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INTENTIONS AND BEHAVIORS: TESTING SPIRAL OF SILENCE IN A SOCIAL
MEDIA CONTEXT

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June 2014

Submitted in partial fulfillment of requirements for the degree

MASTERS OF APPLIED COMMUNICATION THEORY AND METHODOLOGY

at the

CLEVELAND STATE UNIVERSITY

May 2017

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Student's Date of Defense: May 10, 2017

ACKNOWLEDGMENTS

I would like to thank my advisor, Dr. Cheryl Bracken, for spending so much time reading and editing my many drafts, for answering my infinite questions, and for her patience and attention to detail.

I would also like to thank my co-advisor, Dr. Kathleen Stansberry, for inspiring the use of theory and topic (vaccination) in this study, and for sharing her vast knowledge of social media tools.

I also would like to thank my committee member, Dr. Richard Perloff, for helping to shape this project in its early stages with invaluable insight, challenging questions, and macro-level thinking.

INTENTIONS AND BEHAVIORS: TESTING SPIRAL OF SILENCE IN A SOCIAL MEDIA CONTEXT

CARLINA DIRUSSO

ABSTRACT

This study tests for a spiral of silence effect on Facebook using vaccination as the controversial topic. Participants were required to have a Facebook account and to log in to their account to participate in the experiment. The three experimental conditions were real Facebook posts containing a meme about vaccines and a comment thread, where the manipulation occurred. The anti-vaccination condition had mostly anti-vaccination comments (9 of 10); the pro-vaccination condition had mostly pro-vaccination comments (9 of 10); and the mixed condition had an equal number of pro- and anti-vaccination comments (4 pro and 4 anti). Participants could leave a comment on the Facebook post; *commenting* on the post and *intentions* to engage with the post were the two dependent variables. Results found no difference in commenting or in intentions among the experimental conditions. Vaccination attitudes did not predict commenting but did predict intentions. There were no interaction effects of condition and attitudes on either commenting or intentions. A total of six comments were made across all conditions. Most of the comments supported vaccines. Results indicate vaccination did not inspire strong enough attitudes to create a spiral of silence effect on Facebook in this experiment.

Keywords: spiral of silence, Facebook, social media, opinions, vaccination

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CHAPTER I

INTRODUCTION AND RATIONALE

In recent years, scholars have investigated the impact of new media, including social networking sites (SNSs), on public opinion. Research has explored whether people are willing to express their opinions in this new media environment, and if so, under what conditions. Noelle-Neumann's (1974, 1977) spiral of silence theory assumes people are less likely to express their opinions if they feel their opinion is in the minority. Research has largely found support for a spiral of silence effect on SNSs (Ho & McLeod, 2008; Lee & Kim, 2014; Shen & Wang, 2015; Xiaodong & Li, 2016; Yun & Park, 2011). However, much of that research used experimental conditions that displayed clear, majority opinion climates, when a notable feature of SNSs is a lack of such majority opinions. The diversity of SNS users enables people to encounter a multitude of opinions regarding even a single issue, making it difficult to identify a dominant opinion. This study aims to determine if a spiral of silence effect is present in opinion climates where opinions are equally mixed by simulating vaccination conversations on Facebook.

Of all SNSs, Facebook is the most used site, engaging roughly 79% of Internet users of all ages and income levels (Greenwood, Perrin, & Duggin, 2016). Also, Facebook users are more politically engaged than users of other SNSs, and approximately 66% of Facebook users get news from Facebook, more than any other SNS (Gottfried & Shearer, 2016). Thus, the current study built experimental conditions within Facebook, portraying stimuli and comments from fellow Facebook users.

The combination of Facebook and the anti-vaccination movement is relevant to study for several reasons. SNSs are by far the most used type of social media for seeking and sharing health information (Chou, Hunt, Beckjord, Moser, Hesse, 2009). Yet, user-generated material on SNSs often provides misinformation and potentially dangerous suggestions regarding health concerns, especially related to vaccination (Nan & Daily, 2015; Wolfe & Sharp, 2005). Additionally, studies have found that vaccine-related information on SNSs is largely negative and not credible (Kata, 2010, 2011), and the misinformation being shared is becoming more frequent, especially on Facebook, in which anti-vaccination groups are active in posting and sharing faulty research and news. One of the largest groups, National Vaccine Information Center, has over 185,000 members, and each post garners hundreds of likes, comments, and shares.

Additionally, this study adds to spiral of silence literature by testing the effect of mixed opinion climates, defined here as a climate in which two or more opinions are perceived as equally prominent, and thus there is no clearly stated dominant opinion. Much of the spiral of silence literature, especially the more recent literature examining spiral of silence online, has not yet studied the impact of mixed opinion climates on one's willingness to speak out. The current study, like traditional spiral of silence studies,

presented two experimental conditions with opposing dominant opinion climates (i.e., pro- versus anti-vaccination). Unlike traditional spiral of silence studies, the current study added a third experimental condition that tests the mixed opinion climate, which displayed equal amounts of pro- and anti-vaccination sentiments. Thus, this third experimental condition adds a new component to spiral of silence literature.

This study also contributes to the methodology of spiral of silence literature. Scholars have critiqued the hypothetical nature of survey questions often used in spiral of silence studies, arguing that the dependent variable of “speaking out” is not adequately measured by a hypothetical questionnaire item (Glynn, Hayes, & Shanahan, 1997; Katz and Baldassarre, 1992; Scheufele, Shanahan, and Lee, 2001). Rather, scholars suggest an experimental design would better measure the dependent variable. Thus, the current study enabled users to leave a comment in a real Facebook setting. The researchers measured whether or not people comment, and then coded for *what* people commented. This experimental design increases validity and also gives insight into what kind of responses participants will have.

Further, much of the anti-vaccination literature published in last 20 years has sought to understand the content and frequency of anti-vaccination conversations (Bean 2011; Davies, Chapman, & Leask, 2002; Jacobson et al., 2007; Kata, 2010; Kata, 2011; Wolfe, 2002). Only recently have scholars begun to examine the *effects* of interacting with anti-vaccination sentiments, especially online (Betsch, Renkewitz, Betsch, and Ulshöfer, 2010; Fabry, Gagneur, & Pasquier, 2011; Kortum, Edwards, and Kortum, 2008; Nan & Madden, 2012). However, to the author’s knowledge, anti-vaccination discussions online have not yet been examined in a spiral of silence context. Considering the growing

popularity of the anti-vaccination movement, its strength in numbers on Facebook, and the danger posed by increasing numbers of unvaccinated children, it is important to study anti-vaccination through a public opinion lens, examining how other Facebook users—either pro- or anti-vaccination—contribute (or not) to the spiral of vaccination conversations.

The following chapters will contain a literature review regarding the spiral of silence and the anti-vaccination movement, a methods section with information about stimulus materials and measures, and a results section with anticipated analyses.

CHAPTER II

LITERATURE REVIEW

Spiral of Silence

Noelle-Neumann's spiral of silence theory (1974) posits that fear of social isolation is a fundamental part of the public opinion process. In this theory, public opinion is defined as controversial viewpoints that people are able to publicly express without becoming isolated; this definition of public opinion applies to both malleable subjects (e.g., in-flux opinions) and fixed customs (e.g., cultural values) (Noelle-Neumann, 1974; 1977). To illustrate the role of fear in the formation of public opinion, Noelle-Neumann references Floyd Allport's (1937) example: "the pressure brought to bear on householders in a neighborhood to shovel the snow from their sidewalks" (Noelle-Neumann, 1974, p. 43). Evident in this example, avoiding social isolation is more important than one's own judgement; regardless of a householder believing s/he should shovel snow, s/he likely will do so if her/his neighbors condone it. Prioritizing isolation-avoidance over personal

judgement appears to be a condition of life in human society, according to Noelle-Neumann (1974), as it enables humans to achieve sufficient integration. Additionally, this fear of isolation is not only comprised of a fear of social separation, but also a fear of doubting one's own ability to form judgements. Thus, fear of isolation is an integral part of all public opinion processes (Noelle-Neumann, 1974).

In order to assess when there is a threat of isolation, people constantly observe their social environment through their quasi-statistical sense, which is a cognitive ability that allows people to assess how similar or different others' opinions are to their own, and above all, to evaluate the strength, urgency, and chances of success of particular viewpoints (Noelle-Neumann, 1974). When an individual is forming an opinion about two conflicting viewpoints, s/he has two primary outcomes: 1) s/he discovers that s/he agrees with the prevailing view, which boosts self-confidence, enables her/him to express feelings openly, and frees her/him from the fear of isolation; or, 2) s/he discovers that her/his opinion opposes the prevailing view, which may lead her/him to feel uncertain about him/herself and lowers the chances of expressing opinion (Noelle-Neumann, 1974). After quasi-statistically assessing the current public opinion climate, one considers her/his own stance in comparison, which influences degree of willingness to express opinion. To put it more simply, people who perceive themselves to be in the minority are less likely to publicly express their opinions to avoid social isolation; on the contrary, people who perceive themselves in the majority do not have that same fear of isolation and are more likely to publicly express their opinions.

In her later work, Noelle-Neumann (1977) makes an important distinction between opinions that are static and those that are subject to change. For opinions that are

relatively static, like cultural customs or values, one *has* to act in accordance with this opinion in public or else risk becoming isolated. Contrarily, for disputable or in-flux opinions, one must determine which opinion he *can* express without becoming isolated (Noelle-Neumann, 1977). Ultimately, this pattern of withholding and expressing opinions creates a spiraling effect: the dominant opinions gain more and more ground, while the alternative opinions become weaker and weaker. This happens because representatives from the dominant opinion are quite verbal about it, which reinforces its dominant nature, while representatives from the other opinion remain silent. Thus, the often reinforced prevailing opinion appears stronger than it really is, while suppressed opinions seem weaker than in reality. Noelle-Neumann (1977) explains the spiraling effect as follows:

The result is a spiral process which prompts other individuals to perceive the changes in opinion and to follow suit, until one opinion has become established as the prevailing attitude while the other opinion will be pushed back and rejected by everybody with the exception of the hard core that nevertheless sticks to that opinion. (p. 144)

Therefore, understanding when a spiraling effect occurs is important because it has the potential to greatly influence public opinion. In the above quote, Noelle-Neumann hints at the impact of hard core opinions, which are further discussed in the following section about individual differences that may influence the spiral of silence.

Individual differences. Although empirical support has been found for the spiral of silence in many contexts (Atkin, 1969; Hayes, Shanahan, & Glynn, 2001; Mutz, 1994; Salmon & Neuwirth, 1990; Scheufele & Moy, 2000), not all people conform to the majority or withhold minority opinions. Social-psychological individual differences have been shown to influence a person's motivation to express opinion

(Gearhart & Zhang, 2014; Scheufele & Moy, 2000). Both classic spiral of silence research (Mutz, 1989; Willnat, 1996) and recent research pertaining to spiral of silence online (Gearhart & Zhang, 2014, 2015; Kim, Kim & Oh, 2014; Lee & Kim, 2014; Xiaodong & Li, 2016) have identified several individual difference variables that likely influence one's willingness to express opinion. Such differences, which have been widely accepted as important measured independent variables in spiral of silence research, include: willingness to self-censor (one's willingness to withhold their own opinion in interpersonal contact when it could cause disagreement), issue importance (perceptions of importance of the issue), and issue knowledge (knowledge about the issue) (Gearhart & Zhang, 2014, 2015; Kim, Kim & Oh, 2014; Lee & Kim, 2014; Mutz, 1989; Scheufele & Moy, 2000; Willnat, 1996; Xiaodong & Li, 2016). The current study employed a questionnaire that measured these three individual-level variables.

Hardcore opinions. Additionally, Glynn and McLeod (1984) noted another, less commonly studied individual difference variable influencing spiral of silence, *hardcore opinions*. Noelle-Neumann (1974) briefly mentions the impact this variable could have on a spiral of silence effect, stating that individuals with hardcore opinions are more likely to speak out about the issue, regardless of whether their opinion is perceived as majority or minority. In their study about voting predictions, Glynn and McLeod (1984) found that hardcore opinions significantly interacted with public opinion perception. Thus, the current study measured opinions about the issue (i.e., vaccination) to test for hardcore opinions.

Spiral of silence online. Initially, some scholars believed the spiral of silence effect would not exist, or be very minute, in online communication contexts. For example, Metzger (2009) suggested “the spiral of silence in its original form may have little predictive power in the new media environment” (p. 570). Further, Schulz and Roessler (2012) theorized that, because individuals are able to select the information with which they come into contact online, creating a “subjective-pluralistic pattern,” those individuals will believe they are surrounded by more like-minded people online than in real-world contexts. Thus, this projection effect will decrease a fear of isolation, and individuals online will be more likely to express their opinions, minimizing the spiral of silence effect on the Internet.

Other early critics drew attention to two more aspects of the Internet that they thought could reduce a spiral of silence effect: anonymity and lack of interpersonal presence. Researchers suggested the absence of these aspects would prevent any substantial sanction from being imposed on the individuals, especially sanction caused by physical presence (e.g., physical intimidation, gesture, name calling) (Jeffres, Neuendorf, & Atkin, 1999). However, empirical studies have since found support for a spiral of silence effect in online social environments, even those with anonymity (Yun & Park, 2011).

Two of the earlier studies examining spiral of silence on the Internet conducted experiments in online chatrooms. Wanta & Dimitrova’s (2000) study was conducted during the 1996 U.S. presidential debate and reported that postings increased for the winning candidate and decreased for the losing candidate over the course of the campaign, indicating a spiral of silence effect. Another study examined conversations about abortion in an anonymous online forum and reported that minority opinion holders

were more likely than majority opinion holders to display moderate opinions or to conceal them altogether (McDevitt, Kiouisis, & Wahl-Jorgensen, 2003). Both studies stated that anonymity on the Internet reduces a spiral of silence effect, even though it is still present¹. Because SNSs use is usually not anonymous, the current study examined spiral of silence on non-anonymous SNSs, specifically Facebook, which operates using the individual's personal information.

Spiral of silence on SNSs. Anonymous online chatrooms and SNSs are quite different because of the anonymity aspect; SNSs are not anonymous and are based on real-world relationships. Because of this, Gearhart & Zhang (2014) suggest SNSs are a specific kind of online communication to which the spiral of silence might be applicable. Recent research on spiral of silence online has largely focused on such SNSs, in which support has been found for a spiral of silence effect (Xiaodong & Li, 2016; Yun & Park, 2011). The current study examines conversations specifically on Facebook, a SNS that is based on personal relationships and offers constant opportunities for users to speak out via comments on posts. The following paragraphs will discuss research regarding spiral of silence on SNSs, including individual predictors specific to speaking out online.

