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# Countering Anti-Vaccination Rumors on Twitter

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## ABSTRACT

This study examined the effects of the counter-rumor on changes in the belief about the anti-vaccination claim, anxiety associated with the rumor, intentions to vaccinate a child and share the rumor. Particularly, we tested whether argument strength, source expertise, as well as the recipient's previously held attitude toward vaccination, could affect these outcomes. First, the pilot tests were conducted to check source expertise (N = 161) and argument strength (N = 74; N = 73) and select sources and messages used in the experiment. A 2 (argument strength: strong vs. weak) x 2 (expertise source: high vs. low) between-subjects factor experimental design was employed, and we conducted an online experiment (N = 400) set up in the Qualtrics. Participants were recruited via *Prolific*, a crowdsourcing website.

The results showed that attitude toward mandatory vaccination had an impact on the change in the belief about the anti-vaccination claim. We also found that source expertise had a significant impact on the change in anxiety. Those who read the counter-rumor from CDC reported greater decrease in their anxiety than those who read the counter-rumor from a layperson user. This finding suggests that heuristic processing occurs in the reception of the anti-vaccination rumor and the counter-rumor that refutes the claim, such that people are less likely to feel anxious about the anti-vaccination rumor when they receive the counter-rumor from high expertise source.

Furthermore, the results showed a significant interaction between argument strength and source expertise on the change in vaccination intention. When participants read the counter-rumor from CDC, they reported greater increase in their intention to vaccinate a child in response to the strong argument than they did in response to the weak argument. On the contrary, when they read the counter-rumor from a layperson user, the opposite pattern appeared, such that they

reported greater increase in their vaccination intention in response to the weak argument than they did in response to the strong argument. This finding reveals that cue-message congruency plays a crucial role in increasing the effectiveness of the counter-rumor and promoting behavioral change.

The theoretical implications of the current findings are discussed in light of cognitive dissonance theory, the dual-process model of information processing, and online rumor literature. The practical implications of the findings are further discussed with regard to designing strategies and interventions that mitigate the harmful consequences of health-related rumors.

# COUNTERING ANTI-VACCINATION RUMORS ON TWITTER

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# CHAPTER 1: INTRODUCTION

Concerns about online health-related rumors have rapidly grown since the Internet has become a popular venue for seeking and sharing health information (Chua & Banerjee, 2017a). Confronted by an ever-increasing volume of health information in today's online environment, people find it difficult to judge the veracity of such information, and this environment has also caused a deluge of unverified claims and false information (Kim, 2018; Tan, Lee, & Chae, 2015).

Social media, in particular, have become a breeding ground for online health rumors. Capitalizing upon the connectedness of social networks, social media sites, notably Twitter, function as key vehicles for expediting online rumor spread (Doerr, Fouz, & Freidrich, 2012). Social media allow people to pass along information instantly to other users through the use of social sharing features, therefore contributing to the far-reaching spread of information (Li & Sakamoto, 2015). These channels also facilitate the spread of health-related rumors. A plethora of misleading health information and health-related hoaxes are being widely circulated on social media, which fuels public confusion and anxiety (Tan et al., 2015). These health rumors may lead to adverse consequences on public health; when these rumors go viral, they not only sway the public conversation but also result in resistance to evidence-based health information among the public (Nagler, 2014).

Anti-vaccination rumors may exemplify the case of health rumors spread on social media that could undermine the public's health decision. The false rumors associated with vaccination, for instance, which claim that measles-mumps-rubella (MMR) causes autism, are known to drive vaccine refusals and hinder MMR eradication (Larson, Cooper, Eskola, Katz, & Ratzan, 2011). The recent nationwide measles outbreak in the U.S. has revealed the growing problem linked to

social media-fueled anti-vaccination movement (Ortutay, 2019). Particularly, due to the collaborative power of the social network that enables users to connect with like-minded others, people can easily fall into the loop of self-referencing and social media often serve as an echo-chamber that reinforces their pre-existing attitudes (Witteman & Zikmund-Fisher, 2012). For this reason, it is important to identify factors that make counter-rumors (i.e., messages that refute rumors) persuasive as a fundamental step to cope with anti-vaccination rumors on social media.

To date, the prior literature with a subject of online rumors has mainly focused on rumor perception and transmission, while relatively little scholarly efforts have been made to examine the effectiveness of the counter-rumor (Ozturk et al., 2015). Moreover, it is unclear what factors could moderate the effects of the counter-rumor in reducing belief in rumors and intention to share these rumors. There is not much research investigating how source and message characteristics of the counter-rumor, as well as the recipient's previously held attitude toward the topic of the message, influence the changes in perception of the rumor and behavioral intentions.

Therefore, the current study aims to study the effectiveness of the counter-rumor by investigating the variables that might enhance or diminish the effects of the counter-rumor. Specifically, drawing upon the theoretical frameworks of cognitive dissonance (Festinger, 1957) and dual-process models (Chaiken, 1980, 1987; Petty & Cacioppo, 1986), it examines whether and how source expertise and argument strength of the counter-rumor, as well as the recipient's previously held attitude toward vaccination, affect one's cognitive, affective, and behavioral responses to the anti-vaccination rumor—one's belief in the anti-vaccination claim, anxiety, intentions to vaccinate a child and share the rumor.

This study holds significance for both theory and practice. On the theoretical front, this study provides insights into the psychological mechanism underlying the effectiveness of the

counter-rumor. The results of this study can help explain moderating influences in shaping the effects of the counter-rumor and develop testable predictions drawn from theories of persuasion. Given that there is little empirical investigation that tests the effects of the counter-rumor in a social media context, this study contributes to the emerging body of online rumor research. On the practical front, this study can offer cues to public health officials and communication professionals to find ways to combat online health rumors. The knowledge about the effects of the counter-rumor can be applied to develop strategies and interventions that curb the menace of online health misinformation and anti-vaccination rumors and mitigate their harmful consequences.

The dissertation is organized as follows. Chapter two reviews the rumor literature; first, we review the key concepts of rumor theory and the body of research pertaining to rumors and counter-rumors on social media. The theories of cognitive dissonance and the dual-process models are also reviewed to build the hypotheses. Next, Chapter three presents the method section; the study design and the experimental procedure, and pilot tests conducted to check and select the stimuli are explained. We also offer the detailed information about measures used to assess the key variables. Chapter four reports the statistical analyses of the data collected from the experiment in relation to the hypotheses and research question. Finally, Chapter five discusses the theoretical and practical implications of the findings and suggests the future directions of the study.

# CHAPTER 2: LITERATURE REVIEW

## Rumor Theory

Rumor has been defined as "an unverified information proposition for belief that bears topical relevance for persons actively involved in its dissemination" (Rosnow & Kimmel, 2000, p .122). This definition highlights the key characteristics of a rumor—importance and ambiguity (Allport & Postman, 1947a). As Allport and Postman (1947a) postulated in their seminal book, *The Psychology of Rumor*, the intensity of rumor lies in the essential conditions of "importance" and "ambiguity." After investigating the features of rumors that were prevalent during the World War II, Allport and Postman (1947a) proposed the formula for the generation and dissemination of a rumor, which emphasizes that the relation between these key factors is not additive but multiplicative ($Rumor \approx importance \times ambiguity$) (p. 33). It implies that if either of the factors is zero, then rumor never occurs. For instance, for a rumor to occur and spread, the content of the rumor must be important to both message sender and recipient. If the message has no importance for people, certainly there is no reason for them to care about and pass along the message to other people. Also, if the message does not contain some degree of ambiguity, then that can be already conceived as facts which no longer require further clarification or interpretation, and there is no rumor that people feel susceptible.

Specifically, in terms of information dimensions, rumor can be distinguished from gossip and news. Rumor and gossip involve informal communication or hearsay, but unlike gossip with limited significance of the content (i.e., idle talk about other people, someone's private life), rumor largely pertains to the topics that people consider more important and relevant and issues of significance for a group (Bordia & DiFonzo, 2004; Rosnow & Kimmel, 2000). Also, rumor can be differentiated from news in terms of veracity. Although rumor shares the element of

topical relevance with news, the former is mostly unverified and lacks "secure standards of evidence" (Allport & Postman, 1947b, p. ix), whereas the latter includes information that is ostensibly checked or confirmed by a credible source (Rosnow & Kimmel, 2000). By its structure, as rumor is constructed around unsubstantiated information, it incorporates a conjecture nature, which is often prefaced with a cautionary note indicating lack of verification such as "I don't know if this is true…" or "I heard that…" (DiFonzo & Bordia, 2007).

The hypothesis-like characteristic of rumors is related to their functions—they help avoid or manage uncertain or threatening events or situations (DiFonzo & Bordia, 2007). From a social psychological perspective, scholars point to rumoring as a process of *collective sense-making* or *problem-solving* (Bordia & DiFonzo, 2004; Shibutani, 1966). As proposed by Fiske (2004), humans have a core motive to understand social situations. Particularly, when people encounter situations of uncertainty, they try to make sense of and explain the meaning or the impact of those situations, and rumor activity serves as a collective effort to resolve such ambiguity and fill the information gap (DiFonzo & Bordia, 1998). Rumor activity is also associated with *threat management* (DiFonzo & Bordia, 2007). In response to the core human motive to control one's environment (Fiske, 2004), when people are faced with unexpected circumstances in which they feel that their welfare is endangered, they often turn to rumors to cope with or act against threats and reduce the possible negative outcomes (DiFonzo & Bordia, 2007). For example, rumors especially ripple in the outbreak of catastrophic events such as disasters (e.g., earthquakes, floods, nuclear accidents) (Prasad, 1935; Turner, 1994) and intergroup conflicts (Knopf, 1975). In the face of such threatening situations where may imperil one's life or health, rumors function to help groups to prepare for threats and find ways to gain a sense of control (DiFonzo & Bordia,

2007). In this vein, *rumor mongering* can be viewed as a collective transaction to make sense of and manage threats amid uncertainty.

In addition to the cognitive aspect of rumors (i.e., uncertainty), rumor transmission involves also an affective dimension represented in anxiety (Anthony, 1973; Jaeger, Anthony, & Rosnow, 1980; Rosnow, Esposito, & Gibney, 1988; Walker & Beckerle, 1987). Jaeger, Anthony, and Rosnow (1980) measured the trait anxiety of students and tested the effects of an experimentally manipulated rumor about some students' marijuana use. The researchers found that participants high in anxiety were more likely to spread this rumor than those low in anxiety. Walker and Beckerle (1987) further manipulated state anxiety, planting anxiety-enhancing and anxiety-reducing rumors. It was also found that those who were highly anxious transmitted the rumor more often than those who were less anxious. Simply put, the more anxious a person feels, the more likely he or she spreads a rumor. Hence, rumor can be viewed as a verbal outlet to relieve emotional pressure by elaborating uncertain information (Oh, Kwon, & Rao, 2010).

In this way, in the stage of rumor transmission, people become motivated to spread rumors to resolve ambiguity and alleviate anxiety. On the other hand, the process in which the veracity of rumor is assessed occurs in between the generation and transmission stages (DiFonzo & Bordia, 2007). Prior research has identified the belief in a rumor as another key factor of rumor spread (Rosnow, 1991; Rosnow et al., 1988); it has been found that individuals are more inclined to pass along a rumor they believe is true than the one they believe is false (Rosnow, Yost, Esposito, 1986). For example, in their study which surveyed workers experiencing a labor dispute, Rosnow et al. (1986) reported that there was a linear relationship between belief in the rumor about a strike threat and the likelihood of its transmission. Similar findings were also reported across a variety of contexts, including the acceptance and transmission of rumors

surrounding the violent crime (Rosnow et al., 1988), or the sniper shootings on college campus (Pezzo & Beckstead, 2006), and rumors about AIDS (Kimmel & Keefer, 1991).

Despite their inclination to discern the truth of a rumor, however, people are often bad at this task (DiFonzo & Bordia, 2007). False rumors gain popularity in many occasions and are widely accepted by the public. One of the factors that influence belief in a rumor pertains to the degree of consistency with the rumor recipient's previously held attitude. Researchers have claimed that attitude-consistent rumors tend to be accepted by recipients; if a rumor supports what the recipient already believes to be true, it is likely that he or she would lend greater credence to it (Allport & Postman, 1947a, 1947b; Ambrosini, 1983; Festinger et al., 1948; Knapp, 1944). This approach arises from Festinger's (1957) *cognitive dissonance* theory that suggests that humans strive to maintain internal psychological consistency by accepting the information congruent with their preexisting beliefs, and actively avoiding the information that contradicts their beliefs. For example, a large body of research noted that prejudicial attitudes toward certain social, religious, and racial groups significantly influenced the belief in rumors: Belief in rumors across various social contexts, such as rumors about incidents of African-Americans' criminal tendencies (e.g., Allport & Postman, 1947a, 1947b), wedge-driving rumors in wartime (e.g., "the Catholics in America are trying to evade the draft," Knapp, 1944, p. 24), and rumors stimulating anti-communist sentiments (Festinger et al., 1948), were found to be related to individuals' existing prejudiced viewpoints.

In this regard, rumor can also be viewed to assist the process of "justification construction" that supports the desired conclusion (Kunda, 1990, p. 483). As Kunda (1990) labeled it as the mechanisms for *motivated directional biases*, such mechanisms imply that humans are more likely to arrive at particular, directional conclusions that they want to arrive at

(p. 480), rather than attending to relevant information more carefully to yield accurate conclusions. To put it simply, people are motivated to believe what they want to believe. Kunda (1990) also noted that this justification process is illusionary because individuals often do not even recognize that their reasoning is biased by their goals: They search the memory for the beliefs that could be used to support the desired conclusion, and access knowledge to construct beliefs that could logically support the desired conclusion (p. 483). In the context of rumor perception, this biased reasoning can be certainly found. When evaluating rumors, people are inclined to favor and trust those that justify their previously held attitudes or beliefs (DiFonzo & Bordia, 2007). As stated by scholars in the rumor literature (e.g., Allport & Postman, 1947a, 1947b; Knapp, 1944; Rosenthal, 1971), rumor gains legitimacy when it is consistent with the desired belief structures, and it serves to rationalize the biased attitude among individuals.

Another key factor influencing belief in rumor is the perceived credibility of a source. As research in persuasion has argued that source credibility is related to attitude formation and change (e.g., Eagly & Chaiken, 1993; Hovland & Weiss, 1951; Petty & Cacioppo, 1986), it is likely that the communicator's credibility has a significant influence on the belief in a rumor message (Difonzo & Bordia, 2007). The cognitive theories of persuasion—the dual process models such as the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986) and the Heuristic-Systematic Model (HSM; Chaiken, 1980, 1987)—suggested that the characteristics of a source, in particular, source credibility can affect the effectiveness of communication when a person's motivation or ability to process information is low. When a message comes from a more credible communicator, recipients are more likely to be persuaded by the message (Petty, Cacioppo, & Goldman, 1981). In the context of rumor perception, attribution to a credible, well-positioned source can be also found. Knapp (1944) argued that "good" (successful) rumor tends

to be attributed to a high authoritative source: “This gives the rumor both prestige and the appearance of veracity” (p. 30). In a similar way, Blake, McFaul, and Porter (1974) found that when rumors are heard from a high authority and media source, the believability of those rumors increases. In accordance with those conclusions, Porter (1984) reported that rumor communicator’s credibility was moderately to strongly correlated with the belief in rumors about birth control. Taken together, these findings indicate that source credibility can be a key determinant of rumor believability.

**Rumors and Counter-Rumors on Social Media**

Rumors usually spread by word-of-mouth, which is passed along from one person to another (Allport & Postman, 1947a). However, with the rise of the computer-mediated channels such as the Internet and social networking sites (SNSs), this mode of transmission has become much amplified. The proliferation of interactive media technologies has expedited rumor propagation by facilitating people to pass along online rumors: These technologies allow information to travel faster and further than ever before (Chua, Tee, Pang, & Lim, 2017).

Capitalizing on the connectedness of social networks, SNSs, notably Twitter, have become a key vehicle for precipitating online rumor spread (Doerr et al., 2012). Twitter plays a crucial role in conveying and sharing rumor messages. In a Twitter environment, people can post a brief message of up to 280 characters, called tweets. These messages are immediately broadcast to the audience, including a user’s followers (Li & Sakamoto, 2015). Particularly, the interactive feature of “retweet” enables users to easily share and forward information to their followers with a single click, thereby contributing to the instant and far-reaching dissemination of information. Moreover, since rumors are typically short expressions in structure that consists of a small set of statements signaling what people are unsure about, (Difonzo & Bordia, 2007),

the tweet that imposes a length restriction of 280 characters functions as a popular online rumor message.

As rumors spread on social media, the overflow of those rumors calls for attention from scholars. While interactive technologies and social media platforms facilitate real-time information creation and propagation (Jansen, Zhang, Sobel, & Chowdury, 2009; Sankaranarayanan, Samet, Teitler, Lieberman & Sperling, 2009; Sutton, Palen, & Shklovski, 2008), there have been growing concerns about the accuracy and credibility of information transmitted by these technologies. In times of large-scale crises (e.g., national disaster, terrorist attack, disease outbreak), a plethora of misleading or false information is being widely circulated on social networks (Friggeri, Adamic, Eckles, & Cheng, 2014; Starrbirbird, Maddock, Orand, & Mason, 2014). In fact, social media have potential to serve as a "social reporting" tool that allows users to be the first responders who can gather community intelligence and leverage effective responses during social crises (Li & Rao, 2010; Oh, Agrawal, & Lao, 2013). Despite these advantages, the deluge of misinformation circulated on social media raises the question about the efficacy of social media as a major hub of information, and thus, they are often denigrated as "a collective rumor mill" that spreads unsubstantiated claims, in extreme cases, fabricated content, or so-called *fake news* (Leberecht, 2010; Oh et al., 2013).

A growing body of literature has examined the underlying mechanisms of rumor perception and transmission in the social media context. Several prior works on online rumors have traced the pattern of rumor spread and the ways in which social network structures affect its pattern (e.g., Friggeri et al., 2014; Kwon & Cha, 2014; Shin, Jian, Driscoll, & Bar, 2017; Vosoughi, Roy, & Aral, 2018). In the social media context, particularly on Twitter, a rumor diffusion process has been typically characterized by "having one or more cascades, which we

define as instances of a rumor spreading pattern that exhibit an unbroken retweet chain with a common, singular origin" (Vosoughi, Roy, & Aral, 2018, p. 1). A rumor cascade, for example, starts when a user posts a tweet message (e.g., text, photo, link to an article) that contains a claim about the topic. Other users then propagate the rumor by retweeting it.

In the large-scale empirical analysis of true and false information from six fact-checking organizations, Vosoughi et al. (2018) found that misinformation diffused significantly farther and faster than the truth of all categories (e.g., politics, terrorism, national disaster, science), and such misinformation was more novel than the truth. Friggeri et al. (2014) traced the rumor transmission on Facebook and analyzed the path that rumors spread across social networks. They found that rumor cascades tended to run deeper in social networks than reshare cascades, and a reshare of a rumor was deleted if it received a comment containing the link to a fact-checking article (Friggeri et al., 2014). Their results also revealed the persistency of rumors. The popularity of rumors exhibited bursty patterns, which means that rumors never quite died out; rumors were often dormant for weeks or months, and then they became popular again through an external shock or spontaneously (Friggeri et al., 2014).

