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## Our Issue or Their Issue? Media Coverage and Framing of the Zika Virus Epidemic

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**Abstract:**

How does news media respond to health emergencies abroad? From 2015 to 2018, Zika virus disease spread rapidly throughout Latin America before arriving in the continental US. Despite risks to adults and newborns, it is unclear how media coverage responded and framed the risk for its audience. In this article, we argue that while frequency of coverage was responsive to infections, its content failed to promote proactive health behavior. To assess these claims, we analyze each article (442) dealing with Zika virus published between 2015-2018 by the New York Times. We find that the amount of coverage reflected infections but did not change once the virus arrived in the US. Furthermore, content analysis using the LIWC text analysis program reveals that coverage emphasized differences between communities (those affected and those at home) and that present and past time orientations dominated coverage as opposed to future time orientations.

**Key Words:** epidemic, framing, media coverage, public health, Zika Virus

**1. Introduction**

In late 2014, doctors in Brazil's easternmost tip began treating individuals displaying pink rashes, red eyes, fever, joint pain, and headaches. No individuals were desperately ill and tests ruled out dengue fever and other common diseases. As cases rose, doctors began extensive testing and in May 2015 confirmed the type of virus: Zika. Once Zika's connections to fetal development and neurological diseases solidified, governments across Latin America began declaring national health emergencies (McNeil et al., 2016), beginning with Brazil on 11 November 2015. By the end of 2015, 26 countries and territories in the Americas had confirmed thousands of Zika virus cases as well as syndromes associated with the virus (PAHO, 2020). In response, the World Health Organization (WHO) declared a Public Health Emergency of International Concern (PHEIC), only the fourth time it had been declared.

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This article examines the scope and nature of media coverage regarding Zika virus disease. We built on existing literature which examines the social construction of Zika virus in media (Laurent-Simpson and Lo, 2019; Ribeiro et al 2018) as well as literature seeking to grasp the determinants of coverage. To understand frequency of coverage, we ask: was coverage responsive to the prevalence of infections and how did coverage change once Zika virus was identified in the US? To grasp the nature of coverage, we ask: how was the content of coverage on Zika virus framed, what prescriptions were advocated, and how did content change once the virus was identified in the US?

To answer these questions, we created two novel datasets and conducted a content analysis of all articles published in the New York Times between 2015 and 2018. Our findings demonstrate that after a sluggish start, the frequency of coverage was broadly responsive to the total number of cases in Latin America to the middle of 2016. The frequency of coverage then declined despite confirmed Zika virus infections in the contiguous US, with articles only appearing intermittently after January 2017. As for the nature of coverage, content analysis of 442 articles reveals that coverage did not promote proactive public health responses; it emphasized differences among communities and focused on the past and present as opposed to future time orientations of the virus. This type of coverage was arguably less likely to result in preventive behavior than if the coverage emphasized the risks of the virus and the lessons to be learned from Latin America.

To develop these arguments, this article proceeds in several further sections. Section 2 offers a brief literature review of international news flows and the ability of the news media to shape the public and political agenda. We then introduce our theoretical expectations in Section 3, discuss our data and methods in Section 4, and present our results in Section 5. The article concludes with a discussion of our results and their implications for public health.

## **2. Domestic News Coverage of Disasters**

News media can play an important role in disseminating information during infectious disease outbreaks (Renn, 1992; Wakefield and Elliott, 2003; Hansen, 2018). This—the creation of a risk profile—is increasingly possible on a global scale due to the expanding connections brought about by technology and globalization (Giddens 1991). The shift from the local to the global creates a modern risk environment which allows for knowledge to have a great impact, even if trust needs to be first established by organizations (see Giddens 1991, section IV). As part of global developments, academic work has argued that media can influence public knowledge and perceptions of risk among its readers (Rossmann et al., 2017; Kott and Limaye, 2016; Gislason, 2013) and that it can set the agenda for public

debate and political change (Cohen, 1963; McCombs and Shaw, 1972; Iyengar and Kinder, 2010; Baumgartner and Jones, 2010). News coverage, however, depends on a series of factors which determine the newsworthiness of events, including relevance, cultural affinity, location, and nation hierarchy (Golan 2006). This literature focuses on decision-making processes of the ‘gate-keepers’—the journalists and editors who decide what is included in news and what is left out (Shoemaker & Vos, 2009; Shoemaker, 1996; Tuchman, 1978; White, 1950). In making decisions, professional norms and values dictate the selection of stories, determined by whether items are newsworthy for publication (Bennett, 2006; Galtung and Ruge, 1965; Harcup and O’Neill, 2001, 2017).

However, journalists are not always neutral judges of newsworthiness. For example, several studies have highlighted the vast discrepancies in the frequency of coverage based on the location of distant events (Adams, 1986; Boyd-Barrett, 1979; Chang et al., 1987; Dahlgren, 1982; Galtung, 1971; Lee, 1980; Madec, 1981; Meyer, 1989; Schiller, 1969; Singhal & Sthapitanonda, 1996; Tomlinson, 1991). Similarly, newsgathering logistics (Cho and Lacy, 2000; Leung and Huang, 2007), economic relationships (Chang, 1998; Chang et al., 2000), and cultural affinity (Wu, 2000) help explain systematic differences in the frequency of coverage of distant events.

Beyond frequency of coverage, academic work has sought to understand how the news production process leads to the presentation of dominant frames and narratives. Frames are critical because they can subtly evoke reactions and suggest certain actions for their readers (Greer and Singer, 2017). Authors and editors of news articles ‘encode’ content by imbuing it with genre cues, implied interpretation, narratives, and frames (Hall 1973; 1980). While individual consumers engage in ‘decoding’ these messages, there still remains a risk that these dominant narratives might imply the threats are more distant and less proximate than they are (Hall 1973; 1980). Yet, when news coverage presents distant events as being directly relevant for the local audience, it can set the agenda for preparing for these events at home (Jamieson & Van Belle 2019a; Ribeiro et al 2018). In short, “if the audience can relate with the circumstances, they might identify more easily with the event” (Hanusch, 2008: 342-343). In the absence of identification between communities, and if differences are emphasized between communities, the prospect of policy learning in response to distant events becomes much more remote (Jamieson & Van Belle 2018).

In addition to our contributions to the broader literature on media coverage and framing, this article continues a conversation with literature on Zika virus in particular. Seeking to provide policy recommendations, an early study about Zika virus examined the relationship between news coverage, social media mentions, and online searches in early 2016 (Southwell et al 2016). The authors found that

news coverage of public health announcements creates brief windows of information sharing, issue engagement, and online searching. These windows can be critical in addressing perceptions and providing recommendations for the disease. Turning to framing, Ribeiro and coauthors (2018) analyzed media coverage of Zika among two major newspapers in Brazil and found that coverage was dominated by a ‘war’ frame which focused on eradicating mosquitos and in controlling microcephaly.

