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# COMPARING TWO MODES OF PRESENTATION ON PERCEPTIONS OF FLU THREAT AND ATTRIBUTIONS FOR ITS GLOBAL OUTBREAK

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**Abstract**
This study compared the effects of presenting the H1N1 flu threat using two different modes of presentation: via an interactive map (visual mode) versus using words and numbers (numerical mode) on people's threat perceptions (susceptibility and severity) regarding the H1N1 flu, attributions for the rapid spread of the H1N1 virus, and intentions to seek additional information about the H1N1 flu in the next 6 months. Three hundred eighteen undergraduate students were recruited to take part in this experiment. Results found that compared to those exposed to a numerical representation of the H1N1 flu threat, or receiving a control message, those exposed to a visual representation of the threat reported greater feelings of H1N1 flu susceptibility and held stronger immigration-related attributions for the spread of the virus. Also, the visual representation of the H1N1 flu threat reinforced the negative attitudes among those who already held aversive attitudes toward Mexicans, as reflected in stronger immigrant-related attributions for the spread of the virus. Implications of the results for designing messages involving outbreaks of communicable diseases (such as the H1N1 virus) are discussed.

***Keywords:*** *H1N1 Virus, Perceptions of Mexicans, Visual Representations, Framing, Communication of Risk.*

## 1. INTRODUCTION

The H1N1 flu virus has been rapidly spreading throughout the U.S. and worldwide since April 2009. Recently, the H1N1 flu has been spreading fast enough that scientists have begun to prep for a pandemic (Coughlan, 2009). As the spread has become more rapid in the last couple of months, many nations have taken actions to try and prevent their citizens from being exposed to this threat, including imposing travel bans to destinations in Mexico (where it was reported to have originated), quarantining people at airports and border control facilities those individuals who exhibit symptoms of the H1N1 flu (McNeil, 2009).

Some of the earliest cases of the H1N1 flu were found to have originated in Mexico (Coughlan, 2009). This has led some Americans to be fearful of travel to Mexico and this fear was instigated further when Vice President Biden stated that Americans should stay off of planes and subways (Saltonstall, 2009), a statement that was later retracted due to the panic it caused. It was shortly after this statement that cruise ships quit docking at Mexican ports costing Mexico millions of dollars in tourism (McNeil, 2009), because Americans simply did not have a desire to travel to Mexico.

Since the H1N1 flu was believed to have originated in Mexico (Coughlan, 2009), the perception of H1N1 flu risk associated with both the country and its people has increased. Media coverage of the H1N1 flu has largely been negative and has led to an increase in fear among the general public. For example, the media began covering stories about the H1N1 virus outbreak by terming it the swine flu outbreak. This coverage led people to believe that if they consumed pork products, they would be at risk. Therefore, in order to correct these misconceptions about this virus and its method of transmission, the media renamed the swine flu the H1N1 flu.

In presenting the H1N1 flu threat to the public, the media has at its disposal different means of presenting the information, such as via the use of primarily a visual mode (e.g., using maps to depict the spread of the virus over time) or numerical mode (e.g., citing statistics to depict prevalence of the disease).

The way that the media presents information to the public has a profound effect on how people ultimately process the messages, affecting their perceptions and attributions for different events. Therefore, the purpose of this study was to investigate how the presentation of the H1N1 flu threat via either a visual or textual form can affect: (a) people's perception of susceptibility for contracting the H1N1 flu, (b) people's perceptions regarding the severity of the H1N1 flu, and (c) attributions people make about the rapid spread of the H1N1 flu both in the U.S. and globally. Additionally, the study also compared the effects of visual versus textual depiction of the H1N1 flu threat on people's intentions to seek more information regarding the H1N1 flu.

## 2. NUMERICAL AND VISUAL COMMUNICATION OF RISK

The presentation of risk in communication can be discussed in terms of numerical and visual risk. Numerical communication of risk occurs when numbers are used to describe the likelihood of some event occurring (Lipkus, 2007). On the other hand, visual risk occurs when graphics or other visual displays are used to describe the likelihood of some event occurring (Lipkus, 2007). Both of these presentations of risk have advantages and disadvantages that lead to the effectiveness of each mode of communication.

When numeric communication of risk is presented, it tends to be advantageous because the numbers presented tend to be precise and therefore lead to more accurate perceptions of risk (Lipkus, 2007). Furthermore, numeric communication of risk conveys scientific credibility (Lipkus, 2007). Numbers can also be easily converted to other metrics and their accuracy can be verified (Lipkus, 2007). This accuracy can be attributed to the fact that the amount of risk can be computed using algorithms to obtain a summary score that can be easily understood by the public (Lipkus, 2007; Windschill & Wells, 1996).