In 2014, Pew Research published a study that found a significant spiral of silence effect on Facebook and Twitter, in which users reported to be less willing to voice their opinion if they felt their friends and followers disagreed with their point of view (Hampton et al., 2014). Additionally, the findings suggest social media users have a broad awareness of their online networks, and thus they are especially receptive to the opinions of those around them (Hampton et al, 2014).

¹ The spiral of silence results for these two studies are near significant. However they are both widely cited as early research that found support for spiral of silence in online contexts.

Multiple studies have found evidence that “people are influenced by their perceptions of majority opinion in an online environment, regardless of their perceptions of the general public opinion” (Lee & Kim, 2014, p. 273; Chang & Park, 2012; Yun & Park, 2011). This suggests there might be different underlying processes that influence the spiral of silence on social media than in interpersonal contexts. However, these processes are not yet clear. For example, some studies report that fear of isolation, although a significant predictor of speaking out in interpersonal contexts, may not be a significant predictor on social media (Ho & McLeod, 2008; Xiaodong & Lie, 2016).

In a study testing the outspokenness of Chinese social media users, Xiaodong & Li (2016) found that fear of isolation had neither a significant main effect on outspokenness, nor a significant interaction effect with opinion climate on outspokenness. Interestingly, they did find a significant spiral of silence effect, in which participants were reluctant to speak out when they perceived they were minority opinion holders on social media (Xiaodong & Li, 2016). Other social media studies have also found non-significance for fear of isolation as a predictor, despite a significant spiral of silence effect (Ho & McLeod, 2008; Lee & Kim, 2014; Yun & Park, 2011). This suggests some aspects of the spiral of silence theory may need to be modified for SNS contexts.

Exploring new potential predictors for spiral of silence on SNSs, Gearhart and Zhang (2014) studied how likely Facebook users were to comment on a message containing gay bullying sentiments. They explored several possible contributors to the spiral of silence, finding that willingness to self-censor was negatively related to speaking out (i.e., leaving a comment), and issue importance and time spent on SNSs were positively related to speaking out. It is important to note that interpersonal spiral of silence studies

conceptualize the dependent variable as *speaking out* or *expressing opinion*. In studies about the spiral of silence on SNSs, such as Gearhart and Zhang's (2014) and the current study, the dependent variable of speaking out is conceptualized as *leaving a comment* on a social media post, or the act of writing a message in response to a stimulus on social media. Leaving a comment on SNSs gives people a chance to speak out, similar to in interpersonal group conversations (Gearhart & Zhang, 2014).

In a separate study, Gearhart and Zhang (2015) found that speaking out (e.g., commenting) on SNSs is positively related to congruent opinion climate and frequency of general SNS use. Also, SNS political participation (how often one posts political content on his or her SNS) and the perceived importance of SNSs for politics are both positively related to speaking out on SNSs, regardless of whether the individual perceived a congruent opinion climate (Gearhart & Zhang, 2015). This reflects offline research suggesting that politically interested people are more likely to declare one's opinion (Baldassare & Katz, 1996). Additionally, issue knowledge, how much an individual knows about the issue, has been found to be a significant predictor of speaking out in both offline and online contexts (Kim & Kim, 2014; Salmon & Neuwirth, 1990; Willnat, 1996).

Spiral of silence research applications. The core assumption of spiral of silence theory is that willingness to express opinions is influenced by perceived support for those opinions. The majority of research investigating this phenomenon has used survey methods, in which participants responded to questions about their hypothetical willingness to speak out (Glynn et al., 1997; Salwen, Lin, & Matera, 1994). Even more recently, hypothetical response strategies, such as outspokenness and likelihood of

commenting, are used in self-reported online questionnaires to measure spiral of silence effects on SNSs (Gearhart & Zhang, 2014, 2015; Lee & Kim, 2014; Xiaodong & Li, 2016). Glynn et al. (1997) conducted a meta-analysis of spiral of silence research and overall found little support for the notion that perceived support for opinions influences willingness to express opinions. They argued this is likely because “the hypothetical nature of the situation presented in survey questions may not engender the kinds of psychological states that putatively produce spiral of silence effects” (Glynn et al., 1997, p. 461). Rather, they suggest that experimental designs are perhaps better suited to answer these kinds of questions. The results from Scheufele, Shanahan, and Lee’s (2001) study support this notion, finding that participants reported greater willingness to speak out in a questionnaire than in a focus group. Katz and Baldassarre (1992) also noted the utility of asking respondents if they are willing to speak out publicly (e.g., in a focus group or a news report) rather than hypothetically.

Additionally, Yun & Park (2011) used an experimental design that allowed participants to actually post in an online form to test the spiral of silence, manipulating anonymity and opinion climate. They found that anonymity did not significantly predict posting, but congruent opinion climate did (Yun & Park, 2011). The design of their study was effective in controlling the opinion climates within the created online forums and in testing real-time responses from participants. The current study adopted a similar experimental design to test the spiral of silence on Facebook, in which participants had an opportunity to comment in real-time while logged into their actual Facebook pages.

Another factor of spiral of silence research addresses people’s misperceptions of the public opinion climate, often called pluralistic ignorance. Pluralistic ignorance stems

from the “looking-glass perception,” which is the tendency for people to perceive that others agree with them (Fields & Schuman, 1976; Taylor, 1982). Later, O’Gorman (1975; O’Gorman & Garry, 1976) built on that idea and termed pluralistic ignorance as the occurrence when the minority position perceives themselves to be the majority and vice versa (Taylor, 1982). Because spiral of silence posits that people’s perception (i.e., quasi-statistical sense) of public opinion influences the formation of public opinion, it is important to assess whether or not people accurately perceive the environment in the first place. Researchers have found support for pluralistic ignorance influencing participants’ perceptions of public opinion and willingness to express their own opinion (O’Gorman, 1975; O’Gorman & Garry, 1976; Scheufele & Moy, 2000; Taylor, 1982). Thus, Taylor (1982) suggests spiral of silence researchers should measure how people perceive the opinion climate in experimental conditions to test and control for pluralistic ignorance. The current study employed a questionnaire that assessed the accuracy of participants’ perceptions of the opinion climates within the given experimental condition.

Mixed opinion climates. Generally, spiral of silence research refers to congruency of opinion climate as one’s perception of whether their own viewpoint is consistent with the majority opinion of the public (Noelle-Neumann, 1974; Ho, Chen, & Sim, 2013). The current study tested for effects of congruency of attitude and opinion climate, but it also tested the lesser studied effect of mixed opinions within one climate or condition. Few studies have examined the impact of a mixed opinion climate, a common occurrence on SNSs. For example, a single comment thread on a Facebook post often displays multiple, opposing viewpoints about the same issue; while one user might leave a comment favoring a given viewpoint, another user can also comment opposing that same

viewpoint. The diverse opinions on SNSs create mixed opinion climates, making it difficult for individuals to confidently identify the majority opinion (Shen & Wang, 2015). Shen & Wang (2015) tested the effect of such mixed viewpoints across the media environment. Their experiment contained two media platforms: TV news and online news. They found that if people perceived mixed opinions between TV and online, they were more likely to remain silent. Individuals were most likely to speak out when they perceived both television news coverage and online opinion as congruent, whereas intention to speak out was lowest when one was perceived as negative and the other positive (Shen & Wang, 2015).

Shen & Wang's (2015) study, although hinting at what the current study seeks to manipulate, does not exactly test the mixed opinion climates that will be shown in this experiment. Their findings are important to mention, nonetheless, because they support the notion that mixed opinions about the same issue have an effect on spiral of silence. Because there is no empirical evidence that indicates how participants will respond to an equally mixed opinion climate in one experimental condition, the following research question is proposed:

RQ₁: In which experimental condition (pro-vaccination, anti-vaccination, or mixed) will participants be most likely to leave a comment?

Based on literature regarding individual differences and the spiral of silence, the following are proposed:

H₁: Willingness to self-censor will be negatively related to commenting.

H₂: Commenting will be positively related to (a) Facebook political participation, (b) importance of SNSs for politics, (c) issue importance, and (d) issue knowledge.

The experimental conditions each displayed the same Internet meme that presents an opinion-neutral message about vaccines. The following section will further discuss the anti-vaccination movement.

The Anti-Vaccination Movement

Origins. The first vaccine was created in the United Kingdom in the late 1700s by Edward Jenner, who found that smallpox could be prevented by inoculation with small doses of live, infectious material. Soon after this discovery came the UK's Vaccination Act of 1840, which provided free smallpox vaccinations on a mass scale. Then, the UK passed the Vaccination Act of 1853, which required all infants to receive the smallpox vaccine before three months of age. This act—and its extension in 1867 that increased the vaccination age to 14—enabled the government and state to heavily fine or imprison parents who did not vaccinate their children. It was this extension in 1867 that propelled the official formation of the anti-vaccination movement, then-called the Anti-Compulsory Vaccination League (Porter & Porter, 1988; Wolfe & Sharp, 2002).

Toward the end of the 19th century, the anti-vaccination movement spread throughout Europe, the United States, and Canada. It garnered support and shared messages through riots, pamphlets, books, journals, and demonstrations that attracted up to 100,000 people (Wolfe & Sharp, 2002). Modern anti-vaccination arguments have not changed much since the 18th and 19th centuries, and the main points still address vaccine adverse effects and failures, “infringement of personal liberty, and an unholy alliance between the medical establishment and the government to reap huge profits for the medical establishment at the expense of the public” (Wolfe & Sharp, 2002, p. 431). Although the

movement's arguments remain consistent, the means of disseminating information have changed, especially by way of the Internet (Wolfe & Sharp, 2002).

Anti-vaccination information online. Anti-vaccination information online is extensive and diffused in all forms: websites, blogs, social media sites (SNSs), and videos. Several content analyses have found patterns in the information presented on anti-vaccination websites, which are similar to the arguments originating in the 19th century, such as vaccine adverse effects and government and pharmaceutical conspiracy. These same analyses also found that anti-vaccination websites' information tends to be deceptive and medically inaccurate (Bean 2011; Davies, Chapman, & Leask, 2002; Jacobson, Targonski, & Poland, 2007; Kata, 2010; Kata, 2011; Wolfe, 2002). Not only is anti-vaccination information online often inaccurate, but vaccine information in general tends to be mixed and contradictory. Web searches for vaccine information produce both anti- and pro-vaccine websites (Kata, 2010; Madden, Nan, Briones, & Waks, 2012; Wolfe, Sharp, & Lipsky, 2002; Zimmerman et al., 2005), and a range of online content regarding specifically the human papillomavirus (HPV) vaccine also contains mixed information. For example, several studies found that the HPV vaccine has been depicted both positively and negatively in SNS posts (Keelan et al., 2010), online news articles (Habel, Liddon, & Stryker, 2009), general websites (Madden et al., 2012), and YouTube videos (Ache & Wallace, 2008; Briones, Nan, Madden, & Waks, 2012). Examples of contrasting article/video headlines from these studies include "A Cancer Vaccine Triumph" and "The Slut Shot" (Habel et al., 2009).

Although both positive and negative depictions of vaccines exist online, the negative ones tend to be more popular among Internet users. One study found that 32% of

immunization videos on YouTube opposed vaccination and had higher ratings and more views than pro-vaccination videos (Keelan, Pavri-Garcia, Tomlinson, & Wilson, 2007). Additionally, Seeman, Ing, and Rizo (2010) found that 60% of influenza vaccine top search results contained anti-vaccination views and had each been shared and viewed thousands of times on SNSs, more than pro-vaccination views.

Negative information about vaccines also tends to be more persuasive than pro-vaccine information, as indicated by a number of recent studies. For example, Kortum, Edwards, and Kortum (2008) found that online anti-vaccination messages led to significant beliefs in misinformation about vaccines among high school students. Similarly, another study demonstrated that, after viewing mainstream anti-vaccination websites, pregnant women in Quebec were less likely to receive an H1N1 vaccine than pregnant women who consulted a medical professional (Fabry, Gagneur, & Pasquier, 2011). Betsch et al. (2010) found that browsing anti-vaccination websites for just 5 to 10 minutes increased risk perceptions of vaccines, decreased risk perceptions of omitting vaccines, and overall decreased intentions to vaccinate.

Finding similar results, Nan and Madden (2012) directly compared effects of viewing positive versus negative blog posts about the HPV vaccine, indicating that people exposed to the negative blog post held more negative attitudes toward the HPV vaccine, perceived the vaccine to be less safe, and had lower intentions to receive the vaccine than those in a control group. Additionally, exposure to a positive blog post did not increase safety perceptions or intentions to vaccinate. These findings indicate the impact anti-vaccination messages have on attitudes and behavioral intentions, even with brief exposure, and even more so than pro-vaccination messages (Nan & Daily, 2015).

The impact of anti-vaccination information online poses a threat to both individuals and the community. Salathé and Khandelwal (2011) conducted a simulation of infectious disease transmission and found that if the clusters of negative vaccine sentiments on social media “lead to clusters of unprotected individuals, the likelihood of disease outbreaks is greatly increased” (Salathé & Khandelwal, 2011, p. 1). This indicates that both the prevalence and influence of negative vaccine sentiments online warrant further academic research.

The current study seeks to understand how Facebook users interact with these potentially dangerous anti-vaccination messages, and whether or not users choose to engage in the conversation by expressing their opinion. Participants were asked about their current attitude toward vaccines, as this is expected to influence whether or not they leave a comment. However, it is unclear what kind of relationship the two variables will have because there is no known empirical evidence showing the relationship between attitude toward vaccines and speaking out in a spiral of silence experiment on social media. It could be hypothesized that participants are more likely to leave a comment in conditions that display an attitude toward vaccines which is similar to their own. For example, a pro-vaccination Facebook user could be more likely to comment in the pro-vaccination condition because they share the majority opinion, and therefore, fear of isolation is reduced. However, the other factors that are specific to social media (i.e., SNS political participation, importance of SNS for politics) complicate the spiral of silence process in this experiment, and sharing the majority opinion might not be the only influencer of speaking out. Because there is no evidence to indicate the nature of the

relationship between attitude toward vaccines and commenting, the following research question is proposed:

RQ_{2a}: How will attitude toward vaccines be related to leaving a comment in the three experimental conditions?

RQ_{2b}: What will participants write in the comments? How does that content relate to attitude toward vaccines and the experimental conditions?

RQ₃: Is there a relationship between commenting in the experimental conditions and reporting behavioral intentions?

CHAPTER III

METHOD

Study Design

A post-test only experiment was conducted online using Qualtrics A/B testing option. There were three conditions which each displayed an opinion about vaccination (i.e., anti-vaccination, pro-vaccination, and equally mixed pro- and anti- opinions). The experimental conditions were presented via staged Facebook posts. The manipulation for each condition occurred in the comment thread of the Facebook posts.