In a similar approach but utilizing American news outlets to understand risk perception, Sell et al (2018) found that the vast majority of news stories in the US contained risk-elevating messages (96%) while 64% contained risk-minimizing messages. However, once Zika virus was confirmed in the US, messages changed and varied depending on whether locations had local transmissions. A further study compared the coverage of Zika virus in national to local newspapers in the US. The authors found that local news contained a higher quality coverage, particularly about avoiding infection. On the other hand, their analysis revealed that sensationalist language and imprecise risk information were common in both national and local coverage (Jerit et al 2018).

Putting together the lessons from existing literature on news coverage, the nature of content, and recent work on Zika virus in the media, we begin to form our theoretical expectations. In general, we expect news media coverage to be responsive to Zika virus developments including overall Zika virus cases as well as key events. We also expect that news media interpret distant events as holding lessons for their local community, which could be the catalyst for preventive behavior at home. Finally, we expect coverage and its content to change once Zika virus is found to be transmissible within the US. In the following section, we expand on these theoretical expectations.

### **3. Theory**

#### ***3.1. Frequency of News Coverage***

Given the rapid spread of Zika virus, we expect the frequency of coverage—as measured by the number of articles published about Zika virus—will be positively related to the total number of confirmed cases in Latin America. Although there are differences in coverage depending on the location of the event, our literature review suggests that coverage is generally responsive to events. Professional norms, perceptions of newsworthiness, and news values combine to provide journalists and editors with incentives to cover important stories.

It is also possible that key events lead to increases in coverage of Zika virus. Given our focus on coverage in the US, we expect that as the threat of infection becomes more proximate, there will be an increase in coverage because editors and journalists present Zika virus as a concern close to home. In

this instance, we expect news coverage to be affected by a development seriously endangering Americans: the first American confirmed to have been infected with the virus in the continental US. This is particularly important as it marks a shift from the virus as something that could be prevented by avoiding travel to infected areas to a threat that presents a much greater threat to Americans at home. Collectively, we expect an increase in news coverage of Zika after the shift of the virus as an overseas threat to a domestic one. This leads to our first two hypotheses:

*Hypothesis 1. As the number of total Zika virus cases increases, the number of articles about Zika increases.*

*Hypothesis 2. After the first case of Zika is confirmed in the US mainland, the number of articles about Zika increases.*

### **3.2. The Nature of News Coverage**

Beyond frequency of coverage, previous research demonstrates that newspapers interpret distant events for their local audiences (Jamieson & Van Belle 2018). This is the result of commercial incentives to achieve and sustain an audience, but there are also incentives to set the agenda for policy initiatives in the public interest (Jamieson & Van Belle 2019b). Recent work demonstrates that newspapers are less likely to present distant events as holding lessons for their own community when the affected community has a lower degree of development than the newspaper's community (Jamieson & Van Belle 2019a). The outbreak of Zika virus was primarily located in Latin America, a region which is comparatively less wealthy and less developed than the US. From these lessons, we expect that coverage of Zika virus will reflect perceived differences between the experiences of those affected by the outbreak and the NYT audience. The coverage could reflect perceived differences in several ways.

First, the coverage could feature more self-exclusive pronouns compared to self-inclusive pronouns. Self-inclusive pronouns include the words *I* and *we*, subtly revealing shared experiences. Prior research establishes how language can subtly reveal psychological differences between in-groups and out-groups (Maass et al., 1989; Semin and Fiedler, 1988; Slatcher et al., 2007; Stone and Pennebaker, 2002; Sutton, 2010; Tausczik and Pennebaker, 2010). These differences could prove to be significant in preventing lessons from being learned if they prevent the audience from making connections between overseas events and their own risks of contracting Zika virus.

Because the initial outbreak of Zika virus occurred in distant Brazil, it is likely that NYT coverage reflected implicit beliefs that the disease was unlikely to affect the US. Accordingly, we expect that self-exclusive pronouns would be far more frequent than self-inclusive pronouns in newspaper coverage; that is, the NYT reported the epidemic as affecting *others* and not likely to affect their audience. However, it is possible that there are changes in the use of personal pronouns over time. As the threat of Zika virus become more proximate and after Zika virus was confirmed in the US, we might observe greater use of self-inclusive pronouns and less use of self-exclusive pronouns. If this is the case, coverage would change to reflect the greater likelihood of the newspaper's audience being directly affected. This leads to our third and fourth hypotheses:

*Hypothesis 3. News coverage features more self-exclusive pronouns than self-inclusive pronouns.*

*Hypothesis 4. News coverage features more self-inclusive pronouns after the first confirmed case of Zika virus in the mainland US.*

Next, we expect that news coverage of Zika virus identify the potential future threat for the US. While journalists logically report on events that have already occurred, potentially dangerous events give journalists the opportunity to report about their future consequences and recommended preventative behavior. For instance, the *Los Angeles Times* coverage of the future threat of earthquakes were often the most viewed articles on the newspaper's website (S. Grad, personal communication, October 2, 2017). In our analysis, we expect that NYT coverage of Zika virus focused on its future consequences. As Zika virus spread throughout Latin America, it was inevitable that the disease would infect Americans, either by traveling to the region or as the spread of infected mosquitos arrived in the US.

While coverage of past and present events is also expected, we expect future time orientating to increase even more once the first autochthonous case of Zika virus in the continental US is confirmed. As cases emerge in the US, we expect greater coverage about the ways the country should deal with the risk of infection. This leads to our fifth and sixth hypotheses:

*Hypothesis 5. The time orientation in the coverage of Zika virus includes more future focus than past and present focus.*

*Hypothesis 6. The future time orientation in the coverage of Zika will increase after the first confirmed case of Zika in the mainland US.*

#### **4. Data and Methods**

To test our hypotheses, we analyzed news coverage by the New York Times from the beginning of 2014 to the end of 2018. Widely seen as the newspaper of record (Golan 2006; Skewes & Black 2006) that continues to index with other news providers and influence the political agenda (Golan 2006; McCombs 2004; Dearing and Rogers, 1996; Rogers and Chang, 1991), coverage in the NYT continues to have historical, political, and a strong daily impact (Meeks 2012). It is an award winning newspaper with high national circulation (Tracy 2020) which has been used in an array of content analysis studies including recent work by Zulli (2019), Krumbein (2017), and Di Salvo & Negro (2015). Because of the NYT's reputation and its influence on the public agenda, it is an appropriate news outlet to study the frequency and nature of coverage of Zika virus.

##### **4.1. Case Selection**

Our focus on Zika virus disease rests on its recent severity and rapid spread. Moreover, we can point to a rough beginning and end to the emergency. Zika virus was first identified in Brazil in May 2015. The arrival of Zika virus predated its detection by several months. It had been suggested that the virus either arrived during the 2014 World Cup soccer tournament (12 June to 13 July, 2014) or during the Va'a canoe event held in Rio de Janeiro (12-17 August 2014). However, as Faria et al (2016) find, the arrival of Zika virus occurred between May and December 2013.<sup>1</sup> While Zika infected mosquitos cannot be completely eradicated, we can point to the end of national emergencies and low number of infections as constituting the end of the epidemic, something evident by the beginning of 2018 (see Figure 2).