However, in the end, people can appreciate numbers because they are familiar and consequently, people tend to prefer the numbers as their source of communication about risk

(Lipkus, 2007). While numerical communication of risk is very advantageous, there are some disadvantages worth discussing. Numerical communication of risk houses an inability to address the problems that some have with understanding the numbers (Lipkus, 2007; Lipkus, Samsa, & Rimer, 2001; Woloshin, Schwartz, Moncur, Gabriel, & Toteson, 2001). Another possibility is that the algorithms used to produce the amount of risk may be incorrect (Johnson & Slovic, 1995; Lipkus, 2007), which could lead individuals feel a false sense of risk.

Overall, the advantages seem to outweigh the disadvantages. Numerical communication of risk receives the best results when natural frequencies are used (Gigerenzer & Edwards, 2003; Lipkus, 2007). Ultimately using these frequencies reduces misinterpretations because they reference the targeted group (Gigerenzer & Edwards, 2003; Lipkus, 2007). While numerical communication is effective when it is used by itself when communicating risk, it is often more effective when it is combined with graphics.

Graphs and pictures are often used as supplemental material to numerical communication of risk (Lipkus, 2007). Like numerical communication of risk, visual communication of risk also has advantages and disadvantages. One advantage of using graphs to communicate risk is that these graphs can summarize a large amount of data and show patterns (Clevelan & McGill, 1984). In addition, these visual forms of communication are often able to attract and hold people's attention because the data is displayed in concrete visual terms (Lipkus, 2007; Lipkus & Hollands, 1999). Lastly, visual communication of risk enables people to easily visualize part-to-whole relationships (Lipkus, 2007; Reyna, Brainerd, & Numeracy, 2008).

However, the data patterns that do emerge may discourage people from looking at the details of the risk (Lipkus, 2007). And, if these graphs are poorly designed, they may not be understood (Lipkus, 2007). Additionally, with the varying educational backgrounds of everyone, people may not have the educational resources to interpret the graphs (Kreps, 2008; Lipkus, 2007). Graphs are often hard to create due to the technical programs they may require (Lipkus, 2007). Graphs often call attention to some things while ignoring others therefore leading to a potential to mislead about the magnitude of the risk (Lipkus, 2007). Oftentimes, the part of the graph that receives the most attention may influence interpretation and ultimately behavior (Jarvenpaa, 1990; Lipkus, 2007).

While we do have some understanding of what numerical communication of risk can do to affect behavior, there is still a need for research determining how graphical displays affect risk perception (Lipkus, 2007). But, graphs are good for promoting risk, specifically the risk of the H1N1 flu for two main reasons. First, certain graphs are more suited for certain tasks (Lipkus, 2007). For example, the expanding dots shown in the maps to express the spread of the H1N1 flu are very effective in showing both how the H1N1 flu is being spread as well as how many people are being affected. The larger the dots, the more people are affected. Second, a goal of visual communication is to promote accurate judgments of magnitude (Lipkus, 2007). For example, the global perspective of the expanding dots showed the magnitude of the spread of the H1N1 flu pandemic quite clearly.

## 3. Presentation of Risk and Perception of Risk

The amount of risk that an individual perceives is dependent on the type of communication used to spread the messages as well as the emotions and attitudes that an individual is feeling and thinking at the time of cognition. The way a message is communicated (numerically or visually) and the overall design of a message can enhance the effects of the message. Based on the content, an individual feels a certain amount of salience. When the message is negative, they feel different levels of risk.

Differences between text and visual messages can affect attitudes. Visual displays have been shown to enhance the communication of risk on specific issues (Lipkus & Hollands, 1999). For instance, graphics that are used to illustrate a message allow data patterns to be noticed that may not be seen or recognized under a numerical message simply because numerical data is easier to see (Lipkus & Hollands, 1999) and when viewed in visual representations such as a map, messages are often conveyed more clearly than would be in text.

Also, graphics tend to hold people's attention because they display information in concrete terms and allow for a framework for cognitive processing (Lipkus & Hollands, 1999). By actually being able to see the spread of the H1N1 flu in the United States, audiences will see how much it has grown versus just reading about it. In fact, graphs effectively communicate risk when the issues are risk magnitude, relative risk, cumulative risk, uncertainty, and interactions (Lipkus & Hollands, 1999). Because the H1N1 flu is a huge risk to Americans' health, a map would be the most effective way to communicate its risk. Ultimately, visual messages help describe numerical messages but in a more immediate, vivid, and memorable manner.