Sample and Procedures

This study employed an online survey and experiment via Qualtrics to answer and test the research questions. The experiment required users to have a Facebook account, as Facebook posts were used as the experimental conditions. Therefore, upon entering the survey, participants first consented to partaking in the survey and to allowing the survey to access their personal Facebook account and login information. The survey required

participants to login to Facebook to view real Facebook posts as stimuli to enhance external validity.

Stimulus Materials

All three experimental conditions displayed a Facebook post inside of a staged Facebook page (i.e., HealthConvo, HealthConvo2, HealthConvo3) created by the authors. (See Appendix X for the Facebook comments). The Facebook post consisted of a vaccine-neutral meme and a comment thread with 10 comments. The post (i.e., meme) was the same in all three conditions; the manipulation in vaccination opinions occurred in the comment thread.

Manipulation Test

The first manipulation test conducted prior to the experiment indicated that participants did not accurately perceive the majority opinion within each experimental condition. Therefore, the authors capitalized keywords (e.g., SAFE, HEALTHY, DEADLY, SCAM) in each comment to act as heuristics so the participants could more easily identify the majority opinion climate. A second manipulation test, which contained keywords in all caps, showed that participants did accurately perceive the majority opinion in each condition. Results from a one-way ANOVA showed the groups were statistically significant ($F_{(2, 19)}=5.08, p=0.02$): anti-vaccination ($M=2.20$), pro-vaccination ($M=3.50$), mixed ($M=2.77$). Therefore, the keyword capitalization from this second manipulation test was used in the experiment.

Vaccine neutral meme. A still-image Internet meme (i.e., an image with text over it) was used as the Facebook in the experimental conditions because memes are frequently used by anti-vaccination groups on SNSs, and a single anti-vaccination meme can acquire

hundreds of comments and likes on Facebook. Still-image memes are popular likely because they are easily shareable across various social media platforms and usually garner a significant amount of activity (i.e., likes, comments, shares, retweets) on SNSs. Research also suggests they induce significant effects on viewers, depending the content and context (Milner, 2013; Williams, Oliver, Aumer, Meyers, 2016). The meme in this study displayed an image and text that relates to vaccines but does not display either a pro- or anti-vaccination attitude. The image in the meme is a pair of boxing gloves and contains the text, “Protect yourself. Protect children.” This meme was the Facebook post used in all three experimental conditions. See Figure 1 below.

Figure 1.
Meme Presented in all Conditions



Anti-vaccination comments. Nine of the 10 comments in this condition express anti-vaccination sentiments. Comments were constructed by the author based on real

comments found in Facebook posts from anti-vaccination groups. See Figure A.1. in the Appendix for a screenshot of the comments.

Table 1.

Comments in Experimental Conditions

Anti-Vaccination	Pro-Vaccination	Mixed Opinion
Vaccines are HARMFUL... Poisonous! They cause disease!	Vaccines keep you HEALTHY!! They help your body fight off diseases.	People have different opinions when it comes to vaccines.
Vaccines are a SCAM, period! People's immune systems are enough.	Vaccines are SAFE, period! We need vaccines to PROTECT ourselves!!	Vaccines are safe and effectively defend against disease.
Big Pharma is hiding research that shows vaccines are DEADLY!! Wake up sheeple!	Pharma research has found vaccines are SAFE!! Protect the herd!	The HPV vaccine has serious side effects.
The HPV vaccine is TERRIBLE and unsafe. So many side effects.	The HPV vaccine is SAFE and a great invention in science! Yay for protection for girls!	The HPV vaccine is a totally safe immunization.
The propaganda media MANIPULATES people into thinking they need POISON flu shots!	Everyone should get the SAFE flu shot this year. Stay STRONG and HEALTHY!!	Vaccines are a SCAM, period! People's immune systems are enough.
Immunization laws are meant to protect children from disease.	The government has vaccination laws to force children to get vaccinated.	Vaccines are SAFE, period! People's immune systems are not enough.
All vaccines are DANGEROUS! Especially the HPV vaccine. It's a SCAM meant for profit!	The HPV vaccine is a MIRACLE shot! It SAVES girls from getting cancer!	Big Pharma is hiding research that shows vaccines are DEADLY!! Wake up sheeple!
Pharma studies have found vaccines cause AUTISM and more diseases!	Research found vaccines are SAFE and they prevent illness!	Pharma research has found vaccines are SAFE!! Protect the herd!
The HPV vaccine has SERIOUS SIDE EFFECTS!! Don't get it!	I feel so much more SECURE and SAFE now that I got the HPV vaccine!	The HPV vaccine is a MIRACLE shot! It SAVES girls from getting cancer!
The government has AWFUL vaccination laws to force children to get vaccinated against their parents' will!	Immunization laws create herd IMMUNITY!	I think people just have mixed opinions about vaccines.

Pro-vaccination comments. Nine of the 10 comments in this condition express pro-vaccination sentiments. Comments were constructed by the author based on real comments found in Facebook posts about vaccination discussions. See Figure A.2. in the Appendix for a screenshot of the comments.

Mixed comments. The comment thread has a total of 10 comments. Four of the comments are anti-vaccination and four are pro-vaccination, thus displaying a mixed opinion climate. The first and last comments contain a neutral statement about vaccines. This was to ensure the participants perceived a mixed opinion climate; the first and last comments might be more memorable than the middle ones. All comments are constructed by the author based on real Facebook comments. See Figure A.3. in the Appendix for a screenshot of the comments.

Measurement

Independent Variables

There were two forms of measurement: participants' commenting behavior within the experimental conditions and the questionnaire responses. Commenting behavior within the experiment is measured by coding whether or not participants left a comment in their randomly assigned Facebook post. The questionnaire items are described below.

Perception of climate. One item measures how accurately respondents perceived the opinion climate about vaccines in their randomly assigned experimental condition. The item asks, "What do you think was the dominant opinion about vaccination in the Facebook post you just saw?" Response categories are "1 = Anti-vaccination" to "5 = Pro-vaccination."

Fear of isolation. This two-dimensional scale from Yun & Park (2011) was adapted from Moy, Domke, and Stamm (2001), Scheufele and Moy (2000), and Scheufele et al. (2001). The first dimension measures fear of isolation in society. Sample questions include “In general, I worry about being isolated if people disagree with me” and “In general, I enjoy avoiding arguments.” The second dimension measures fear of isolation online. Sample questions include “Online, I worry about being isolated if people disagree with me” and “Online, I try to avoid getting into arguments.” Response categories range from 1 = “almost never true” to 5 = “almost always true.” Cronbach’s Alpha = .78

Facebook political participation. Six items modified from the Online Political Participation Scale from de Zúñiga, Jung, and Valenzuela (2012) measure how often participants use Facebook for politics. Political participation on Facebook was measured on a 5-point scale from 1 (rarely) to 5 (all the time) in answer to the question, “How often do you use Facebook to X?,” including the following activities: “Post your political message on your Facebook,” “Post your response on others’ political view on others’ Facebook,” “Read others’ political opinion on others’ Facebook walls,” “Subscribe to a political newsfeed/magazine,” “Sign up to volunteer for a campaign/issue,” and “Send a political opinion to others using Facebook message.” Cronbach’s Alpha = .83

Importance of SNSs for politics. A four-item scale from Rainie and Smith (2012) is used to ask participants about the importance of SNSs for (a) keeping up with politics, (b) debating or discussing political issues, (c) finding others who share political views, and (d) recruiting people to get involved with political issues (1 = “very important” to 4 = “none at all important”). Cronbach’s Alpha = .85

Issue importance. Two items will assess perceived importance of vaccines. Mutz (1989) and Willnat (1996) found that issue importance is a consistent predictor of public expression of opinions. Both studies used a one-item measure to assess perceived issue importance. Like these studies, this item will ask respondents to indicate on a four-point scale (1 = not important at all, 4 = very important) how important they consider vaccines to themselves. Gearhart and Zhang (2014) also found issue importance to be a significant predictor of opinion expression in their study about national gay rights. Because vaccines are both a personal and national issue, this study will also ask respondents to indicate on a four-point scale (1 = not important at all, 4 = very important) how important they consider vaccines to the nation. Cronbach's Alpha = .82

Issue knowledge. A nine-item scale from Zingg and Siegrist (2012) is used to assess the level of knowledge the respondents have on vaccines and vaccination. Each item presents a statement about vaccines, which respondents indicate as 1 = "correct", 2 = "incorrect", or 3 = "do not know". Sample items include "Without broadly applied vaccine programs, smallpox would still exist" and "The immune system of children is not overloaded through many vaccinations." Sample reverse coded items include, "Vaccines are superfluous, as diseases can be treated (e.g., with antibiotics)" and "Vaccinations increase the occurrence of allergies." Cronbach's Alpha = .83

Willingness to self-censor. An eight-item scale from Hayes, Glynn, and Shanahan (2005a, 2005b) is used to assess one's willingness to withhold their own opinion in interpersonal contact when it could cause disagreement. Matthes et al. (2012) found this scale to work cross-culturally and claimed this concept drives this spiral of silence. Sample items include, "It is difficult for me to express my opinion if I think others won't

agree with what I say” and “When I disagree with others, I’d rather go along with them than argue about it.” Sample reverse coded items include, “It is easy for me to express my opinion around others who I think will disagree with me.” Item responses are a 1 = “strongly disagree” to 5 = “strongly agree” scale. Cronbach’s Alpha = .81

Prior beliefs about vaccination in general. A two-dimensional, eight-item scale from Nan and Daily (2015) is used to measure one’s beliefs about vaccines. All items are to be reverse coded. Sample items from the first dimension, perceived efficacy, include, “There is little scientific proof that immunization prevents infectious diseases” and “Vaccines are ineffective in preventing diseases.” Sample items from the second dimension, perceived safety, include, “Vaccines actually cause more diseases than they prevent” and “Vaccination has adverse side effects.” Item responses are 1 = “strongly disagree” to 7 = “strongly agree”. Cronbach’s Alpha = .91

Demographics. Subjects were asked to indicate what device they used to complete the survey, age, highest level of completed education, racial ethnicity, living location, and political views.

Dependent Variables

Behavioral intention. This scale contains five items that ask about hypothetical behavioral responses to the experimental condition. The scale asks, “How likely is it that you would do the following behaviors in response to the Facebook post you saw on the previous page?” The five items are, “Leave a comment,” “Like’ the post,” “Like’ one of the comments,” “Reply to any of the comments,” and “Share the post.” Response categories range from 1 = “Extremely unlikely” to 5 = “Extremely likely.” Cronbach’s Alpha = .79

Commenting. The dependent variable *commenting* is the act of writing a message in response to a stimulus on social media. In this experiment, commenting is measured by whether or not respondents left a comment in the Facebook post. The content of the comments were coded after data collection via sentiment analysis using three codes regarding vaccine sentiments: positive, negative, or neutral.

Table 2.
Scale Reliabilities

Scales	Number of Items	Cronbach's alpha
Behavioral Intention	5	.80
Fear of Isolation	14	.78
SNS Political Participation	6	.83
Importance of SNS for Politics	4	.85
Issue Importance	2	.82
Issue Knowledge	9	.83
Willingness to Self-Censor	8	.81
Prior Beliefs about Vaccination	9	.91

Procedures

The entire experimental procedure was as follows: Participants were given a link via email that directed them to the online survey. They consented to participating and to giving the survey access to their Facebook accounts. Then, the survey randomly assigned each participant to one of three experimental conditions in Facebook. Each experimental condition manipulated the majority opinion about vaccines (i.e., anti-vaccination, pro-

vaccination, or mixed opinions). The conditions were presented on a slide in Qualtrics that instructed participants to click on a hyperlink that would open a page in Facebook. A prompt on the slide instructed participants to thoroughly review the Facebook post and the comments, and then to return to the Qualtrics page to complete the survey. The prompt also said participants were welcome to contribute to the conversation by commenting on the post, but were not required to do so. Once participants returned to the survey, they completed a questionnaire.

Any comments made by participants were not posted on the Facebook post. The authors altered the Facebook page settings so that all comments were moderated and blocked by the Facebook page creator. Therefore, the experimental conditions were entirely staged and monitored throughout the experiment. This prevented effects of ascending and descending opinions, which Noelle-Neumann (1977) states could alter the likelihood of speaking out. An ascending opinion is one which gains momentum in an opinion climate; although this opinion might initially be the minority, once people start speaking out, it could ascend into the majority. Therefore, this would simultaneously create a descending opinion, in which the once majority opinion would descend into the perceived minority.

Table 3.
Research Questions and Hypotheses Results

		Supported	Results
RQ1:	In which experimental condition (pro-vaccination, anti-vaccination, or mixed) will participants be most	n/a	No significant differences among experimental conditions

	likely to leave a comment?		
H ₁ :	Willingness to self-censor will be negatively related to commenting.	Yes	Commenting is negatively related to willingness to self-censor
H ₂ :	Commenting will be positively related to: (a) Facebook political participation, (b) importance of SNSs for politics, (c) issue importance, (d) issue knowledge.	No	Commenting is negatively related to issue knowledge. No other significant relationships
RQ _{2a} :	How will attitude toward vaccines be related to leaving a comment in the three experimental conditions?	n/a	No significant interaction effect of experimental condition and vaccine attitudes on commenting
RQ _{2b} :	What will participants write in the comments? How does that content relate to attitude toward vaccines and the experimental conditions?	n/a	4 of 6 total comments were in anti-vaccination condition. Most of the comments were in support of vaccines.
RQ ₃ :	Is there a relationship between commenting in the experimental conditions and reporting behavioral intentions?	n/a	Commenting and behavioral intentions have a significant positive relationship

CHAPTER IV

RESULTS

The data collected from this experiment were input into SPSS for analysis. The independent and dependent variables were tested using bivariate correlations and two-factor ANOVAs.

Sample Description

A total of 204 respondents participated in the study. The sample was composed of 40% ($n=81$) male and 60% ($n=123$) female participants. Participants' ages ranged from 18 to 50, with a mean of 23 years old ($SD=5.10$). In terms of race, 67% were Caucasian ($n=137$), 13% were African American ($n=26$), 9.8% were Other (i.e., multiracial, Native American, or Latino; $n=20$), and 6% were Asian ($n=12$). The results also indicated that 67% ($n=138$) had Some College education, 16% ($n=33$) had a College Degree, 12% ($n=25$) were High School Graduates (or equivalent), 3.4% ($n=7$) had a Graduate Degree,

and .5% had Some High School ($n=1$). More descriptive statistics about all demographic variables can be found in Table B.1. in the Appendix.

