a conversation, controlling the flow of messages within conversations, the centralization

scores would have been higher. For example, if the CDC or WHO had regularly posted Tweets with important information about Zika, other users had shared and responded to this Tweet, and the health organization continued conversation with these responses, the conversations would have been ‘centered’ around the health organization and the centralization score would be higher. Likewise, this type of engagement between the health organization and publics would indicate that health organizations were engaging in proximity and risk.

Results from the quantitative coding analysis, which will be discussed in further detail below, found that health organizations did not heavily participate in the conversations regarding Zika and the Olympics during the timeframe of data collection. Because the reciprocity and centralization scores are calculated using the entire dataset, and not just a subset such as health organizations, the connection between the overall outputs to the research question is not as strong as it would have been if health organizations had a stronger voice in the Zika conversation. This, however, does not mean that there are no interesting conclusions that can be drawn from these numbers.

As stated above, the low reciprocity scores found in the analysis of both the use of mentions and replies in the dataset indicate that in general individuals were not responding to each other. This may be explained by people being more likely to use Twitter to disseminate information or statements rather than engage in conversations with other users (Jiang et al., 2014; Park et al., 2016; Van der Goot, 2013). If individuals were not responding to each other, likely the content that was being spread did not lend itself to requiring a response. For example, users may have been posting links or commenting on the Olympic games, rather than asking questions or attempting to prompt

conversations. This was supported in the results, which found that the majority of Tweets included at least one link.

Because of the 140-character limit on Twitter, links appear to be the most efficient way to disseminate a large amount of information on the platform. Though the sources of the links were not explored during the coding process, it was clear that these links often led to media articles dealing with the Olympics, ranging from the games themselves, the athletes, Zika, and more. This appears to have contributed to the lack of dialogue use. If users are simply providing a summary of a news article and posting a link, they are not engaging in dialogue directly through Twitter.

Likewise, if health organizations are only linking to information, whether it is related to Zika or not, they are not engaging in dialogue with publics. This was noted in the results, as even when health organizations did post about Zika, they often fell back on only posting links rather than engaging with and responding to users. The low number of replies also indicates that not only were individuals not responding to health organizations, but health organizations were not responding to individuals. For dialogue to occur, there needs to be conversation, which on Twitter cannot happen without replies.

The lower centralization scores found in the analysis of replies and mentions indicates that conversations that did occur did not have strong single points of connection. Rather conversations were spread out between 'random' users who posted in each conversation a limited number of times. This can be explained by the lack of posts from health organizations like the CDC and WHO during the data collection timeframe. As authoritative voices with a large number of followers, these users potentially could have played a central role in framing the discussions surrounding Zika.

Instead, the conversations about Zika were loosely clustered and more dispersed among individual users, with few single points of communication. Had a health organization posted more information about Zika that other users could engage with, the centralization scores would have likely been higher. In other words, if organizations posted content that other users shared, responded to, and generated more conversations about, and the organizations maintained conversation through replies, the health organizations would become central points of communication.

The overall analyses of mentions and replies also helps demonstrate the general lack of users replying to each other in the data. Analysis of the use of mentions in the data revealed a large number of nodes and ties, as well as a relatively high diameter representing the overall size of the discussions of Zika and the Olympics, in comparison to the analysis of replies. These numbers together demonstrate the greater use of mentions, or when a Tweet essentially links to another user, rather than actually replying to other users. This was backed up in the results, which found that the majority of coded Tweets did employ the use of mentions.

This high number of mentions can be explained again by the general use of Twitter to disseminate information rather than hold conversations. When users ‘share’ other users’ Tweets, the information from that initial Tweet is further spread and the original user is ‘mentioned.’ Within the data set, it appears users were far more likely to simply share the Tweets they saw rather than engage with them through replies and conversation. This can potentially be explained by the initial content of the Tweets being shared. Tweets that simply summarize an article and post a link are not invitations to reply and discuss, but rather an invitation to spread.