Other studies have similarly reported the bursty temporal patterns of rumor transmission. Kwon & Cha (2014) showed that rumors spread in spiky patterns that involve multiple periodic peaks and long life spans. Another study that conducted the analysis of political rumors on Twitter found that homophilous network structures plays a crucial role in rumor transmission, such that rumor spreaders exhibited strong partisan structures wherein they selectively transmitted negative rumors about opposing candidates (Shin et al., 2017). These results indicated that Twitter enabled the circulation of false rumors via homophilous networks (Shin et al., 2017).

While aforementioned studies have explored how rumors spread, scholars have also investigated factors that drive users to trust and share rumors on social media (Chua, Banerjee, Guan, Xian, & Peng, 2016). These studies tend to focus on the characteristics of rumors that include source ambiguity and content-related factors (e.g., length, the presence of images, sentiment) (e.g., Chua et al., 2016; Kim & Bock, 2011; Oh et al., 2010; Oh et al., 2013). Oh et al. (2013), for instance, investigated the antecedents of rumormongering on Twitter using data collected from three social crises (i.e., the Mumbai Terrorist attacks, the Toyota recall, the Seattle café shooting incident). Their analysis showed that the factors of source ambiguity, personal involvement, and anxiety predicted the rumor spread under social crisis situations (Oh et al., 2013).

Chua et al. (2016) examined how content-related factors—such as the length of a rumor, the textual or pictorial rumor, and positive or negative sentiment in a rumor—as well as the risk propensity (i.e., an individual's tendency to take risks based on the assessment of potential consequences), might jointly affect intention to trust and share rumors in the context of online health-related rumors. They found that long and textual rumors were more likely to be trusted and shared than short and pictorial rumors regardless of risk propensity (Chua et al., 2016). In addition, their results indicated that negative rumors were perceived differently among risk-adverse and risk-seeking users, such that risk-adverse users were reluctant to trust and share negative rumors, whereas risk-seeking users were reluctant to trust but prone to share negative rumors. This study holds significance for both theory and method, since it provides empirical evidence about differential perceptions of rumor characteristics as a function of the individual difference and experimentally tests the proposed relationships.

Furthermore, Kim and Bock (2011) explored the cognitive and emotional mechanisms of online rumor spread. In the context of the online rumor about a Korean celebrity, this study found that informational factors (i.e., source credibility, argument strength, a rumor recipient's prior attitude, issue involvement) and normative factors (i.e., consensus) led to emotional responses to a rumor and thus contributed to rumor spread online (Kim & Bock, 2011). This study contributes to the online rumor literature, as it attempts to incorporate various dimensions of informational factors related to online rumors and uncover the extent to which these factors influence users' emotions and thus affect their sharing decision.

Another key emerging strand of online rumor research is the study about counter-rumors. In response to the spread of false rumors online, scholars have begun to examine ways to mitigate the impact of rumors on users through counter-rumors (Ozturk et al., 2015; Tanaka, Sakamoto, & Matsuka, 2012). *Counter-rumor* is defined as a message that refutes or debunks a rumor (Chua & Banerjee, 2017b). It is often interchangeably called "rumor refutation" (Ozturk, Li, & Sakamoto, 2015), "rumor denial" (Bordia, DiFonzo, Haines, & Chaseling, 2005), or "rumor correction message" (Chua et al., 2017). This type of message is a commonly used a strategy to reduce people's belief in a rumor, therefore leading people to be less likely to be misinformed (Bordia, DiFonzo, & Schulz, 2000; Bordia, DiFonzo, & Travers, 1998).

Scholars have also suggested that there are different types of rumor refutation strategies such as "factual elaboration" which gives an emphasis on facts (reinforcing correct facts), and "simple rebuttal" (using fewer statements in refuting the false rumor) (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012; van der Meer & Jin, 2019). Besides, the source of the corrective message matters in the evaluation of the counter-rumor (Nyhan & Reifler, 2012) and how the credibility of such source is perceived in the online environment. When false rumors thrive in

sizable segments of the population, expert sources (including government and public health agencies) and news agencies generally intervene through issuing messages to control the spread of rumors. However, with the growth of online and social media channels which allow low levels of entry barrier and yet lack established gatekeeping mechanisms, individuals can react against the spread of rumors through user-generated messages (Ozturk et al., 2015). For example, users can counter the rumor spread directly by posting comments/messages questioning or denouncing the veracity of the rumor. Moreover, when some information is not easily verifiable through official sources, such participation is likely to be observed (Ozturk et al., 2015).

Some prior works have tested the effectiveness of counter-rumors in mitigating the rumor spread (e.g., Ozturk et al., 2015; Tanaka et al., 2012). Tanaka et al. (2012) examined the effects of exposure to counter-rumors on people's intent to spread rumors on Twitter. This study found that when people were exposed to counter-rumors before rumors, rumor spread was significantly decreased, compared to when they were exposed to rumors before counter-rumors. Extending this work, Ozturk et al. (2015) further tested several design ideas for reducing the spread of rumors—for instance, the designs tested in this study include displaying only rumors, only counter-rumors, rumors with corresponding counter-rumors, and rumors with a warning statement (i.e., "The content of this tweet had appeared in a rumor website"). It appears that pairing rumors with counter-rumors or a warning statement was effective at reducing the spread of rumors; participants were less likely to share rumors in the presence of counter-rumors or a warning message.

Despite these scholarly efforts to explore ways to reduce the spread of rumors on social media, to date, there is not much research identifying factors that make counter-rumors persuasive. Particularly, it is unclear how source and message characteristics of counter-rumors

can play in such mechanism. Furthermore, we know little about the role of the individual difference, such as the rumor recipient's previously held attitude, in the perception of counter-rumors. Given that an individual's prior attitude affects the acceptance of rumors (Allport & Postman, 1947a, 1947b), it is also important to investigate whether this factor may moderate the effectiveness of counter-rumors. To contribute to the literature, the present study seeks to uncover the psychological mechanism underlying the effectiveness of counter-rumors by clarifying the key determinants that shape decision to trust and share these messages.

**Anti-Vaccination Rumors on Twitter**

Rumors associated with the health domain are pervasive on social media (Qi, Banerjee, & Chua, 2017). The disease outbreak, for example, has spawned a number of false rumors. During the Ebola outbreak in 2014, numerous misinformation and conspiracy theories were being circulated on Twitter, that "Ebola could be airborne in some cases," "Health officials might inject Ebola patients with lethal substances" or "Ebola vaccine only works on white people" (Jin et al., 2014, p. 91). Also, false rumors related to the issue of vaccination, which claim that MMR vaccine causes autism, drive vaccination refusals and hinder public health officials' efforts for immunization (Larson et al., 2011).

The prevalence of health-related hoaxes could lead to damaging consequences on the public health (Chua and Banerjee, 2017a). Some liken the mechanism of rumor spread to the propagation of viruses (Jin, Dougherty, Saraf, Cao, & Ramakrishnan, 2013). When users encounter rumors, they are likely to share the entries with other users. In other words, those who are infected with false rumors could infect others in their social networks without questioning the accuracy of those rumors (Chua et al., 2016). When rumors go viral, they not only cause confusion but also result in resistance to health recommendations among the public (Chua &

Banerjee, 2017a; Nagler, 2014). Exposure to health rumors may adversely affect people's health behaviors (DeClerque, Tsui, Abul-Ata, & Barcelona, 1986; Tan et al., 2015). Rumors about contraceptive use causes weakness, for instance, were found to be related to its decreased use among Egyptian women (DeClerque et al., 1986). If rumors were left unrefuted, such rumors could have undermined public trust and adoption of evidence-based health efforts and worsen the spread of the epidemic (Oyeyemi, Gabarron, & Wynn, 2014; Tan et al., 2015). Also, if rumors about vaccination persist on social media, it could have a detrimental impact on the public's intent to get vaccinated, thereby causing vaccination refusals and deteriorating the vaccine-preventable disease outbreaks (e.g., measles, pertussis, poliomyelitis) (Larson et al., 2011). Given the societal cost of health misinformation and rumors, it is therefore vital to find ways to counter these rumors.

Vaccine-related rumors particularly thrive online. The proliferation of those new media platforms that allow for the rapid sharing of information enables vaccine-related rumors to become widespread online (Witteman & Zikmund-Fisher, 2012). As the advent of new media technologies facilitates the two-way, interactive communication among users (Lewandowsky et al., 2012), it has transformed the communication environment around vaccines "from top-down, expert-to-consumer (vertical) communication towards non-hierarchical, dialogue-based (horizontal) communication" (Larson et al., 2011, p. 528). The public increasingly questions recommendations made by health experts and organizations, creates or engages with online communities that argue against or for vaccines, and shares vaccine-related information (and misinformation) through the use of social sharing buttons (Larson et al., 2011; Lewandowsky et al., 2012). In fact, much of the web-based vaccine information contains anti-vaccine content (Bean, 2011; Keelan, Pavri, Balakrishnan, & Wilson, 2010), and such information often employs

the scientific-sounding language to lend credence to anti-vaccine content (Jones et al., 2012; Kata, 2012).

Social media which enable the connectedness among users have become a breeding ground for anti-vaccination activists (Dredze, Broniatowski, Smith, & Hilyard, 2016). These sites provide unprecedented, real-time access to attitudes and beliefs of other people as well as the vast amount of information available online (Dredze et al., 2016). Twitter especially has become as a key source of vaccination information (Love, Himelboim, Holton, & Stewart, 2013). Twitter allows users to readily post and share a message to their followers with a single click, therefore resulting in the rapid spread of the message to a broad audience (Li & Sakamoto, 2015). The retweet function amplifies the virality of the message; for example, if a public figure tweets about vaccines, millions of followers instantly read this tweet and can retweet it to other users. Indeed, anti-vaccination sentiment was often magnified by public figures such as Jenny McCarthy and Robert F. Kennedy Jr. who tweeted about vaccination and its link with autism (Kata, 2012).

Twitter also enables users to connect with other like-minded people (Witteman & Zikmund-Fisher, 2012). The connective power of the social network brings together those who were considered as outliers or small extremist groups—and allows them to easily and uncritically interact with like-minded others (Kata, 2012). On the downside, it can be easy to fall into the pitfall of self-referencing and thus reinforcing the networks that "can fool users into believing there are many who share their beliefs, when in reality it may only be a small committed group" (Kata, 2012, p. 3779). The influence of like-minded others facilitated by the social network on Twitter can exacerbate the polarization of opinions in online vaccination debate (Witteman & Zikmund-Fisher, 2012).

**Cognitive Dissonance Theory and Confirmation Bias**

In explicating the psychodynamics underlying rumor perception and sharing, one of the key factors that may account for such mechanisms is the role of prior attitude (DiFonzo & Bordia, 2007). As previously discussed, motivated reasoning (Kunda, 1990) may occur in rumor belief and transmission. Since people are motivated to draw the conclusion that they want to arrive at (Kunda, 1990), such biased reasoning can be applied to determine the extent to which they trust and share rumors. The motivation to reach the desired conclusion may bias the evaluation of rumors, hence, it is possible that they favor and accept the rumors that are consistent with their previously held attitudes, yet they actively avoid and reject the information or claims that counter to their attitudes (Allport & Postman, 1947a, 1947b; Knapp, 1944).

Festinger's (1957) *cognitive dissonance* theory explains how humans construct and sustain their biased beliefs. This theory was inspired by an investigation of rumors following an earthquake in India in 1934. In a study of rumor spread during the Indian earthquake, Festinger (1957) wondered why fear-arousing rumors about worse disasters to come were widely accepted and circulated among earthquake survivors. He suggested that the experience of having survived a severe earthquake created the dissonance, and rumors offered survivors something to be frightened about, which means that they actually serve as "fear-justifying" rumors (Festinger, 1957). In other words, rumors were found to provide people with information that fits with what they already felt (Rosnow, 1980). Based on these findings, He theorized the basic tenets of cognitive dissonance theory: Recognition of dissonance (or inconsistency) creates discomfort. Hence, it can motivate an individual to reduce the dissonance by accepting the information and message consistent with one's prior belief/attitude and avoiding the information and message that contradict one's prior belief/attitude (Festinger, 1957).

Cognitive dissonance can be pronounced in a social media environment. As previously mentioned, the era of Web 2.0 where enables connectedness among users makes it easy for an individual to connect with other like-minded individuals and access information that confirms one's belief (Lewandowsky et al., 2012; Witteman & Zikmund-Fisher, 2012). The rise of social media, in particular, which empowers users to organize a group with those who share similar views, has transformed the information landscape into "echo chambers," which refer to a description of the situation where people are exposed only to information that reinforces their existing opinions (Barberá, Jost, Nagler, Tucker, & Bonneau, 2015; Lewandowsky et al., 2012).

Hence, *confirmation bias* in which attitude-consistent messages are preferred over attitude-discrepant messages (Kahneman & Tversky, 1973) can occur in individuals' processing of information in online and social media environments (Workman, 2018). A number of studies have found empirical support for a confirmation bias in online information exposure and social media exchanges. For example, in the context of exposure to online political information, Garrett (2009) found that people are more likely to look at information that reinforces their opinions, and they spend more time reading it. Similarly, Knobloch-Westerwick, Johnson, and Westerwick (2014) showed that the confirmation bias is found in online information searches on political topics. Their results indicated that people tend to prefer attitude-consistent information over attitude-discrepant information. Furthermore, using social media data mining technology, Workman (2018) tested whether social media conversations would change or reinforce individuals' previously held positions. The analysis showed support for a confirmation bias, such that people are less likely to change their sentiments based on social media commentary.

Closely relevant to the topic of false information, a recent study by Yum and Jeong (2018) suggested that biased information processing occurs in the fake news perception. This

study revealed that a person's prior belief plays a crucial role in causing biased processing of the fake news, such that people are more likely to perceive news messages which are inconsistent with their prior beliefs to be the fake news, and they also exhibit less intention to share those messages with others.

In the context of the current study, a recipient's previously held attitude toward vaccination can be conceptualized in several ways, as it is the multi-faceted construct. First, a recipient's attitude toward the necessity of vaccination—whether he or she thinks that vaccination is necessary for protecting children against serious diseases—is an important aspect of vaccination attitude (World Health Organization, 2019). According to the World Health Organization (2019), one of the common misconceptions about immunization is the distrust in the necessity of vaccination to prevent children from contracting vaccine-preventable diseases (e.g., mumps, measles, rubella, pertussis, varicella, Hepatitis B). For example, there exists the false belief that vaccines are not effective at protecting children against diseases, such that diseases had already begun to disappear before vaccines were introduced (WHO, 2019), and natural immunity works better than immunity through vaccination (Burgess, 2019), and vaccines cause more harm than good (Jones et al., 2012; WHO, 2019). In this vein, a recipient's attitude toward the necessity of vaccination can be suggested as a key aspect of vaccination attitude to be assessed.

Another key aspect of vaccination attitude is the issue of mandatory vaccination. Vaccine mandate has been at the center of the debate amid the recent nationwide measles outbreak in the U.S. (Omer, Betsch, & Leask, 2019). In response to the recent outbreak, several U.S. states are considering making vaccination to be required by law; the state of New York eliminated religious and personal belief exemptions and passed the legislation mandating vaccination (Omer

et al., 2019). This decision on mandatory vaccination, for example, has faced strong oppositions from a group of anti-vaccination parents who filed lawsuits challenging this law (West, 2019). It shows that attitude toward mandatory vaccination can be a crucial aspect that constitutes vaccination attitude. In this vein, the current study attempts to assess a recipient's attitude toward mandatory vaccination as a key dimension of vaccination attitude.

Lastly, the overall attitude toward vaccination—whether a person supports or is against vaccination—should be taken into consideration to assess a recipient's attitude toward vaccination. While it is reported that the majority of the U.S. adults support childhood vaccination and believe that the health benefits of vaccination outweigh the risks (Pew Research Center, 2019a), it is still important to note that small committed groups of people who oppose vaccination reinforce their networks and worsen the polarization of public opinions in online debate. Hence, the current study also seeks to assess the overall attitude toward vaccination as a key dimension of vaccination attitude.

Based on the theoretical framework of cognitive dissonance and confirmation bias and recent findings related to online and social media settings discussed above, the following hypotheses are proposed:

> **H1**: A recipient's previously held attitude toward vaccination will affect the changes in perception of the anti-vaccination rumor, anxiety, and behavioral intentions, such that those who support vaccination will report greater decrease in the belief about the anti-vaccination claim (**H1a**), decrease in anxiety (**H1b**), increase in intention to vaccinate a child (**H1c**), decrease in intention to share the rumor (**H1d**) after exposure to the counter-rumor than will those who oppose vaccination.

**Effectiveness of Counter-Rumors and the Dual-Process Models**

Counter-rumors that refute rumors can be conceived of as persuasive messages, since the aim of counter-rumors is to persuade people not to believe rumors (Bordia et al., 2005). In this regard, the literature on attitude change and persuasion can be applied to the study of the effectiveness of counter-rumors (Bordia et al., 2005). The key theoretical framework that may provide insights into what makes counter-rumors persuasive is the dual route of cognitive processing (Bordia et al., 2005). In psychology, the elaboration likelihood model (ELM; Petty & Cacioppo, 1986) and the heuristic-systematic model (HSM; Chaiken, 1980, 1987) are commonly used for explaining the cognitive processing of information. Both models present two paths of cognitive processing wherein people evaluate persuasive messages.

The ELM posits two routes to persuasion, *the central and peripheral routes* (Petty & Cacioppo, 1986). The central route processing refers to an elaborated route which requires more cognitive efforts. This central processing includes scrutinizing message content for the strength or quality of arguments and leads to issue-relevant thinking.[1] Particularly, it occurs when the message recipient's motivation to process information is high. The key factor that affects the recipient's motivation level is personal relevance (Park, Levine, Kingsley Westerman, Orfgen, & Foregger, 2007). Petty and Cacioppo (1986) termed personal relevance (or issue involvement) to indicate the extent to which a topic involves personal meanings or important consequences (Petty & Cacioppo, 1986). For topics that are personally relevant, people are likely to process information centrally and scrutinize the message content (Park et al., 2007). Hence, under the conditions of high elaboration likelihood, messages containing strong arguments tend to have a

[1] Strong arguments are typically defined as those in which "when subjects are instructed to think about the message, the thoughts that they generate are predominantly favorable," whereas weak arguments are defined as those in which "when subjects are instructed to think about them, the thoughts that they generate are predominantly unfavorable" (Petty & Cacioppo, 1986, p. 32).

greater impact on attitude toward the message than those containing weak arguments. Conversely, when the message recipient's motivation to process information is low, the peripheral route processing occurs, which indicates the process in which people make decision about a persuasive message based on simple cues (e.g., source characteristics). Accordingly, it means that under low elaboration likelihood, the peripheral cues such as the perceived expertise or attractiveness of the message source could influence a person's attitude toward the message (Petty & Cacioppo, 1986).