Research Question 1 and 2a

Research Question 1 asked in which experimental condition are participants most likely to leave a comment. The results of a two-factor ANOVA predicting commenting from experimental condition and vaccination attitudes are shown in Table 4. The main effect of vaccination attitudes is non-significant ($F_{(1, 193)}=.43, p = .51$), and the main effect for experimental condition is also non-significant ($F_{(1, 193)}=1.88, p = .16$). Research Question 2a asked about a possible interaction effect between vaccination attitudes and experimental condition on commenting. The interaction effect between experimental condition and vaccination attitudes is non-significant ($F_{(1, 193)}=.64, p = .53$).

Table 4.
Two-Factor ANOVA Predicting Commenting from Experimental Condition and Vaccination Attitudes

	<i>M</i>	<i>SD</i>	<i>n</i>	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.	Partial η^2
Condition				0.11	2	0.06	1.88	0.16	0.02
Pro	0.03	0.17	70						
Anti	0.06	0.24	67						
Mixed	0.00	0.00	62						
Vaccine Attitudes				0.01	1	0.01	0.43	0.51	0.002
Pro	0.04	0.19	104						
Anti	0.02	0.14	95						
Condition X Attitudes				0.38	2	0.02	0.64	0.53	0.01
Pro/Pro-Att	0.03	0.16	39						
Pro/Anti-Att	0.03	0.18	31						
Anti/Pro-Att	0.09	0.28	35						
Anti/Anti-Att	0.03	0.18	32						
Mixed/Pro-Att	0.00	0.00	30						
Mixed/Anti-Att	0.00	0.00	32						

Error	5.65
Corrected Total	5.82

Because *commenting* has such a low sample size ($n=6$), which likely decreased statistical power, the dependent variable *behavioral intentions* (i.e., reported behavioral intentions to comment or to interact with the experimental condition) was also used to test Research Question 1 and Research Question 2a. Regarding Research Question 1, the results of a two-factor ANOVA predicting behavioral intentions from experimental condition and vaccination attitudes are shown in Table 5. The main effect of experimental condition is non-significant ($F_{(2, 199)}=1.28, p = .28$), while the main effect for vaccination attitudes is significant ($F_{(1, 199)}=6.33, p = .01, \eta^2 = .03$). Participants with more negative attitudes toward vaccines ($M=2.47, SD=0.90$) have greater behavioral intentions than participants with more positive attitudes toward vaccines ($M=2.14, SD=0.90$). Regarding Research Question 2a, the interaction effect between experimental condition and vaccination attitudes is non-significant ($F_{(2, 199)}=.56, p = .57$).

Table 5.
Two-Factor ANOVA Predicting Behavioral Intention from Experimental Condition and Vaccination Attitudes

	Mean	SD	<i>n</i>	Sum of Squares	<i>df</i>	Mean Square	F	Sig.	Partial η^2
Condition				2.08	2	1.04	1.28	0.28	0.01
Pro	2.33	0.93	71						
Anti	2.15	0.91	69						
Mixed	2.41	0.89	65						
Vaccine Attitudes				5.14	1	5.14	6.33	0.01	0.03
Pro	2.14	0.90	110						
Anti	2.47	0.90	95						
Condition X Attitudes				0.92	2	0.46	0.57	0.57	0.01
Pro/Pro-Att	2.17	0.91	40						

Pro/Anti-Att	2.53	0.94	31
Anti/Pro-Att	1.94	0.80	37
Anti/Anti-Att	2.40	0.96	32
Mixed/Pro-Att	2.34	0.98	33
Mixed/Anti-Att	2.48	0.81	32
Error			161.4
Corrected Total			169.85

Hypothesis 1 and 2

Hypothesis 1 predicted a negative relationship between willingness to self-censor and commenting. The results of a Pearson's correlation test was significant and it revealed a negative relationship between willingness to self-censor and commenting ($r(199) = -.18$, $p < .01$) (See Table 6.). In other words, as participants' willingness to self-censor increased, the likelihood of commenting decreased. Thus, Hypothesis 1 was supported.

Hypothesis 2 predicted commenting will be positively related to Facebook political participation, importance of SNSs for politics, issue importance, and issue knowledge. The results of a Person's correlation test was significant among only one of these variables, issue knowledge. The test revealed a negative relationship between commenting and issue knowledge ($r(199) = -.16$, $p < .05$) (See Table 6.). In other words, as participants' reported vaccine knowledge decreased, the likelihood of commenting increased. Thus, Hypothesis 2 was not supported.

Table 6.
Pearson's Correlations Among Variables

	1	2	3	4	5	6	7	8
1. Behavioral Intentions	1							
2. Commenting	.17*	1						
3. Fear of Isolation	-.07	-.25*	1					

4. Facebook Political Importance	.11	.13	-.21*	1				
5. SNS Political Importance	-.11*	-.10	.21*	-.44*	1			
6. Vaccine Importance	-.05	.08	-.09	-.05	.05	1		
7. Vaccine Knowledge	.06	-.16*	.16*	-.19*	.07	-.32*	1	
8. Willingness to Self-Censor	.01	-.18*	.57*	-.03	.02	.04	.04	1

Notes: * $p < .05$; two-tailed

Research Question 2b

To address Research Question 2b, the comments left in the experimental conditions were analyzed for content. A total of six comments were made in the entire experiment. Four comments were left in the anti-vaccination condition, and two comments were left in the pro-vaccination condition. Three of the four comments in the anti-vaccination condition were in support of vaccines, drawing attention to vaccines' effectiveness in preventing disease and death, and discrediting the claim that vaccines are linked to autism. For example, one comment says, "Vaccines help prevent preventable deaths in children!" The fourth comment left in the anti-vaccination condition could be interpreted as containing an anti-vaccination attitude, saying, "I haven't got a vaccine in years." Of the two comments made in the pro-vaccination condition, one was in support of vaccines (i.e., highlighting herd immunity) and one was unrelated to vaccines (i.e., commenting on the style of the Facebook post).

Research Question 3

Research Question 3 asked about the relationship between commenting and behavioral intentions, and a Pearson's correlation test revealed a significant positive

relationship between commenting and behavioral intentions ($r(199) = .17, p < .05$) (See Table 6.).

Additional Analyses

Fear of isolation is traditionally an important independent variable in spiral of silence, although some studies found a significant spiral of silence effect online without a significant relationship with fear of isolation (Xiaodong & Li, 2016; Yun & Park, 2011). Therefore, an ANOVA was conducted to test fear of isolation with the predictors biological sex, vaccination attitudes, and experimental condition. The results are shown in Table 7. The main effect of vaccination attitudes is non-significant ($F_{(1, 192)}=2.03, p = .16$), the main effect of experimental condition is non-significant ($F_{(2, 192)}=1.23, p = .33$), but the main effect of biological sex is significant ($F_{(1, 192)}=12.19, p = .001, \eta^2=.06$). Female participants ($M=2.98, SD=0.60$) reported a higher fear of isolation than male participants ($M=2.70, SD=0.53$). Additionally, a Pearson's correlation test found a significant negative relationship between fear of isolation and commenting ($r(199) = -.25, p < .001$) (See Table 6.). In other words, as participants' reported fear of isolation decreased, the likelihood of commenting increased.

Table 7.

Two-Factor ANOVA Predicting Fear of Isolation from Biological Sex, Experimental Condition, and Vaccination Attitudes

	Mean	SD	n	Sum of Squares	df	Mean Square	F	Sig.	Partial η^2
Condition				0.74	2	0.37	1.13	0.33	0.01
Pro	2.91	0.59	71						
Anti	2.84	0.66	68						
Mixed	2.86	0.50	65						
Vaccine Attitudes				0.67	1	0.67	2.03	0.16	0.01

Pro	2.81	0.63	110						
Anti	2.93	0.52	94						
Biological Sex				3.99	1	3.99	12.19	0.001	0.06
Male	2.70	0.53	81						
Female	2.98	0.60	123						
Condition X				0.14	2	0.07	0.22	0.81	0.002
Attitudes									
Pro/Pro-Att	0.03	0.16	39						
Pro/Anti-Att	0.03	0.18	31						
Anti/Pro-Att	0.09	0.28	35						
Anti/Anti-Att	0.03	0.18	32						
Mixed/Pro-Att	0.00	0.00	30						
Mixed/Anti-Att	0.00	0.00	32						
Attitude X BioSex				0.02	1	0.02	0.05	0.83	0.00
Pro/Female	2.93	0.61	64						
Pro/Male	2.65	0.55	46						
Anti/Female	3.03	0.51	59						
Anti/Male	2.77	0.50	35						
Condition X Bio				1.21	2	0.60	1.84	0.16	0.02
Sex									
Pro/Female	3.06	0.61	38						
Pro/Male	2.73	0.51	33						
Anti/Female	2.98	0.63	47						
Anti/Male	2.51	0.61	21						
Mixed/Female	2.90	0.54	38						
Mixed/Male	2.81	0.46	27						
Condition X Bio				0.14	2	0.07	0.22	0.81	0.002
Sex X Attitude									
Pro/Fem/Anti	3.04	0.64	18						
Pro/Male/Anti	2.81	0.52	13						
Mix/Fem/Anti	2.98	0.44	20						
Mix/Male/Anti	2.86	0.27	12						
Anti/Fem/Anti	3.07	0.46	20						
Anti/Male/Anti	2.61	0.67	10						
Pro/Fem/Pro	3.08	0.60	20						
Pro/Male/Pro	2.68	0.51	20						
Mix/Fem/Pro	2.81	0.64	18						
Mix/Male/Pro	2.77	0.57	15						
Anti/Fem/Pro	2.91	0.74	26						
Anti/Male/Pro	2.42	0.56	11						
Error				62.91					
Corrected Total				69.42					

To further test fear of isolation in this study, a two-factor ANOVA was conducted predicting fear of isolation from experimental condition, vaccination attitudes, and race. The main effect of experimental condition is non-significant ($F_{(1, 172)}=.64, p = .53$). The main effect of vaccination attitudes is significant ($F_{(1, 172)}=8.13, p = .01, \eta^2=.05$). Participants with anti-vaccination attitudes ($M=2.94, SD=0.53$) reported greater fear of isolation than participants with pro-vaccination attitudes ($M=2.81, SD=0.64$). Also, the main effect of race is significant ($F_{(1, 186)}=3.19, p = .03, \eta^2=.05$). Caucasian participants ($M=2.93, SD=0.61$) reported highest fear of isolation, followed by Other ($M=2.8, SD=0.65$) then African American participants ($M=2.73, SD=0.41$), and lastly Asian participants ($M=2.61, SD=0.65$) (See Table 8.).

Table 8.

Two-Factor ANOVA Predicting Fear of Isolation from Race, Experimental Condition, and Vaccination Attitudes

	Mean	SD	n	Sum of Squares	df	Mean Square	F	Sig.	Partial η^2
Condition				0.45	2	0.22	0.64	0.53	0.07
Pro	2.90	0.59	69						
Anti	2.83	0.66	66						
Mixed	2.88	0.52	60						
Vaccine Attitudes				2.84	1	2.84	8.13	0.01	0.05
Pro	2.81	0.64	105						
Anti	2.94	0.53	90						
Race				3.34	3	1.11	3.19	0.03	0.05
Caucasian	2.93	0.61	137						
African Am	2.73	0.41	26						
Asian	2.61	0.65	12						
Other	2.81	0.65	20						
Condition X Attitudes				0.14	2	0.07	0.22	0.81	0.002
Pro/Pro-Att	0.03	0.16	39						
Pro/Anti-Att	0.03	0.18	31						
Anti/Pro-Att	0.09	0.28	35						
Anti/Anti-Att	0.03	0.18	32						

Mixed/Pro-Att	0.00	0.00	30						
Mixed/Anti-Att	0.00	0.00	32						
Attitudes X Race				2.18	3	0.73	2.08	0.11	0.04
Pro/Caucasian	2.87	0.63	51						
Pro/Af Am.	2.27	0.44	21						
Pro/Asian	2.07	0.63	8						
Pro/Other	2.82	0.59	10						
Anti/Caucasian	3.02	0.55	86						
Anti/Af Am.	2.84	0.32	5						
Anti/Asian	2.88	0.50	4						
Anti/Other	2.76	0.73	10						
Condition X Race				2.29	6	0.38	1.09	0.37	0.04
Pro/Caucasian	2.91	0.62	49						
Pro/Af Am.	2.90	0.38	7						
Pro/Asian	2.56	0.65	5						
Pro/Other	3.07	0.59	8						
Anti/Caucasian	2.93	0.66	46						
Anti/Af Am.	2.67	0.45	9						
Anti/Asian	2.62	0.93	3						
Anti/Other	2.51	0.75	8						
Mixed/Cauc	2.94	0.54	42						
Mixed/Af Am.	2.67	0.40	10						
Mixed/Asian	2.66	0.63	4						
Mixed/Other	2.88	0.34	4						
Attitudes X Condition X Race				0.34	5	0.07	0.21	0.96	0.01
Anti/Pro/Cauc.	2.92	0.72	18						
Anti/Pro/Af Am.	2.93	0.40	6						
Anti/Pro/Asian	3.00	0.19	3						
Anti/Pro/Other	3.07	0.63	3						
Anti/Anti/Cauc.	3.06	0.52	17						
Anti/Anti/Af Am.	2.19	0.28	8						
Anti/Anti/Asian	3.36	0.00	1						
Anti/Anti/Other	2.57	0.94	5						
Anti/Mixed/Cauc.	3.09	0.32	16						
Anti/Mixed/AfAm.	2.83	0.33	7						
Anti/Mixed/Asian	2.66	0.63	4						
Anti/Mixed/Other	2.79	0.10	2						
Pro/Pro/Cauc.	2.91	0.56	31						
Pro/Pro/Af Am.	2.71	0.00	1						
Pro/Pro/Asian	1.89	0.35	2						
Pro/Pro/Other	3.07	0.63	5						
Pro/Anti/Cauc.	2.85	0.73	29						
Pro/Anti/Af Am.	1.71	0.00	1						
Pro/Anti/Asian	2.25	0.96	2						
Pro/Anti/Other	2.40	0.44	3						

Pro/Mixed/Cauc.	2.85	0.63	26
Pro/Mixed/Af Am.	2.31	0.35	3
Pro/Mixed/Asian	0.00	0.00	0
Pro/Mixed/Other	2.96	0.56	2
Error			60.09
Corrected Total			69.42

To further test differences in biological sex, a two-factor ANOVA was conducted predicting commenting from biological sex, experimental condition, and vaccination attitudes. The main effect of vaccination attitudes is non-significant ($F_{(1, 186)}=0.82, p=.37$) and the main effect of experimental condition is significant ($F_{(1, 186)}=4.13, p=.02, \eta^2=.04$). Also, the main effect of biological sex is significant ($F_{(1, 186)}=4.17, p=.04, \eta^2=.02$). The interaction effect of experimental condition and biological sex is also significant ($F_{(1, 186)}=3.07, p=.05, \eta^2=.03$). In other words, males ($M=0.05, SD=0.22$) were more likely to comment than females ($M=0.02, SD=0.13$). Also, participants were most likely to comment in the anti-vaccination condition ($M=0.06, SD=0.24$) followed by the pro-vaccination condition ($M=0.03, SD=0.17$) and then the mixed condition ($M=0.00, SD=0.00$). Lastly, the interaction effect of experimental condition and biological sex shows that males in the anti-vaccination condition were the most likely to comment ($M=0.16, SD=0.37$) while females in the anti-vaccination condition were the least likely to comment ($M=0.02, SD=0.15$) (See Figure C.1. in Appendix). No participants commented in the mixed condition, either male or female ($M=0.00, SD=0.00$) (See Table 9.).