Despite the high number of mentions used in Tweets, few directly mentioned health organizations. Had health organizations posted more information about the virus, it is likely users may have been more likely to share these messages and more posts overall would have mentioned these health organizations. Though that would still be an example of dissemination over dialogue, it could also have given more opportunities for individuals to ask questions and health organizations to respond, increasing dialogue.

Lastly, health organizations could have potentially increased their centralization scores had they better monitored the conversations happening about Zika through the use of hashtags. The results from that the majority of Tweets also included hashtags, linking topics of discussion rather than other users. Though most of these hashtags within the dataset dealt with the Olympic games rather than Zika, a sizable amount regardless tagged the virus. As a way to easily find all Tweets talking about the same topic, health organizations could have used hashtags to monitor conversations about Zika to better engage, or even create their own hashtags to better focus discussions. Instead, only a handful of hashtags directly related to health organizations.

Research Question Two: Qualitative Content Analysis

The second research question asks whether health organizations utilized Kent and Taylor's (2002) dialogic tenets, as measured through a qualitative content analysis. This research question was divided into five sub-research questions specifically asking whether Tweets from health organization embodied each of the five tenets of dialogue (Kent & Taylor, 2002). Expanding from the outputs given from the Netlytic analysis of the conversations surrounding Zika on Twitter during the Olympics, the quantitative content analysis likewise found that there was little dialogue, especially from health

organizations. Of the Tweets that did use dialogue, there was minimal representation for three of the tenets and sub-research questions; mutuality, proximity, and risk. Despite the low number of Tweets collected from health organizations, there was regardless a notable representation of the tenet of empathy within though Tweets, giving some evidence toward the third sub-research question. There was no representation for the final tenet; commitment, meaning there was no evidence toward the final sub-research question.

These overall results can be explained first and foremost by the lack of Tweets from health organizations within the overall conversation regarding Zika and the Olympics. Of course there will be little to no dialogue from health organizations if they are not talking to Twitter users in the first place. As stated above, the health organizations that were posting during the data collection period were predominantly health programs at colleges and universities, and health-centered news media; not the CDC or WHO. Had these authoritative voices been more present during the conversations surrounding Zika and the Olympics, it is possible that the overall topics covered would have been more focused on the health impacts of Zika, and discussions would have been more centered on the organizations, providing more opportunities for organizations to engage in dialogue with publics.

Another likely reason health organizations were not engaging in dialogue with publics was that they were not directly applying communication theories such as Kent and Taylor's (2002) tenets of the dialogic theory in their communication efforts. Though this analysis applies the dialogic tenets to the communication (or lack thereof) of health organizations during the 2016 Rio Olympics, the lack of messages found heavily implies that health organizations were not utilizing dialogic principles in their communication.

Though any increase in communication would be an improvement even without a specific theory to guide messages, the use of a communication theory like the dialogic theory would be beneficial for health organizations in building beneficial relationships with publics.

It is also possible that part of the reason that health organizations were not responding to individual Zika concerns is simply because they were not asked in the first place to do so. This relationship can also go the other way, however, as individuals without seeing health organization posts may not have known they could have asked. Additionally, the general topics of conversation regarding Zika and the Olympics may have appeared too far ‘off-topic’ to what health organizations would feel compelled to participate in. For example, despite the vast majority of Tweets in some way dealing with the virus and the games (which is unsurprising given that the Tweets were only collected if they mentioned both “Zika” and “Olympics”), these conversations rarely seemed to deal with the health impacts of the virus, and had little to do with health organizations.

Some of these (off) topics within the overarching conversation regarding Zika and the Olympics included commentary on the opening ceremony, concerns over the safety of the event, and commentary on the athletes. The most notable example of commentary on athletes was Hope Solo, the goalie for the US Women’s Soccer Team, who was a controversial figure during the games because of her comments about Brazil and the Zika virus prior to the games. Every time she came into possession of the soccer ball during play, outraged local Brazilian spectators would chant “Zika.” This led to a large amount of commentary on Twitter, with some individuals finding the chanting amusing, others critiquing Solo for the initial comments, or some defending her against the chants. While

these conversations certainly dealt with the Olympics and the virus, they had little to do with the health aspects of Zika. Health organizations, thus, were not a part of this conversation, though they potentially could have been as a way to make conversations about Zika more salient for individuals.