There are distinct differences when viewing a visual message versus reading a numerical message. Research has shown that judgments related to comprehension (e.g. clarity, salience, and complexity) were stronger with visual representations of the data versus numerical representations of the same data (Johnson & Slovic, 1995).

If audiences actually view the H1N1 flu spreading, that presents a more graphic depiction of the H1N1 flu invasion than a numerical representation would or could present. Similarly, visual representations of health information can substitute effectively for verbal information in order to promote comprehension and retention of message content (Buck, 1998; Doak, Doak, Friedell, & Meade, 1998; Stableford & Root, 1999). If individuals can comprehend the message, then they are more likely to perceive risk than those who cannot understand the message clearly. Source credibility has also been found to be more effective for visually communicated messages versus numerically communicated messages (Kopfman, Smith, Yun, & Hodges, 1998). For instance, seeing a news organization's logo can instantly give credibility, especially if it is brought to our attention visually.

However, those in the numerical condition may or may not see the logo because their cognitive resources are devoted towards reading and comprehending the text. Those in the visual condition likely have more cognitive resources available to devote to other things. When all the components are taken together, research has shown that visual messages are superior in communicating risk to numerical messages (Parrott, Silk, Dorgan, Condit, & Harris, 2005).

How a message is communicated can ultimately affect the amount of risk one perceives. For instance, one study showcased that those that *viewed* messages regarding car crashes held a higher perceived risk of being involved in one than those who *read* messages (Buellens, Roe, & Van den Bulck, 2008). Therefore those that view messages regarding the H1N1 flu should hold a higher perceived risk (i.e., more susceptibility and severity) of contracting the virus than those that read a message, which in turn should elicit higher perceived risk than those that received a "control" message simply defining what the H1N1 flu is (i.e., how it was transmitted from pigs to human in a mutated form) and offering suggestions for preventing its spread.

H1: Individuals in the visual condition will have a higher perception of H1N1 flu susceptibility and severity than those in the numerical or control condition.

H2: Individuals in the numerical condition will have a higher perception of H1N1 flu susceptibility and severity than those in the control condition.

The amount of risk that one perceives is a potential motivator for health behavior change or even health behavior awareness (Becker, 1974; Weinstein, 1998; Witte, 1992). Since it is expected the visual messages of the H1N1 flu pandemic will elicit the highest risk perception compared to the numerical or control frames, it can be predicted that these individuals will also report the highest intent to seek information regarding the H1N1 flu. Previous research has found that risk perception is a positively related with information-seeking behaviors. For example, Friedman et al. (2006) found that among women with breast cancer symptoms, lower perceived risk for breast cancer was associated with greater delay in seeking medical consultation while higher perceived risk was related to shorter delay in information-seeking. Bernhardt, McClaine, and Parrott (2004) investigated people's online health information seeking for genetic information and found perceived risk for genetic abnormality to be a positive predictor. Schwartz, Lerman, Miller, Daly, and Masny (1995) found that high perceived risk for ovarian cancer was associated with high scores on health monitoring, defined as the tendency to seek out and attend to threat-relevant information. Thus, the following hypothesis is posited:

H3: Individuals in the visual condition will report a higher intention to seek information about the H1N1 flu than those in the numerical or control condition.

### 3.1. Communication of Risk and the Impact on Attributions

Communication of risk has also been shown to affect the emotions and attitudes of those that process the numerical or visual message. In fact, positive and negative emotions trigger corresponding positive and negative risk assessments (Johnson & Tversky, 1983). Emotions can make people feel more pessimistic about the issue, which can lead to risk aversion (Hsee & Weber, 1997).

Specifically, fear leads to pessimistic judgments and risk aversion as they delve deeper into the message (Lerner & Keltner, 2000; Lerner & Keltner, 2001; Lerner, Small, & Lowenstein, 2004). If individuals have a negative disposition prior to seeing the message, they will process the message negatively (Marcus, Neuman, & MacKuen, 2000; Brader, 2006).

Therefore, depending on the emotions of participants prior to viewing the message, it may affect how the visual or numeric message is processed. Geographical location has also been shown to have an effect on perceived threat and perceived risk. Recent research (de Zwart, Veldhuijzen, Elam, Aro, Abraham, Bishop, Voeten, Richardus, & Brug, 2009) illustrated that geographical location did have an effect on perceived threat and risk of contracting SARS (Severe Acute Respiratory Syndrome). SARS originated in Asia.