Table 9.

Two-Factor ANOVA Predicting Commenting from Biological Sex, Experimental Condition, and Vaccination Attitudes

	Mean	SD	n	Sum of Squares	df	Mean Square	F	Sig.	Partial eta ²
Condition				0.23	2	0.12	4.12	0.02	0.04
Pro	0.03	0.17	70						
Anti	0.06	0.24	66						
Mixed	0.00	0.00	62						
Vaccine Attitudes				0.02	1	0.02	0.82	0.37	0.00
Pro	0.04	0.19	104						
Anti	0.02	0.15	94						
Biological Sex				0.12	1	0.12	4.17	0.04	0.02
Male	0.05	0.22	77						
Female	0.02	0.13	121						
Condition X BioSex				0.19	2	0.09	3.07	0.05	0.03
Pro/Male	2.73	0.51	33						
Pro/Female	3.06	0.61	38						
Anti/Male	2.51	0.61	21						
Anti/Female	2.98	0.63	47						
Mixed/Male	2.81	0.46	27						
Mixed/Female	2.90	0.54	38						
Condition X Attitudes				0.07	2	0.04	1.28	0.28	0.01
Pro/Pro-Att	0.03	0.16	39						
Pro/Anti-Att	0.03	0.18	31						
Anti/Pro-Att	0.09	0.28	35						
Anti/Anti-Att	0.03	0.18	32						
Mixed/Pro-Att	0.00	0.00	30						
Mixed/Anti-Att	0.00	0.00	32						
Attitude X BioSex				0.02	1	0.02	0.05	0.83	0.00
Pro/Female	0.03	0.18	62						
Pro/Male	0.05	0.22	42						
Anti/Female	0.00	0.00	59						
Anti/Male	0.06	0.24	35						
Condition X Bio Sex X Attitude				0.09	2	0.04	1.56	0.21	0.02
Pro/Fem/Anti	0.00	0.00	18						
Pro/Male/Anti	0.08	0.28	13						
Mix/Fem/Anti	0.00	0.00	20						
Mix/Male/Anti	0.00	0.00	12						
Anti/Fem/Anti	0.00	0.00	21						
Anti/Male/Anti	0.10	0.32	10						
Pro/Fem/Pro	0.05	0.23	19						
Pro/Male/Pro	0.00	0.00	20						

Mix/Fem/Pro	0.00	0.00	17
Mix/Male/Pro	0.00	0.00	13
Anti/Fem/Pro	0.04	0.20	26
Anti/Male/Pro	0.22	0.44	9
Error			62.91
Corrected Total			69.42

A two-factor ANOVA was conducted to predict commenting from race, vaccination attitudes, and experimental condition. The main effect of experimental condition was significant ($F_{(2, 166)}=6.39, p = .02, \eta^2=.07$). Participants in the anti-vaccination condition ($M=0.06, SD=0.24$) were most likely to leave a comment, followed by those in the pro-vaccination condition ($M=0.03, SD=0.17$), and lastly those in the mixed condition ($M=0.00, SD=0.00$). The main effect of vaccination attitudes was non-significant ($F_{(1, 166)}=2.31, p = .13$). The main effect of race was significant ($F_{(3, 166)}=3.11, p = .03, \eta^2=.05$). Participants in the Other race category ($M=0.05, SD=0.22$) were most likely to leave a comment, followed by African American participants ($M=0.04, SD=0.20$), then Caucasian participants ($M=0.03, SD=0.17$), and lastly Asian participants ($M=0.00, SD=0.00$), who did not leave any comments. The interaction effect of vaccination attitudes and experimental condition was significant ($F_{(2, 166)}=3.84, p = .02, \eta^2=.04$) (See Figure C.2. in Appendix). Participants with pro-vaccination attitudes in the anti-vaccination condition ($M=0.09, SD=0.29$) were most likely to leave a comment, followed by participants with anti-vaccination attitudes in the pro-vaccination condition ($M=0.03, SD=0.18$), followed by participants with anti-vaccination attitudes in the anti-vaccination condition ($M=0.03, SD=0.18$).

There was also a significant interaction effect of vaccination attitudes and race ($F_{(3, 166)}=4.22, p = .01, \eta^2=.07$) (See Figure C.3. in Appendix). African American

participants with pro-vaccination attitudes ($M=0.20$, $SD=0.45$) were most likely to leave a comment, followed by Other participants with anti-vaccination attitudes ($M=0.10$, $SD=0.32$), followed by Caucasian participants with pro-vaccination attitudes ($M=0.04$, $SD=0.19$). There was also a significant interaction effect of experimental condition and race ($F_{(6, 166)}=3.56$, $p = .002$, $\eta^2=.11$) (See Figure C.4. in Appendix). Other participants in the anti-vaccination condition ($M=0.13$, $SD=0.35$) were most likely to leave a comment, followed by African American participants in the anti-vaccination condition ($M=0.11$, $SD=0.33$), followed by Caucasian participants in the anti-vaccination condition ($M=0.05$, $SD=0.21$), and lastly Caucasian participants in the pro-vaccination condition ($M=0.04$, $SD=0.20$). All other race and experimental condition interactions had no effect size ($M=0.00$, $SD=0.00$). Finally, there was a significant interaction effect between vaccination attitudes, race, and experimental condition ($F_{(5, 166)}=4.80$, $p = .000$, $\eta^2=.13$) (See Figure C.5. in Appendix). African American participants with pro-vaccination attitudes in the anti-vaccination condition were most likely to leave a comment ($M=1.00$, $SD=0.00$), followed by Other participants with anti-vaccination attitudes in the anti-vaccination condition ($M=0.20$, $SD=0.45$), followed by Caucasian participants with pro-vaccination attitudes in the anti-vaccination condition ($M=0.07$, $SD=0.27$), and then Caucasian participants with anti-vaccination attitudes in the pro-vaccination condition ($M=0.06$, $SD=0.24$), and lastly Caucasian participants with pro-vaccination attitudes in the pro-vaccination condition ($M=0.03$, $SD=0.18$). Asian participants, regardless of vaccination attitudes, were least likely comment in all conditions ($M=0.00$, $SD=0.00$) (See Table 10.).

Table 10.

Two-Factor ANOVA Predicting Commenting from Race, Experimental Condition, and Vaccination Attitudes

	Mean	SD	n	Sum of Squares	df	Mean Square	F	Sig.	Partial eta ²
Condition				0.23	2	0.12	4.12	0.02	0.04
Pro	0.03	0.17	70						
Anti	0.06	0.24	66						
Mixed	0.00	0.00	62						
Vaccine Attitudes				0.02	1	0.02	0.82	0.37	0.00
Pro	0.04	0.19	104						
Anti	0.02	0.15	94						
Race				0.12	1	0.12	4.17	0.04	0.02
White	0.05	0.22	77						
Black	0.02	0.13	121						
Asian									
Other									
Condition X Attitudes				0.19	2	0.09	3.07	0.05	0.03
Pro/Pro-Att	0.03	0.16	38						
Pro/Anti-Att	0.03	0.18	30						
Anti/Pro-Att	0.09	0.29	33						
Anti/Anti-Att	0.03	0.18	31						
Mixed/Pro-Att	0.00	0.00	28						
Mixed/Anti-Att	0.00	0.00	29						
Attitudes X Race				0.35	3	0.12	4.22	0.01	0.07
Pro/Caucasian	0.04	0.19	51						
Pro/Af Am.	0.20	0.45	21						
Pro/Asian	0.00	0.00	8						
Pro/Other	0.00	0.00	10						
Anti/Caucasian	0.02	0.14	80						
Anti/Af Am.	0.00	0.00	5						
Anti/Asian	0.00	0.00	4						
Anti/Other	0.10	0.32	10						
Condition X Race				0.59	6	0.10	3.56	0.00	0.11
Pro/Caucasian	0.04	0.20	48						
Pro/Af Am.	0.00	0.00	7						
Pro/Asian	0.00	0.00	5						
Pro/Other	0.00	0.00	8						
Anti/Caucasian	0.05	0.10	44						
Anti/Af Am.	0.11	0.13	9						
Anti/Asian	0.00	0.00	3						
Anti/Other	0.13	0.35	8						
Mixed/Cauc	0.00	0.00	39						
Mixed/Af Am.	0.00	0.00	10						

Mixed/Asian	0.00	0.00	4						
Mixed/Other	0.00	0.00	4						
Attitudes X				0.66	5	0.13	4.80	0.00	0.13
Condition X Race									
Anti/Pro/Cauc.	0.06	0.24	18						
Anti/Pro/Af Am.	0.00	0.00	6						
Anti/Pro/Asian	0.00	0.00	3						
Anti/Pro/Other	0.00	0.00	3						
Anti/Anti/Cauc.	0.00	0.00	17						
Anti/Anti/Af Am.	0.00	0.00	8						
Anti/Anti/Asian	0.00	0.00	1						
Anti/Anti/Other	0.20	0.45	5						
Anti/Mixed/Cauc.	0.00	0.00	16						
Anti/Mixed/AfAm	0.00	0.00	7						
Anti/Mixed/Asian	0.00	0.00	4						
Anti/Mixed/Other	0.00	0.00	2						
Pro/Pro/Cauc.	0.03	0.18	30						
Pro/Pro/Af Am.	0.00	0.00	1						
Pro/Pro/Asian	0.00	0.00	2						
Pro/Pro/Other	0.00	0.00	5						
Pro/Anti/Cauc.	0.07	0.27	27						
Pro/Anti/Af Am.	1.00	0.00	1						
Pro/Anti/Asian	0.00	0.00	2						
Pro/Anti/Other	0.00	0.00	3						
Pro/Mixed/Cauc.	0.00	0.00	23						
Pro/Mixed/AfAm	0.00	0.00	3						
Pro/Mixed/Asian	0.00	0.00	0						
Pro/Mixed/Other	0.00	0.00	2						
Error				62.91					
Corrected Total				69.42					

CHAPTER V

DISCUSSION

Summary of Results

Spiral of silence theory posits that people who feel their opinions are in the minority are less likely to speak out. Contrarily, people who perceive their opinions are in the majority are more likely to speak out. Research Questions 1, 2, and 2a attempted to identify a spiral of silence effect on Facebook using the topic of vaccination. Because the results of this portion of the study were non-significant, there was no observed spiral of silence effect. There was no significant difference in commenting among the experimental conditions. There also was not a significant interaction effect between vaccination attitudes and experimental condition on commenting. However, it is possible that the low sample size of commenting ($n=6$) lacked the statistical power to have much significance. Therefore, the alternative dependent variable, behavioral intentions, was also used to measure speaking out. Commenting and behavioral intentions were

significantly positively related. This reflects past research, like the theory of reasoned action, which suggests there should be a strong correlation between behavioral intentions and action (Fishbein & Azjen, 1975).

Behavioral intentions were significantly predicted by vaccination attitudes. Participants with anti-vaccination attitudes were more likely to report intentions to interact with the Facebook posts than participants with pro-vaccination attitudes. However, vaccination attitudes did not have a significant interaction effect with experimental condition on behavioral intentions. In order to identify a spiral of silence effect, there should be a significant interaction between vaccination attitudes and experimental condition on behavioral intentions or speaking out. Since such an effect was non-significant, a spiral of silence effect cannot be concluded from these variables.

Interestingly, participants with anti-vaccination attitudes were more likely to report intentions to interact with the Facebook post than those with pro-vaccination attitudes. Yet, the majority (four out of six) of the comments made in the experiment were supporting vaccination. Only one comment had anti-vaccination sentiments, and the other comment was neutral. This suggests a few things about applying the spiral of silence theory on Facebook. First, perhaps personality traits, rather than vaccination attitudes, better predict whether or not people feel comfortable speaking out in that medium. Traditionally, spiral of silence states that participants with pro-vaccination attitudes would not have commented – at least not so frequently – in the anti-vaccination condition. Since the opposite of that behavior was observed, it is possible that other individual-level factors influenced participants' willingness to comment. Second, participants might have taken into account their perceptions of the national opinion

toward vaccination, which is overwhelmingly pro-vaccination (Funk, Kennedy, & Hefferon, 2017). If participants perceived their opinion to be in the national majority, regardless of the experimental condition at-hand, this could have influenced their likelihood of speaking out (Ho, Chen, & Sim, 2013). For example, the participants who left pro-vaccination comments in the anti-vaccination condition might have done so because they perceived their opinions as the majority nationally. However, this reasoning goes against research that states “people are influenced by their perceptions of majority opinion in an online environment, regardless of their perceptions of the general public opinion” (Lee & Kim, 2014, p. 273).

Hypothesis 1 and 2 tested commonly used variables in spiral of silence online research. There was a significant negative relationship between willingness to self-censor and commenting, which supports previous research (Gearhart & Zhang, 2014). This also supports spiral of silence theory, which states that some individuals are less likely to speak out due to communication apprehension or other personality traits (Willnat, Lee, & Detenber, 2002). Hypothesis 2 was not supported and predicted that commenting would be positively related to Facebook political participation, importance of SNSs for politics, issue importance, and issue knowledge. Prior literature has found significant relationships between those variables and speaking out. For example, Gearhart and Zhang (2015) found positive relationships between speaking out and SNS political participation, importance of SNSs for politics, and issue importance. However, none of those four variables had a significant relationship with commenting in this study. Again, this could be a result of the small sample size of commenting.