Many Tweets also featured general dissatisfaction with the games being hosted in Brazil, which had received media attention prior to the event (Barbara, 2016). This contributed to having more than a third of the tweets being coded as having a negative sentiment. Similar to the media discussions regarding the Olympics (Barbara, 2016), Tweets also included concerns over the safety of the event, Brazil's unstable economy, the potentially overreaching militarized policing for the games, and of course the risks to athletes and spectators from the Zika virus. Though these Tweets often included Zika in their list of woes against the Olympics, they did not delve into the health aspects of the disease, link to health organizations, or ask questions about the risks. Likewise, health organizations did not appear to properly address public concerns regarding the virus through Twitter.

Additionally, a large amount of the Tweets regarding the Olympics and Zika were categorized as "Zika humor," jokes made about the virus regarding the overall event, athletes, or the unfortunate choice of dancers at the opening ceremony wearing costumes resembling mosquitos. Not only did these jokes often have little to nothing to do with the health aspects of Zika, they seemed to disregard the seriousness of the disease and take away from potential space where conversations about the health outcomes of the virus could have been discussed. Health organizations did not engage with these Zika jokes, though potentially they could have addressed the humor or, if careful, use humor in their

own messages to gain public attention. In this regard, the topics of conversations surrounding Zika and the Olympics may have limited the use of dialogue from health organization.

Additionally, it is possible health organizations do not perceive Twitter as an effective platform to engage with publics, despite the findings that Twitter can potentially be used to build dialogue. As the quantitative coding analysis found, Twitter is currently being used predominantly as a platform for information dissemination, often by posting links to external news articles with short blurbs. It is also possible health organizations do not value dialogue with publics, and are rather content with simply disseminating information. Though dialogue can potentially be included within Tweets, the current culture of Twitter solely as a way for organizations to post links rather than engage with publics may encourage health organizations to ‘play it safe’ rather than try to truly build dialogues with publics.

Another potential limitation to health organizations utilizing dialogue is the 140-character limit of Twitter (Jiang et al., 2014; Van der Goot, 2013); it is difficult to include all five tenets of dialogue without much space to do so. Within the number of Tweets from health organizations, individual postings typically only employed one or two of the tenets of dialogue each. While this means that that it is possible for organizations to enact some tenets of dialogue in messages, it also indicates that it be difficult to more fully embody the tenets of dialogue in individual Tweets.

If an organization is to achieve true dialogue as defined by Kent and Taylor (2002), likely it can only be done through using multiple tweets. Additionally, the limited use of dialogue within individual Tweets can be discouraged by the general practices of

users on Twitter; if other organizations are predominantly sending summaries of articles with links, it would stand to reason that health organizations would follow the same trend rather than engage in dialogue. Lastly, health organizations may not have formal training on why building dialogue with publics is important and how to do so through the Twitter platform.

It is difficult to say from the small number of Tweets collected from health organizations whether more dialogue would have been found had health organizations like the CDC and WHO been more active on Twitter during this time frame within the Olympics; however, the finding that there was some representation of dialogue within the few number of health organization Tweets is encouraging. Though the results from this study found no examples of health organizations enacting the final tenet of commitment within the 140-character limit, it is still possible to use the platform for mutuality, proximity, risk, and most notably from the findings, empathy.

Tweets can enact the tenet of mutuality by directly inviting users to collaborate or discuss topics such as Zika, as well as explicitly stating that they share goals with the public like safety. Though there was limited representation of mutuality in the Tweets from health organizations in the data sample, with proper understanding of dialogue Tweets certainly could enact this tenet. Proximity can be enacted by health organizations most notably by responding to user questions and concerns. Social media platforms like Twitter give organizations the opportunity to directly converse with publics and build dialogue. Though the use of replies from health organizations was limited, a simple change in social media policy to more directly interact with publics via Twitter could quickly increase the level of dialogue from this tenet.