A great deal of research has applied and tested the basic tenets of the ELM. For example, Petty, Cacioppo, and Goldman (1981) presented counterattitudinal messages containing either strong or weak arguments that originate from the source of either high or low expertise. Their results showed that these variables interacted with the personal relevance (i.e., the extent to which a message topic is personally relevant). That is, messages containing strong arguments had a greater effect on attitude in the high relevance condition, whereas messages from a high expertise source had a greater effect in the low relevance condition (Petty et al., 1981). In a replicated study, Petty, Cacioppo, and Schumann (1983) manipulated the different peripheral cue (i.e., the attractiveness of product endorser). Consistent with prior findings, the argument quality (strong vs. weak) appeared to have a greater impact on attitude change in the high relevance condition, whereas the peripheral cue (celebrity endorser vs. non-celebrity endorser) had a greater impact on attitude change in the low relevance condition (Petty et al., 1983).

In similar ways, the HSM model also proposes two ways of information processing, *systematic and heuristic processing* (Chaiken, 1980, 1987). Like the ELM's central route, systematic processing is conceptualized as a comprehensive, analytic processing of information relevant to the judgment task. Also, similar to the ELM, systematic processing implies that

message recipients exert considerable cognitive efforts in judging the validity of a message's advocated position, and recipients' cognitive ability and motivation are its important determinants. On the other hand, heuristic processing is a more limited mode of information processing that is less effortful and requires fewer cognitive resources than systematic processing. When people process information heuristically, they employ simple decision rules which "link a surface feature of the message or the context" to the validity of judgment (Maheswaran, Mackie, & Chaiken, 1992, p. 318). This model uses the term "heuristic cue" that affects people's judgments; for example, the heuristic cue such as an expertise cue activate quick judgment rules (i.e., "experts' statements can be trusted"), that leads people to think that information conveyed by expert communicators is credible (Eagly & Chaiken, 1993).

Although these two models propose similar dual routes of information processing, what is unique to the HSM model is the assumption that under the circumstances conductive to the two modes of processing, heuristic and systematic processing may co-occur (Chaiken, 1980, 1987; Chaiken, Liberman, & Eagly, 1989). This *concurrent processing* implies that heuristic and systematic processing can exert independent (i.e., additive) or interdependent (i.e., interactive) effects on judgment (Chaiken et al., 1989). First of all, according to the HSM model, if the inference derived from the heuristic processing does not contradict that derived from systematic processing, judgment can be influenced by both processing modes (Maheswaran et al., 1992). This independent effect is termed the *additivity effect*. For example, if the expectation based on the heuristic cue is congruent with subsequent processing of message content (e.g., high expertise cue strong argument, low expertise cue weak argument), people are likely to form their attitudes based on both the heuristic cue and message content (Chaiken et al., 1989; Maheswaran & Chaiken, 1991).

However, systematic processing can often attenuate the judgmental impact of heuristic processing, which is termed *attenuation effect* (Maheswaran & Chaiken, 1991). This effect occurs when the inference based on the heuristic cue is incongruent with that provided by systematic processing. For example, if the information provided by the expertise cue indicates that experts' opinions are credible, but systematic processing of the information about message content contradicts this expectation (e.g., high expertise weak argument, low expertise strong argument), people might discount the impact of the expertise cue. In other words, systematic processing kicks in, and one's judgment could be affected by message content (Chen & Chaiken, 1999; Maheswaran et al., 1992). Given the possibility for concurrent processing, hence, it is necessary to examine whether heuristic cue and message content could independently or jointly affect judgment.

Another key variable that should be taken into consideration in terms of testing the effectiveness of counter-rumors is the prior attitude toward vaccination. Particularly, the extent to which a rumor message is consistent with a person's prior attitude may determine the route of cognitive processing (Yum & Jeong, 2018). Maheswaran & Chaiken (1991) noted that although the recipient's motivation or ability to process information plays an important role in determining the route to persuasion, it does not fully explain what promotes systematic processing. They suggested that individuals tend to maximize their judgmental confidence, and thus, when it comes to evaluating a message, they try to "achieve some sufficient or desired level of confidence" (labelled as a *sufficiency principle*) (Maheswaran & Chaiken, 1991, p. 14). It implies that people tend to make cognitive efforts and engage in systematic processing until they feel certain that their judgments are correct (Chen & Chaiken, 1999). In this regard, research has found that in low motivation settings, systematic processing can occur if recipients receive

incongruent messages (i.e., the heuristic cue is incongruent with the valence of message content) (Maheswaran & Chaiken, 1991).

This sufficiency principle can be applied to predict how the prior attitude might play in the perception of the counter-rumor. It is possible to assume that if people receive the counter-rumor message to be inconsistent with their prior attitudes, this could enhance systematic processing, and they might be affected by the message containing strong arguments. More specifically, in the context of the anti-vaccination rumor, those who oppose vaccination would perceive the counter-rumor to be inconsistent with their prior attitudes, hence they could engage in systematic processing and be affected by the strength of the argument that the counter-rumor contains. Conversely, those who support vaccination would perceive the counter-rumor to be consistent with their prior attitudes, thereby, they could make their judgments based on the heuristic cue. In this regard, it is important to examine the role of the prior attitude toward vaccination in investigating the effectiveness of the counter-rumor, and especially test whether this variable can interact with source and message characteristics of the counter-rumor.

Based on the theoretical framework of dual-process models and the literature reviewed above, the following hypotheses are suggested:

> **H2**: The argument strength of the counter-rumor will affect the changes in perception of the anti-vaccination rumor, anxiety, and behavioral intentions, such that the counter-rumor containing strong arguments than the counter-rumor containing weak arguments will result in greater decrease in the belief about the anti-vaccination claim (**H2a**), decrease in anxiety (**H2b**), increase in intention to vaccinate a child (**H2c**), decrease in intention to share the rumor (**H2d**).

**H3**: The expertise source cue of the counter-rumor will affect the changes in perception of the anti-vaccination rumor, anxiety, and behavioral intentions, such that the counter-rumor from high expertise source than the counter-rumor from low expertise source will result in greater decrease in the belief about the anti-vaccination claim (**H3a**), decrease in anxiety (**H3b**), increase in intention to vaccinate a child (**H3c**), decrease in intention to share the rumor (**H3d**).

Given that the HSM model suggests that there might be interaction effects between heuristic cue and message content such as *attenuation hypothesis* discussed above (e.g., Maheswaran & Chaiken, 1991), it is conceivable that the argument strength and source expertise of the counter-rumor might interact one another to influence persuasive outcome variables. However, there is limited evidence on the interaction effect in the context of online rumor research, and particularly, little is known about how the previously held attitude toward the issue could interact with the source and message characteristics of the counter-rumor to influence persuasive outcomes. Hence, we propose the research question as follows:

**RQ**: How will the previously held attitude toward vaccination, argument strength, and source expertise interact one another to affect the changes in the belief about the anti-vaccination claim, anxiety, and intentions to vaccinate a child and share the rumor?

Figure 1 shows the conceptual model that describes the proposed relationships.

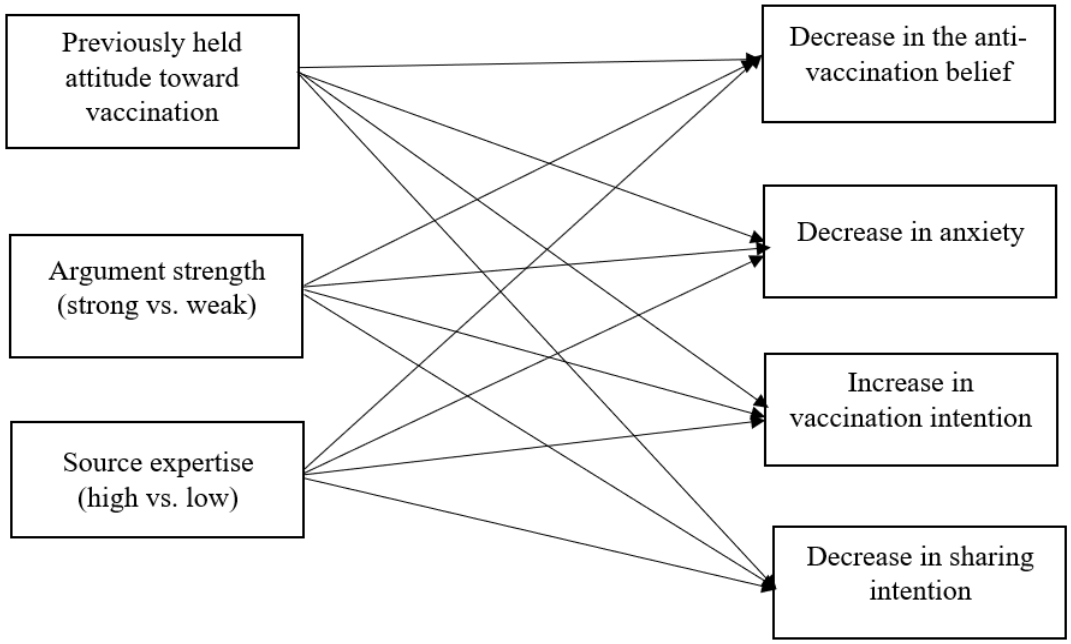



*Figure 1*. The proposed conceptual model

## CHAPTER 3: METHOD

### Study Design

To examine the effects of source expertise, argument strength, and the prior attitude toward vaccination on changes in the belief in the anti-vaccination claim, anxiety, and behavioral intentions (i.e., intentions to share the rumor and vaccinate a child), the current study employed a 2 (argument strength: strong vs. weak) x 2 (expertise source: high vs. low) between-subjects factor experimental design. As for the independent variables, the argument strength and source expertise were manipulated in the experimental procedure. Participants' factor, on the other hand, the prior attitude toward vaccination was measured at the beginning of the study. The dependent variables—belief in the anti-vaccination claim, anxiety, intentions to share the rumor

and vaccinate a child—were measured after exposure to stimuli. The experimental procedure is detailed later in the method section.

An online experiment set in the Qualtrics system was conducted. Using a randomizer tool in the Qualtrics, the random assignment was conducted through the system. Participants were randomly assigned to one of the four experimental conditions: group 1 (strong argument from high expertise cue; N = 102), group 2 (weak argument from high expertise cue; N = 97), group 3 (strong argument from low expertise cue; N = 102), and group 4 (weak argument from low expertise cue; N = 99).

**Recruitment**

Participants were recruited via *Prolific*, the crowdsourcing platform (https://prolific.co/). *Prolific* is a recently established crowdsourcing site where registered workers are able to take part in academic research in exchange for payment. This crowdsourcing site was founded in 2014, by a group of academics from Oxford and Sheffield Universities in U.K., which is mainly geared towards researchers (Peer, Brandimarte, Samat, & Acquisti, 2017).

Similar to Amazon's Mechanical Turk (*MTurk*) in design and purpose, this site also enables online subject recruitment, yet it explicitly fits the needs of academic researchers (Palan & Schitter, 2018). It provides a wide range of prescreening criteria which allow researchers to screen participants to target certain demographics in terms of gender, age, race/ethnicity, nationality, country of birth, current country of residence, language, sexual orientation, marital status, employment status, religious affiliation, political affiliation, socioeconomic status, etc. Also, as compared to *MTurk*, it clearly informs participants that they are recruited for participation in research, and also offers a reasonable cost to participants (Palan & Schitter, 2018). To date, a number of researchers across a range of academic fields have registered with

*Prolific* and *Prolific*-sourced data has been successfully employed in a variety of areas, such as psychology (e.g., Callan, Kim, Gheorghiu, & Matthews, 2016), food science (e.g., Simmons, Woods, & Spence, 2018), and economics (e.g., Marreiros, Tonin, Vlassopoulos, & Schraefel, 2017).

Furthermore, recent studies have tested the quality of the data collected through *Prolific*. For example, Peer et al. (2017) compared the data quality between *Prolific*, *MTurk* and another crowdsourcing site called *CrowdFlower*, and they found that *Prolific*-sourced data showed higher data quality than data from *CrowdFlower*, and comparable to the data from *MTurk*. *Prolific* participants, in particular, scored higher on attention-check questions than *CrowdFlower* participants, and the sample from Prolific was able to reproduce existing results. In terms of the characteristics of participants, *Prolific* participants were found to be much more diverse than MTurk participants. They also observed lower levels of propensity to engage in dishonest behavior among *Prolific* participants, as compared to MTurk participants. Given these advantages, *Prolific* was chosen as the site to recruit participants for the experiment in the current study.

In this study, when recruiting participants via *Prolific*, we selected two prescreening criteria—nationality and age. Since this study is based on the context of the vaccination issue in the U.S., the study participation was limited to the U.S. participants. As the vaccination issue can also be personally relevant to adults of reproductive age and who might have or plan to have a school-aged child (or children), the age for participation was limited to the adults who are over 18 years old and no older than 55.

**Participants**

The sample consists of 400 participants. 53.3% of the participants were female, whereas 46.8% of them were male. The average age was 30.60 years ($M$ = 30.60, $SD$ = 9.54), ranging from 18 years old and 55 years old. The majority of participants identified themselves as Caucasian (68%), 11% as Hispanic/Latino, 9.3% as African American, 8.5% as Asian/Pacific Islander, 0.3% as Arab/Middle Eastern, 0.3% as Native American, and 2.8% as other racial/ethnic groups. For the education level, 38.3% were high school graduates, 33.8% had a 4-year college degree, 16% had a 2-year college degree, 11% had a graduate degree, and 1% had less than high school education. For religion, 16.5% of them identified themselves as Protestant, 16% as Roman Catholic, 2% as Jewish, 1.8% as Muslim, 2% as Buddhist, 0.3% as Orthodox, 0.5% as Hindu, 35.8% as Atheist, and 25.3% as other religions (e.g., Presbyterian, Episcopalian). As for marital status, 22.5% of them were married, 0.5% were widowed, 4.5% were divorced, 1.8% were separated, and 70.8% were never married. The descriptive characteristics of demographic variables are presented in Table 1.

Table 1. *Descriptive Characteristics of Demographic Variables* ($N$ = 400)

| Variables | *N* (%) |
|---|---|
| *Gender* | |
| Male | 187 (46.8%) |
| Female | 213 (53.3%) |
| | |
| *Race/Ethnicity* | |
| Caucasian | 272 (68%) |
| African American | 37 (9.3%) |
| Asian/Pacific Islander | 34 (8.5%) |
| Hispanic/Latino | 44 (11%) |
| Native American | 1 (0.3%) |
| Arab/Middle Eastern | 1 (0.3%) |
| Other | 11 (2.8%) |
| | |
| *Marital Status* | |
| Married | 90 (22.5%) |

| | |
|---|---|
| Widowed | 2 (0.5%) |
| Divorced | 18 (4.5%) |
| Separated | 7 (1.8%) |
| Never married | 283 (70.8%) |
| | |
| *Having a school-aged child in household* | |
| Yes | 107 (26.8%) |
| No | 293 (73.3%) |
| | |
| *Religion* | |
| Protestant | 66 (16.5%) |
| Roman Catholic | 64 (16%) |
| Orthodox (Greek or Russian Orthodox) | 1 (0.3%) |
| Jewish | 8 (2%) |
| Muslim | 7 (1.8%) |
| Buddhist | 8 (2%) |
| Hindu | 2 (0.5%) |
| Atheist | 143 (35.8%) |
| Other | 101 (25.3%) |
| | |
| *Education* | |
| Less than high school | 4 (1%) |
| High school graduate | 153 (38.3%) |
| 2-year college degree | 64 (16%) |
| 4-year college degree | 135 (33.8%) |
| Graduate degree | 44 (11%) |
| | |
| *Annual household income* | |
| Under $25,000 | 87 (21.8%) |
| $25,000-$29,999 | 37 (9.3%) |
| $30,000-$34,999 | 34 (8.5%) |
| $35,000-$39,999 | 19 (4.8%) |
| $40,000-$49,999 | 38 (9.5%) |
| $50,000-$59,999 | 40 (10%) |
| $60,000-$84,999 | 62 (15.5%) |
| Over $85,000 | 83 (20.8%) |

**Procedure**

First, participants were informed that the purpose of this study was to examine their perceptions of messages related to the issue of vaccination. In the consent form, it was briefly mentioned that participants would read social media messages about a given topic and be asked to answer what they think about these messages and the topic of vaccination in general. The clarification required by the Institutional Review of Board was included that participants might not be initially informed about the nature and purpose of the study, but they would be fully informed about its details at the end of the study.

Upon providing their consent, participants were randomly allotted to one of the four experimental conditions, and they were first asked to answer the filtering question on whether they have an active Twitter account. If they have an active account on Twitter, they were eligible to participate in the study. If not, they were directed to the end of the survey. Then, they started answering the questions regarding their attitudes toward vaccination. The vaccination attitude was assessed in several ways, which is explained later in the measures section. Next, they were asked to report the personal relevance of the vaccination issue. They also reported their social media use in general, which is the frequency of checking social media on a typical day. Afterward, participants answered demographic variables (e.g., age, gender, race/ethnicity, marital status, having a school-aged child (or children), religion, education, income).

Next, the anti-vaccination rumor was presented in a tweet format. The content of the anti-vaccination rumor which was used in this study described the alleged connection between MMR vaccine and autism, such that the vaccine data is fabricated and MMR vaccine causes autism among children. Its content was created based on information related to the issue of vaccination available on Twitter (For details, see the stimuli section). After exposure to the anti-vaccination

rumor, participants were asked to rate their belief in the anti-vaccination claim, how they feel about the rumor (i.e., anxious, worried), and intentions to share this rumor with others and vaccinate their child.

This was followed by the counter-rumor, which refutes the anti-vaccination rumor. The counter-rumor was also presented in a tweet format, and vaccination-related information retrieved from Twitter was adapted to create the content of the counter-rumor.

To select the counter-rumor messages, we conducted pilot tests: First, we conducted a pilot test to check the perception of source expertise with 161 participants. As a result of the pilot test, Centers for Disease Control and Prevention (CDC) was selected as the high expertise source, whereas layperson user was selected as the low expertise source (For details of the results from the pilot study, see the stimuli section). Next, we conducted a couple of pilot tests to check the argument strength. The first pilot test for the argument strength was conducted with 74 participants. Based on the results from this test, four stimuli were selected (see the details in the stimuli section). To create the identical word counts across the messages, we revised these four messages and ran the second pilot test with 73 participants. As a result, two messages that showed a significant difference in the strength of the argument were selected as stimuli. The procedure and results of the pilot tests are detailed in the stimuli section.

The source and message characteristics of counter-rumors were manipulated as follows: a) a message refuting the rumor with strong argument from high expertise cue, b) a message refuting the rumor with weak argument from high expertise cue, c) a message refuting the rumor with strong argument from low expertise cue, and d) a message refuting the rumor with weak argument from low expertise cue.