Our interest in Zika coverage and its content is due to the disease becoming an epidemic and a Public Health Emergency of International Concern. These developments occurred due to its rapid spread and potential health effects, including Guillain-Barré syndrome (GBS) and microcephaly (Latin American Weekly Report, 2016). Microcephaly affects head size, affects brain growth, and may result in convulsions and cause physical and learning disabilities as babies develop (WHO, 2016b). Its connection to microcephaly was established in Brazil where it was significantly more likely to affect newborns in regions with laboratory-confirmed Zika virus transmission (2.8 cases per 10,000) compared to regions

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<sup>1</sup> Massad et al (2017) point to a similar time of arrival: sometime between October 2013 and March 2014.



without (.06 cases per 10,000) and epidemiology research identified temporal and geospatial evidence linking Zika virus disease during the first trimester of pregnancy with the increased birth prevalence of microcephaly (Kleber de Oliveira et al. 2016). Guillain-Barré syndrome is an autoimmune neurological disease in which the body's immune system produces antibodies against its own nerves (Pluta et al., 2011). About 5 percent of patients die from complications, which can include paralysis of the muscles that control breathing, blood infections, lung clots, or cardiac arrest (WHO, 2016a). According to the *John Hopkins Bloomberg School of Public Health*, even if Zika infected mosquitos only attacked 1 percent in the US population, it "would cause more than 704,000 infections, 200 cases of microcephaly and 423 cases of Guillain-Barré. The [conservative] 1-percent attack rate could result in \$1.2 billion in medical costs and productivity losses" (Lee 2017).<sup>2</sup>

Given its spread, health threat, and potential repercussions, the Zika virus emergency represents a key case to examine the nature of the news coverage. Furthermore, given the continued influence of leading broadsheet newspapers on the public and political agenda, it is important to understand when and how newspaper coverage describes infectious diseases to effectively promote preventive behavior.

#### **4.2. Sample of Newspaper Articles**

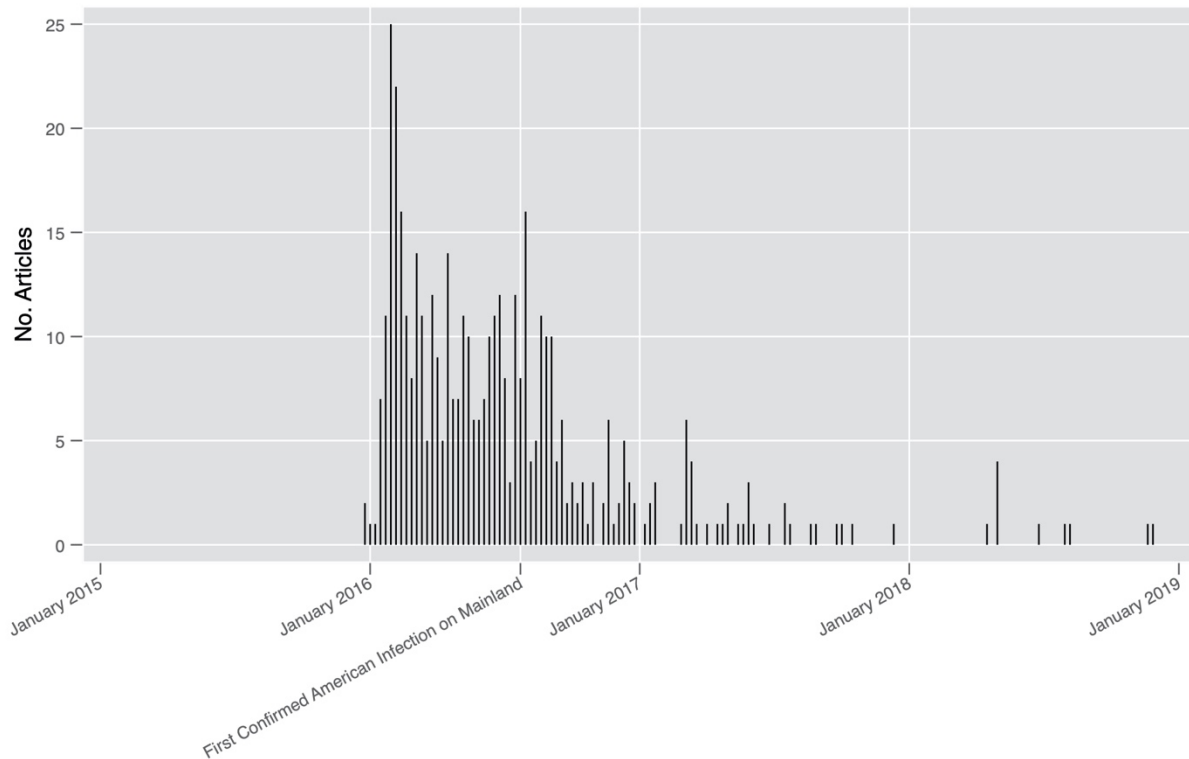
To test our hypotheses, we collected all articles about Zika virus published in the New York Times over a five-year period, from 1 January 2014 to 31 December 2018, inclusive. Articles were collected through a keyword search on LexisNexis Academic using the search terms "Zika" OR "Zika virus" in the NYT in this date range. The initial search returned 921 articles. We were concerned about bias due to articles only containing only passing references to Zika, especially given that the Olympic Games (5-21 August, 2016) were hosted by Rio de Janeiro in the middle of our data collection period.

To mitigate against this possibility, we read each article and retained only those where Zika virus was the primary focus of the story. To provide a common example, an article that discussed the fact an athlete was not participating in the Games because of the risk of contracting Zika would be kept in our sample. Articles covering an event that briefly mentioned that athletes were absent due to Zika virus were discarded.

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<sup>2</sup> <https://www.jhsph.edu/news/news-releases/2017/cost-of-zika-outbreak-in-the-united-states-could-high.html>

**Figure 1. Weekly News Coverage of the Zika Virus in the New York Times, 2015-2018.**



After reviewing articles for relevance, we ended up with 442 articles in the sample. The first article about Zika during this period appeared in the newspaper on 29 December 2015, and the last article in our sample appeared on 28 November 2018. Figure 1 presents the distribution of articles in our sample over time, including the date of the first confirmed American infection on the US mainland.

#### **4.3. The Frequency of News Coverage**

To test our hypotheses, we created two datasets from the corpus of articles. The first dataset is at the weekly level of analysis to determine how situational factors account for the frequency of coverage. The dependent variable for our weekly analysis is the number of NYT articles about Zika virus in a week. This is simply the number of articles per week left in our sample after discarding articles where Zika was a peripheral topic.

We have two independent variables in our analysis of weekly data. The first is the total number of cases (logged) of Zika reported in Latin America for every week from 1 January 2015 to 31 December 2018. This figure is the total number of all autochthonous suspected and confirmed cases of Zika virus in the following countries and territories: Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas,

Barbados, Belize, Bermuda, Bolivia, Bonaire, Saint Eustatius and Saba, Brazil, Canada, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominica, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Saint Barthelemy, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Sint Maarten, Suriname, Trinidad and Tobago, Turks and Caicos Islands, United States of America, Uruguay, Venezuela, Virgin Islands (UK), and Virgin Islands (US). This data is compiled from official statistics produced by country’s health ministries and departments, which is publicly available through the Zika weekly reports published by the PAHO (2020).