This potential change in policy relates to the tenet of risk, as organizations may prefer not to respond to users quickly or adapt communication style from more official press releases. Though the results only found some examples of risk in the Tweets from health organizations, this tenet too can be increased with more and quicker responses to user questions and concerns. Together, the limited use of mutuality, proximity, and risk in the data sample can be traced back to the lack of health organizations replying to users, and overall could be improved markedly by increasing the number of replies.

As seen in the findings, empathy can also be achieved through the Twitter platform. Messages that offer support to individuals and address public concerns, especially when done through replies, is an effective way to enact the tenet of empathy through Twitter. The greater use of empathy from health organizations on Twitter compared to the other tenets possibly results from empathy already being incorporated into the messages from health organizations during public health crises, essentially translating from press releases and articles to Tweets. In contrast, health organizations traditionally do not directly respond to publics, thus do not naturally embody the first three tenets as easily.

Lastly, despite there being no representation of the tenet of commitment found in the data sample, this does not entirely mean that it is impossible to enact this tenet through the Twitter platform. Likely there was no representation found in the coding because, compared to the other tenets, commitment especially would require multiple tweets to fully enact. If health organizations become a larger part of the conversations surrounding public health crises such as the Zika outbreaks, there is a greater chance of commitment being enacted through their multiple Twitter messages. Over the course of a

social media campaign, health organizations can thus potentially display a deep understanding of public goals, and go above and beyond expectations in addressing public concerns.

Implications

The first implication of these findings is that health organizations are not nearly as involved in the conversations regarding public health crises online as they could be. Whether individuals were asking for information or not, health organizations are in a unique position of expertise and visibility that the responsibility of information dissemination and dialogue surrounding crises like the Zika virus should have likely fallen to them, rather than individual users or even the media. As such, during public health crises health organizations should be far more active in the public discourse.

Along with a general lack of communication in the discourse surrounding Zika and the Olympics, health organizations overall did not utilize Kent and Taylor's (2002) tenets of dialogue. Despite some representation of some of the tenets, most notably empathy, even when individual Tweets embodied some dialogue it was at most two tenets. An important takeaway from this is that individual Tweets may be too limited in characters to fully embody all the tenets of dialogue; however, multiple Tweets from health organizations during a media campaign could together embody the tenets of dialogue. This is likely the only way to truly build the tenet of commitment, which this research did not find. Future case studies can directly look at overarching messages from health organizations for the presence or lack of dialogue over the course of a public health crisis.

Another important takeaway for health organizations, and potentially the easiest way to increase the use of dialogue in messages, would be for the organizations to often and quickly respond to user questions and concerns regarding Zika. This most directly would increase the tenets of proximity and risk, as well as provide additional opportunities to embody mutuality and empathy. Organizations can also post more content for other users to share and engage with, as well as create hashtags to focus conversations

Overall, this research found that the current use of Twitter by health organizations is limited, and does not effectively build dialogue with publics; however, it is not impossible to create dialogue through Twitter. The limited use of dialogue in the small number of Tweets from health organizations demonstrates that some dialogue has already been used, and more communication from organizations would also mean more dialogue. Though it will require a greater understanding of the tenets from health organizations to best build true dialogue with publics, the potential to use Twitter as a means to do so is there.

Limitations

As with all studies, this research had a number of limitations. One of the most prominent limitations was the lack of Tweets from health organizations within the data. Though this did provide interesting findings in how health organizations were not active within the discussions surrounding Zika, it also made answering the question of whether health organizations used dialogue in their Twitter messages challenging. It is difficult to say from only twelve Tweets from health organizations whether they overall do or do not use the tenets of dialogue. Future research could utilize case studies of specific health

organizations and their messages to more fully answer the question of whether their overall social media messages embody the tenets of dialogue or not.