After exposure to the counter-rumor, participants rated the manipulation check items, and then, they again rated their belief in the anti-vaccination claim, anxiety associated with the rumor, and behavioral intentions (i.e., sharing and vaccination intentions) (the same items used after the exposure to the rumor). At the end of the experiment, they were debriefed about the true nature of the study. The debriefing statement clarified the purpose and procedure of the study (i.e., what they answered in the study), and informed participants that arguments and information in the tweets they read were created on the basis of information being circulated on Twitter. They were also notified that they had an option to withdraw their data if they did not want their responses to be included in the study. Table 2 shows the experimental design employed in this study.

Table 2. *Study Design*

| | Exposure to rumor | Time 1 measure | Exposure to counter-rumor | Time 2 measure |
|---|---|---|---|---|
| Condition 1 | Rumor | Belief, anxiety, behavioral intentions | Strong argument from high expertise | Belief, anxiety, behavioral intentions |
| Condition 2 | Rumor | Belief, anxiety, behavioral intentions | Weak argument from high expertise | Belief, anxiety, behavioral intentions |
| Condition 3 | Rumor | Belief, anxiety, behavioral intentions | Strong argument from low expertise | Belief, anxiety, behavioral intentions |
| Condition 4 | Rumor | Belief, anxiety, behavioral intentions | Weak argument from low expertise | Belief, anxiety, behavioral intentions |

**Stimuli**

As mentioned earlier, since this study focuses on the anti-vaccination rumors on Twitter, stimuli were constructed in a tweet format. The screenshot of the tweet layout was first captured, and message content was added into this layout. For a rumor message, the Twitter "person" was

given a gender-neutral pseudonym (“Taylor Smith,” @TaylorSS), and the profile picture showed no personally identifiable features, but instead depicted an image retrieved from anti-vaccination account on Twitter. The stimulus presented in a tweet contained a claim about the alleged link between MMR vaccine and autism. The arguments presented in the rumor tweet were created using the information that was searched via hashtags such as #vaccines, #vaccination, #vaccineinjury, #MMR, #measles, #autism, #antivaxxer, #antivax, and #vaccinefree on Twitter, as well as the anti-vaccination website (e.g., Learn The Risk). The rumor tweet says as follows, “Don’t get fooled by all the lies about vaccines. The vaccine data is rigged, and there’s been a cover-up. Vaccines aren’t safe at all, do harm our kids and make them get sick. MMR vaccine causes autism among our kids. Seriously, don’t vaccinate. #antivax #vaccinefree (268 characters). The anti-vaccination rumor tweet was also identical across four conditions. Appendix 1 shows the rumor tweet used in the study (See Appendix 1).

For the counter-rumor messages, four messages were created in a tweet format by manipulating the argument strength and expertise source cue. The arguments presented in the counter-rumor tweets were created using the information that was searched via hashtags such as #vaccines, #vaccination, #MMR, #measles, #immunization #vaccineswork, #vaccinessavelives on Twitter, as well as CDC’s website, and the pro-vaccination organization website (e.g., Immunization Action Coalition, Colorado Children’s Immunization Coalition’s ‘Immunize For Good’).

The argument strength was manipulated by either suggesting the verifiable evidence to refute the anti-vaccination rumor (strong argument) or simply presenting the assertion against the rumor without evidence (weak argument) (Yum & Jeong, 2018). The strong argument focused on refuting the claim regarding the link between MMR vaccine and autism, specifically which

argues that the journal *The Lancet* fully retracted the article that claims the link between MMR vaccine and autism. This argument also suggests that a robust body of research—more than 25 studies—over the past decade demonstrated that MMR vaccine does not cause autism. The strong argument says as follows, "#factcheck Medical consensus exists: vaccines are safe and save lives. The journal The *Lancet* fully retracted the article that claims the link between MMR vaccine and autism. More than 25 studies over the decade demonstrated MMR vaccine does not cause autism. #VaccinesSaveLives" (279 characters).

The weak argument asserted the absolute necessity of vaccination and that the MMR vaccine undoubtedly is safe and does not cause autism. This argument warned people not to fall for the anti-vaccination made-up claim, which was defined as baseless, complete hoax information, but it did not refute the reasoning of the MMR vaccine-autism claim. The weak argument says as follows, "It needs to be said again: Must vaccinate your kids. Don't fall for this anti-vax made-up claim. It is not true, baseless, complete hoax information. Without a question, MMR vaccine is safe and does not cause autism. No more denying. #VaccinesSaveLives" (263 characters).

The length of the rumor and counter-rumors was relatively equal. Specifically, the rumor tweet (268 characters), the counter-rumor tweets containing strong (279 characters) and weak arguments (263 characters) were created in a similar number of characters.

To manipulate the expertise source cue, the counter-rumor messages were attributed to either of two sources: CDC (high expertise source) versus a layperson user (low expertise source). The professional source for the high expertise condition was operationalized as the U.S. government agency aiming to protect public health, which is CDC (@CDCgov). The real logo and profile image of the CDC were taken from its official Twitter account and photoshopped into

stimuli. The blue verified badge that lets people know that an account of public interest is authentic was included together with the CDC source. In contrast, the layperson source for the low expertise condition is operationalized as a non-expert user, which is labelled as a gender-neutral pseudonym "Morgan Miller" (@MMiller07). A blue verified badge was not included with this source.

Appendix 2 features the counter-rumor tweets used in the study, which includes, a) the counter-rumor tweet from CDC (strong and weak arguments) b) the counter-rumor tweet from a layperson user (strong and weak arguments). See Appendix 2.

**Pilot Tests**

The rumor tweet and counter-rumor tweets presented above were selected as a result of the pilot tests. As briefly mentioned earlier, multiple pilot tests were conducted to check the source expertise and argument strength. First, the pilot test for source expertise (N = 161) was conducted. We checked the perceived expertise and credibility of several sources: CDC, Twitter user, health organization, medical doctor, and celebrity. More specifically, except for a Twitter user which we created for this study, the real profile images of their official Twitter accounts were used for the pilot test. For the health organization, the image of the Immunization Action Coalition (aka IAC) was used. For the medical doctors, two specific figures, who are established vaccine experts—Dr. Paul Offit (@DrPaulOffit) and Dr. Nancy Messonnier (@DrNancyM_CDC)—were used. Dr. Paul Offit is a well-known pediatrician and vaccine researcher (e.g., the co-inventor of a Rotavirus vaccine), and Dr. Nancy Messonnier is the acting director of the Center for Preparedness and Response in CDC, also specializing in vaccines. For the celebrities, two particular celebrities who are vaccine advocates—Amanda Peet (@realamandapeet) and Seth MacFarlane (@SethMacFarlane)—were chosen. For a Twitter user,

a gender-neutral pseudonym named “Blake Lacey (@blacey05)” was created and used in the test.

In the pilot test, the tweet content was identical across seven conditions. Its content includes the message, which says, “Vaccines are safe, effective, and save lives. They are key to keep everyone safe from serious diseases. Immunization is the best protection.” The examples of the stimuli in the pilot test are presented in Appendix 3.

Participants were randomly assigned to one of the seven conditions set up in the Qualtrics. They were recruited via *Prolific*. Participants were asked to identify the source of the tweet they read: 1) CDC, 2) Twitter user, 3) IAC, 4) medical doctor, 5) celebrity. Additionally, if they recall the name of the medical doctor or celebrity, they were asked to specify who he or she was. They rated the perceived expertise of the tweet source on a 7-point semantic differential scale with five pairs of adjectives (not expert/expert, unqualified/qualified, unknowledgeable/knowledgeable, inexperienced/experienced, unskilled/skilled). They also rated the perceived credibility of the tweet source on a 7-point semantic differential scale with five pairs of adjectives (not at all credible/credible, cannot be trusted/can be trusted, unreliable/reliable, untrustworthy/trustworthy, inaccurate/accurate).

For the source recall, whereas participants tended to correctly identify CDC (93% of them assigned to CDC group), many of them failed to identify Dr. Paul Offit as a medical doctor (26.1% of them assigned to Dr. Offit group), and Amanda Peet as a celebrity (17.4% of them assigned to Amanda Peet group). Of those who failed to accurately identify the source, the majority of them chose a Twitter user over these public figures. The possible reason for this result is that many of them might have been unfamiliar with certain public figures. Specifically, Dr. Offit’s account does not have a blue verified badge on Twitter, hence it is likely that

participants who haven't heard of him failed to recognize him as a medical doctor. Similarly, because Amanda Peet's account does not have a blue verified badge either, this might have influenced participants' answers.

To check the source expertise, the one-way analysis of variance (ANOVA) was conducted. The results of the pilot test showed that there were significant differences among sources, $F$ (6, 154) = 22.42, $p < .001$, and CDC was the highest expertise source ($M$ = 6.49, $SD$ = .99), whereas sources such as a Twitter user ($M$ = 3.81, $SD$ = 1.11) and celebrities (Amanda Peet, $M$ = 3.71, $SD$ = 1.40; Seth MacFarlane, $M$ = 3.79, $SD$ = 1.26) were shown to have lower expertise than other sources (Dr. Offit, $M$ = 4.36, $SD$ = 1.41; Dr. Messonnier, $M$ = 6.10, $SD$ = 1.05; IAC, $M$ = 5.34, $SD$ = 1.25). As discussed above, there was a possibility that a Twitter user was interpreted as a broad term, which might have been confused with medical doctor or celebrity. In addition, participants' attitudes toward certain celebrity figures could affect the perceived expertise. Hence, we decided to use a Twitter (or layperson) user as the low expertise source for the experiment.

Furthermore, in terms of the perceived source credibility, there were significant differences among sources, $F$ (6, 154) = 13.95, $p < .001$, such that CDC was perceived to be the most credible source (M = 6.50, SD = .82), whereas sources such as a Twitter user ($M$ = 4.39, $SD$ = 1.01) and celebrities (Amanda Peet, $M$ = 4.35, $SD$ = 1.28; Seth MacFarlane, $M$ = 4.56, $SD$ = 1.16) were shown to have lower expertise than other sources (Dr. Offit, $M$ = 4.71, $SD$ = 1.26; Dr. Messonnier, $M$ = 5.96, $SD$ = .99; IAC, $M$ = 5.26, $SD$ = 1.28).

Taken together, as a result of the pilot test, we chose to use CDC as the high expertise source, whereas a layperson user as the low expertise source for the experiment. Table 3 shows the descriptive information about the sources used in the pilot test. See Table 3.

Table 3. *Demographic Information about Sources used in the Pilot Test* (*N* = 161)

| Source | *M (SD)* | *N* |
|---|---|---|
| 1) Twitter user (@blacey05) | 3.81 (1.11) | 24 |
| 2) CDC | 6.49 (0.99) | 27 |
| 3) Organization (Immunization Action Coalition) | 5.34 (1.25) | 21 |
| 4) Medical doctor_Paul Offit | 4.36 (1.41) | 23 |
| 5) Medical doctor_Nancy Messonnier | 6.10 (1.05) | 23 |
| 6) Celebrity_Amanda Peet | 3.71 (1.40) | 23 |
| 7) Celebrity_Seth MacFarlane | 3.79 (1.26) | 20 |

For the argument strength, six messages were first created based on the information searched via hashtags (e.g., #vaccines, #immunization, #vaccineswork, #vaccinessavelives) on Twitter. Specifically, message 1 contains the strong argument explaining that scientific evidence from a decade of research, including a recent study from *Annals of Internal Medicines* in 2019, shows that MMR vaccine is not associated with the risk for autism. Message 2 also presents the strong argument claiming that vaccines undergo rigorous safety testing prior to being approved by FDA and a wealth of research refutes the link between MMR vaccine and autism. Message 3 presents the strong argument asserting that the article which claims the link between MMR vaccine and autism was retracted from the journal *The Lancet*, and more than 25 studies over the decade demonstrated that MMR vaccine does not cause autism.

Message 4 involves the weak argument emphasizing that MMR vaccine is undoubtedly safe and refusing to vaccinate kids cannot be justified by any reason. It also warns against the fear mongering anti-vaccination claim. Similarly, message 5 includes the weak argument which says the absolute necessity and safety of vaccination and gives a warning on the false claim. Finally, message 6 deals with the weak argument simply saying not to trust the anti-vaccination claim and urging people not to deny the fact that MMR vaccine is safe.

The pilot test was conducted with 74 participants drawn from *Prolific*. Each participant rated the extent to which he or she agreed with the items adopted from Bordia et al. (2005) measuring the perceived argument strength on a 7-point Likert-type scale (1 = strongly disagree, 7 = strongly agree) (e.g., how effective/strong/persuasive do you think the message/arguments presented in the message was?). These items were averaged to create a single argument strength scale ($\alpha$ = .91 for the message 1; $\alpha$ = .94 for the message 2; $\alpha$ = .94 for the message 3; $\alpha$ = .95 for the message 4; $\alpha$ = .91 for the message 5; $\alpha$ = .95 for the message 6)

The results indicated that there was the largest variance between message 3 and message 5: message 3 exhibited the highest score in perceived argument strength ($M$ = 5.75, $SD$ = 1.23), whereas message 5 showed the lowest score in it ($M$ = 3.37, $SD$ = 1.52). A paired t-test showed that there was a significant difference between these messages, $t$ (73) = 12.93, $p$ < .001. In addition, there was a large variance between the message 2 ($M$ = 5.48, $SD$ = 1.25) and message 6 ($M$ = 3.58, $SD$ = 1.68), $t$ (73) = 10.99, $p$ < .001. However, as there were some differences in the number of characters, these messages were revised to have a relatively equal number of the characters.

The second pilot test was conducted to check the perceived argument strength of the revised messages. In this test, message A features the weak argument insisting on the necessity of vaccination without evidence and warning against the false claim. message B presents the strong argument which refutes the link between MMR vaccine and the risk for autism based on the retraction of the article claiming its link from the journal, and more than 25 studies that demonstrated no link between them. Message C includes the strong argument which asserts that vaccines undergo rigorous safety testing and a wealth of research shows no relation between MMR vaccine and autism. Lastly, message D presents the weak argument merely urging not to

trust the anti-vaccination made-up claim and calling such claim hoax information. It concludes the necessity of vaccination as well.

73 participants recruited via *Prolific* again rated their agreement with items measuring the perceived strength of the argument (1 = strongly disagree, 7 = strongly agree). These items were averaged to create a scale ($\alpha = .87$ for message A; $\alpha = .90$ for message B; $\alpha = .90$ for message C; $\alpha = .92$ for message D). The results indicated that message B showed the highest score in perceived argument strength ($M = 5.34$, $SD = 1.27$), whereas message D showed the lowest score in it ($M = 3.08$, $SD = 1.56$). A paired t-test showed that there was a significant difference between these messages, $t\ (72) = 11.90$, $p < .001$. Hence, based on the results of the pilot tests, these two messages were selected for the stimuli in the experiment.

**Measures**

*Attitude toward vaccination.* Attitude toward vaccination was measured in several ways. First, we measured participants' attitudes toward the necessity of vaccination; participants were asked to report whether they think that vaccination is necessary for protecting children against serious diseases (1 = yes, 2 = no). Second, we assessed participants' attitudes toward mandatory vaccination—whether they support mandatory vaccination; they reported whether they think that vaccination should be required by law (1 = yes, 2 = no). Lastly, they answered whether they support or are against vaccination (1 = I support vaccination, 2 = I am against vaccination).

*Belief in the anti-vaccination claim.* Seven items adopted from Shapiro, Holding, Perez, Amsel, & Rosberger, (2016) were used to assess belief in the anti-vaccination claim. After they read the anti-vaccination rumor, participants rated their agreement with the following statements on a 7-point Likert-type scale (1 = strongly disagree, 7 = strongly agree): 1) vaccine safety data is often fabricated, 2) immunizing children is harmful and this fact is covered up. 3)

pharmaceutical companies cover up the dangers of vaccines, 4) people are deceived about vaccine efficacy, 5) vaccine efficacy data is often fabricated, 6) people are deceived about vaccine safety, 6) the government is trying to cover up the link between vaccines and autism. (α = .97). After exposure to the counter-rumor, the same items were asked to rate their belief "now." The items were averaged to create a scale for the pre-exposure belief (α = .97, *M* = 1.91, *SD* = 1.37) and the post-exposure belief (α = .98, *M* = 1.85, *SD* = 1.40). A comparison of these scores was used to test the effectiveness of the counter-rumor. To create the scale of change in belief, post-exposure belief scores were subtracted from pre-exposure scores (*M* = .06, *SD* = .52). The positive scores indicate that there was a decrease in the belief, whereas the negative scores indicate that there was an increase in the belief.

*Anxiety.* Two items adopted from Bordia et al. (2005) were used to assess participants' level of anxiety associated with the rumor. After they read the anti-vaccination rumor, participants rated how the tweet opposing vaccination makes them feel: 1) How anxious does the tweet opposing vaccination make you feel? (1 = not at all anxious, 7 = very anxious indeed) 2) How worried are you about the tweet against vaccination? (1 = not worried at all, 7 = very worried indeed). After exposure to the counter-rumor, the same items were asked to rate their anxiety "now." The items were averaged to create a scale for the pre-exposure anxiety (*r* = .82, *M* = 3.38, *SD* = 1.96) and the post-exposure anxiety (*r* = .89, *M* = 3.02, *SD* = 1.95). A comparison of these scores was used to test the effectiveness of the counter-rumor. To create the scale of change in anxiety, post-exposure anxiety scores were subtracted from pre-exposure anxiety scores (*M* = .36, *SD* = 1.02). The positive scores indicate that there was a decrease in anxiety, whereas the negative scores indicate that there was an increase in anxiety.

*Intention to vaccinate a child.* Two items assessed the intention to vaccinate a child. Participants rated their likelihood to vaccinate a child (1 = definitely not, 7 = definitely yes): 1) I would definitely vaccinate my child, 2) I would have my child vaccinated if I have a child. The items were averaged to create a scale for the pre-exposure vaccination intention ($r$ = .89, $M$ = 6.45, $SD$ = 1.29) and the post-exposure vaccination intention ($r$ = .98, $M$ = 6.49, $SD$ = 1.31). Change in vaccination intention was used to test the effectiveness of the counter-rumor, and it was created from subtracting post-exposure scores from pre-exposure scores ($M$ = -.04, $SD$ = .33). The negative scores indicate that there was an increase in vaccination intention, whereas the positive scores indicate that there was a decrease in vaccination intention.