During the SARS breakout, there was very little travel to Asia and they suffered similar tourism losses as Mexico did as news of the H1N1 flu pandemic broke. However, Asia is much further away than Mexico. Therefore the effects of a H1N1 flu outbreak in the United States are much more likely to occur due to its geographical location.

The H1N1 flu outbreak is said to have originated in Mexico, where the earliest cases were first identified (Cohen, 2009). Mexico is our neighbor and those in the United States recognize that the geographical distance between the U.S. and Mexico is not far. Because of this geographical closeness, Americans are likely to attribute the spread of the H1N1 flu to Mexicans migrating to the United States. Such attributions are further fueled by media reports of travel bans to Mexico (McNeill, 2009) and our Vice President suggesting people avoid traveling to

Mexico (Saltonstall, 2009). These negative emotions may further reinforce negative attitudes some people hold towards Mexicans and immigrants as a whole.

Most individuals who are racist (i.e., those who have negative attitudes towards a specific race) usually are strong in their opinions. So, when these individuals view negative numerical or visual messages about that race, those messages should provide reinforcement of those views. Research has shown that these racist views are being transferred to negative views about immigration.

For instance, Shelton and Coleman (2009) examined racial attitudes and attitudes towards immigration after Hurricane Katrina. They found that both national and local factors influenced beliefs about Katrina evacuees. They concluded that the dynamics of race/ethnicity and negative feelings toward immigrants drove negative beliefs about those who relocated to their areas. This is similar to those immigrants coming to the United States after the H1N1 flu became extremely prevalent in Mexico. Similar research has shown that individuals that viewed media coverage regarding the aftermath of Hurricane Katrina had stronger negative racial attitudes than those that did not view the media coverage (Haider-Markel, Delehanty, & Beverlin, 2007).

Other research has assessed the association between Anglo aversion to Latinos, physical proximity to Latinos, and contact with ethnic minorities and preferences for immigration policies (Ayers, Hofstetter, Schnakenberg, & Kolody, 2009). Researchers found that attitudes about immigration may be motivated more by racial resentments than other considerations (Ayers et al, 2009).

This type of research has also been examined in Europe. Boomgaarden and Vliegenthart (2009) looked at whether news coverage of immigrants and immigration issues relates to macro-level dynamics of anti-immigration attitudes in Germany and found that both the frequency and the tone of coverage of immigrant actors in the news significantly influenced dynamics in anti-immigration attitudes.

Immigration is now becoming discussed in the literature as a racial issue. With the spread of the H1N1 flu and the influx of Mexican immigrants entering into the United States, it ultimately provides a justification for some people who already have an aversion to Mexican immigrants to maintain their negative attitudes towards Mexican immigrants.

Thus, the following hypotheses are posited regarding the relationship between numerical and visual communication of risk and attributions made regarding the spread of the H1N1 flu.

H4: Individuals in the visual condition will more likely attribute spread of the H1N1 flu to immigration-related factors (increase in Mexican immigrants, lack of border control) than those in the numerical or control condition.

H5: Individuals holding a high level social aversion toward Mexicans will more likely attribute the spread of the H1N1 flu to immigration-related factors than those holding a low level of social aversion toward Mexicans.

## 4. METHOD

### 4.1. Participants

Three hundred eighteen undergraduate students aged 18-25 ($M$ = 19.64 years, SD = 2.40) were recruited from communication and geography classes at a large Midwestern university. They were invited to take part in the study for research credit via email and/or personal announcements in class. The current sample consisted of 113 males (35.5%) and 205 females (65.5%). The class standing composed of 184 freshmen (57.9%), 62 sophomores (19.5%), 30 juniors (9.4%), 19 seniors (6.0%) and 23 participants who skipped the question (7.2%). Approximately 75% of the sample was White, 5.7% African-American, 4.8% Hispanic, 4.8% Asian, 5.4% Alaska Native or American Indian, and 4.4% mixed. The majority of the sample was Catholic (57%) or Protestant (42%) and largely Republican (61.3%), with some Democrats (23.3%) and Independents (14.2%) comprising the group.

**4.2. Experimental Design**

This study utilized a 1 x 3 factorial design where 3 experimental conditions were created: A visual message condition (n = 108), a numerical message condition (n = 99) and a control message condition (n = 111). Both the visual message and numerical message conditions described the spread of the H1N1 flu using either a visual message (interactive map) or numerical message (news story) respectively. The interactive map and the news story were adopted from online news websites (e.g., New York Times, BBC) that provided coverage on the global spread of the H1N1 flu pandemic. The control message presented basic facts about the H1N1 flu (e.g., how it was transmitted from pigs to humans, what the virus is made of genetically) offered on the Centers for Disease Control and Prevention (CDC) website.