Another limitation was the relatively limited time range of data collection, with Netlytic only collecting data during three days of the Olympics. Despite Netlytic capturing many Tweets from these days, the data pool did not capture a broader representation of the conversation regarding Zika throughout the Olympics. For example, it is possible health organizations were more active on Twitter before the Olympics, but not as much during the games. Additionally, the Tweets collected were also more prone to only represent events happening during those three days, such as the Zika chanting with Hope Solo. Multiple individuals retweeting off-topic conversations cluttered the data and took away potential findings from health organizations. Future research could continue collecting Tweets over the entire course of a public health crisis for a broader representation of the messages from health organizations.

Regarding the coding of dialogue, an additional limitation was the use of nominal rather than interval measures. Tweets were coded for either the presence or lack of the individual of tenets of dialogue, rather than the degree to which that tenet was represented. For example, each Tweet could have been rated on a scale between 1 and 5 for the level of each tenet represented. Though this would have required far more coder training for reliable results, the additional data would have given insights into the degree to which each tenet was or was not represented. Future research on dialogue could utilize more interval scales to provide additional insights into the degree to which organizations do or do not use the tenets.

One last potential limitation was the use of quantitative coding rather than qualitative coding. Though the quantitative process allowed for far more Tweets to be coded, with findings that could only be drawn from the larger-scale numbers provided, qualitative coding would have provided more in-depth analyses of individual Tweets and larger themes. Future research, even using the same data, could utilize a quantitative codebook to find richer themes found within the data.

Appendix

Appendix A: IRB Approval for Pilot Study

Dear Daniel,

I wanted to let you know that your IRB Protocol entitled, "*Zika Tweets & the Olympics: Health Information Seeking & Threatening Salience on Twitter*," has been approved effective from 10/27/2016 through 12/12/2016. The signed action of the board form, approval memo, and close-out form will be sent to you via campus mail. Your protocol has been assigned No. 17-0158. Thank you again for working with us to get your protocol approved.

All research must be conducted in accordance with this approved submission, meaning that you will follow the research plan you have outlined in your protocol, use approved materials, and follow university policies.

Please take special note of the following important aspects of your approval :

Any changes made to your study require approval ***before*** they can be implemented as part of your study. Contact the Office of Research Integrity at researchintegrity@jmu.edu with your questions and/or proposed modifications. An addendum request form can be located at the following URL: <http://www.jmu.edu/researchintegrity/irb/forms/irbaddendum.doc>.

As a condition of the IRB approval, your protocol is subject to annual review. Therefore, you are required to complete a Close-Out form before your project end date. You ***must*** complete the close-out form unless you intend to continue the project for another year. An electronic copy of the close-out form can be found at the following URL: <http://www.jmu.edu/researchintegrity/irb/forms/irbcloseout.doc>.

If you wish to continue your study past the approved project end date, you must submit an Extension Request Form indicating a renewal, along with supporting information. An electronic copy of the close-out form can be found at the following URL: <http://www.jmu.edu/researchintegrity/irb/forms/irbextensionrequest.doc>.

If there are in an adverse event and/or any unanticipated problems during your study, you must notify the Office of Research Integrity within 24 hours of the event or problem. You must also complete adverse event form, which can be located at the following URL: <http://www.jmu.edu/researchintegrity/irb/forms/irbadverseevent.doc>.

Although the IRB office sends reminders, it is ultimately ***your responsibility*** to submit the continuing review report in a timely fashion to ensure there is no lapse in IRB approval.

Appendix B: Health Information National Trends Survey (HINTS)

National Cancer Institute (2015), modified

General Internet Habits

1. “How often do you ___?” (1 = Almost Never, 2= Rarely, 3 = Sometimes, 4 = Often)

Statements	1	2	3	4
Access the Internet?				