*Intention to share rumor.* Five items adapted from prior studies (Alhabash, McAlister, Quilliam, Richards, & Lou, 2015; Kim, 2018) are used to assess intention to share the rumor. On a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree), participants are asked to rate their agreement with the following statements: 1) The tweet about with a claim about anti-vaccination is worth sharing with others, 2) I would recommend the tweet with a claim about anti-vaccination to others, 3) I would 'Like' the tweet with a claim about anti-vaccination on Twitter, 4) I would 'Retweet' the tweet with a claim about anti-vaccination on Twitter, and 5) I would 'Reply' to the tweet with a claim about anti-vaccination on Twitter. These items were also asked before and after exposure to the counter-rumor. The post-exposure items asked participants to rate their intentions "now." The items are averaged to create a scale for pre-exposure sharing intention ($\alpha$ = .83, $M$ = 1.61, $SD$ = .96) and post-exposure sharing intention ($\alpha$ = .91, $M$ = 1.73, $SD$ = 1.24). Change in sharing intention was also created by subtracting post-exposure scores from pre-exposure scores ($M$ = -.12, $SD$ = .98). The positive scores indicate that

there was a decrease in sharing intention, whereas the negative scores indicate that there was an increase in sharing intention.

*Control variables.* Personal relevance and having a school-aged child were included as covariates. Given that the extent to which individuals are personally involved with the issue has a significant place in persuasion (Petty & Cacioppo, 1986) and it has been considered to have an impact on rumor perception and sharing (Oh et al., 2013), this variable was examined as a covariate. Personal relevance was measured by asking how relevant participants perceived the issue of vaccination personally relevant to themselves (1 = not at all relevant, 7 = very relevant) ($M$ = 5.29, $SD$ = 1.59). As having a school-aged child (or children) has been identified as a key factor that might affect individuals' attitudes toward vaccination (Jones et al., 2012), it was also included as a covariate. This variable was measured by asking whether participants have a school-aged child (or children) in their household (1 = yes, 0 = no). 73.3% of them answered that they do not have a school-aged child, whereas 26.8% answered that they do have a school-aged child.

*Manipulation check items.* Operationalization of argument strength variations have generally relied on participants' ratings of argument strength (O'Keefe, 2003). In this regard, three items adopted from Bordia et al. (2005) were used to check the argument strength, 1) how effective do you think the message in the follow-up tweet was? (1= not effective at all, 7 = very effective), 2) how strong were the arguments presented in the follow-up tweet? (1 = not strong at all, 7 = very strong), 3) How persuasive were the arguments presented in the follow-up tweet? (1 = not persuasive at all, 7 = very persuasive) ($\alpha$ = .94).

A 7-point semantic differential scale with five pairs of adjectives (not expert/expert, unqualified/qualified, unknowledgeable/knowledgeable, inexperienced/experienced,

unskilled/skilled) (Lee & Sundar, 2013; Ohanian, 1990) was also employed to check the perceived source expertise ($\alpha = .97$).

# CHAPTER 4. RESULTS

## Manipulation Check

To check the experimental manipulation of the counter-rumor, a series of independent t-tests were conducted. The results indicated that participants in strong argument groups ($M = 5.24$, $SD = 1.50$) rated greater perception of argument strength than those in weak argument groups did ($M = 4.28$, $SD = 1.51$), $t\ (398) = 6.38$, $p < .001$. Hence, the manipulation of the argument strength was successful.

The results of the independent t-test showed that participants who read the counter-rumors from CDC ($M = 6.36$, $SD = 1.06$) rated greater perception of source expertise than those who read the counter-rumors from a layperson user ($M = 4.04$, $SD = 1.50$), $t\ (398) = 17.80$, $p < .001$. Thus, the manipulation of the source expertise was also successful.

## Normality Tests

Before running the analyses, normality tests were conducted to check the normal distribution of the variables. The tests showed that the skewness of the variables of changes in the belief in the anti-vaccination claim, anxiety, vaccination and sharing intentions ranged from -2.54 to .37. Specifically, the skewness of the change in the anti-vaccination claim was .37, which is approximately symmetrical. The skewness of the change in anxiety was 1.34, which is positively skewed. The skewness of the change in vaccination intention was -1.98, which is negatively skewed. The skewness of the change in sharing intention was -2.54, which is also negatively skewed. Considering that the values for skewness between -2 and 2 are generally considered acceptable to prove normal distribution (George & Mallery, 2010), and the

distribution of the variables was not highly skewed, the current study ran the analyses without transforming the variables.

**Distribution of Variables Across Conditions**

We also examined whether there were potential differences of the distribution of variables (e.g., demographic and control variables) across four experimental conditions. The one-way analysis of variance tests (ANOVA) were conducted to examine the potential differences of the continuous variables across groups. There was no significant difference among groups in terms of age, $F$ (3, 395) = 1.96, $p > .10$, and personal relevance, $F$ (3, 396) = .26, $p > .10$. The Chi-square tests were conducted to examine the differences of the categorical variables among groups. The results indicated that there was no significant difference in terms of gender, $\chi^2$ (3) = .10, $p > .10$, race/ethnicity, $\chi^2$ (18) = .17, $p > .10$, marital status, $\chi^2$ (12) = .21, $p > .10$, having a school-aged child in the household, $\chi^2$ (3) = .07, $p > .10$, religion, $\chi^2$ (24) = .28, $p > .10$, or education, $\chi^2$ (12) = .21, $p > .10$. But there was a significant difference in the annual household income level, $\chi^2$ (21) = .30, $p < .05$. Overall, except for the income level, significant differences in the distribution of the variables were not found.

**Correlations**

Given that the distribution of the variables of changes in belief in the anti-vaccination claim, anxiety, vaccination and sharing intentions are not exactly symmetrical in general (as discussed above), we ran Spearman's rho correlational tests to examine the relationships among the measured variables. As shown in the Table 4, the results indicated that having a school-aged child (or children) (yes =1, no = 0) was positively associated with personal relevance ($r$ = .26, $p < .001$), the belief in the anti-vaccination claim (pre-exposure: $r$ = .14, $p$ = .006; post-exposure: $r$ = .12, $p$ = .01), and intention to share the rumor (pre-exposure: $r$ = .14, $p$ = .006; post-exposure: $r$

= .10, $p$ = .04), but it was not associated with attitude toward mandatory vaccination, anxiety, and vaccination intention. Personal relevance was negatively associated with attitude toward mandatory vaccination (yes = 1, no = 2) ($r$ = -.21, $p$ < .001), the belief in the anti-vaccination claim (pre-exposure: $r$ = -.21, $p$ < .001; post-exposure: $r$ = -.23, $p$ < .001), and was positively associated with anxiety (pre-exposure: $r$ = .20, $p$ < .001; post-exposure: $r$ = .21, $p$ < .001) and vaccination intention (pre-exposure: $r$ = .25, $p$ < .001; post-exposure: $r$ = .23, $p$ < .001), but it was not associated with sharing intention. Attitude toward mandatory vaccination (yes = 1, no = 2) was positively associated with the belief in the anti-vaccination claim (pre-exposure: $r$ = .39, $p$ < .001; post-exposure: $r$ = .44, $p$ < .001) and sharing intention (pre-exposure: $r$ = .20, $p$ < .001; post-exposure: $r$ = .21, $p$ < .001), and was negatively associated with anxiety (pre-exposure: $r$ = -.24, $p$ < .001; post-exposure: $r$ = -.24, $p$ < .001) and vaccination intention (pre-exposure: $r$ = -.50, $p$ < .001; post-exposure: $r$ = -.52, $p$ < .001).

The belief in the anti-vaccination claim before exposure to the counter-rumor (pre-exposure) was negatively associated with anxiety (pre-exposure: $r$ = -.12, $p$ = .02; post-exposure: $r$ = -.13, $p$ = .01) and vaccination intention (pre-exposure: $r$ = -.62, $p$ < .001; post-exposure: $r$ = -.59, $p$ < .001), and positively associated with sharing intention (pre-exposure: $r$ = .44, $p$ < .001; post-exposure: $r$ = .40, $p$ < .001). This variable of the anti-vaccination belief after exposure to the counter-rumor (post-exposure) was negatively associated with anxiety (pre-exposure: $r$ = -.15, $p$ =.003; post-exposure: $r$ = -.16, $p$ = .001) and vaccination intention (pre-exposure: $r$ = -.62, $p$ < .001; post-exposure: $r$ = -.61, $p$ < .001), and positively associated with sharing intention (pre-exposure: $r$ = .43, $p$ < .001; post-exposure: $r$ = .41, $p$ < .001).

Anxiety before exposure to the counter-rumor (pre-exposure) was positively associated with vaccination intention (pre-exposure: $r$ = .19, $p$ < .001; post-exposure: $r$ = .19, $p$ < .001), but

it was not associated with sharing intention. This variable of anxiety after exposure to the counter-rumor (post-exposure) was also positively associated with vaccination intention (pre-exposure: $r = .20$, $p < .001$; post-exposure: $r = .20$, $p < .001$), but it was not associated with sharing intention.

Vaccination intention before exposure to the counter-rumor (pre-exposure) was negatively associated with sharing intention (pre-exposure: $r = -.35$, $p < .001$; post-exposure: $r = -.34$, $p < .001$). This variable of vaccination intention after exposure to the counter-rumor (post-exposure) was also negatively associated with sharing intention (pre-exposure: $r = -.35$, $p < .001$; post-exposure: $r = -.32$, $p < .001$). The correlations among the measured variables are presented in Table 4. And the means and standard deviations of the measured continuous variables are presented in Table 5. The descriptive characteristics of attitudinal groups (pro-vaccine mandate vs. anti-vaccine mandate) are also presented in Table 6.

Table 4. *Correlations Among the Measured Variables*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Having a school-aged child | - | 0.26*** | 0.07 | 0.14** | 0.12* | -0.04 | -0.07 | -0.03 | -0.02 | 0.14** | 0.10* |
| 2. Personal relevance | | - | -0.21*** | -0.21*** | -0.23*** | 0.20*** | 0.21*** | 0.25*** | 0.23*** | 0.01 | -0.01 |
| 3. Attitude toward vaccine mandate | | | - | 0.39*** | 0.44*** | -0.24*** | -0.24*** | -0.50*** | -0.52*** | 0.20*** | 0.21*** |
| 4. Anti-vaccination belief (pre) | | | | - | 0.89*** | -0.12* | -0.13* | -0.62*** | -0.59*** | 0.44*** | 0.40*** |
| 5. Anti-vaccination belief (post) | | | | | - | -0.15** | -0.16** | -0.62*** | -0.61*** | 0.43*** | 0.41*** |
| 6. Anxiety (pre) | | | | | | - | 0.87*** | 0.19*** | 0.19*** | -0.01 | 0.001 |
| 7. Anxiety (post) | | | | | | | - | 0.20*** | 0.20*** | 0.03 | 0.01 |
| 8. Vaccination intention (pre) | | | | | | | | - | 0.91*** | -0.35*** | -0.34*** |
| 9. Vaccination intention (post) | | | | | | | | | - | -0.35*** | -0.32*** |
| 10. Sharing intention (pre) | | | | | | | | | | - | 0.67*** |
| 11. Sharing intention (post) | | | | | | | | | | | - |

*Note.* *$p < .05$, **$p < .01$, ***$p < .001$. (two-tailed), having a school-aged child in household (yes = 1, no = 0), attitude toward vaccine mandate (yes = 1, no = 2)

Table 5. *Means and Standard Deviations of the Measured Continuous Variables*

| Variables | *M* | *SD* |
|---|---|---|
| Personal relevance | 5.29 | 1.59 |
| Anti-vaccination belief (pre) | 1.91 | 1.37 |
| Anti-vaccination belief (post) | 1.85 | 1.40 |
| Anxiety (pre) | 3.38 | 1.96 |
| Anxiety (post) | 3.02 | 1.95 |
| Vaccination intention (pre) | 6.45 | 1.29 |
| Vaccination intention (post) | 6.49 | 1.31 |
| Sharing intention (pre) | 1.61 | 0.96 |
| Sharing intention (post) | 1.73 | 1.24 |

Table 6. *Descriptive Characteristics of Attitudinal Groups*

| | Attitude toward vaccine mandate | |
|---|---|---|
| | Yes | No |
| | *M* (*SD*) | *M* (*SD*) |
| Anti-vaccination belief (pre) | 1.54 (0.88) | 3.06 (1.90) |
| Anti-vaccination belief (post) | 1.45 (0.87) | 3.09 (1.92) |
| Anxiety (pre) | 3.65 (2.01) | 2.53 (1.54) |
| Anxiety (post) | 3.29 (2.03) | 2.17 (1.39) |
| Vaccination intention (pre) | 6.82 (0.58) | 5.29 (2.03) |
| Vaccination intention (post) | 6.86 (0.53) | 5.31 (2.10) |
| Sharing intention (pre) | 1.47 (0.73) | 2.05 (1.38) |
| Sharing intention (post) | 1.61 (1.15) | 2.10 (1.43) |

**Effectiveness of the Counter-Rumor**

As the preliminary analysis, the effectiveness of the counter-rumor was tested using a series of the paired t-tests. First, a paired t-test was conducted to compare the difference between the pre-exposure belief and the post-exposure belief. The results showed that there was a statistically significant difference between the pre-exposure belief scores and the post-exposure belief scores, $t$ (399) = 2.26, $p < .05$. Participants reported lower scores in the post-exposure

belief ($M$ = 1.85, $SD$ = 1.40) than they did in the pre-exposure belief ($M$ = 1.91, $SD$ = 1.37). This means that the conspiracy belief about vaccination was reduced after exposure to the counter-rumor.

A paired t-test was conducted to compare the difference between the pre-exposure anxiety and the post-exposure anxiety. The results showed that there was a significant difference between the pre-exposure anxiety and the post-exposure anxiety, $t$ (399) = 7.03, $p < .001$. Participants reported lower scores in the post-exposure anxiety ($M$ = 3.02, $SD$ = 1.95) than they did in the pre-exposure anxiety ($M$ = 3.38, $SD$ = 1.96). This means that anxiety was reduced after exposure to the counter-rumor.

We compared the difference between the pre-exposure vaccination intention and the post-exposure vaccination intention. The results indicated that there was a significant difference between the pre-exposure vaccination intention and the post-exposure vaccination intention, $t$ (399) = -2.62, $p$ = .01. Participants reported higher scores in the post-exposure vaccination intention ($M$ = 6.49, $SD$ = 1.31) than they did in the pre-exposure vaccination intention ($M$ = 6.45, $SD$ = 1.29). This means that vaccination intention increased after exposure to the counter-rumor.

Finally, the difference between the pre-exposure sharing intention and the post-exposure sharing intention was compared. The results showed that there was a significant difference between the pre-exposure sharing intention and the post-exposure sharing intention, $t$ (399) = -2.39, $p < .05$. Interestingly, participants reported higher scores in the post-exposure sharing intention ($M$ = 1.73, $SD$ = 1.24) than they did in the pre-exposure sharing intention ($M$ = 1.61, $SD$ = .96). This means that sharing intention increased after exposure to the counter-rumor.

Overall, the results indicated that exposure to the counter-rumor was effective at reducing the belief in the anti-vaccination claim and anxiety and increasing vaccination intention. However, it also increased the intention to share the rumor, which is different from expectations. Table 7 presents the paired t-test results of the effectiveness of the counter-rumor. See Table 7.

Table 7. *Paired T-Tests for the Pre- and Post- Exposure to the Counter-Rumor*

| | *M* | *SD* | *t* value | *df* | significance |
|---|---|---|---|---|---|
| Anti-vaccination belief (pre) | 1.91 | 1.37 | 2.26 | 399 | $p = .02$ |
| Anti-vaccination belief (post) | 1.85 | 1.40 | | | |
| Anxiety (pre) | 3.38 | 1.96 | 7.03 | 399 | $p < .001$ |
| Anxiety (post) | 3.01 | 1.95 | | | |
| Vaccination intention (pre) | 6.45 | 1.29 | -2.62 | 399 | $p = .01$ |
| Vaccination intention (post) | 6.49 | 1.31 | | | |
| Sharing intention (pre) | 1.61 | 0.96 | -2.39 | 399 | $p = .02$ |
| Sharing intention (post) | 1.73 | 1.24 | | | |

**Effects of Attitude Toward Vaccination**

Before examining the effects of attitude toward vaccination on changes in the belief in a rumor, anxiety, and behavioral intentions, several measures of vaccination attitude were first analyzed in the sample. The preliminary analyses showed that the vast majority of participants supported the necessity of vaccination to protect children (94%) and supported vaccination in general (95.5%). However, there were some variances in terms of their attitudes toward mandatory vaccination: 24.3% of them oppose mandatory vaccination whereas 75.8% supported mandatory vaccination. Hence, we decided to use attitude toward mandatory vaccination as the assessment of vaccination attitude for subsequent analyses.

A series of the independent t-tests were conducted to examine the effects of vaccination attitude on the belief in a rumor, anxiety, vaccination and sharing intentions. The results showed that there was a significant difference between those who support mandatory vaccination and those who oppose mandatory vaccination in terms of the reduction in the belief in the anti-vaccination claim, $t$ (398) = 2.03, $p < .05$. In other words, the belief in the anti-vaccination claim was significantly reduced among those who support mandatory vaccination. Those who support mandatory vaccination reported lower belief in the anti-vaccination claim ($M$ = .09, $SD$ = .50) after exposure to the counter-rumor than those who oppose mandatory vaccination did ($M$ = -.03, $SD$ = .55). Thus, H1a was supported.

The results showed that there was no significant difference between those who support mandatory vaccination ($M$ = .36, $SD$ = 1.03) and those who oppose mandatory vaccination ($M$ = .36, $SD$ = 1.01) in terms of anxiety reduction, $t$ (398) = -.02, $p > .10$. H1b was not supported.

The results showed that there was no significant difference between those who support mandatory vaccination ($M$ = -.05, $SD$ = .28) and those who oppose mandatory vaccination ($M$ = -.03, $SD$ = .46) in terms of the increase in vaccination intention, $t$ (398) = -.61, $p > .10$. H1c was not supported.

The results indicated that there was no significant difference between those who support mandatory vaccination ($M$ = -.14, $SD$ = 1.01) and those who oppose mandatory vaccination ($M$ = -.06, $SD$ = .90) in terms of sharing intention reduction, $t$ (398) = -.69, $p > .10$. H1d was not supported.

Taken together, participants' attitudes toward mandatory vaccination had a significant impact on the reduction in the conspiracy belief after exposure to the counter-rumor, but did not have an impact on changes in anxiety, vaccination and sharing intentions. Table 8 shows the

results of the effects of attitude toward mandatory vaccination on the outcome variables. See Table 8.

Table 8. *Independent T-Tests for Changes in the Anti-Vaccination Belief, Anxiety, and Vaccination and Sharing Intentions by Attitude Toward Vaccine Mandate*

| | Attitude toward vaccine mandate | | | | | | |
|---|---|---|---|---|---|---|---|
| | Yes | | No | | | | |
| | *M* | *SD* | *M* | *SD* | *t* value | *df* | significance |
| Change in anti-vaccination belief | 0.09 | 0.50 | -0.03 | 0.55 | 2.03 | 398 | $p = .04$ |
| Change in anxiety | 0.36 | 1.03 | 0.36 | 1.01 | -0.02 | 398 | $p$ = ns |
| Change in vaccination intention | -0.05 | 0.28 | -0.03 | 0.46 | -0.61 | 398 | $p$ = ns |
| Change in sharing intention | -0.14 | 1.01 | -0.06 | 0.9 | -0.69 | 398 | $p$ = ns |

**Effects of Argument Strength**

The independent t-tests were conducted to examine the effects of argument strength on changes in the belief in a rumor, anxiety, and vaccination and sharing intentions. The results indicated that there was no significant difference in the change in the belief in the anti-vaccination claim between those who read the counter-rumor containing strong arguments ($M = .07$, $SD = .61$) and those who read the counter-rumor containing weak arguments ($M = .05$, $SD = .40$), $t$ (398) = .37, $p > .05$. H2a was not supported.