**4.3. Procedures**

Participants were first asked to read an informed consent screen, and after they agreed to participate in the study by clicking on the appropriate link, were directed to 1 of 3 online surveys hosted on the Survey Monkey server. Each online survey represented a different message condition. All participants were randomly assigned to 1 of the 3 experimental conditions, where they first were exposed to a specific message about the H1N1 flu, then asked to respond to a series of items assessing their general attitudes toward immigrants, aversion to Mexicans, perceived susceptibility and severity regarding the H1N1 flu, intent to seek information about the H1N1 flu, and demographic information. Finally, respondents were debriefed about the study.

**4.4. Message Selection**

Two different media frames depicting the spread of the H1N1 flu virus were selected for this study. For the visual message condition, participants were shown two different interactive maps that traced the spread of the H1N1 flu virus both in the U.S. and globally. Both interactive maps visually depicted H1N1 flu incidence data based on the World Health Organization’s special reports about the prevalence of the H1N1 flu (i.e., number of confirmed cases and deaths reported). One map was created by the New York Times while the other was created by the BBC. Both maps provided a visual timeline to show both the spread of the virus over time as well as its severity. Each confirmed H1N1 flu case and death were depicted on the map using different colored dots. Specifically, the map showed death tolls with black dots and expanding orange circles to indicate the severity of the spread of the H1N1 flu (i.e., to depict the magnitude of the spread of H1N1 flu). The larger the circle, the more severe the situation is for people living in a particular state and served as an effective means to manipulate susceptibility. Additionally the interactive maps also provided details tracking the H1N1 flu pandemic from the very first incident to the most recent incidents.

For the numerical message condition, two news documents describing the spread and severity of the H1N1 flu were selected for the study. Both stories were special articles published by the BBC, with the headlines: “U.S. passes million swine flu cases” (BBC News, 2009, July 27) and “Global swine flu deaths top 700” (BBC News, 2009, July 5). The former was framing the H1N1 flu pandemic numerically by including U.S. officials’ estimates regarding the number of H1N1 flu cases expected in the next three months. In the latter report, the H1N1 flu pandemic was also communicated numerically but focused more on conveying the death toll count globally rather than just in the United States. A photo accompanied the story of Mexicans wearing masks.

For the control message condition, participants were directed to a page on the CDC website that provided a scientific definition of H1N1 (i.e., what the genetic make-up is of the H1N1 virus and how it differs from other flu strains such as the regular flu strain, the avian bird flu, and the pig flu), its contagiousness (i.e., how the virus mutated as it traveled from pigs to humans), symptoms of the H1N1 flu, and different ways to protect oneself from becoming infected (Centers for Disease Control and Prevention, 2009, August 5).

## 5. MEASURES

### 5.1. Covariates

*Political affiliation.* Participants' political affiliation was measured with a single item, "Generally speaking, do you consider yourself a Republican, Democrat, or Independent?" It may be that because Republicans generally adopt more conservative stances on social issues such as immigration that they may be more affected by the communication used to talk about the H1N1 flu pandemic (i.e., directly related to Mexican immigrants) than Democrats or Independents.

*Attitude toward immigration.* A single item was used to assess participants' general attitude toward immigration. The item was adopted from a study by Ward and Msgoret (2008) and asked participants to describe their general views of immigrants on a scale from (0) very unfavorable to (100) very favorable.

*Aversion to Mexicans*. Using an adapted measure from Parrillo and Donoghue (2005), aversion to Mexicans was measured with a modified version of the Bogardus Social Distance Scale. Participants were asked the extent they would be comfortable having Mexican people admitted to: (a) citizenship to my country, (b) employment in my occupation, (c) my street as neighbors, (d) my club as personal chums, and (e) close kinship by marriage. They were asked to indicate their agreement by marking an X next to the appropriate items. An index was created by summing across the four items. A dummy variable was created to indicate level of Mexican aversion, with two to four items marked coded as (1) to indicate a high level of social aversion toward Mexicans and zero or one item marked coded as (0) to indicate a low level of social aversion toward Mexicans. Participants' class standing, sex, religious affiliation, and ethnicity were also treated as covariates in the analyses.