The only significant relationship was a negative relationship with issue knowledge and commenting. The less knowledge participants had about vaccines, the more likely they were to comment. This finding does not support previous literature, which has found a positive relationship between issue knowledge and speaking out in both offline and online contexts (Kim & Kim, 2014; Salmon & Neuwirth, 1990; Willnat, 1996). The current finding could be a result of a lack of moral loading in the topic of vaccines. Moral loading is a notable feature of the operationalization of public opinion expression; it means that “the issue under study has to be a controversial one with a clearly identifiable moral loading attached to it” (Scheufele & Moy, 2000, p. 15; Noelle-Neumann, 1993). In other words, participants might not have felt strongly enough about vaccines to comment about them, regardless of their level of vaccine knowledge. McKeever, McKeever, Holton, and Li (2015) conducted a study that measured communicative action online using the topic of vaccination, similar to the current study. In this study, there was a significant spiral of silence effect found among mothers who support vaccination. However, their study’s participants were mothers with young children, and therefore the topic of vaccination was likely more morally loaded for them than it is for college students, as in the current study. This would explain why the current study did not find a spiral of silence effect using the same topic.

When paired with the alternative dependent variable behavioral intentions, the only significant relationship was a negative relationship with importance of SNSs for politics, which does not support past literature (Gearhart and Zhang, 2015). In other words, as perceived importance of SNSs for politics decreased, intentions to engage with the experimental Facebook post increased. This difference could be explained again by a lack

of moral loading in the topic of vaccination (Scheufele & Moy, 2000). Perhaps vaccination does not have enough moral loading – meaning, participants did not have strong enough attitudes about vaccines – to inspire strong intentions to speak out about them, regardless of perceived importance of SNSs for politics.

A total of six comments were made in the experiment; two in the pro-vaccination condition, four in the anti-vaccination, and zero in the mixed condition. The majority (3 out of 4) of the comments made in the anti-vaccination condition were in support of vaccines. This finding could still be supported by the spiral of silence theory if those participants who left a comment had strong positive attitudes toward vaccines. Spiral of silence theory states that some individuals with strong opinions will speak out regardless of the perceived majority climate (Glynn & McLeod, 1984; Noelle-Neumann, 1974). However, the results from Research Question 1 did not reveal a significant main effect or interaction effect between vaccination attitudes and experimental condition on commenting. Therefore, it cannot be concluded that the pro-vaccination comments in the anti-vaccination condition were a result of strong opinions, and so the spiral of silence is not supported here. Additionally, perhaps participants felt the need to comment pro-vaccination sentiments in the anti-vaccination condition because of a third-person effect. The third-person effect posits that individuals feel other people are more affected by a given stimulus than he/she is (Davison, 1983). If participants believed other people would be affected by reading the anti-vaccination comments, this could explain why they decided to leave a comment, as sort of an attempt to combat any negative effects on others from those comments.

Notably, there were no comments left in the mixed opinion condition. Introducing a mixed opinion experimental condition was unique to this study, as prior spiral of silence research traditionally presents experimental conditions with a clear, majority opinion (Glynn et al., 1997; Scheufele & Moy, 2000). Because this was the only experimental condition in which participants made zero comments, it can be an indication that strong opinions – rather than mixed opinions – in experimental conditions are optimal for spiral of silence research. Again, this is reflected in the need for a strong moral loading in the issue under study. A mixed opinion climate likely reduces the perceived moral loading of the issue.

There was a significant positive relationship between commenting and behavioral intentions. Actions and behavioral intentions should theoretically be correlated, according to the Theory of Reasoned Action (Fishbein & Azjen, 1975). Therefore, this supports the authors' decision to use behavioral intentions as an alternative dependent variable due to the low sample size of commenting. If the overall experimental sample size was larger, it is likely that more participants would comment, and therefore the analyses from commenting might have been more similar to the analyses from behavioral intentions. For example, with more statistical power, there might be a significant main effect of vaccination attitudes on commenting.

The additional analyses tested various aspects of individual-level variables. Fear of isolation is a traditionally important variable in spiral of silence research and was tested in the current study. Fear of isolation had a significant negative relationship with commenting, which supports previous literature that states increased fear of isolation will lead to a decreased likelihood of speaking out (Noelle-Neumann, 1974; Scheufele &

Moy, 2000). Participants with greater fear of isolation also reported greater anti-vaccination attitudes. This could explain why most of the comments made in the experiment contained pro-vaccination sentiments. It is possible that participants with anti-vaccination attitudes felt greater fear of isolation because their vaccination attitudes are against the mainstream. A PEW Research Center survey found that 88% of Americans believe the benefits of vaccines outweigh the risks (Funk et al., 2017). Therefore, if participants in the current study felt that their anti-vaccination attitudes were already in the minority, this could have increased their fear of isolation. In turn, this would have prevented them from leaving a comment in this experiment. On the contrary, participants with pro-vaccination attitudes felt less fear of isolation because their vaccination attitudes are mostly supported at the national level, which could have increased their likelihood of leaving a comment. Additionally, females reported greater fear of isolation than males, and males were more likely to comment than females. This again supports previous literature that found a negative relationship between fear of isolation and speaking out (Noelle-Neumann, 1974; Scheufele & Moy, 2000).

Differences among racial groups were also explored using the dependent variable commenting. Participants in the Other racial category were the most likely to leave a comment, followed by African American participants, and then Caucasian participants. Asian participants did not leave any comments. Additionally, there were significant interaction effects between race, vaccination attitudes, and experimental conditions. These findings support previous literature that have found race to be significant individual-level predictors of outspokenness (Willnat et al., 2002).

Overall this study has found a lack of support for a spiral of silence effect on Facebook through the conversation topic of vaccination. The interaction effects of vaccination attitudes and experimental condition on both commenting and behavioral intentions were non-significant, which does not support the spiral of silence theory. Although anti-vaccination attitudes did significantly predict increased behavioral intentions in *all* experimental conditions, these findings do not support spiral of silence because the majority opinion is irrelevant in that equation. If anti-vaccination participants had greater behavioral intentions in the anti-vaccination condition, and weakest behavioral intentions in the pro-vaccination condition, then this would have supported spiral of silence. However, because anti-vaccination attitudes had greater behavioral intentions in *all* conditions, there was no observed spiral of silence effect. Regarding the small amount of actual behaviors (i.e., commenting), this also does not indicate a spiral of silence effect because vaccination attitudes and experimental condition had neither significant main effects nor significant interaction effects on commenting.

Ultimately, the lack of support likely stems from two main issues: 1) a lack of statistical power from a low sample size in the dependent variable *commenting*, and 2) the topic of vaccination did not have enough moral loading to produce variance. It is probable that the lack of moral loading caused the low sample size; participants simply did not feel strongly enough about vaccines to comment in the experiment. What these findings suggest is that in order to apply the spiral of silence to Facebook as a communication medium, the topic of conversation should be a controversial issue with a strong moral attachment. For example, social media marketers who wish to create a conversation on SNSs about health conversations should only consider the spiral of

silence as a guiding theory if the health issue is controversial with a clearly identifiable moral component. Otherwise, the issue will likely not have enough moral loading to adhere to the typical spiral of silence model.

Aside from moral loading, another variable that creates tension in the spiral of silence theory in this study is issue importance. Past research has shown issue importance to be a significant predictor of speaking out; the more important one finds an issue, the more likely one is to speak out (Salmon & Neuwirth, 1990). If participants feel the topic is important, they likely will feel more social pressure to defend their beliefs about the topic and speak out in a public setting. In this study, issue importance was not significantly related to any variables. This supports the notion that this sample of college students did not find vaccination to be a morally loaded topic; the sample also did not find vaccination to have enough importance, which points to the low number of participants who commented in the experiment.

The data from this study—namely, the low sample of size of the depending variable—makes it difficult to make sound conclusions about the study's results, and therefore also difficult to make contributions to spiral of silence literature. However, despite the lack of support from data, this study does make a methodological contribution the spiral of silence research, as it is the first of its kind to create this experimental design within Facebook. The authors manipulated Facebook pages and posts to measure the dependent variable of speaking out within Facebook itself, using participants' real Facebook pages. This design was unique and will likely produce variance when used in future spiral of silence research if a few changes are made to the construction of the experimental sample and conditions, as discussed in the following section.

Limitations and Future Research

The current study has several limitations. As stated before, the topic under study likely did not have enough moral loading to produce variance in the dependent variable, commenting. Scale responses for vaccination attitudes ranged from 15 (anti-vaccination) to 63 (pro-vaccination) ($M=47.56$, median=47). Because the mean and median responses are much closer to pro-vaccination attitudes than anti-vaccination ones, this indicates that the study's overall sample did not have the strong, divided opinions that work best when studying the spiral of silence. Future spiral of silence research should be aware of the necessity of moral loading and controversial topics. Another consideration for future research is to carefully choose the sample so participants have strong opinions about the issue. For example, the current study's sample was comprised mostly of college students, who probably do not often think about vaccination as a controversial issue. As stated earlier, the McKeever et al. (2015) study about vaccination and spiral of silence had a sample of mothers with young children. This sample was more likely to have strong opinions about vaccination. Future spiral of silence research should also consider choosing a sample who have a special interest in the topic under study.

Additionally, the current study did not measure perceptions of national opinions about vaccination, which could have influenced whether or not participants left a comment. Studies have found a difference in public opinion expression when participants are given experimental opinions in a reference group opinion climate versus a national opinion climate (Scheufele & Moy, 2000). For example, Salmon and Neuwirth (1990) found that national opinions had a greater influence on speaking out than community opinions. On the contrary, Oshagan (1996) found that when community opinions and national opinions

are made equally salient, the former are more influential on speaking out. Therefore, future spiral of silence research should measure the potential influence of community/reference opinions versus national/societal opinions.

Conclusion

Although the data from this study did not support the spiral of silence theory, the study did have a methodological contribution to studying spiral of silence on SNSs. Learning to manipulate SNSs for experimental research purposes is increasingly valuable, as understanding communication processes on SNSs is salient in the communication discipline. Crafting experiments within the SNS under study enhances external validity and is potentially less daunting than building an experimental environment in other mediums. Lastly, the results from this study can teach future spiral of silence researchers is to choose a sample and topic that together induce strong enough attitudes for spiral of silence applications.

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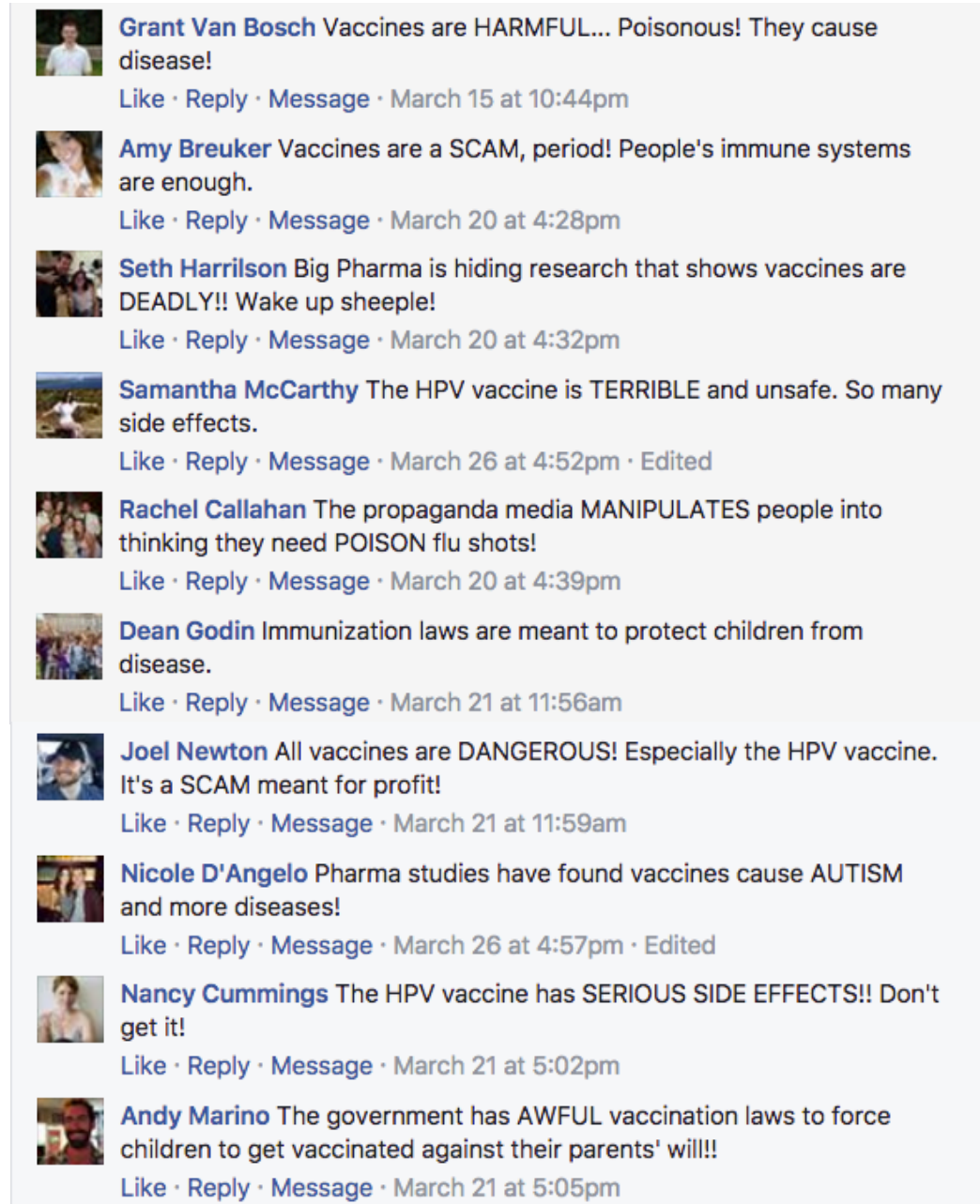
APPENDICES

APPENDIX A

Experimental Condition Comments

Figure A.1.