There was no significant difference in the change in the level of anxiety between those who read the counter-rumor containing strong arguments ($M = .36$, $SD = 1.05$) and those who read the counter-rumor containing weak arguments ($M = .36$, $SD = .99$), $t$ (398) = .02, $p > .05$. H2b was not supported.

There was no significant difference in the change in vaccination intention between those who read the counter-rumor containing strong arguments ($M = -.04$, $SD = .34$) and those who

read the counter-rumor containing weak arguments ($M$ = -.05, $SD$ = .33), $t$ (398) = .13, $p$ > .05. H2c was not supported.

We also found no significant difference in the change in sharing intention between those who read the counter-rumor containing strong arguments ($M$ = -.07, $SD$ = 1.06) and those who read the counter-rumor containing weak arguments ($M$ = -.17, $SD$ = .90), $t$ (398) = .99, $p$ > .05. H2d was not supported.

In summary, the argument strength did not have a significant impact on the change in the belief in the anti-vaccination claim, anxiety, and vaccination and sharing intentions.

**Effects of Source Expertise**

The independent t-tests were conducted to examine the effects of source expertise on changes in the belief in a rumor, anxiety, and vaccination and sharing intentions. The results indicated that there was no significant difference in the change in the belief in the anti-vaccination claim between those who read the counter-rumor from high expertise source (i.e., CDC) and those who read the counter-rumor from low expertise source (i.e., layperson user), $t$ (398) = 1.56, $p$ = .12 ($p$ > .05). We found a trend that those who read the counter-rumor from CDC reported greater decrease in the belief in the anti-vaccination claim ($M$ = .10, $SD$ = .50) than those who read the counter-rumor from a layperson user ($M$ = .02, $SD$ = .54) did, but the difference between them failed to reach the significance level. H3a was not supported.

The results revealed a significant difference in the change in anxiety level, between those who read the counter-rumor from high expertise source and those who read the counter-rumor from low expertise source, $t$ (398) = 2.03, $p$ < .05. Those who read the counter-rumor from CDC reported greater reduction in their anxiety ($M$ = .46, $SD$ = 1.06) than those who read the counter-rumor from a layperson user did ($M$ = .26, $SD$ = .98). Thus, H3b was supported.

We found no significant difference in the change in vaccination intention between those who read the counter-rumor from high expertise source ($M$ = -.06, $SD$ = .33) and those who read the counter-rumor from low expertise source ($M$ = -.03, $SD$ = .34), $t$ (398) = -.99, $p$ > .05. H3c was not supported.

The results showed that there was no significant difference in the change in sharing intention between those who read the counter-rumor from high expertise source and those who read the counter-rumor from low expertise source, $t$ (398) = 1.57, $p$ = .12 ($p$ > .05). We found a trend that those who read the counter-rumor from a layperson user reported greater increase in the intention to share the rumor ($M$ = -.19, $SD$ = 1.05) than those who read the counter-rumor from CDC ($M$ = -.04, $SD$ = .92) did, but the difference between them failed to reach the significance level. H3d was not supported.

Taken together, these results indicated that expertise source had a significant impact on anxiety reduction, but did not have an impact on the belief in the anti-vaccination claim, change in anxiety, vaccination and sharing intentions. Table 9 shows the results of the effects of source expertise on the outcome variables. See Table 9.

Table 9. *Independent T-Tests for Changes in the Anti-Vaccination Belief, Anxiety, and Vaccination and Sharing Intentions by Source Expertise*

| | Source expertise | | | | | | |
|---|---|---|---|---|---|---|---|
| | High | | Low | | | | |
| | *M* | *SD* | *M* | *SD* | *t* value | *df* | significance |
| Change in anti-vaccination belief | 0.10 | 0.50 | 0.02 | 0.54 | 1.56 | 398 | $p$ =.12 |
| Change in anxiety | 0.46 | 1.06 | 0.26 | 0.98 | 2.03 | 398 | $p$ =.04 |
| Change in vaccination intention | -0.06 | 0.33 | -0.03 | 0.34 | -0.99 | 398 | $p$ = ns |
| Change in sharing intention | -0.04 | 0.92 | -0.19 | 1.05 | 1.57 | 398 | $p$ = .12 |

## Interaction Effect

To examine the interaction between argument strength and source expertise, and the interaction between attitude toward mandatory vaccination and argument strength, and the interaction between attitude toward mandatory vaccination and source expertise on the outcome variables, the two-way analysis of covariance (ANCOVA) tests were conducted with the personal relevance and having a school-aged child in one's household with covariates. Also, the three-way ANCOVA tests were conducted to examine the interaction between attitude toward mandatory vaccination, argument strength, and source expertise on the outcome variables (RQ).

### *Interaction Between Argument Strength and Source Expertise*

The results showed that there was no significant interaction effect between argument strength and source expertise on the change in the conspiracy belief, $F$ (1, 394) = .05, $p > .10$. Yet, the same as we found in the aforementioned independent t-test, we found a trend that those who read the counter-rumor from CDC reported greater decrease in the belief in the anti-vaccination claim ($M$ = .10, $SD$ = .50) than those who read the counter-rumor from a layperson user did ($M$ = .02, $SD$ = .54) , and yet the group difference failed to reach the significance level, $F$ (1, 394) = 2.49, $p$ = .12 ($p > .05$).

As for the change in anxiety level, the results showed that there was a significant main effect of source expertise on anxiety reduction, $F$ (1, 394) = 4.24, $p < .05$. $\eta^2 = .01$. Those who read the counter-rumor from CDC reported greater reduction in their anxiety ($M$ = .46, $SD$ = 1.06) than those who read the counter-rumor from a layperson user did ($M$ = .26, $SD$ = .98). This confirms that H3b was supported. However, there was no significant interaction effect between argument strength and source expertise on the change in anxiety, $F$ (1, 394) = 1.52, $p > .05$.

For the change in vaccination intention, a significant interaction effect between argument strength and source expertise on the increase in vaccination intention was found, $F$ (1, 394) = 8.04, $p < .01$, $\eta^2 = .02$. As illustrated in Figure 2, when participants read the counter-rumor from CDC, they reported greater increase in vaccination intention in response to the strong argument ($M$ = -.10, $SD$ = .35) than they did in response to the weak argument ($M$ = -.02, $SD$ = .30). On the other hand, when participants read the counter-rumor from a layperson user, they reported greater increase in vaccination intention in response to the weak argument ($M$ = -.08, $SD$ = .36) than they did in response to the strong argument ($M$ = .02, $SD$ = .31). See Figure 2 below.

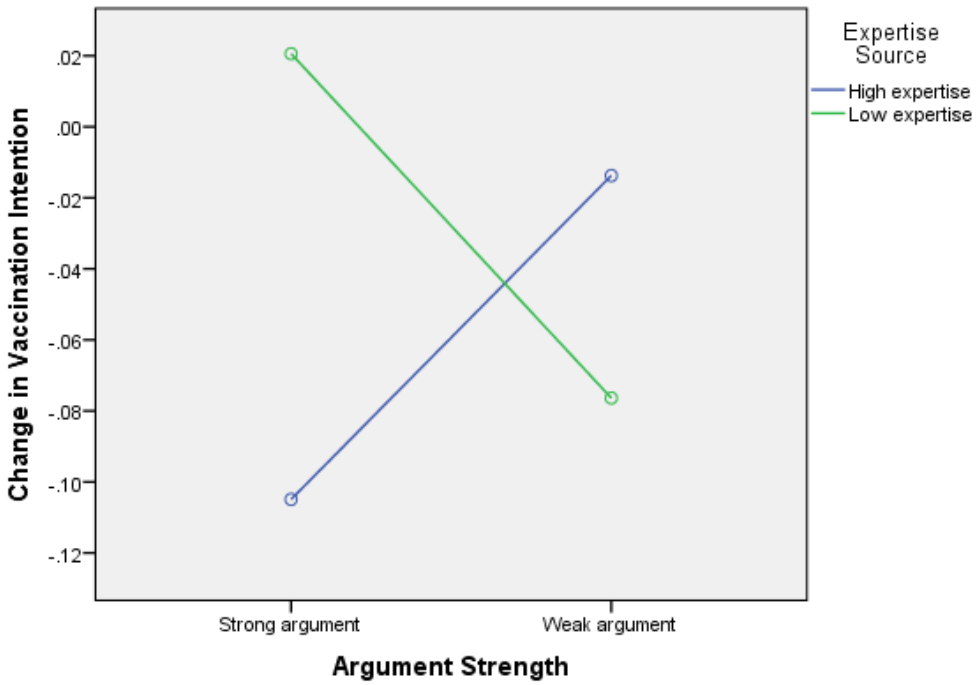



*Figure 2.* Interaction between argument strength and source expertise on the change in vaccination intention.

For the change in sharing intention, the interaction between argument strength and source expertise was not significant, $F$ (1, 394) = .52, $p > .10$. Yet, the same as we found in the

aforementioned independent t-test, we found a trend that those who read the counter-rumor from a layperson user reported greater increase in the intention to share the rumor ($M$ = -.19, $SD$ = 1.05) than those who read the counter-rumor from CDC ($M$ = -.04, $SD$ = .92) did, but the difference between them failed to reach the significance level, $F$ (1, 394) = 2.29, $p$ = .13 ($p$ > .05).

***Interaction Between Attitude Toward Vaccine Mandate and Argument Strength***

The results showed no significant interaction effect between attitude toward mandatory vaccination and argument strength on the change in the conspiracy belief, $F$ (1, 394) = .15, $p$ > .05. Yet, similar to the results from the aforementioned independent t-test, there was a marginally significant main effect of the attitude toward mandatory vaccination on the reduction in the conspiracy belief, $F$ (1, 394) = 3.45, $p$ = .06. Those who support mandatory vaccination reported greater reduction in the belief in the anti-vaccination claim ($M$ = .09, $SD$ = .50) than those who oppose mandatory vaccination did ($M$ = -.03, $SD$ = .55). This confirms a support for H1a.

There was no significant interaction effect between attitude toward mandatory vaccination and argument strength on the change in anxiety, $F$ (1, 394) = .27, $p$ > .05. There were no interaction effects on the change in vaccination intention, $F$ (1, 394) = 1.57, $p$ > .05, the change in sharing intention, $F$ (1, 394) = .30, $p$ > .05, respectively.

***Interaction Between Attitude Toward Vaccine Mandate and Source Expertise***

There was no interaction between attitude toward mandatory vaccination and source expertise in the change in the conspiracy belief, $F$ (1, 394) = .58, $p$ > .05. However, there was a marginally significant main effect of source expertise on the change in the conspiracy belief, $F$ (1, 394) = 2.97, $p$ = .09. The possible reason for this is that incorporating covariates might have

affected the results. This gives a partial support for H3a. Those who read the counter-rumor from CDC reported greater reduction in the belief in the anti-vaccination claim ($M$ =.10, $SD$ = .50) than those who read the counter-rumor from a layperson user ($M$ = .02, $SD$ = .54). There was no interaction effect between attitude toward mandatory vaccination and source expertise on the change in anxiety, $F$ (1, 394) = .58, $p$ > .05, and on the change in vaccination intention, $F$ (1, 394) = .92, $p$ > .05, respectively.

On the other hand, the results showed a marginally significant interaction effect between attitude toward mandatory vaccination and source expertise on the change in sharing intention, $F$ (1, 394) = 3.10, $p$ = .08. $\eta^2$ = .01. As illustrated in Figure 3, those who support mandatory vaccination reported greater increase in their intention to share the rumor when they read the counter-rumor from a layperson user ($M$ = -.26, $SD$ = 1.11) as opposed to when they read the counter-rumor from CDC ($M$ = -.01, $SD$ = .89). On the contrary, those who oppose mandatory vaccination reported greater increase in their intention to share the rumor when they read the counter-rumor from CDC ($M$ = -.14, $SD$ = 1.01) as opposed to when they read the counter-rumor from a layperson user ($M$ = .01, $SD$ = .79) (see Figure 3).

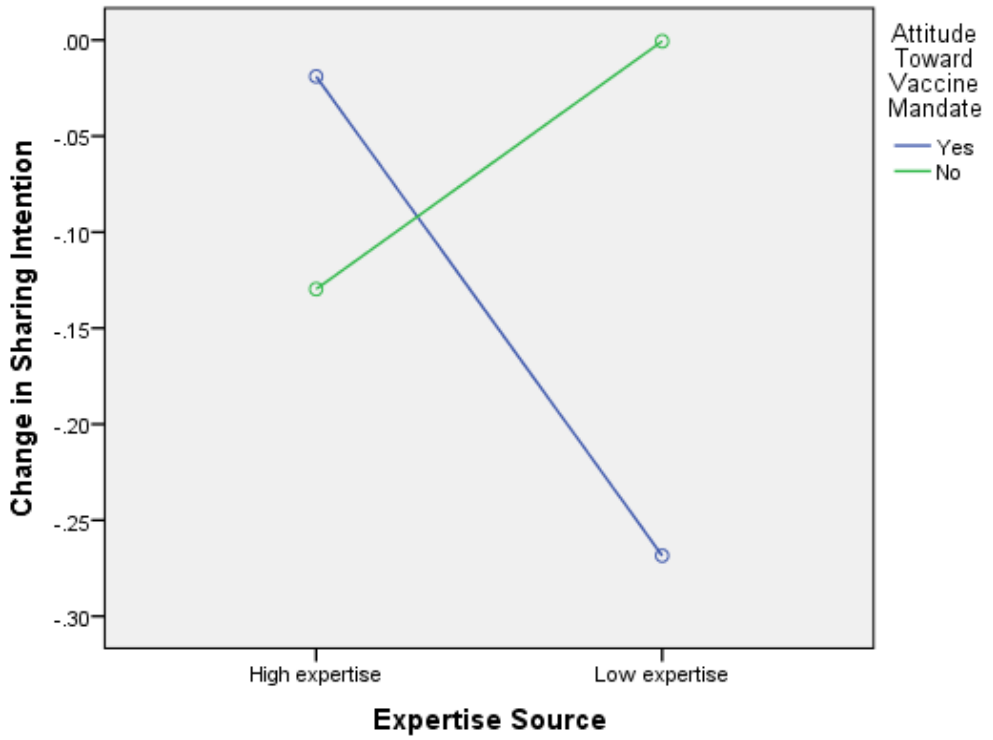



*Figure 3.* Interaction between attitude toward vaccine mandate and source expertise on the change in sharing intention.

***Interaction Between Attitude Toward Vaccine Mandate, Argument Strength, and Source Expertise***

The three-way ANCOVA tests were conducted to examine the effects of attitude toward mandatory vaccination, argument strength, and source expertise on the outcome variables. the interaction between attitude toward mandatory vaccination, argument strength, and source expertise on the change in the belief in the anti-vaccination claim was not significant, $F$ (1, 390) = .01, $p$ > .05.

For the change in anxiety, there was no interaction between attitude toward mandatory vaccination, argument strength, and source expertise on the change in anxiety, $F$ (1, 390) = .48, $p$ > .05. For the change in vaccination intention, the interaction between attitude toward

mandatory vaccination, argument strength, and source expertise on the change in vaccination intention was not significant, $F$ (1, 390) = .71, $p > .05$. There was no significant interaction between attitude toward mandatory vaccination, argument strength, and source expertise on the change in sharing intention, $F$ (1, 390) = .80, $p > .05$.

In summary, the results showed no significant three-way interaction between attitude toward mandatory vaccination, argument strength, and source expertise on the outcome variables.

# CHAPTER 5. DISCUSSION

## Results Summary

This study examined the effects of attitude toward vaccination, argument strength, and source expertise on the changes in the belief about the anti-vaccination claim, in the level of anxiety associated with the rumor, behavioral intentions involving intentions to vaccinate a child and share the rumor. Overall, the findings provide insights into the psychological mechanism underlying the effectiveness of the counter-rumor. One of the major findings is that confirmation bias occurs in the perception of the counter-rumor. In line with the theoretical frameworks of Festinger's (1957) cognitive dissonance, confirmation bias (Kahneman & Tversky, 1973), and recent studies that showed the biased information processing in online and social media environments (e.g., Garettt, 2009; Knobloch-Westerwick et al., 2014; Yum & Jeong, 2018), our findings suggest that the recipient's previously held attitude toward the issue of vaccination plays a crucial role in affecting and changing the belief in the anti-vaccination claim.

First, we found that participants' attitudes toward mandatory vaccination had a significant impact on the change in the conspiracy belief about vaccination. There was a significant difference between those who support mandatory vaccination and those who oppose mandatory

vaccination in terms of the reduction in the conspiracy belief. Those who support mandatory vaccination reported greater reduction in such belief after exposure to the counter-rumor than those who oppose mandatory vaccination did. This result indicates that *confirmation bias*—in which attitude-consistent messages are preferred over attitude-discrepant messages—tends to persist even after exposure to the counter-rumor, and such bias affects the effectiveness of the rumor refutation.

Another finding from this study supports the persistency of confirmation bias, which shows that attitude toward mandatory vaccination interacted with perceived source expertise to affect the change in intention to share the rumor. There was a marginally significant interaction effect between attitude toward mandatory vaccination and source expertise on the change in sharing intention (see Figure 2): Those who support mandatory vaccination reported greater increase in their intention to share the rumor when they read the counter-rumor from a layperson user as opposed to when they read the counter-rumor from CDC. On the other hand, those who oppose mandatory vaccination reported greater increase in their intention to share the rumor when they read the counter-rumor from CDC as opposed to when they read the counter-rumor from a layperson user. Interestingly, these patterns revealed that the effect of source expertise on sharing intention is dependent upon a person's previously held attitude. It indicates that when individuals encounter the counter-rumor that contradicts their prior attitudes, they could refuse to accept the counter-rumor from high expertise source, and they are more likely to share the rumor. It would help to note that this might involve less perceived credibility of the CDC—Among those who oppose mandatory vaccination, the CDC might have been viewed as a part of the conspiracy. This finding demonstrates that confirmation bias serves as the underlying

mechanism shaping and changing the cognitive and behavioral responses to the anti-vaccination rumor.