### 5.2. Outcomes

*Perceived susceptibility for H1N1 flu*. Participants were asked to respond to three items measuring their level of perceived susceptibility regarding the H1N1 flu. They were asked the extent to which they were: (a) likely to get infected with the swine flu in the next 6 months if they do not get the swine flu vaccine, (b) concerned about getting infected with the swine flu in the next 6 months if they do not get the swine flu vaccine, (c) worried about getting infected with the swine flu in the next 6 months if they do not get the swine flu vaccine. The items were assessed on a 7-point Likert-type scale from (1) not at all to (7) very, and averaged across to create an index which yielded good reliability ($\alpha$=.85).

*Perceived severity of the H1N1 flu*. Participants' perceptions regarding the seriousness of H1N1 flu were assessed with three items. Specifically, the items asked: (a) how serious do you think the spread of swine flu is as a health problem, (b) how severe do you think the spread of swine flu is for people living in the U.S. and (c) how severe do you think swine flu is as a health condition? Responses were measured using a 7-point Likert-type scale ranging from (1) not very to (7) very. Items were averaged into an index yielding good reliability (α=.89).

*Attributions regarding spread of the H1N1 flu*. Participants were asked to respond to several items assessing their attributions regarding the spread of the H1N1 flu in the United States. Five items directly attributed the spread of the H1N1 flu in the U.S. to immigration-related factors (e.g., increase in the overall number of immigrants coming to the U.S., increase in the number of Hispanic immigrants coming to the U.S., increase in the number of Mexican immigrants coming to the U.S., ineffective control of U.S.-Mexico border, and illegal immigration). The five immigration-related attributions were averaged into an index and yielded excellent reliability (α=.96). Individuals were asked the extent they attributed the spread the H1N1 flu to these factors ranging from (1) not at all to (7) very much.

*Intent to seek information about the H1N1 flu*. Participants were asked about their intention to seek additional information about the H1N1 flu in the next 6 months for various sources. Specifically, the items asked how likely participants intended to: (a) seek additional information about swine flu, (b) talk to a doctor about swine flu, and (c) search the Internet to learn more about swine flu in the next 6 months. The items were measured on a 7-point Likert-scale ranging from (1) not at all to (7) very likely. The three items were averaged into an index and yielded good reliability (α=.83).

## 6. RESULTS

### 6.1. Descriptive Statistics

Prior to testing the main hypotheses, descriptive statistics were calculated for some of the key variables measured in the study, including: (a) participants' perceived susceptibility for contracting the H1N1 flu, (b) participants' perceived severity regarding the spread of the H1N1 flu virus, (c) extent to which individuals attributed the spread of H1N1 flu to immigration-related factors, (d) intentions to seek more information about the H1N1 flu, and (e) overall attitudes toward immigrants. A summary of the statistics is presented in

**Table 1**. Means and Standard Deviations for Key Study Variables

| Variable | N | M | S.D. |
|---|---|---|---|
| **Perceived susceptibility for contracting the H1N1 flu** | 318 | 3.45 | 1.44 |
| **Perceived severity regarding spread of the H1N1 flu** | 318 | 4.29 | 1.39 |
| **Attribution to immigration-factors for spread of H1N1 flu** | 318 | 3.89 | 1.67 |
| **Intent to seek additional information about H1N1 flu** | 318 | 3.21 | 1.47 |
| **Overall attitude toward immigrants** | 318 | 62.93 | 24.28 |

### 6.2. Test of Hypotheses

To test the first four hypotheses posited, four analyses of covariances (ANCOVAS) were done with perceived H1N1 flu susceptibility, perceived severity of the spread of the H1N1 flu virus, immigration-related attributions for the spread of the H1N1 flu virus, and intention to seek information about the H1N1 flu as the respective dependent variables. For all four ANCOVAs, the independent factor was the framing condition (visual, text, control) that participants were randomly assigned into. The aforementioned covariates were controlled for in the analyses. To test the last hypothesis, an ANCOVA was performed on the data set with immigration-related attributions for the spread of the H1N1 flu virus as the dependent variable and social aversion to Mexicans (low, moderate, high) as the independent factor.

### *6.2.1. Hypothesis one*

The first hypothesis predicted that individuals in the visual condition will report a higher perception of H1N1 flu susceptibility and severity than those in the numerical or control condition. For H1N1 flu susceptibility, the model for the experimental conditions was significant, $F(2, 308) = 21.57$, $p < .001$, partial $\eta^2 = .12$, accounting for approximately 12 percent of the overall variance after controlling for covariates. Specifically, participants exposed to the visual depiction of the spread of the H1N1 flu reported significantly higher perceptions of susceptibility to the H1N1 virus than those exposed to a numerical depiction of the H1N1 flu spread or those exposed to the control message (see Table 2).