The second independent variable is the moment when Zika turned from being a distant threat to Americans to a domestic risk—when the first confirmed case of infection in the continental US occurred in Florida on July 29, 2016. For analysis, this significant change in the threat presented to Americans is aggregated to the weekly level. The event is treated as a dummy variable, where 0 indicates a date that is prior to the event and 1 indicates dates after which the first confirmed case took place.

Adopting the principles of Achen (2006), we limit our models to parsimonious models including only two independent variables. Although this means there are alternative explanations we do not test, the results in the following section indicate that our models account for a large amount of the variation in our dependent variable: the frequency of news coverage of Zika in the NYT. Because our dependent variable is continuous, our primary means of analysis is OLS regression with robust standard errors of our weekly data. To examine the direction of causality, we supplement these models with Granger causality tests.

Table 1 presents descriptive statistics of this data. The table indicates the wide amount of variation in our dependent and independent variables, as well as the dummy variable accounting for coverage before and after key events.

**Table 1. Descriptive Statistics of Weekly Data.**

	<b>Weeks</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min.</b>	<b>Max.</b>
No. Articles	208	2.125	4.153	0	25
Total Cases (Log)	207	7.098	1.565	2.303	11.324
First American infected on mainland confirmed	208	0.611	0.489	0	1

#### 4.4. The Nature of News Coverage

Our second dataset consists of the content of each article. To analyze the content, we used the Linguistic Inquiry and Word Count (LIWC) text analysis program. LIWC is a text analysis program that counts words in psychologically meaningful categories. LIWC is able to detect meaning in text, by identifying words associated with several psychologically-relevant categories, encompassing different emotions, thinking styles, and social concerns (Tausczik and Pennebaker, 2010). We use the updated 2015 dictionary, which builds upon the prior 2007 version, which has performed well in tests of validity (Pennebaker and Francis, 1996; Pennebaker et al., 2015; Tausczik and Pennebaker, 2010).

For the nature of news coverage, our interest centers on two dependent variables. The first is the number of self-exclusive pronouns relative to the number of self-inclusive pronouns, a typology measurable in the LIWC dictionary and used previously in social psychological research about social categorization (Gustafsson Sendén et al., 2013). Table 2 presents examples of the two different kinds of pronouns we examine. Self-inclusive pronouns are analogous to first-person pronouns where people refer to themselves (I, me, mine), or to a collective group to which they identify (we, us, our). Their use could have subtle psychological effects on readers, reinforcing in-group identity between the newspaper, its journalists, its audience, and the people described in the news coverage of a given event. The use of these pronouns could emphasize similarities between the victims of Zika virus and the risks faced by the US. In contrast, self-exclusive pronouns are third-person pronouns where people refer to others (she, her, him), or to a collective group to which they do not identify (they, their, they'd). For Zika virus, the use of these pronouns could emphasize differences between the risks faced by the newspaper and its audience, and the plight of victims of Zika described in its coverage.

**Table 2. Examples of Self-inclusive and Self-exclusive Pronouns.**

	<b>Self-inclusive Pronouns (1st Person Pronouns)</b>	<b>Self-exclusive Pronouns (3rd Person Pronouns)</b>
<b>Individual (Singular Pronouns)</b>	I, me, mine	she, her, him
<b>Collective (Plural Pronouns)</b>	we, us, our	they, their, they'd

Source: Adapted from Gustafsson Sendén et al. (2013) and Pennebaker et al. (2015).

The LIWC program produces outputs for every variable in the dictionary, which consist of the percentage of words in each text that match each category. These scores can then be analyzed to assess

the frequency of variables in the text. However, it is important that theory guide the interpretation and analysis of the variables. To measure the frequency of self-exclusive pronouns, we use the sum of the means of third-person singular pronouns and third-person plural pronouns, respectively. For self-inclusive pronouns, we use the sum of the means of the first-person singular and first-person plural pronouns.

Our second variable of interest regarding the content of coverage is time orientation in the coverage. Time orientation essentially relates to the tense used in the coverage of the epidemic—whether articles primarily refer to the past, the present, or the future. Table 3 presents some examples of words in each of these three categories. As mentioned above, journalism normally covers events that have already occurred, or are occurring at the time of writing. However, potentially dangerous events—including natural disasters and health emergencies—allow journalists to discuss what might happen in the future, particularly in their own community. Not only does this type of coverage fulfill the public service obligations of quality journalism but it also serves commercial imperatives by making distant events relevant for their own audience. We analyzed time orientation by using the mean score produced by the LIWC analysis, which is the percentage of words in a given text that features each kind of time orientation. The analysis of the nature of coverage is simple—we compare the means of the variables. The point of this analysis is to examine the nature of the coverage as it could have implications for public health initiatives in the US in response to the spread of Zika virus abroad.

**Table 3. Examples of Time Orientations.**

Past Focus	Present Focus	Future Focus
ago, did, talked	today, is, now	may, will, soon

Source: Adapted from Pennebaker et al. (2015).

## 5. Results

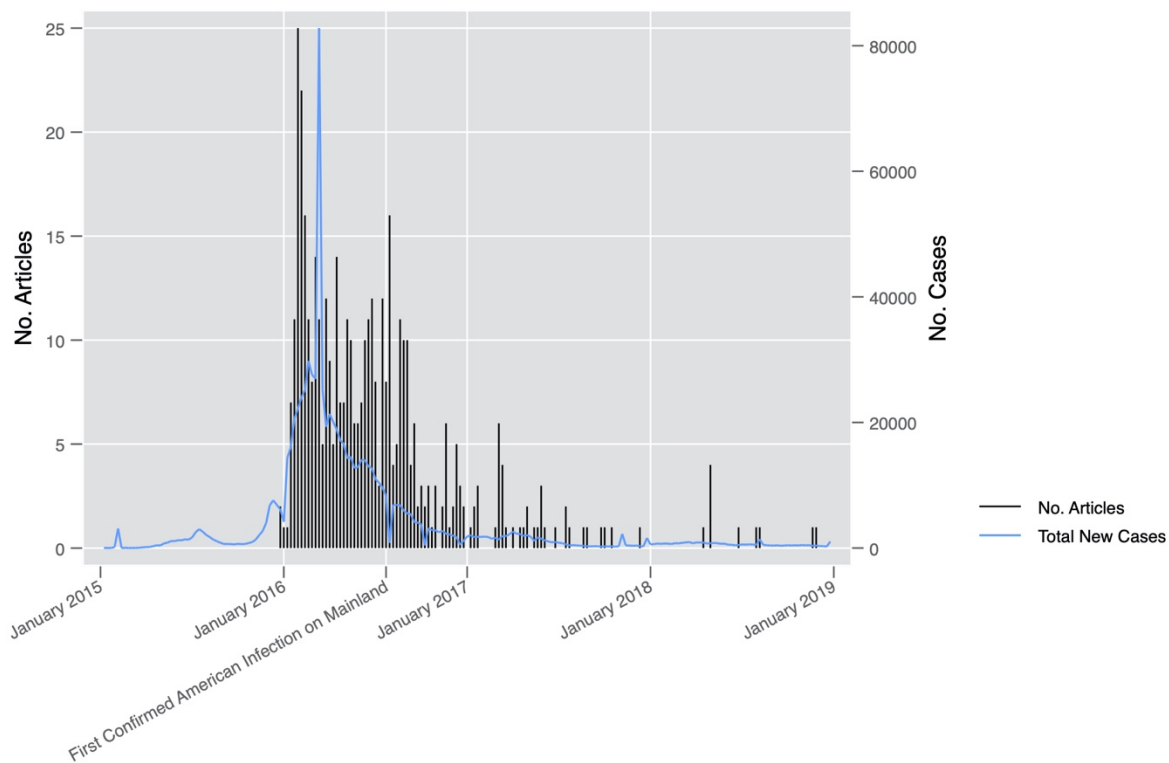
The results indicate support for our theoretical expectations that the frequency of articles about Zika was contingent on the total number of cases of the virus (*Hypothesis 1*) but shed doubt on the impact that the detection of Zika virus in the US had on coverage (*Hypothesis 2*). We find support for our expectations that the coverage featured significantly more self-exclusive pronouns than self-inclusive pronouns (*Hypothesis 3*) but find no changes in these once Zika virus appeared in the US (*Hypothesis 4*).