We also found that source expertise had a significant impact on the change in participants' level of anxiety associated with the anti-vaccination rumor. The results indicated that those who read the counter-rumor from CDC reported greater decrease in their anxiety than those who read the counter-rumor from a layperson user. This finding suggests that heuristic processing occurs in the reception of vaccine-related information. According to the dual-process model of information processing (Petty & Cacioppo, 1986; Chaiken, 1980, 1987), individuals often look for mental shortcuts and are likely to make their judgments based on simple cues. In the context of this study, the heuristic cue such as expertise source (i.e., CDC) could activate the quick judgment rules—experts' statements can be qualified and trusted—which led participants to think that the counter-rumor message conveyed by expert communicators is credible (Eagly & Chaiken, 1993). Indeed, the less effortful and limited mode of information processing has increased among the Internet users (Sundar, 2008). As claimed by Sundar (2008), with the vast amount of information available on the Internet, such reliance on heuristic cues have become pronounced in the online and social media environments. This is also applicable to the processing of health information. For example, recent studies have found that cues related to health communicators' professional qualifications (e.g., Twitter user names that indicate health professionals) have an impact on users' judgments of content credibility (Lee & Sundar, 2013). In this vein, our finding suggests that individuals tend to employ simple decision rules and exhibit reliance on expertise source to process and judge vaccine-relation information, and they are less likely to feel anxious or worried about the anti-vaccination rumor when they receive the counter-rumor from expert sources such as government agency.

The results found no significant effect of argument strength on the outcome variables. The possible explanation for these results could be related to the tendency of heuristic processing in a social media environment. Besides, Twitter has a length restriction, which allows a brief message up to 280 characters in a tweet. As the tweet generally contains a short statement and does not involve thorough arguments, people might have not carefully evaluated the strength of the argument when they read the tweet. Another possible reason for these results is that this study had fewer participants who oppose mandatory vaccination than those who support mandatory vaccination. As discussed earlier, research has found that when people perceive the message to be consistent with their own beliefs or attitudes, they tend to engage in heuristic processing and less likely to scrutinize the strength of the argument (Maheswaran & Chaiken, 1991). In this vein, it is possible to assume that this could have enhanced heuristic processing in the evaluation of the counter-rumor.

Another noteworthy finding is that there was a significant interaction effect between argument strength and source expertise on the increase in vaccination intention (see Figure 1). When participants read the counter-rumor from CDC, they reported greater increase in their intention to vaccinate a child in response to the strong argument than they did in response to the weak argument. In contrast, when they read the counter-rumor from a layperson user, the opposite pattern appeared, such that they reported greater increase in their vaccination intention in response to the weak argument than they did in response to the strong argument.

The HSM's *attenuation hypothesis* may account for this interaction effect found in our study. The *attenuation hypothesis* suggests that if the heuristic cue-based inference is inconsistent with other available judgment-relevant information (e.g., the quality and the valence of persuasive message content), systematic processing tends to be activated and attenuate the

effect of the heuristic cue (Chen & Chaiken, 1999; Maheswaran et al., 1992). In other words, when cue-message incongruency occurs, it contradicts the expectations based on the cue, and leads individuals to scrutinize the message content (Chen & Chaiken, 1999). Our finding reveals that cue-message incongruency could have affected the results. When participants read the counter-rumor containing strong arguments from CDC (i.e., high expertise source strong argument), it did not violate their expectations about the content quality. However, when they read the counter-rumor containing weak arguments from CDC (i.e., high expertise source weak argument), it contradicted their expectations about the content quality, which could decrease vaccination intention. On the other hand, when they read the counter-rumor containing weak arguments from a layperson user (i.e., low expertise source weak argument), it was congruent with their expectations about the content quality. But when they read the strong counter-rumor from a layperson user (i.e., low expertise source strong argument), it produced incongruency between the heuristic cue and message content and could backfire, resulting in decrease in vaccination intention. This finding implies that the perception of cue-message congruency can be crucial to enhance the persuasiveness of the counter-rumor in promoting behavioral change.

Additionally, as shown in the preliminary analysis, findings indicate overall effectiveness of the counter-rumor in reducing the belief in the anti-vaccination claim, anxiety related to the rumor, and increasing vaccination intention. However, the counterintuitive finding was observed with regard to sharing intention, such that participants reported higher scores in their intentions to share the anti-vaccination rumor after exposure to the counter-rumor than before exposure to the counter-rumor. In other words, rumor sharing intention increased after exposure to the counter-rumor. One of the possible reasons for this result might be due to the fact that sharing behavior itself involves somehow ambiguous meanings. Retweeting and replying on Twitter do

not necessarily indicate that users agree with or endorse the views presented in the tweet (Metaxas et al., 2014). In many occasions, for instance, we can find that users' profiles contain a disclaimer saying that retweeting does not mean endorsement or agreement (i.e., RT ≠ endorsement) (Metaxas et al., 2014). Replying to a tweet reflects message deliberation, which refers to users' active and public discussions of a given message within one's online social network (Alhabash & McAlister, 2015). Likewise, it is possible that replying to a tweet is not construed to endorsement or agreement, and in fact, we often find that some comments are used to oppose the opinions expressed in the tweet. Besides, retweet and reply functions on Twitter might involve some degree of corrective actions; for example, when people are critical of the opinions expressed in a particular tweet, they often retweet the message to bring it to the attention of the audience in their networks along with their corrective comments, or they reply to the message to express their dissenting opinions. Another possible reason for this result could be because participants might have misread the instructions which refer to the sharing of the anti-vaccination rumor. As they were exposed to the rumor and counter-rumor in a consecutive manner in this experiment, there was the possibility that participants might have misinterpreted the instructions and assumed that the sharing question referred to the rumor rather than the counter-rumor.

**Limitations and Future Directions**

The limitations of this study should also be recognized in terms of interpreting the findings. First, the measures to assess participants' prior attitudes toward vaccination need to be further developed. The current study used several dichotomous scales to assess participants' attitudes toward the necessity of vaccination, mandatory vaccination, and their pro- and anti-vaccination attitudes in general. However, as mentioned earlier, the use of these scales has some

limitations as the number of participants who oppose vaccination was much lower than the number of those who support vaccination. Also, it is important to acknowledge that the dichotomous scale provides a much lesser range of responses to measure the attitude than the continuous scale does. In this vein, future studies should develop a range of scales that assess participants' varying levels of attitudes toward the issue of vaccination. Particularly, it would be interesting to examine how those who have neutral attitudes toward vaccination—neither support nor oppose vaccination—respond to the counter-rumor, and whether differential patterns could emerge among them compared to other groups of vaccine supporters and opponents.

Second, it should be acknowledged that there might be ceiling and floor effects of the variables in this study due to large standard deviations. As shown in Table 5, the continuous measured variables exhibited large standard deviations and were found to be skewed. Also, normality tests of the change scales indicated that the distribution of these variables is not exactly symmetrical although most of them showed the acceptable range of the values for skewness ranging from -2 and 2 (George & Mallery, 2010). Given that, findings of this study should be interpreted cautiously considering that there is limited variability in the gathered data. Future studies should try to examine responses among participants with a wider range of vaccination attitudes.

Third, we need to test the current study design across a variety of demographic samples. Another issue found in the current sample is that only 26.8% had a school-aged child (or children) in their household, which could increase personal involvement with the issue of vaccination. Therefore, it is recommended that future studies should test the study design among those who have school-aged children. In addition, religion has been considered as one of the key factors that could influence decision on vaccination (Belluz, 2019). It has been found that

religious belief plays a key role in affecting parents' decision to avoid or refuse the vaccination of their children (Shelton, Snavely, De Jesus, Othus, & Allen, 2013). For example, as of June 2019, 44 states in the U.S. allow religious exemptions for vaccinations despite the growing concerns over vaccination amid the measles outbreak (Pew Research Center, 2019b). Some religious communities where vaccination rates are low, such as the Orthodox Jewish community, have been particularly hit by the recent nationwide measles outbreak (Andrews, 2019). Nevertheless, it has been reported that a group of anti-vaccination parents filed lawsuits challenging the New York state law that eliminated religious exemptions (West, 2019). For this reason, it would be worth investigating how the counter-rumor works among certain religious groups. Also, the lack of variance in participants' attitudes toward vaccination (e.g., pro- and anti-vax), which was noted earlier, might appear differently with different demographic groups. Therefore, it is important to test the study design across various demographic groups.

Fourth, the expansion of the vaccination topic is necessary to generalize the findings found in this study. This study focuses on the issue of childhood immunization, which deals with the much-discussed claim that MMR vaccine is linked to the risk for autism. However, there are a wide range of vaccine types, including DTaP (diphtheria, tetanus, pertussis) vaccine, Hepatitis B vaccine, varicella (chicken pox) vaccine, HPV (human papilloma virus) vaccine, and flu vaccine. Future studies need to test various topics of vaccination to explore whether findings could be replicated. In terms of the topic of vaccine safety itself, it is important to acknowledge that there are several claims involved in this topic. In addition to the well-known claim about MMR vaccine–autism link, for instance, a number of false claims have been circulated, arguing that vaccines contain toxic chemicals such as mercury and thimerosal which can cause brain damage among children (Wessel, 2017). In this regard, it would be needed to test various safety

issues to increase the generalizability in research. Yet, at the same time, it is important to note that there is the possibility that different findings might appear with different health topics. When it comes to replicating the study design, we need to carefully consider the characteristics of the study sample and topic.

Fifth, future studies might consider examining the effects of different message types—anecdotes vs. statistics—on the changes in cognitive, affective and behavioral responses to the anti-vaccination rumor. Scholars point to the prevalence of the anti-vaccination anecdotes circulated on social media sites (Guidry, Carlyle, Messner, & Jin, 2015). Narrative information could have a greater impact on the recipient's attitude and behavioral change as compared to statistical information (Green & Brock, 2000). When it comes to designing the counter-rumor message, the knowledge about narrative persuasion could be applied to increase its effectiveness. Hence, it would be valuable examining what types of the counter-rumor message (e.g., narrative vs. statistical evidence) could be effective at reducing the belief in the anti-vaccination, anxiety, and eliciting positive behavioral change.

Finally, the use of the mock tweet screenshots might have limited ecological validity of the study since it differs from the live Twitter environment. The static nature of screenshots used as stimulus did not fully reproduce the actual social media setting where participants interact with a variety of features on the site. To address this limitation, future studies need to expand the current study design to a more realistic environment that enables participants to have greater interactions with the site.

**Implications and Conclusion**

Overall, this study provides important insights into what makes the counter-rumor persuasive. Results indicated that confirmation bias persists when participants process and judge

the anti-vaccination rumor and the subsequent counter-rumor which refutes its claim. Those who support mandatory vaccination reported greater decrease in their belief about the anti-vaccination claim than those who oppose mandatory vaccination. This implies that the effectiveness of rumor refutation varies by one's previously held attitude. On the theoretical front, it reaffirms the persistency of confirmation bias and the tendency of cognitive dissonance pronounced in the rumor perception on social media. This finding shows that classic theories of cognitive dissonance and confirmation bias can be applied to understand the underlying process in which people trust and change their beliefs about anti-vaccination rumors in the online world.

In addition, we found a marginally significant interaction effect between attitude toward mandatory vaccination and source expertise on the change in intention to share the rumor. The effect of source expertise on rumor sharing intention is contingent upon one's previously held attitude toward mandatory vaccination. Results showed that those who support mandatory vaccination reported greater increase in their intention to share the anti-vaccination rumor when they read the counter-rumor from a layperson user (as opposed to the counter-rumor from CDC). Conversely, those who oppose mandatory vaccination reported greater increase in their intention to share the rumor when they read the counter-rumor from CDC (as opposed to the counter-rumor from a layperson). It implies that when people are faced with the counter-rumor that contradicts their own attitudes, they refuse to accept the counter-rumor from high expertise source and rather are more likely to share the rumor. This finding demonstrates the robustness of the previously attitude toward vaccination in shaping his or her response to source expertise and rumor sharing behavior.

Another key finding is that heuristic processing occurs in participants' responses to the anti-vaccination rumor and the counter-rumor that refutes its claim. The source expertise had a

significant impact on the change in anxiety. Those who read the counter-rumor from CDC reported greater decrease in their anxiety than those who read the counter-rumor from a layperson user. This finding suggests that when it comes the processing of vaccine-related information, individuals tend to be affected by source expertise, and in particular, they are less likely to feel anxious about the anti-vaccination rumor when they receive the counter-rumor from high expertise source. Theoretically, it demonstrates that individuals rely on mental shortcuts and employ simple decision rules when they process health-related misinformation and corrective information on social media, which is in line with HSM theory (Chaiken, 1980; 1987) and Sundar's (2008) heuristic approach to understanding the persuasive effects of online sources.

Furthermore, a significant interaction effect between argument strength and source expertise on the change in vaccination intention indicated that cue-message congruency plays an important role in affecting and changing behavioral intention. Consistent with HSM's *attenuation hypothesis* (Chen & Chaiken, 1999; Maheswaran et al., 1992), when participants read the weak counter-rumor from CDC, it contradicted their expectations about content quality, thus decreased vaccination intention. On the other hand, when they read the strong counter-rumor from a layperson, it created the incongruency between heuristic cue-based inference and content quality, therefore diminished vaccination intention.

This finding about cue-message congruency particularly has practical implications for public health officials and health communicators to find ways to deal with the anti-vaccination rumors and increase the effectiveness of their corrective messages. As reflected in our finding, congruency between heuristic cue and message strength is crucial to increase the persuasiveness of the message in promoting vaccination intention. Hence, when public health agencies such as CDC and WHO launch social media-based campaigns to emphasize the effectiveness and safety

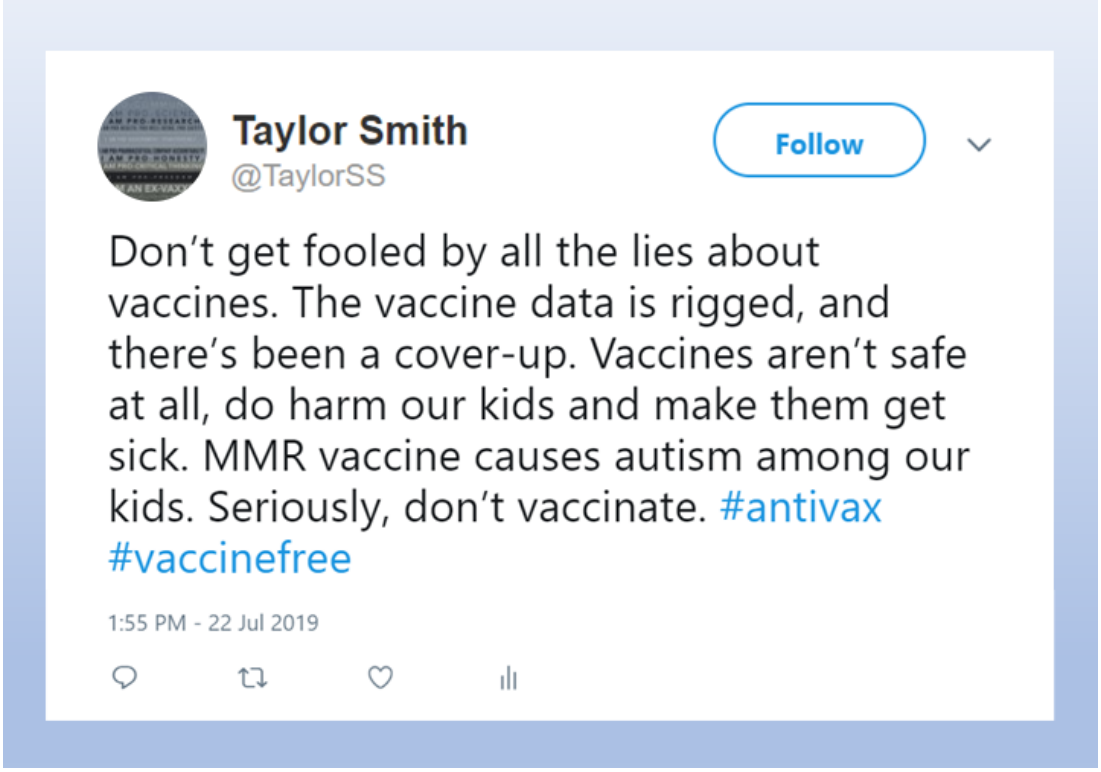
of vaccines (e.g., #VaccinesWork campaign), it is important to note that they should try to create and promote their messages that present high quality arguments. Also, when they plan and conduct health campaigns to combat the anti-vaccination rumors on social media, it would be necessary for public health officials and health communicators to make conscious efforts to produce and disseminate their messages containing strong arguments from high expertise source which maintains cue-message congruency.

Also, since our finding suggests that the presence of high expertise source was effective at reducing public anxiety associated with the anti-vaccination rumor, it is recommended that when public health officials and health communicators tweet and post counter-rumor messages, they need to capitalize on the logo and profile image signifying government agency from which users can infer greater source expertise. In addition, when launching pro-vaccination campaigns on social media, it would be important to make the high expertise source visible and salient to users, thereby allowing users to clearly identify the source of information and messages.

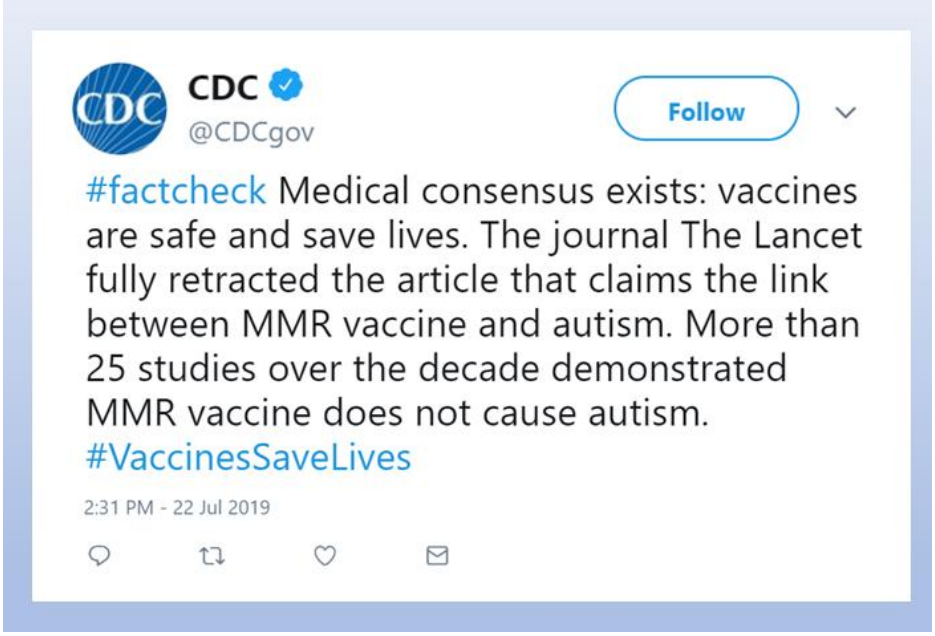
In conclusion, by investigating the effectiveness of the counter-rumor in the context of health misinformation on social media, this study contributes to the emerging body of online rumor literature. The knowledge about moderating influences that enhance or diminish the effects of the counter-rumor on cognitive, affective, and behavioral change can be useful in developing strategies and interventions to mitigate harmful consequences of the anti-vaccination rumors. It is important to know that only conveying facts does not necessarily sway public opinions about health decision. We need to take into consideration who we are dealing with, which source we are using to convey the message, and how strong the message can be.