Similarly, for perceived severity regarding the spread of the H1N1 flu virus, the model for the conditions was also significant, $F(2, 308) = 18.63$, $p < .001$, partial $\eta^2 = .11$, accounting for 11 percent of the overall variance after controlling for covariates. Participants that saw the spread of the H1N1 virus visually reported significantly higher ratings regarding the severity of the H1N1 flu pandemic than those who only read about the spread of the H1N1 virus or those who received the control message (see Table 2). Overall, H1 was supported.

### *6.2.2. Hypothesis two*

The second hypothesis predicted that individuals in the numerical condition will report higher perceptions of H1N1 flu susceptibility and severity than those in the control condition. Looking at the means, participants who read about the spread of the H1N1 flu virus reported significantly higher perceptions of H1N1 flu susceptibility than those exposed to the control message, but did not differ significantly from this condition with regards to perceptions of severity related to the H1N1 flu pandemic (see Table 2). Thus, H2 was partially supported.

### *6.2.3. Hypothesis three*

The third hypothesis posited that individuals in the visual condition will report a higher intention to seek information about the H1N1 flu than those in the numerical or control condition. The model for the experimental conditions was significant, $F(2, 308) = 12.46$, $p < .001$, partial $\eta^2 = .08$, accounting for approximately 8 percent of the overall variance after controlling for covariates. Participants who received a message visually depicting the spread of the H1N1 flu virus across the U.S. and globally reported significantly greater intentions to seek additional information about the H1N1 flu in the next 6 months than those receiving the control message, but did not differ significantly from those exposed to a numerical message describing the spread of the H1N1 flu (see Table 2). Thus, H3 was partially supported.

### *6.2.4. Hypothesis four*

The fourth hypothesis dealt with how different communication types (numerical or visual) of the H1N1 flu pandemic would affect people's attributions for the rapid spread of the H1N1 virus both within the U.S. and abroad. Specifically, it was predicted that individuals in the visual condition will more likely attribute the spread of the H1N1 flu to immigration-related factors (e.g., increase in the number of Mexican immigrants moving to the U.S., lack of strong border control) than those in the numerical or control condition. The overall model for the experimental conditions was significant, $F(2, 308) = 16.07$, $p < .001$, partial $\eta^2 = .09$, accounting for approximately 9 percent of the overall variance after controlling for covariates. Participants who viewed the spread of the H1N1 flu pandemic unfold via interactive maps reported significantly stronger immigration-related attributions for the rapid spread of the H1N1 virus than either individuals exposed to a numerical description of the spread of the H1N1 flu or those who received the control message (see Table 2). Interestingly, those who received a numerical description of the H1N1 flu pandemic did not report much stronger immigration-related attributions for the rapid spread of the virus compared to participants in the control condition. Based on the data, H4 was supported.

**Table 2.** Adjusted Means and Standard Errors for Outcome Variables by Condition*

| **Susceptibility for Contracting H1N1 Flu** | **M** | **S. E.** | **N** |
|---|---|---|---|
| **A: Visual depiction of spread for H1N1 flu** | 4.09[a] | .13 | 108 |
| **B: Numerical description of spread for H1N1 flu** | 3.37[b] | .14 | 99 |
| **C: Control (scientific description of H1N1 flu)** | 2.89[c] | .13 | 111 |
| **Severity of H1N1 Flu Pandemic** | M | S. E. | N |
| **A: Visual depiction of spread for H1N1 flu** | 4.87[a] | .13 | 108 |
| **B: Numerical description of spread for H1N1 flu** | 4.21[b] | .13 | 99 |
| **C: Control (scientific description of H1N1 flu)** | 3.80[b] | .12 | 111 |
| **Immigration-Related Attributions for H1N1 Flu Pandemic** | M | S. E. | N |
| **A: Visual depiction of spread for H1N1 flu** | 4.54[a] | .15 | 108 |
| **B: Numerical description of spread for H1N1 flu** | 3.73[b] | .15 | 99 |
| **C: Control (scientific description of H1N1 flu)** | 3.41[b] | .14 | 111 |
| **Intentions to Seek More Information About H1N1 Flu** | M | S. E. | N |
| **A: Visual depiction of spread for H1N1 flu** | 3.68[a] | .14 | 108 |
| **B: Numerical description of spread for H1N1 flu** | 3.22[a] | .14 | 99 |
| **C: Control (scientific description of H1N1 flu)** | 2.74[b] | .13 | 111 |

*Note*: All the means were adjusted for the different covariates tested in the ANCOVA models. Within each set of means, those that are significantly different at p<..05 will not share a superscript.