Anti-Vaccination Condition Comments

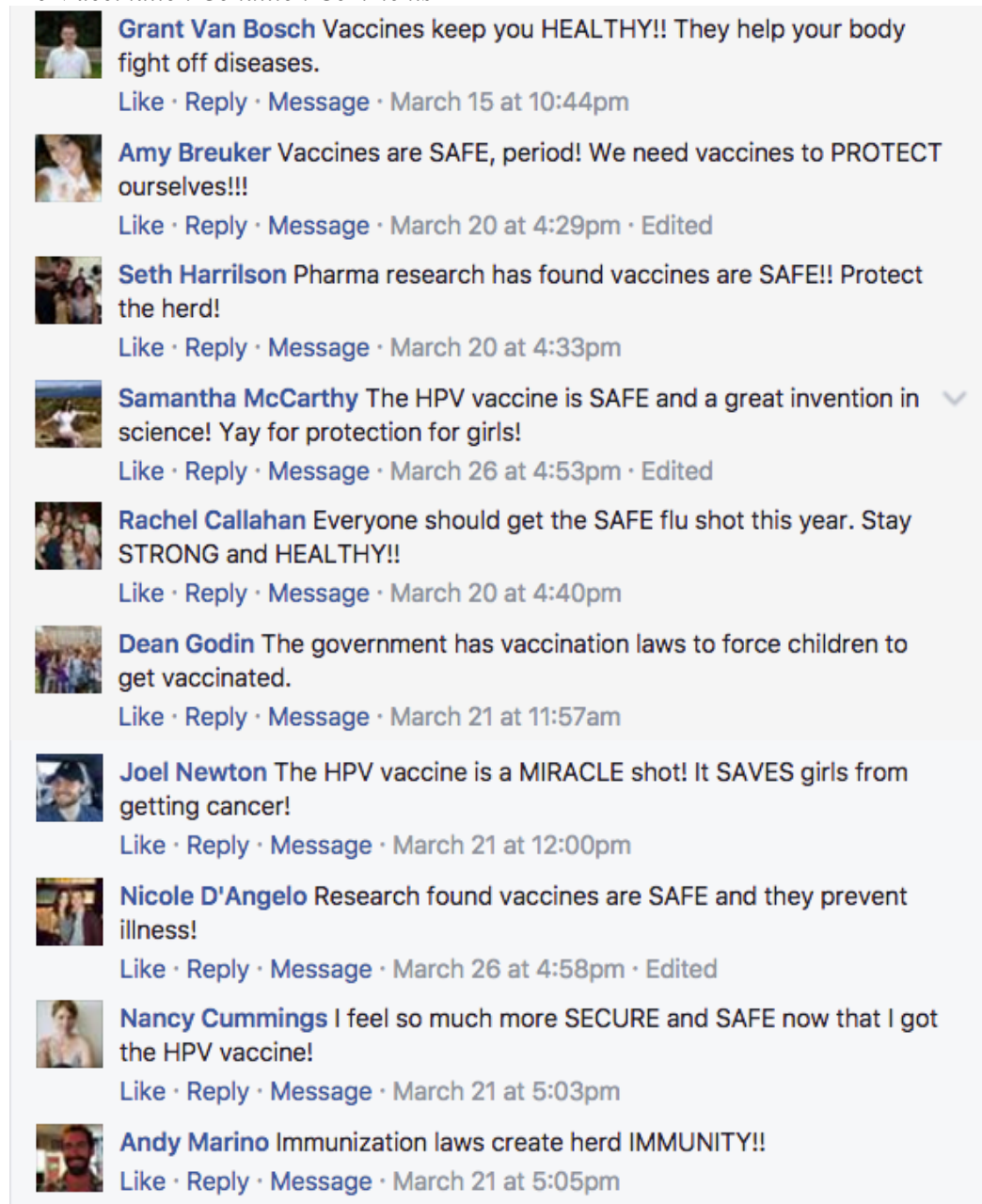


The image is a screenshot of a Facebook page showing a list of comments. Each comment entry includes a small profile picture on the left, followed by the user's name in bold blue text, their comment text, and a line of interaction links (Like, Reply, Message) and a timestamp. The comments are all anti-vaccination in nature. The background of the comment area is light gray.

- Grant Van Bosch** Vaccines are HARMFUL... Poisonous! They cause disease!
Like · Reply · Message · March 15 at 10:44pm
- Amy Breuker** Vaccines are a SCAM, period! People's immune systems are enough.
Like · Reply · Message · March 20 at 4:28pm
- Seth Harrilson** Big Pharma is hiding research that shows vaccines are DEADLY!! Wake up sheeple!
Like · Reply · Message · March 20 at 4:32pm
- Samantha McCarthy** The HPV vaccine is TERRIBLE and unsafe. So many side effects.
Like · Reply · Message · March 26 at 4:52pm · Edited
- Rachel Callahan** The propaganda media MANIPULATES people into thinking they need POISON flu shots!
Like · Reply · Message · March 20 at 4:39pm
- Dean Godin** Immunization laws are meant to protect children from disease.
Like · Reply · Message · March 21 at 11:56am
- Joel Newton** All vaccines are DANGEROUS! Especially the HPV vaccine. It's a SCAM meant for profit!
Like · Reply · Message · March 21 at 11:59am
- Nicole D'Angelo** Pharma studies have found vaccines cause AUTISM and more diseases!
Like · Reply · Message · March 26 at 4:57pm · Edited
- Nancy Cummings** The HPV vaccine has SERIOUS SIDE EFFECTS!! Don't get it!
Like · Reply · Message · March 21 at 5:02pm
- Andy Marino** The government has AWFUL vaccination laws to force children to get vaccinated against their parents' will!!
Like · Reply · Message · March 21 at 5:05pm

Figure A.2.

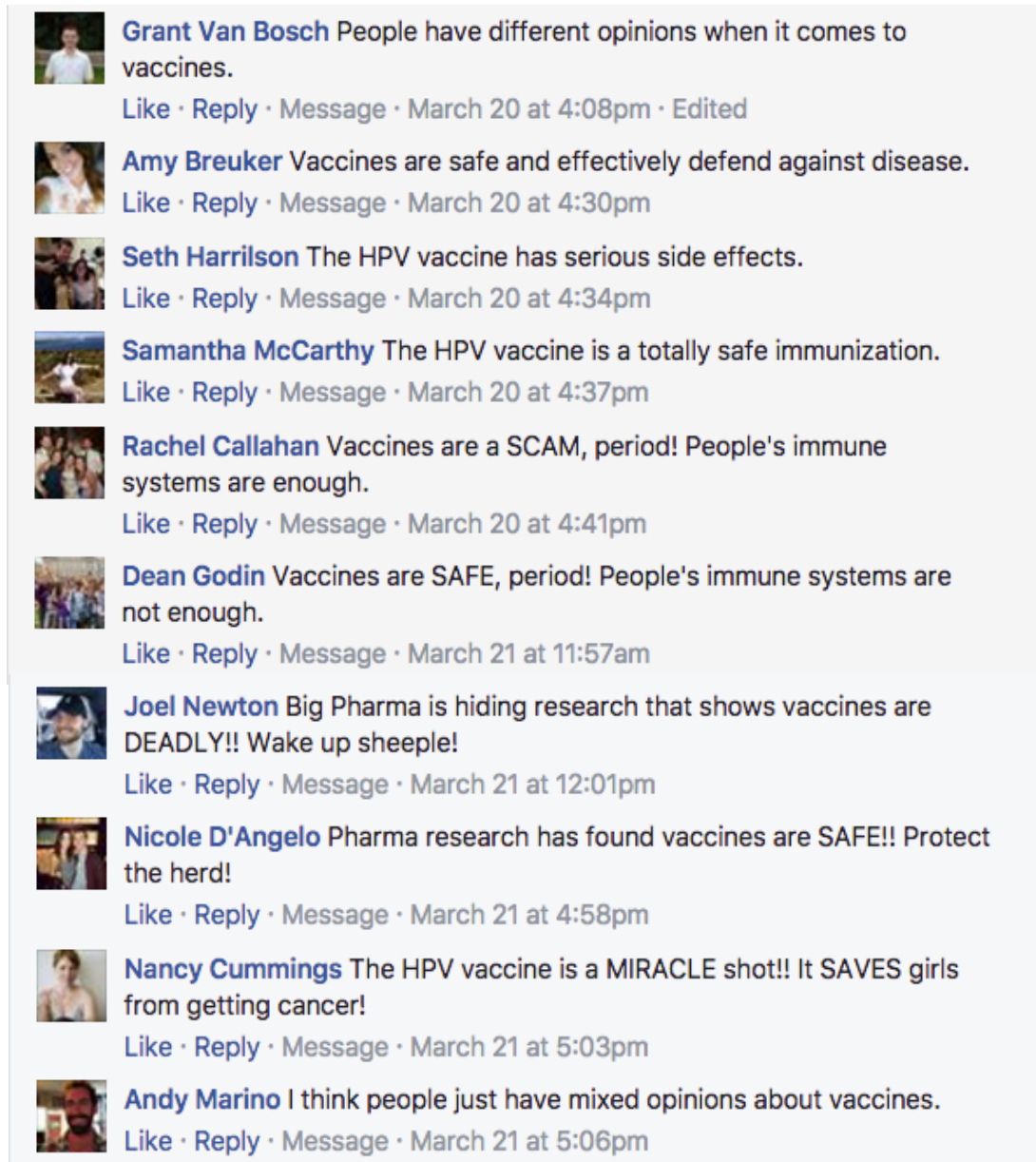
Pro-Vaccination Condition Comments



This figure is a screenshot of a Facebook thread titled "Pro-Vaccination Condition Comments". It displays nine individual comments, each featuring a user's profile picture, name, text, and interaction options (Like, Reply, Message) along with the timestamp. The comments are all supportive of vaccination, mentioning the safety and effectiveness of vaccines, the importance of herd immunity, and the role of government in ensuring vaccination.

- Grant Van Bosch** Vaccines keep you HEALTHY!! They help your body fight off diseases.
Like · Reply · Message · March 15 at 10:44pm
- Amy Breuker** Vaccines are SAFE, period! We need vaccines to PROTECT ourselves!!!
Like · Reply · Message · March 20 at 4:29pm · Edited
- Seth Harrilson** Pharma research has found vaccines are SAFE!! Protect the herd!
Like · Reply · Message · March 20 at 4:33pm
- Samantha McCarthy** The HPV vaccine is SAFE and a great invention in science! Yay for protection for girls!
Like · Reply · Message · March 26 at 4:53pm · Edited
- Rachel Callahan** Everyone should get the SAFE flu shot this year. Stay STRONG and HEALTHY!!
Like · Reply · Message · March 20 at 4:40pm
- Dean Godin** The government has vaccination laws to force children to get vaccinated.
Like · Reply · Message · March 21 at 11:57am
- Joel Newton** The HPV vaccine is a MIRACLE shot! It SAVES girls from getting cancer!
Like · Reply · Message · March 21 at 12:00pm
- Nicole D'Angelo** Research found vaccines are SAFE and they prevent illness!
Like · Reply · Message · March 26 at 4:58pm · Edited
- Nancy Cummings** I feel so much more SECURE and SAFE now that I got the HPV vaccine!
Like · Reply · Message · March 21 at 5:03pm
- Andy Marino** Immunization laws create herd IMMUNITY!!
Like · Reply · Message · March 21 at 5:05pm

Figure A.3.
Mixed Opinion Condition Comments



Grant Van Bosch People have different opinions when it comes to vaccines.
Like · Reply · Message · March 20 at 4:08pm · Edited

Amy Breuker Vaccines are safe and effectively defend against disease.
Like · Reply · Message · March 20 at 4:30pm

Seth Harrilson The HPV vaccine has serious side effects.
Like · Reply · Message · March 20 at 4:34pm

Samantha McCarthy The HPV vaccine is a totally safe immunization.
Like · Reply · Message · March 20 at 4:37pm

Rachel Callahan Vaccines are a SCAM, period! People's immune systems are enough.
Like · Reply · Message · March 20 at 4:41pm

Dean Godin Vaccines are SAFE, period! People's immune systems are not enough.
Like · Reply · Message · March 21 at 11:57am

Joel Newton Big Pharma is hiding research that shows vaccines are DEADLY!! Wake up sheeple!
Like · Reply · Message · March 21 at 12:01pm

Nicole D'Angelo Pharma research has found vaccines are SAFE!! Protect the herd!
Like · Reply · Message · March 21 at 4:58pm

Nancy Cummings The HPV vaccine is a MIRACLE shot!! It SAVES girls from getting cancer!
Like · Reply · Message · March 21 at 5:03pm

Andy Marino I think people just have mixed opinions about vaccines.
Like · Reply · Message · March 21 at 5:06pm

APPENDIX B

Descriptives Table

Table B.1.
Sample Description

	Frequency	Percent
Highest level of completed education		
Some high school	1	0.5
High school graduate (or equivalent)	25	12
Some college	138	68
College degree	33	16
Graduate degree	7	3.5
Living location		
Rural	22	11
Suburban	126	62
Urban	57	28
Political views		
Extremely conservative	3	2
Conservative	29	14
Somewhat conservative	25	12
Moderate, Middle road	72	36
Somewhat liberal	24	11
Liberal	44	22
Extremely liberal	6	3
School		
West Virginia University	79	40
Cleveland State University	111	56
Device		
Smartphone	65	32
Desktop computer	23	11
Laptop computer	112	55
Tablet	5	2

APPENDIX C

Interaction Graphs

Figure C.1. Interaction Effect of Biological Sex and Experimental Condition on Commenting

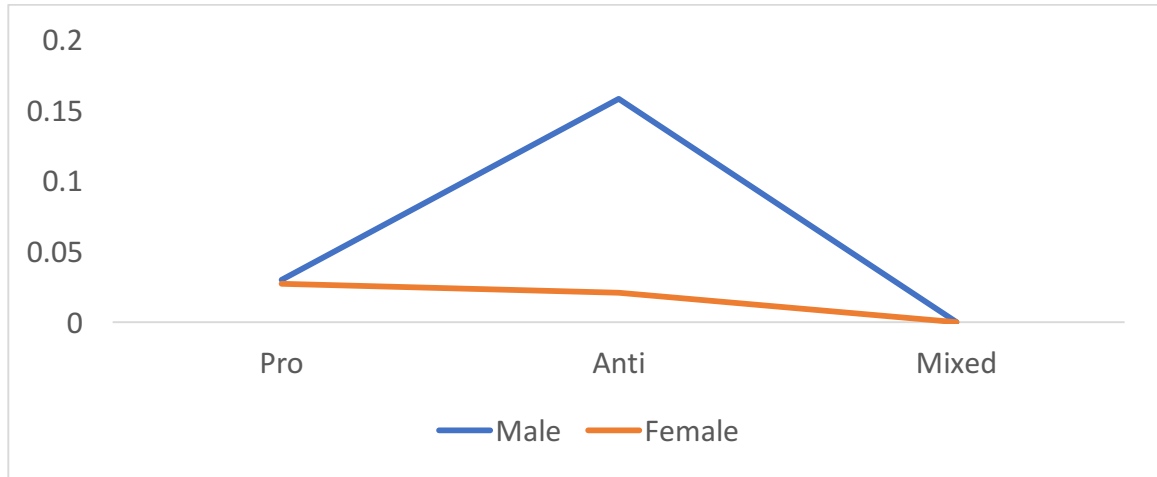


Figure C.2. Interaction Effect of Experimental Condition and Vaccination Attitudes on Commenting