Finally, our data demonstrates that time orientations of the past and present were much more prevalent than future time orientations (*Hypothesis 5*). Surprisingly, these characteristics did not change once Zika virus was detected within the US (*Hypothesis 6*). The following subsections discuss these findings and their implications in greater detail.

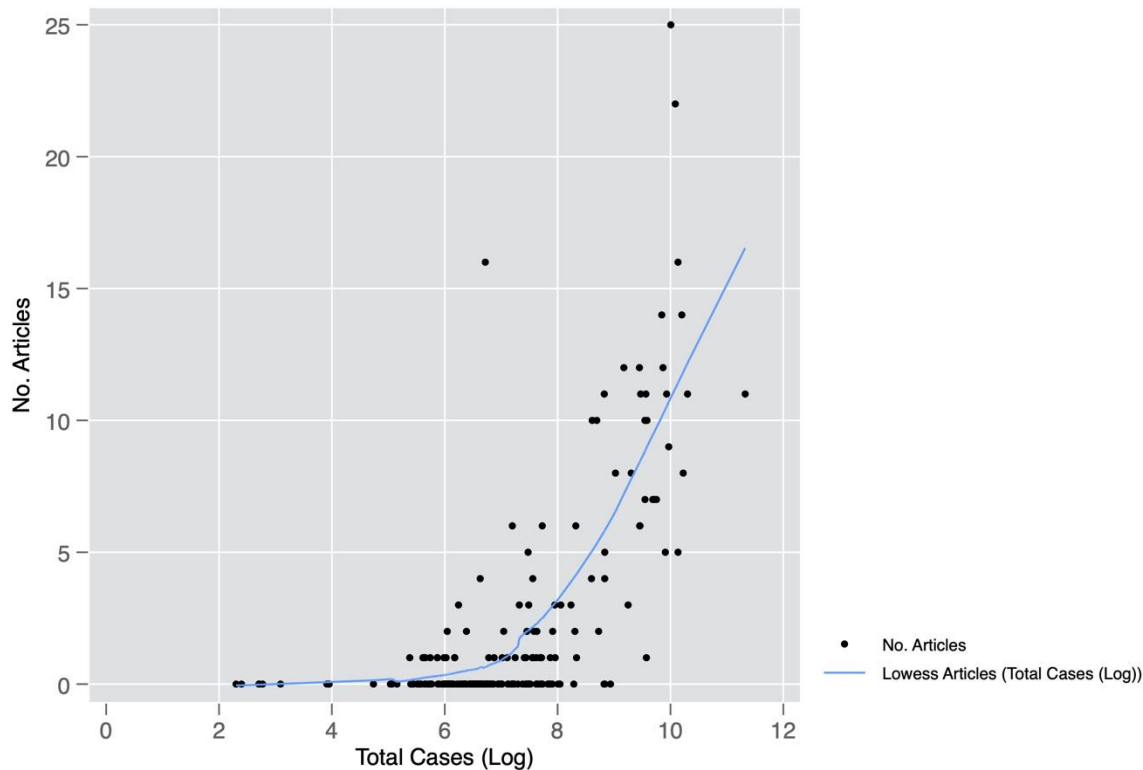
### 5.1. The Frequency of Coverage

First, we examine the relationship between the total number of cases of Zika in Latin America and the number of articles about Zika virus in the NYT, as illustrated in Figure 2 over time. To more clearly demonstrate their relationship, Figure 3 plots the total number of cases (log) on the x-axis and the number of articles on the y-axis, with a locally weighted scatterplot smoothing (lowess) curve fitted to the data.

Figure 2. The Total Number of Cases of Zika and the Frequency of Coverage, by week.



**Figure 3. Scatterplot of the Total Number of Cases of Zika (Log) and the Frequency of Coverage, by week.**



The data suggests that while the relationship between cases and the number of articles is clear, there was a significant time delay in coverage. Significant numbers of Zika virus cases had been reported by May 2015 and the first national health emergency was announced in Brazil on 11 November 2015, yet coverage by the NYT did not begin for several more weeks. Figure 2 demonstrates a complete absence of articles until the first NYT article was published on 29 December 2015.

Although this may be counterintuitive given the dramatic spread of Zika, these results are not surprising. Previous research has identified two processes that result in media coverage delays (Hoffman and Silverberg, 2018). First, there is a delay from an outbreak's index case and the detection of the outbreak by public health authorities. This type of delay depends on the systems in place and their capability to detect disease outbreaks. A second delay exists between an outbreak detection and widespread recognition of the outbreak as an international concern, as was the case with Zika virus. Brazil declared a National Health Emergency on 11 November 2015 yet it was not declared a PHEIC until 1 February 2016, despite the rapid increase in Zika virus cases.

**Table 4. The Frequency of Weekly News Coverage.***Dependent Variable: The Number of Articles about Zika in the New York Times in a week.*

	(1)	(2)
Total Cases (Log)	1.743*** (0.223)	1.656*** (0.203)
First American infected on mainland confirmed		-1.050* (0.482)
Constant	-10.239*** (1.504)	-8.974*** (1.424)
Observations	207	207
$R^2$	0.430	0.444

Standard errors in parentheses

+  $p < 0.1$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ 

Turning to more rigorous tests, Table 4 reports the relationship between our variables of interest. The table demonstrates a positive association between the total number of cases of Zika (log) and the frequency of coverage. A one-unit increase in the natural log of the total cases of Zika is associated with an increase of 1.743 articles in the model with no covariates. These findings also suggest that a critical event—the detection of Zika in the US—appears to have a significant relationship with the number of articles, but not in the expected direction. While the relationship between the number of cases and the number of articles is robust to the inclusion of the incidence of Zika in the continental US, it appears as though Zika becoming a more proximate threat is associated with a reduction in the number of articles about Zika in the NYT.