1. Which of the following, if any, are the reasons you do not access the Internet?

Statements	SD	D	N	A	SA
I am not interested in using the Internet					
The Internet costs too much					
The Internet is too complicated to use					
The Internet is not useful					

General Online Health Information Seeking

1. “How often do you ___?” (1 = Almost Never, 2= Rarely, 3 = Sometimes, 4 = Often)

Statements	1	2	3	4
Read health information on the Internet?				
Use the Internet to look for health or medical information for yourself?				
Use the Internet to look for health or medical information for someone else?				
Find information about health concerns not directly impacting me or my family?				

2. In the past three months, have you done the following things while using the Internet? (Looking up information) (Check all that apply)
- Looked for health or medical information for yourself?
 - Looked for health or medical information for someone else?

- b. Looked for information about physical activity or exercise?
 - c. Looked for information about diet or nutrition?
 - d. Looked for information about protecting yourself from the sun?
 - e. Looked for information about quitting smoking?
 - f. Looked for information about a specific disease?
3. In the last three months, have you used the Internet for any of the following reasons? (Social Media) (Check all that apply)
- a. Shared health information on social media sites?
 - g. Visited a social networking site, such as Facebook or LinkedIn
 - h. Visited a “social networking” site, such as “Facebook” or “LinkedIn” to read and share about medical topics?
 - i. Participated in an online forum or support group for people with a similar health or medical issue
 - j. Exchanged support about health concerns with family or friends?
 - k. Wrote in an online diary or blog (i.e., web log)
 - l. Wrote in an online diary or “blog” (i.e., web log) about any type of health topic
 - m. Watched a health-related video on YouTube
4. In the last three months, have you used the Internet for any of the following reasons? (Information Tracking) (Check all that apply)
- a. Kept track of personal health information such as care received, test results, or upcoming medical appointments?
 - n. Used a website to help you with your diet, weight, or physical activity?

About Zika

1. Please respond to the following statements about the 2015-2016 Zika Virus Outbreaks

Statements	SD	D	N	A	SA
I am well-informed about the Zika virus epidemic					
I have heard a lot about the Zika virus epidemic					
I have visited an Internet website to learn specifically about the Zika virus					
I have used social media to learn specifically about the Zika virus					
I have used Twitter to learn specifically about the Zika virus					

I follow health organizations like the CDC and WHO on Twitter					
Health organizations like the CDC and WHO are useful for spreading information about diseases like Zika					
I watched parts of the 2016 Rio Olympics					
I was concerned about Zika outbreaks at the 2016 Rio Olympics					

Appendix C: Risk Behavior Diagnosis Scale

Witte et al. (1995), modified

SEff

Statements	SD	D	N	A	SA
Access to clear health information is effective in preventing Zika virus spread					
Access to clear health information works in preventing Zika virus spread					
If I have access to clear health information, I am less likely to get the Zika virus					
I am able to access clear health information to prevent getting the Zika virus					
I can maintain access to clear health information to prevent Zika virus spread					
I can easily access to clear health information to prevent Zika virus spread					

SThreat

Statements	SD	D	N	A	SA
I believe that <i>the Zika virus</i> is severe					

I believe that <i>the Zika virus</i> has serious negative consequences					
I believe that <i>the Zika virus</i> is extremely harmful					
It is likely that I will get <i>the Zika virus</i>					
I am at risk for getting <i>the Zika virus</i>					
It is possible that I will get <i>the Zika virus</i>					

Appendix D: Codebook Quantitative Twitter Analysis

Unit of Analysis:

Any complete Twitter post (“Tweet”) that includes reference to the Zika virus AND the 2016 Rio Olympics; Keywords “Zika” and “Olympics” respectively. The messages are in a public online format. The tweets were collected through online data collection and analysis software Netlytic.

Coder

1 = Coder 1

2 = Coder 2

Tweet Basics

- Message ID _____
- Posting Date (mm/dd/yyyy) _____
- Any notes about this tweet? (Information otherwise not captured in codebook)

Tweet is in English

1 = Yes

2 = No

General Sentiment of Tweet

- Positive = 1
- Neutral = 2
- Negative = 3

About the Tweet

- Tweet is clearly related to the Zika virus (1 = yes, 2 = no, 99 = n/a)
- Tweet is clearly related to the 2016 Rio Olympics (1 = yes, 2 = no, 99 = n/a)

- Tweet is from a health organization (ex. CDC, WHO, Hospital, health program at college or university)
- If yes to previous question, which organization is the Tweet from?