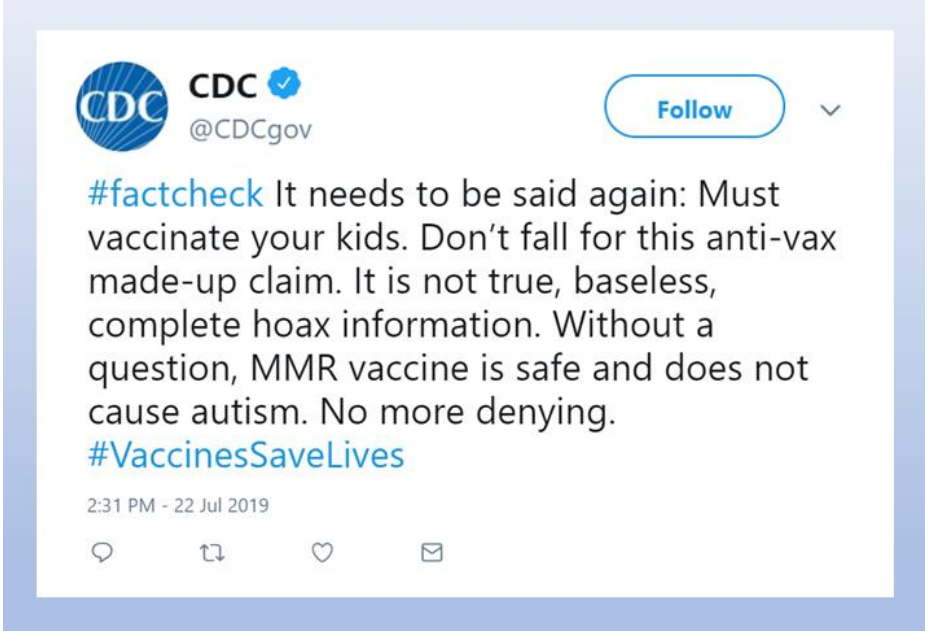
## APPENDICES

Appendix 1. The anti-vaccination rumor tweet



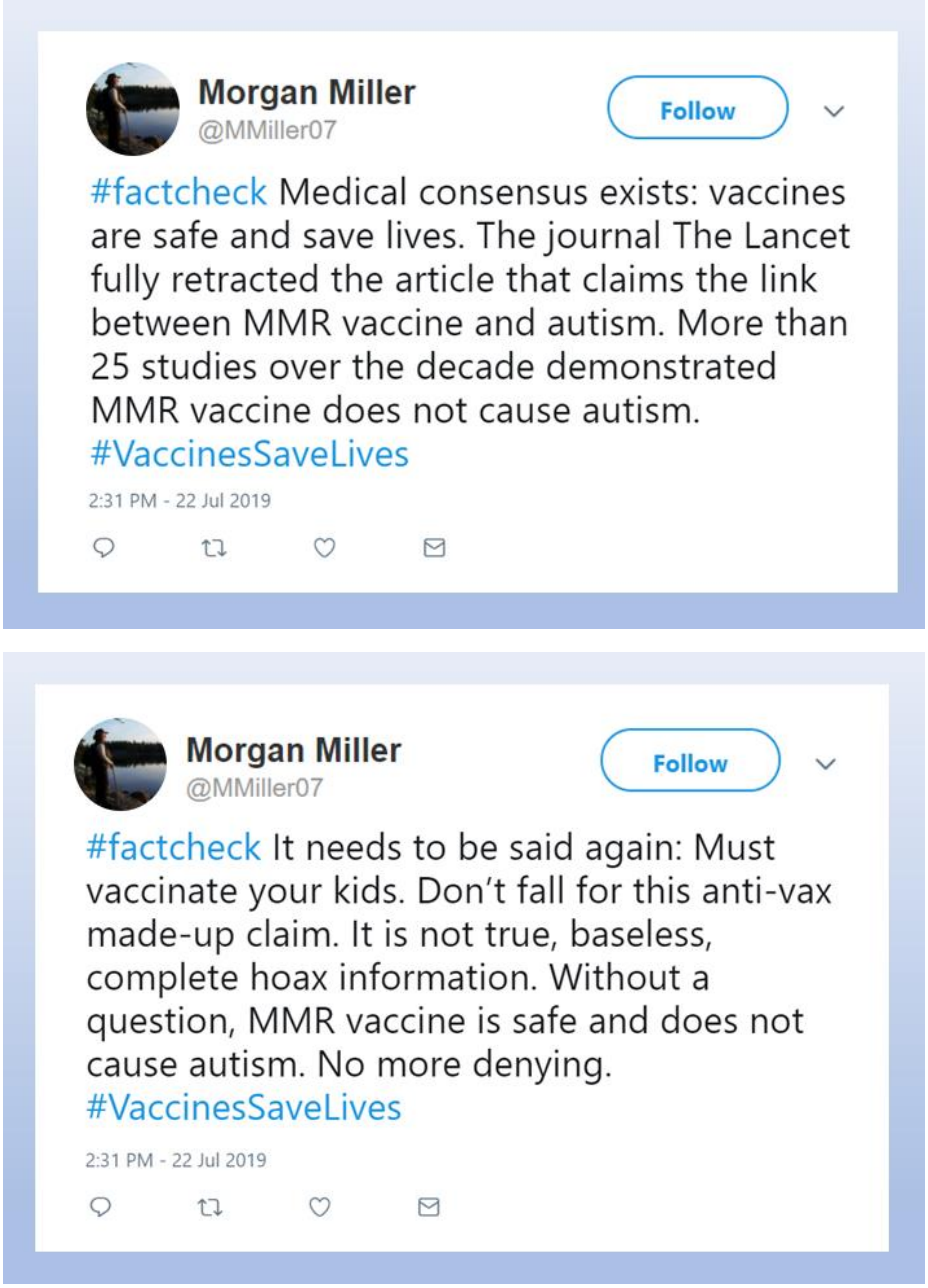
Appendix 2a. The counter-rumor tweet from CDC




*Note.* Above is the strong argument from CDC, and below is the weak argument from CDC.

Appendix 2b. The counter-rumor tweet from a layperson user




*Note.* Above is the strong argument from a layperson user, and below is the weak argument from a layperson user.

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Yum, J., & Jeong, S. (2018). Research on fake news perception and fact-checking effect: Role of prior-belief consistency. *Korean Journal of Journalism & Communication Studies*, *62*(2), 41–80.

# VITA

## EDUCATION

**Ph.D. in Mass Communications**, August 2019
Syracuse University, Syracuse, NY, USA
Dissertation: *Countering anti-vaccination rumors on Twitter*
Advisor: Dr. Tamara Makana Chock

**Certificate in University Teaching**, April 2016
Syracuse Future Professoriate Program, Syracuse University

**M.A. in Media Studies**, December 2013
Syracuse University, Syracuse, NY, USA

**M.A. in Film and Television Studies**, November 2009
The University of Warwick, Coventry, United Kingdom

**Bachelor of Political Science**, February 2007
Korea University, Seoul, South Korea
Minor: Journalism & Mass Communication

## AREAS OF SPECIALIZATION

- The psychology of new media
- Social media theory and practice
- Interactive media and well-being
- Impact of immersive technologies
- Communication theory
- Quantitative research methods

## ACADEMIC APPOINTMENTS

**Adjunct Professor/Lecturer**, Syracuse University, Summer 2018
McNair Scholars Program

**Adjunct Professor/Lecturer**, Syracuse University, Spring 2015
S.I. Newhouse School of Public Communications

**Teaching and Research Assistant**, Syracuse University, 2011–2017
S.I. Newhouse School of Public Communications

## REFEREED JOURNAL ARTICLES

Lee, J., Jung, S., **Kim, J. W.**, & Biocca, F. (2019). Applying spatial augmented reality to anti-smoking message: Focusing on spatial presence, negative emotions, and threat appraisal. *International Journal of Human-Computer Interaction*, 35(9), 751–760. https://doi.org/10.1080/10447318.2018.1489581

Jung, S., Lee, J., Biocca, F., & **Kim, J. W.** (2019). Augmented reality in the health domain: Projecting spatial augmented reality visualizations on a perceiver's body for health communication effects. *Cyberpsychology, Behavior, and Social Networking*, *22*(2), 142–150. https://doi.org/10.1089/cyber.2018.0028

**Kim, J. W.** (2018). Rumor has it: The effects of virality metrics on rumor believability and transmission on Twitter. *New Media & Society, 20*(12), 4807–4825. https://doi.org/10.1177/1461444818784945

**Kim, J. W.** (2018). They liked and shared: Effects of social media virality metrics on perceptions of message influence and behavioral intentions. *Computers in Human Behavior, 84,* 153–161. https://doi.org/10.1016/j.chb.2018.01.030

**Kim, J. W.** (2018). Facebook use for profile maintenance and social grooming and young Korean women's appearance comparison with peers and body image concerns. *Social Media + Society, 4*(2), 1–11. https://doi.org/10.1177/2056305118772835

**Kim, J. W.**, & Chock, T. M. (2017). Personality traits and psychological motivations predicting selfie posting behaviors on social networking sites. *Telematics and Informatics, 34*(5), 560–571. https://doi.org/10.1016/j.tele.2016.11.006

**Kim, J. W.**, & Chock, T. M. (2015). Body image 2.0: Associations between social grooming on Facebook and body image concerns. *Computers in Human Behavior, 48,* 331–339. https://doi.org/10.1016/j.chb.2015.01.009

## CONFERENCE PRESENTATIONS

**Kim, J. W.** (2018, November). *Facebook use for profile maintenance and social grooming and young Korean women's appearance comparison with peers and body image concerns*. Paper to be presented to the Human Communication and Technology Division at the annual meeting of the National Communication Association, Salt Lake City, UT.

**Kim, J. W.** (2018, May). *Rumor has it: The effects of virality metrics on rumor believability and transmission on Twitter.* Paper presented to the Communication and Technology Division at the annual meeting of the International Communication Association, Prague, Czech Republic.

Lee, J., Jung, S., & **Kim, J. W.** (2018, May). *Applying spatial augmented reality to anti-smoking message: Focusing on spatial presence, negative emotions, threat appraisal.* Paper presented to

the Communication and Technology Division at the annual meeting of the International Communication Association, Prague, Czech Republic.

Jung, S., Lee, J., **Kim, J. W.**, & Biocca, F. (2018, May). *Projecting health information onto the body: How embodied augmented reality projection alters the sense of presence and increases attitude change and behavior.* Paper presented to the Information Systems Division at the annual meeting of the International Communication Association, Prague, Czech Republic.

**Kim, J. W.** (2017, April). *Like vs. Share: The differential effects of social media bandwagon cues on the third-person perceptions of health messages and behavioral intentions.* Paper presented to the Health Communication Interest Group at the annual meeting of the Eastern Communication Association, Boston, MA. **[Top Student Paper]**

**Kim, J. W.** (2017, April). *Media use, fear, and health behaviors in a Zika pandemic crisis.* Paper presented at the 2017 D.C. Health Communication Conference, Fairfax, VA.

**Kim, J. W.** (2016, August). *Effects of health news on stigma associated with depression and helping intentions: The mediating role of narrative engagement.* Paper presented to the Korean American Communication Association at the annual meeting of the Association for Education in Journalism and Mass Communication, Minneapolis, MN. **[Top Student Paper]**

**Kim, J. W.,** Liebler, C. M., & Jiang, H. (2016, June). *Social media use, body image concerns, and cultural differences: A comparative study between Korea and the United States.* Paper presented to the Mass Communication Division at the annual meeting of the International Communication Association, Fukuoka, Japan.

Chock, T. M., & **Kim, J. W.** (2015, November). *Should you check your phone? Descriptive and injunctive norms for engaging in CMC activities in FtF interactions.* Paper presented to the Human Communication and Technology Division at the annual meeting of the National Communication Association, Las Vegas, NV.

**Kim, J. W.**, & Chock, T. M. (2015, August). *Why do people post selfies? Investigating psychological predictors of selfie behaviors.* Paper presented to the Communication Technology Division at the annual meeting of the Association for Education in Journalism and Mass Communication, San Francisco, CA.

Chock, T. M., **Kim, J. W**., Chung, M., & Chung, A. (2015, May). *The role of source identification and credibility in the social media impact hypothesis.* Paper presented to the Information Systems Division at the annual meeting of the International Communication Association, San Juan, Puerto Rico.

**Kim, J. W**., Chock, T. M., Chung, M., & Roh, S. (2015, May). *The effects of news about depression: The role of narrative format and controllability attribution.* Paper presented to the Health Communication Division at the annual meeting of the International Communication Association, San Juan, Puerto Rico.

**Kim, J. W.**, & Chock, T. M. (2014, November). *Facebook and body image: Relationships between social grooming in social media and the drives for thinness and muscularity.* Paper presented to the Communication and Social Cognition Division at the annual meeting of the National Communication Association, Chicago, IL.

**Kim, J. W.**, Chock, T. M., Chung, M., & Jung, S. (2014, August). *Social media, risk perception, and the third person effect: The case of Fukushima radiation.* Paper presented to the Communicating Science, Health, Environment and Risk Division at the annual meeting of the Association for Education in Journalism and Mass Communication, Montreal, Canada.

**Kim, J. W.** (2013, August). *Facebook, frenemy?: Examining the relationship between exposure to Facebook profiles and body image.* Paper presented to the Mass Communication and Society Division at the annual meeting of the Association for Education in Journalism and Mass Communication, Washington, D.C.

Chock, T. M., Daley, L., & **Kim, J. W.** (2012, November). *The Stupid Drink campaign: College students' pluralistic ignorance and perceived drinking norms.* Paper presented to the Communication and Social Cognition Division at the annual meeting of the National Communication Association, Orlando, FL.

## RESEARCH EXPERIENCE

**Research Staff** for Dr. Joon Soo Lim, Summer 2018 – Spring 2019
Syracuse University

- Assisted in conducting the research project funded by the Tow Center for Digital Journalism's Knight News Innovation Fellows program, titled "*The Age of AI (Artificial Intelligence): Audience Segmentation and Predictive Audience Engagement*"

**Research Assistant** for Dr. Carol M. Liebler**,** Fall 2016 – Spring 2017
Syracuse University

- Served as an editorial assistant for the book, *Media Scholarship in a Transitional Age: Research in Honor of Pamela J. Shoemaker*

**Research Assistant** for Dr. Tamara Makana Chock**,** Fall 2015 – Spring 2016
Syracuse University

- Conducted a lab-based experiment investigating the effects of virtual reality (VR) environments on social cognition and memory

**Research Assistant** for Dr. Hua Jiang, Summer 2015 and Summer 2016
Syracuse University

- Assisted in conducting an in-depth interview study with public relations professionals to explore the concept of integrated communication and how this impacts the way an organization approaches social media communication

**Research Assistant** for Dr. Tamara Makana Chock**,** Fall 2011 – Spring 2013
Syracuse University

- Conducted multiple stages of survey research evaluating the effects of grant-funded (sponsored by The Century Council) alcohol education campaigns on college students' drinking attitudes and behaviors

## TEACHING EXPERIENCE

**Instructor of Record,** Syracuse University, Summer 2018

- **Research Methods Seminar** (CAS 300, undergraduate course)
  - Taught the upper-level Research Methods Seminar course for the McNair Scholars Program, which prepares first-generation, underrepresented SU students for graduate/doctoral studies with hands-on research and scholarly activities
  - Lectured on quantitative, qualitative, mixed methods research designs
  - Graded students' research proposals, and supervised their research projects

**Instructor of Record,** Syracuse University, Spring 2015

- **Communications and Society** (COM 107, undergraduate course)
  - Co-taught an introductory communication course for undergraduate students, which offers an overview of the history, structure, effects, and future of mass media
  - Lectured on media effects theories and a range of mass communication areas, including journalism, advertising, public relations, the Internet, and social media
  - Advised students, graded assignments and exams

**Teaching Assistant/Lab Instructor,** Syracuse University, Fall 2014

- **Multimedia Storytelling** (COM 117, undergraduate course)
  Supervisor: Professor David Sutherland
  - Taught two lab sessions per week (e.g., camera operations, media editing techniques)
  - Supervised students' visual and digital storytelling projects (i.e., public service announcement, non-fiction, fiction)

## AWARDS & HONORS

**Newhouse Dissertation Research Grant**, S.I. Newhouse School of Public Communications, Syracuse University, Fall 2018

**ICA-CAT Travel Grant Award,** Communication and Technology Division, International Communication Association, Spring 2018

**ICA Travel Grant Award,** International Communication Association, Spring 2018

**ECA Top Student Paper Award,** Health Communication Interest Group, Eastern Communication Association, Spring 2017

**AEJMC-KACA Top Student Paper Award,** Korean American Communication Association Association for Education in Journalism and Mass Communication, Summer 2016

**AEJMC-KACA Travel Grant Award**, Korean American Communication Association Association for Education in Journalism and Mass Communication, Summer 2016

**Newhouse Conference Travel Grant**, S.I. Newhouse School of Public Communications, Syracuse University, Fall 2013 – Summer 2016

**Feinberg Dissertation Support Award**, S.I. Newhouse School of Public Communications, Syracuse University, Spring 2015

**Newhouse Graduate Fellowship**, S.I. Newhouse School of Public Communications, Syracuse University, Fall 2013 – Spring 2014

**Phi Beta Delta International Honor Society**, Syracuse University, Fall 2011 – Spring 2013

**Semester High Honors,** Korea University, 2002 – 2006

## PROFESSIONAL SKILLS

- Research methods: survey and experimental designs
- SPSS and Mplus; analysis of variance, multiple regression, mediation, moderation, factor analysis, structural equation modeling, and other statistical techniques and analyses
- Adobe Creative Cloud; Final Cut Pro X

## SERVICE & MEMBERSHIPS

*University Service*
**Peer Assistant,** Summer 2017
Slutzker Center for International Services (SCIS), Syracuse University

**Graduate Student Representative,** 2014 – 2015
Teaching Standards Committee, S.I. Newhouse School of Public Communications, Syracuse University

**Vice President,** 2014 – 2015
Newhouse Doctoral Student Association, S.I. Newhouse School of Public Communications, Syracuse University

*Professional Service*
**Korean American Communication Association Subcommittee,** 2017 – 2019
National Communication Association (NCA) Program

**Ad Hoc Journal Reviewer**

- New Media & Society
- Body Image: An International Journal of Research
- Social Media + Society
- Information & Management

**Conference Reviewer**

International Communication Association (ICA)

- Communication and Technology Division
- Health Communication Division
- Mass Communication Division

National Communication Association (NCA)

- Human Communication and Technology Division
- Korean American Communication Association

*Professional Memberships*

- Association for Education in Journalism and Mass Communication (AEJMC)
- National Communication Association (NCA)
- International Communication Association (ICA)
- Korean American Communication Association (KACA)