Against our expectations, this suggests that the frequency of news coverage about Zika was driven less by the threat to the newspapers' audience than the number of total cases. This could perhaps be explained by the fact that cases in the US were relatively low—by the end of our sample in December 2018, there had only been 224 confirmed cases.

To further explore the data and solidify the direction of causality in the relationship between total cases and the number of articles published each week, we conducted Granger causality tests. If there is a causal relationship between variables, variation in the independent variable must temporally precede variation in the dependent variable. Granger causality help determine whether this is true in



the data. In short, for a relationship to be considered as indicating Granger causality, the independent variable should have a statistically significant relationship with the dependent variable, but the reverse p-Value—a test of the reverse relationship with the dependent variable predicting the independent variable—should not indicate a p-Value of less than 0.05 (Hall 2017).

**Table 5. Granger Causality Tests.**

Predictor Variable	Dependent Variable	Granger p-Value	Reverse p-Value	Granger Causality
Total Cases (Log)	No. Articles	0.000	0.159	Yes
First American infected on mainland confirmed	No. Articles	0.000	0.000	No

Table 5 presents the results of our Granger causality tests. Again, we find mixed evidence for our hypotheses. As we expected, the natural log of the total number of cases of Zika Granger causes the number of articles published by the NYT about Zika each week. However, the results indicate that we cannot reject the null hypothesis of reverse causality regarding the confirmation of an infection within the continental US. While reverse causality is implausible, the test indicates we cannot definitively state that the frequency of coverage increased after the first confirmed infection in on the American mainland.

Collectively, these results present evidence in support of the hypothesis that the frequency of news coverage is driven by the total number of cases of Zika, even though the coverage did experience a lag when the virus first began to affect Latin America. However, the expectation that confirmed cases in the continental US increases news coverage is not supported.

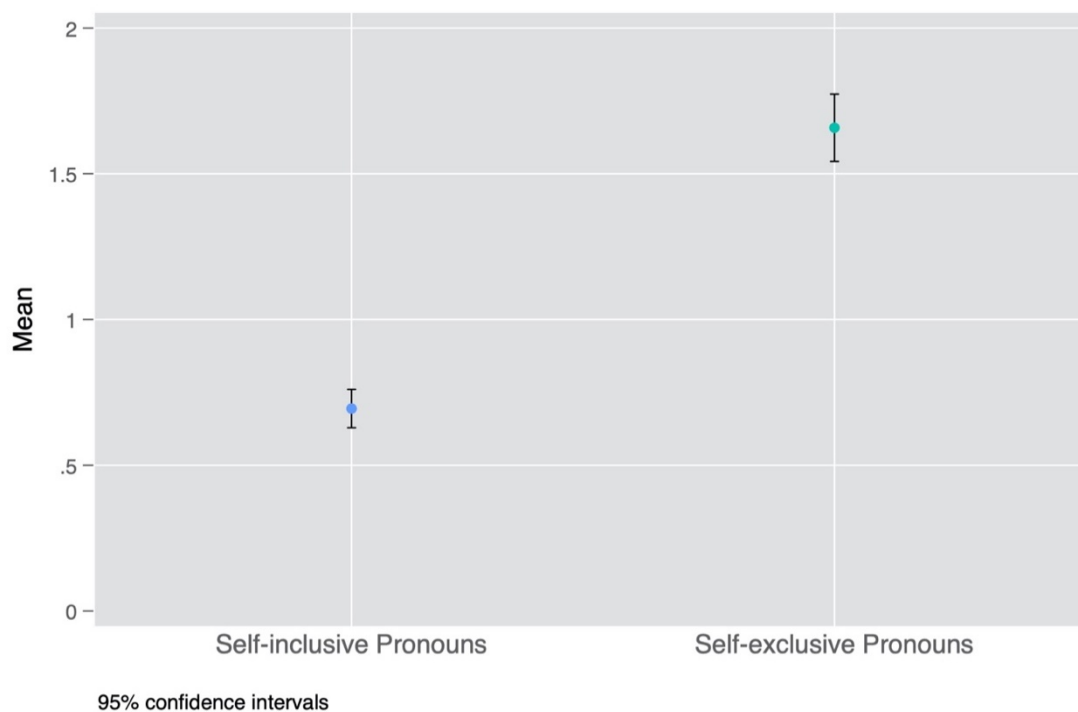
### **5.2. The Nature of coverage**

We also find evidence in support of our hypotheses that the nature of coverage revealed subtle differentiation between communities which could prevent proactive public health initiatives. However, and against our expectations, the identification of Zika within the US had no significant impact on the nature of coverage.

Figure 4 demonstrates that self-exclusive pronouns (e.g. they, their, they'd) were used over twice as frequently as self-inclusive pronouns (e.g. we, us, our). Pronouns help identify focus, priorities, and intentions. Their use is particularly important in demonstrating relationships because they show

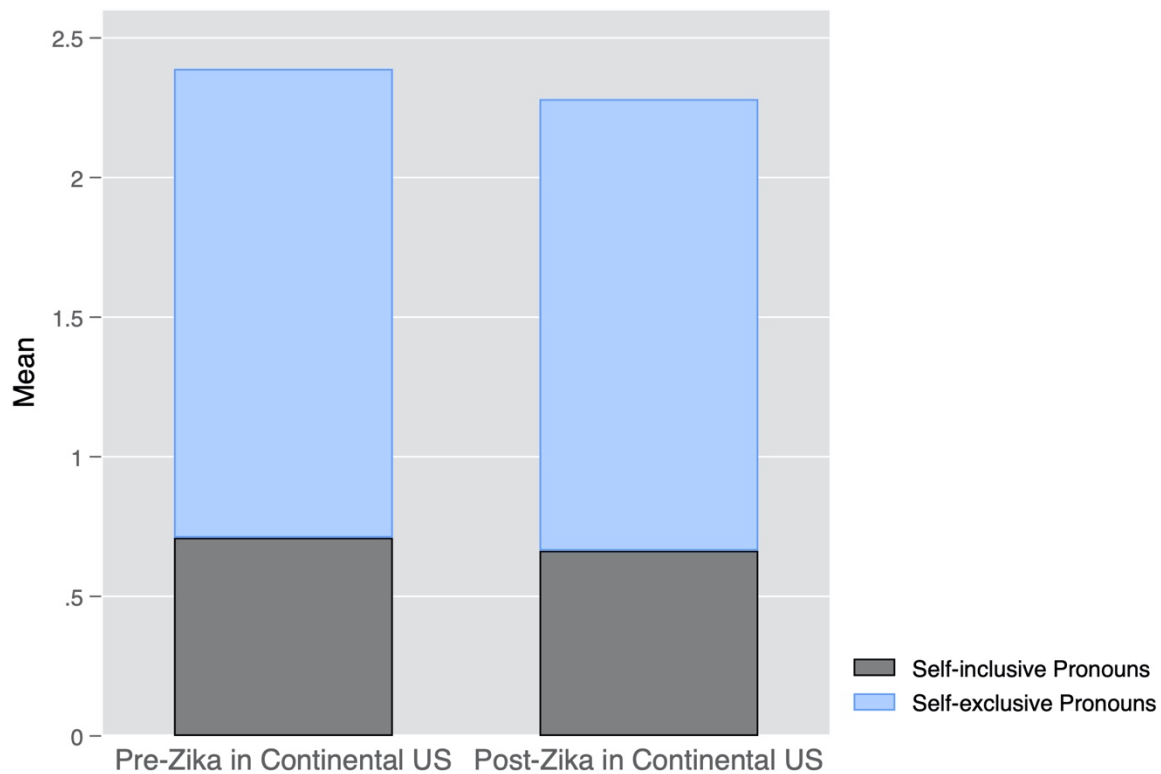
how individuals and groups are referring to each other. The significant difference is surprising given the nature and rapid spread of Zika virus. The virus, which quickly spread from Brazil to the rest of South America, Central America, and the Caribbean would inevitably reach the US, yet the use of self-exclusive pronouns suggests that the NYT understood Zika virus to be an issue of Latin America and not an issue for their audience. Because self-exclusive pronouns were used much more frequently, it is possible that readers did not consider Zika to be a threat for them.