Tweet Includes a Link (1 = yes, 2 = no, 99 = n/a)

- How many links? _____
- Links leads to a video (1 = yes, 2 = no, 99 = n/a)
- Website link is clearly related to Zika (1 = yes, 2 = no, 99 = n/a)
- Website link is clearly related to Olympics (1 = yes, 2 = no, 99 = n/a)
- Website link is clearly related to health organizations (ex. CDC, WHO) (1 = yes, 2 = no, 99 = n/a)
- Website link is clearly off-topic from Zika or Olympics (1 = yes, 2 = no, 99 = n/a)

Tweet includes a Hashtag (1 = yes, 2 = no)

- How many hashtags? (If yes, list number)
- At least one hashtag refers to Zika (1 = yes, 2 = no)
- At least one hashtag refers to the Olympics (1 = yes, 2 = no)
- At least one hashtag refers to a specific health organization (1 = yes, 2 = no)
- At least one hashtag is off-topic from Zika, Olympics, or a health organization (1 = yes, 2 = no)

Tweet includes a “Mention” (represented by “@”) (1 = yes, 2 = no)

- How many mentions? (If yes, list number)
- At least one mention is a health organization (1 = yes, 2 = no)
- If yes to previous question, which health organization(s) is/are mentioned?

Invitation to Dialogue (1 = yes, 2 = no)

Fulfills one of the below definitions

- *Mutuality*, or the recognition of organization–public relationships;
- *Propinquity*, or the temporality and spontaneity of interactions with publics;
- *Empathy*, or the supportiveness and confirmation of public goals and interests;
- *Risk*, or the willingness to interact with individuals and publics on their own terms; and finally,
- *Commitment*, or the extent to which an organization gives itself over to dialogue, interpretation, and understanding in its interactions with publics. (Kent & Taylor, 2002, p. 24)

Dialogic Tenets: If any operationalized examples are included, code tenet as “yes”

Mutuality: The recognition of shared goals and interests. Acknowledgment that organization and publics are inextricably tied together. Characterized by “inclusion or collaborative orientation.” (1 = yes | 2 = no | 99 = N/A). Examples:

- Tweet invites reader to directly collaborate with organization to achieve a goal
- Tweet specifically mentions the shared quality of a goal (ex. safety)

Proximity: The spontaneity and honesty of interactions between companies and their publics. Publics are consulted in matters that influence them and are willing and able to articulate their demands to organizations. “Engagement.” (1 = yes | 2 = no | 99 = N/A). Examples:

- Health organization directly responds to a question
- Health organization retweets a user’s post
- User tweets is responding to a tweet from health organization

Empathy: The supportiveness and confirmation of public goals and interests. Building an atmosphere of support and trust. “Supportiveness” (1 = yes | 2 = no | 99 = N/A). Examples:

- Tweet is a supportive response to another user’s question of concern
- Tweet from health organization specifically addresses other user concerns
- Tweet from health organization makes clear that they understood public concerns

Risk: The willingness of businesses to interact with publics on their terms, despite the possibility of unpredictable outcomes to relationship. “Vulnerability and growth” (1 = yes | 2 = no | 99 = N/A). . Examples: Examples:

- Tweet from health organization makes clear action is being taken to address other user concerns
- Tweet from health organization is answering a question within 24 hours of receiving it
- Tweet from health organization appears to adapt communication style

Commitment: The extent to which an organization gives itself over to ethical dialogue, interpretation, and understanding in its interactions with publics. “Genuineness, honesty, commitment” (1 = yes | 2 = no | 99 = N/A). Examples:

- Tweet from health organization displays deep understanding of public
- Tweet from health organization goes above and beyond expectations in addressing public concern

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