### *6.2.5. Hypothesis five*

The final hypothesis predicted that individuals holding a high level of social aversion toward Mexicans will more likely attribute the spread of the H1N1 flu to immigration-related factors than those holding a low level of social aversion toward Mexicans. Controlling for the other covariates in the study, the overall model was significant, $F(1, 310) = 32.42$, $p < .001$, partial $\eta^2 = .10$, accounting for approximately 10 percent of the overall variance after controlling for covariates.

Specifically, individuals who hold a high level of social aversion toward Mexicans reported significantly higher attributions for the spread of the H1N1 virus to immigration-related factors (adjusted $M = 4.46$, $SE = .13$) than those who hold a low level of social aversion toward Mexicans (adjusted $M = 3.40$, $SE = .12$). H5 was therefore supported.

## 7. DISCUSSION

The purpose of this study was to examine the effects of visual versus numerical communication of the H1N1 flu pandemic on people's perceptions regarding vulnerability in contracting the disease, severity of the pandemic in terms of its spread worldwide, attributions for the rapid transmission of this virus both within the U.S. and across the globe, and intentions to seek additional information about the H1N1 flu. Overall, the results clearly show that a visual representation of the H1N1 flu outbreak can have powerful effects on people's perceptions, especially related to risk judgments. The findings are consistent with previous research that compared the effects of visual vs. numerical communication of similar information on assessments of personal risk (e.g., Parrott et al., 2005) finding that risk perceptions increased when a visual message was used rather than a numerical message in describing the H1N1 flu outbreak. An important implication of this finding is that campaign designers need to consider the type of "packaging" their messages are delivered in and not just think about issues. It may be that there is an interaction between the specific type of message frame used (gain/loss) and the form in which the message is delivered (visual/text) that impacts a person's desire to engage in risk aversive versus risk seeking behaviors. This is an empirical question that future research can examine.

Moreover, it was interesting to find that a visual image (i.e., interactive maps) tracing the transmission of the H1N1 flu outbreak from its origin in Mexico to the U.S. and places abroad could also alter people's attributions for why the H1N1 virus spread as quickly as it did over a span of a few months. Primarily, those who were exposed to the visual message of the H1N1 flu outbreak attributed the rapid spread of the virus to immigrants, in particular, the increase in the number of Mexican and Hispanic immigrants moving to the U.S., as well as to the lack of effective control of the U.S.-Mexico border, and to the increase of illegal immigration in this country. Such an attribution effect was not found among participants who were exposed to the textual frame describing the H1N1 flu outbreak.

This finding has important implications for how the media should consider coverage of not only the H1N1 flu pandemic in the near future, but other disease outbreaks as well. While the use of interactive maps as a message frame may help to more vividly and dramatically depict the severity of disease outbreaks such as the H1N1 virus, and increase the public's perceptions of vulnerability to communicable diseases, thus motivating people to take greater precautions (e.g., washing hands frequently, using hand sanitizers), there may be a downside to using such communication.

The danger is that depending on the geographic origin of the outbreak, people from that region may be discriminated against. In our study, it was found that people who were presented with the visual message for the H1N1 flu outbreak were more likely to attribute the rapid spread of the H1N1 virus to increase in U.S. immigrants (i.e., blaming them for the H1N1 flu outbreak). Such attributions may lead some people to develop racist attitudes toward Mexicans and Hispanics.

Additionally, our study found that among those who already hold aversive attitudes toward Mexicans, framing the H1N1 flu outbreak using visual maps only reinforced their negative attitudes as these individuals reported significantly higher immigrant-related attributions for the rapid spread of the H1N1 virus compared to those received either the numerical message or a control message. So for those who already hold aversive attitudes toward a specific racial/ethnic group, framing a disease outbreak visually by tracing the geographic path of the outbreak may further reinforce feelings of resentment and hatred toward that group if members of that racial/ethnic group are found to immigrate to regions that are part of the outbreak path.

In closing, it is important to consider the consequences of how messages are packaged for public consumption. With regards to outbreaks involving communicable diseases, while there are some good benefits to packaging the information in a visual form rather than in numerical form (e.g., just presenting statistics and facts), it must be acknowledged there are some potential drawbacks as well, in particular, how it may affect people's attitudes toward different racial, ethnic, or cultural groups. While it is important that health campaign designers identify the most effective way to capture the attention of the audience in communicating risk information, scholars need to be wary of unintended negative consequences stemming from something as seemingly innocuous as type of communication.

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