**Figure 4. Self-inclusive and Self-exclusive Pronouns in the News Coverage of Zika.**



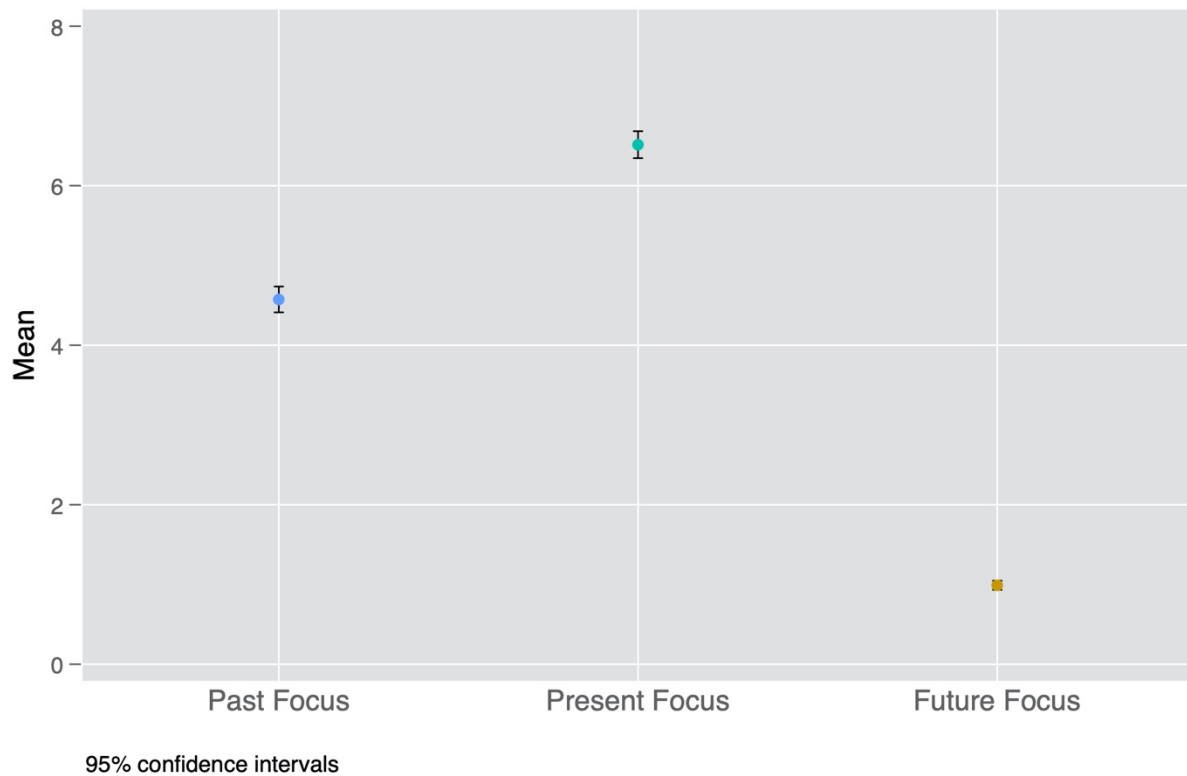
Turning to changes over time, there are no statistically significant differences in the use of self-inclusive or self-exclusive pronouns before and after Zika virus was confirmed to have been contracted by an individual in the continental US. Figure 5 presents a stacked bar graph of the differences in the means of self-inclusive and self-exclusive pronouns after this event took place. The figure illustrates that coverage was very similar during both periods, and the mean of self-inclusive pronouns actually decreased, although this difference was not statistically significant ( $p = 0.51$ ). This kind of coverage is unlikely to have led to any preventive behavior that could have minimized the domestic risks of contracting the virus.

Figure 5. Self-inclusive and Self-exclusive Pronouns in the News Coverage after Confirmed Cases of Zika in the Continental US.



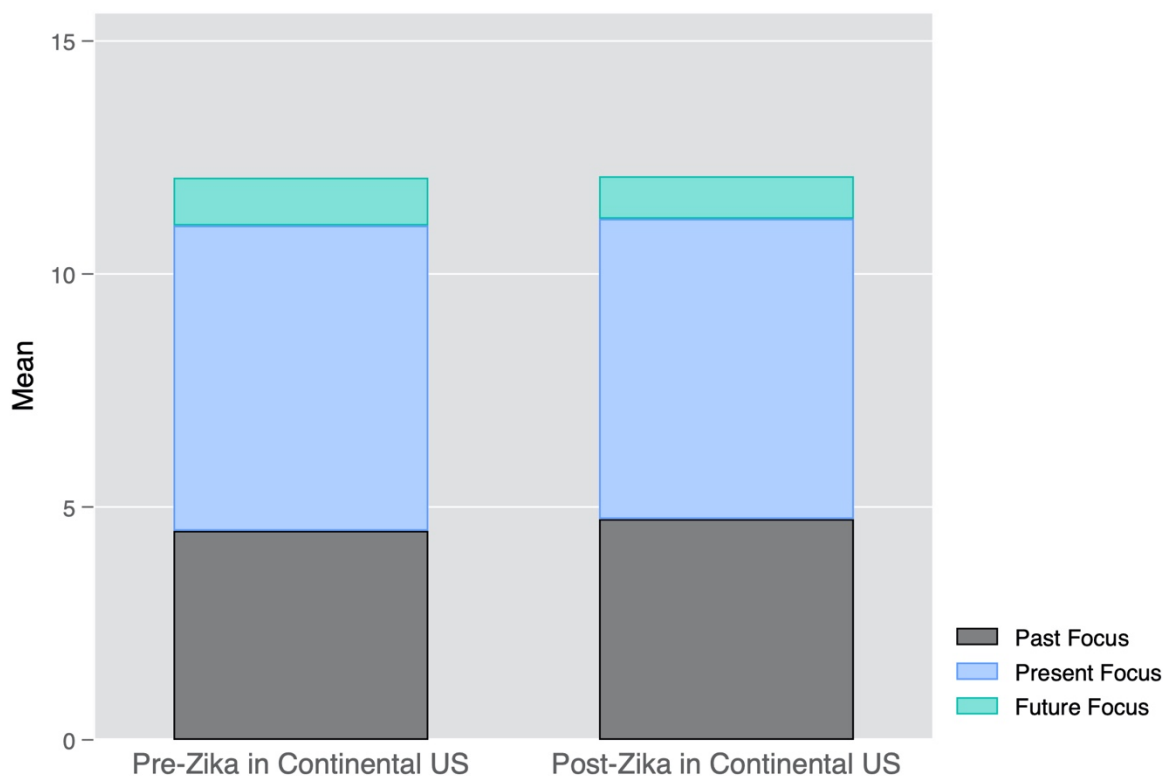
Our analysis is also able to grasp the time orientation of the content of articles. In particular, we are able to distinguish between a past focus (e.g. ago, did, talked), present focus (e.g. today, is, now), and future focus (e.g. may, will, soon). Figure 6 demonstrates that future focus was much less common than past and present focus in the NYT coverage. This has important implications for public health initiatives following the spread of Zika virus. Although it was almost inevitable that the epidemic would spread to the US, the vast majority of the coverage focused on events that had already occurred, and not on the potential for Zika virus to threaten the US. If people do not foresee the virus as a future threat, it is likely that preventive efforts would not be as successful.

Figure 6. Time Orientations in the News Coverage of Zika.



Against our expectations, Figure 7 illustrates that time orientation failed to change once infections in the continental US were confirmed. Means for past focus and present focus remained stable over time, despite the increased risk given the confirmation of Zika virus in Florida. While there were no statistically significant differences in past or present focus between comparison periods, there was a decrease in the mean of future oriented coverage after the confirmed case emerged in the mainland US although the p-value falls just outside standard bounds for statistical significance ( $p = 0.058$ ).

Figure 7. Time Orientations in News Coverage after Confirmed Cases of Zika in the Continental US.



### 5.3. Summary of Results

What picture does our data create regarding Zika virus coverage from 2015 to 2018? Our results indicate that coverage was responsive to events, with a positive association between the weekly number of cases (logged) and the number of articles published each week. However, there is a considerable lag from when the virus was first identified and when coverage begins. Furthermore, there is mixed evidence about the impact that the arrival of Zika virus in the US had on the frequency of coverage. In examining the content of coverage, the data reveal a consistent pattern where coverage implicitly differentiated the risks of Zika to their audience. In particular, coverage was characterized by the greater use of self-exclusive pronouns compared to self-inclusive pronouns. This pattern endured even after the emergence of Zika virus in the continental US. Analysis of time orientation suggests a similar pattern with past and present focus employed to a much greater extent than the future orientation. Against expectations, future focused coverage did not increase after Zika was confirmed in the US.

## 6. Discussion

What should news coverage of health epidemics look like? The potential effects of epidemics mean that it is critical for citizens and politicians to understand their future consequences. If news coverage is to be produced for the public interest, it should attempt to explain the causes, consequences, and any preventative measures related to viruses.

Moreover, it should not treat distant communities as others but be responsive, reflect similarities between communities, and explain potential consequences. Factual and contextualized reporting can be critical in preventing worst case scenarios. This can only occur by identifying potentially affected populations, quickly and consistently reporting on any developments, and explaining how we can protect ourselves. Using news coverage by the New York Times, we find that this was not the case during the Zika virus epidemic in the Americas.

Our analysis demonstrates that coverage did more to emphasize differences between communities than to interpret the spread of the disease as something that could affect Americans. The content of articles demonstrates an implicit focus on citizens of Latin America as distant 'others' (self-inclusive versus self-exclusive pronouns). By creating a gulf between us and them, media framed Zika virus as an issue of Latin America, despite its rapid international spread and despite the low capabilities of Latin American countries to eradicate the virus. As a result, the delay in coverage and its content was arguably less likely to lead to preventive behavior. When media reacts slowly in recognizing and responding to disease outbreaks, the result can lead to a higher number of people affected, a delay in eradicating mosquitoes, and more families affected.

Our analysis, however, does contain limitations. In particular, the NYT could be an outlier. Newspapers in different regions of the US might cover Zika virus in different ways, given both geographic proximity to Latin America and due to the socio-demographic composition of the cities where the newspapers are based. We also expect media coverage to differ in places like Texas and Florida, where Zika virus was most likely to affect individuals given geographically conducive environments for mosquito breeding. Future work can certainly improve on these fronts and attempt to expand the analysis beyond the newspaper of record used here.

Future work can proceed in several ways but here we would like to point out how research can be more receptive to examining media coverage given conditions in Latin American countries. First, future work can examine coverage by country given the unique challenges and capabilities of different countries. In some countries, the spread of the virus may have been out of the control of governments. In Venezuela, a crumbling economy meant less resources for national healthcare and in Ecuador a

strong earthquake allowed Zika virus to spread by creating conditions favorable to mosquito breeding. In cases like these, we should expect a greater concern for individuals in those countries.

Second, in other cases, as in El Salvador, Zika virus raised questions about female reproductive rights and the availability of healthcare. In this case, we should expect framing of media articles not only in health terms but a framing in terms of fundamental human rights and female reproductive rights. On the other hand, the absence of Zika virus in Cuba appeared to bolster perceptions of the nation's strong healthcare system amid the success of their preventative campaign before any autochthonous cases were confirmed. Further empirical research could examine whether our expectations of news coverage in different states reflects their different experiences of the epidemic, and the subsequent policy discussions about healthcare in the public sphere.

Third, our research focuses on the end product – news coverage of the Zika epidemic – and it is beyond the scope of this study to include analysis of the intentions of the journalists involved in communicating risk with the public and best practices according to public health experts. Further scholarship could include interviews with journalists and public health experts to understand how journalists might be able to more effectively communicate risk to their audiences and encourage preventative behavior to address public health threats.

Finally, it is important to understand how journalists perceive their responsibilities during epidemics and pandemics, especially in response to COVID-19. In other news coverage, many newsrooms have recently reexamined their approach to political reporting and adapted to diverge from traditional 'objective' practices to explicitly state where statements from political leaders deviate from the truth. After the COVID-19 pandemic, it is possible that journalists will also reassess their coverage of public health threats and adopt new practices to communicate risk as effectively as possible, even if this means an increased emphasis on predicting future events and straying from previous practices. Future studies should examine both how journalists' perceptions of their role to communicate risk related to public health threats has changed, and what the implications of any changes are for the news coverage of risk. In sum, there are several important areas for future work to address, and we hope this article marks just the beginning of further research and discussion.

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