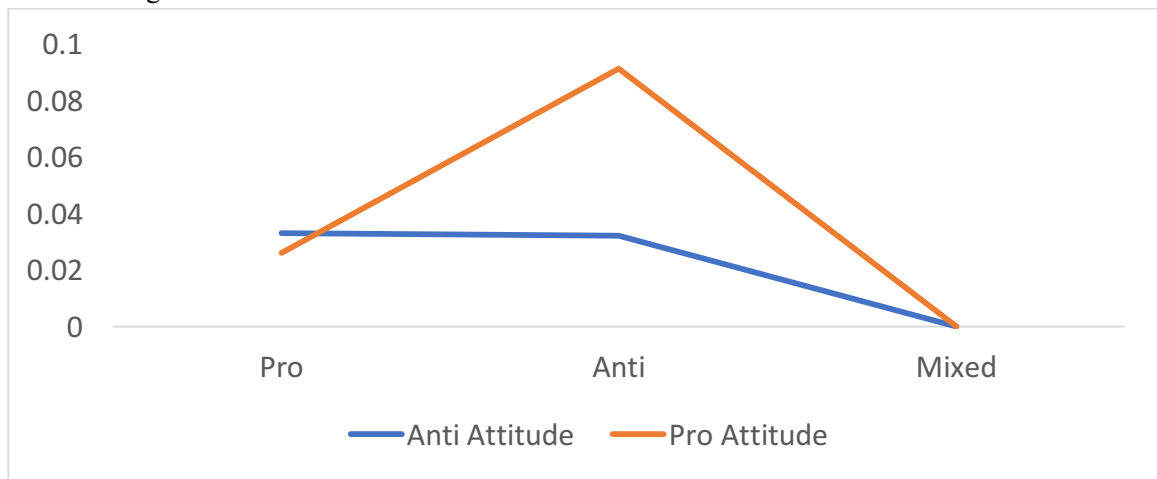


Figure C.3. Interaction Effect of Vaccination Attitudes and Race on Commenting

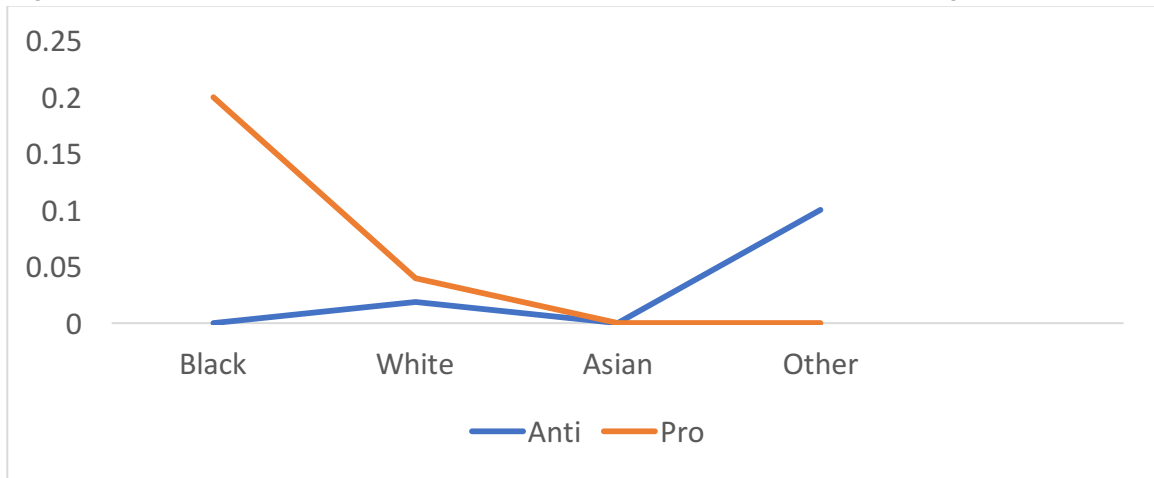


Figure C.4. Interaction Effect of Experimental Condition and Race on Commenting

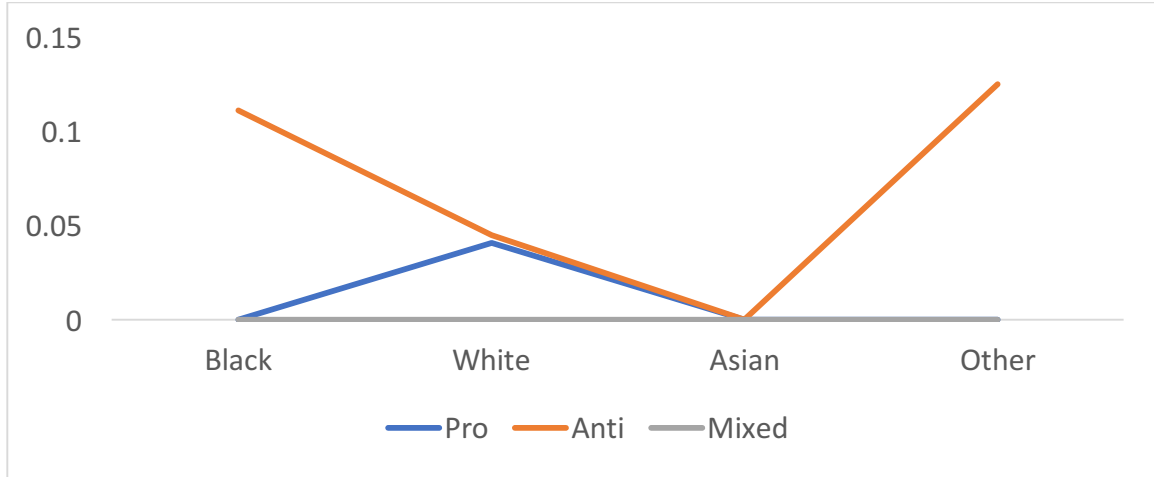
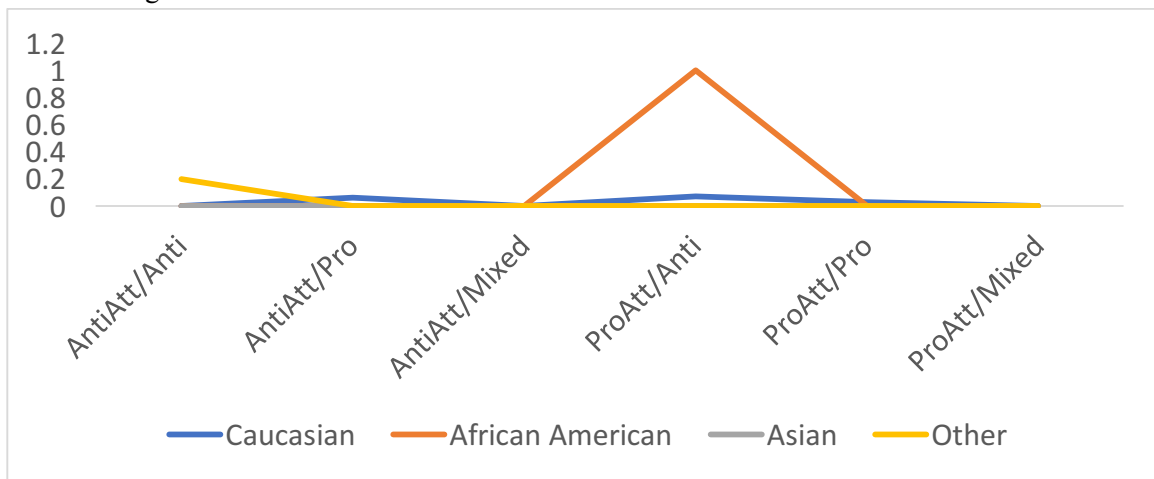


Figure C.5. Interaction Effect of Vaccination Attitudes, Experimental Condition, and Race on Commenting



APPENDIX D

Questionnaire

Q1.2 Our names are Dr. Cheryl Bracken, a faculty member, and Ms. Carlina DiRusso, a graduate student in the School of Communication at Cleveland State University. We are requesting your participation in a research study. The goal of our study is to explore how social media users interact with health-related messages on Facebook. If you want more information about this research study, please contact Dr. Cheryl Bracken at (216/687-4512), email: (c.bracken@csuohio.edu), or Ms. Carlina DiRusso at c.dirusso@vikes.csuohio.edu or 330-501-9855. You may withdraw from this study at any time without any consequence whatsoever. Only summary results may be published, presented or used for instruction. If you agree to participate you will take the survey using this online software. The survey will ask questions your behaviors and attitudes. The survey will last no longer than 15 minutes to finish. There is no way to know which student filled out an individual survey. The data may be used in publications/presentations. No personal identifiers will be included in such data. There are no direct benefits available to you as a participant in this research. Risks associated with participation are considered to be minimal. Such risks are largely limited to compromised confidentiality. In this study, we are asking you to log into your Facebook account. We will not record or share your Facebook login information, and we will not be able to login to your account. The only information from your Facebook account to which the study will have access is your name and profile photo; also, only you will be able to view your name and photo, and only during the experiment. The study will not have access to any other part of your Facebook profile, including your actual Facebook

page or friends. No records will be kept allowing your name to be associated with your responses in the study or on the survey. Your responses will be private. Only the researchers will see the data. Research records will be kept in a locked file. All electronic information will be coded and secured using a password protected file. Only summary results may be published, presented or used for instruction. Some participants may be eligible for extra credit. If this applies to you, you will have the choice to enter your name and the name of your instructor. If you provide your name, it will be removed from the data file before any data analysis is started. Please read the following: "I understand that if I have any questions about my rights as a research subject, I can contact the Cleveland State University Institutional Review Board at (216) 687-3630." You also are at least 18 years of age. Finally, you voluntarily consent to participate in this research study.

- ☐ Yes, I am willing to participate in the current study (1)
- ☐ No. I am not willing to participate in the current study. (2)

Q3.1 How likely is it that you would do the following behaviors in response to the Facebook post you saw on the previous page?

	Extremely unlikely (1)	Somewhat unlikely (2)	Neither likely nor unlikely (3)	Somewhat likely (4)	Extremely likely (5)
Leave a comment (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
'Like' the post (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
'Like' any of the comments (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reply to any of the comments (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Share the post (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4.1 What do you think was the dominant opinion about vaccination in the Facebook post you just saw?

- ☐ Anti-Vaccination = 1 (1)
- ☐ 2 (2)
- ☐ 3 (3)
- ☐ 4 (5)
- ☐ Pro-Vaccination = 5 (6)

Q5.1 In general...

	Almost never true (1)	Rarely true (2)	Occasionally true (3)	Often true (4)	Almost always true (5)
I worry about being isolated if people disagree with me. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't worry about other people avoiding me. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I avoid telling other people what I think when there's a risk they'll avoid me if they knew my opinion. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy avoiding arguments. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arguing over controversial issues improves my intelligence. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy a good argument over a controversial issue. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to avoid getting into arguments. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q6.1 How important do you consider vaccines to yourself?

- ☐ Not at all important (1)
- ☐ Not too important (2)
- ☐ Somewhat important (3)
- ☐ Very important (4)

Q6.2 How important do you consider vaccines to the nation?

- ☐ Not at all important (1)
- ☐ Not too important (2)
- ☐ Somewhat important (3)
- ☐ Very important (4)

Q97 The next questions ask about your online communication behaviors:

	Almost never true (1)	Rarely true (2)	Occasionally true (3)	Often true (4)	Almost always true (5)
Online, I worry about being isolated if people disagree with me. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online, I don't worry about other people avoiding me. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online, I avoid telling other people what I think when there's a risk they'll avoid me if they knew my opinion. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online, I enjoy avoiding arguments. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online, arguing over controversial issues improves my intelligence. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online, I enjoy a good argument over a controversial issue. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Online, I try to avoid getting into arguments. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Q7.1 How often do you use Facebook to...

	Rarely (1)	Sometimes (2)	About half the time (3)	Most of the time (4)	All the time (5)
Post your political message on your Facebook (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Post your response on others' political view on others' Facebook (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Read others' political opinion on others' Facebook walls (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subscribe to a political newsfeed/magazine (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sign up to volunteer for a campaign/issue (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Send a political opinion to others using Facebook message (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q8.9 Indicate whether you believe the following statements are correct, incorrect, or if you do not know.

	Correct (1)	Incorrect (2)	Do not know (3)
Vaccines are superfluous, as diseases can be treated (e.g., with antibiotics). (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Without broadly applied vaccine programs, smallpox would still exist. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The efficacy of vaccines has been proven. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Children would be more resistant if they were not always vaccinated against all diseases. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diseases like autism, multiple sclerosis, and diabetes might be triggered through vaccinations. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The immune system of children is not overloaded through many vaccinations. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Many vaccinations are administered too early, so that the body's own immune system has no possibility to develop. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The doses of the chemicals in vaccines are not dangerous for humans. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccinations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

increase the occurrence of allergies. (9)			
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Q9.1 Overall, how important are social networking sites to you personally when it comes to...

	Very important (1)	Somewhat important (2)	Not too important (3)	Not important at all (4)
Keeping up with political news (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Debating or discussing political issues with others (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finding other people who share your views about important political issues (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recruiting people to get involved with political issues that matter to you (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q10.1 Indicate how much you agree or disagree with the following statements.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
There is little scientific proof that immunization prevents infectious diseases. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccines have not substantially changed the incidence of any major infectious disease. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccination simply does not work. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccines are ineffective in preventing diseases. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11.1 Indicate how much you agree or disagree with the following statements.

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
It is difficult for me to express my opinion if I think others won't agree with what I say. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There have been many times when I have thought others around me were wrong but I didn't let them know. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I disagree with others, I'd rather go along with them than argue about it. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is easy for me to express my opinion around others who I think will disagree with me. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'd feel uncomfortable if someone asked my opinion and I knew that he or she	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

wouldn't agree with me. (5)					
I tend to speak my opinion only around friends or other people I trust. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is safer to keep quiet than publicly speak an opinion that you know most others don't share. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I disagree with others, I have no problem letting them know it. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12.1 Indicate how much you agree or disagree with the following statements.

	Strongl y disagree (1)	Disagre e (2)	Somewha t disagree (3)	Neither agree nor disagre e (4)	Somewha t agree (5)	Agre e (6)	Strongl y agree (7)
Vaccines actually cause more diseases than they prevent. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In general, contracting an infectious disease naturally is safer than being vaccinated against it. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccination weakens a person's immune system. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccination has adverse side effects. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vaccines have long-term, unknown adverse effects. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13.1 What device are you using to complete this survey?

- ☐ Smartphone (1)
- ☐ Desktop computer (2)
- ☐ Laptop computer (3)
- ☐ Tablet (4)
- ☐ Other (5)

Q13.2 What is your biological sex?

- ☐ Male (1)
- ☐ Female (2)
- ☐ Transgender (3)
- ☐ Transsexual (4)
- ☐ Other (5)

Q13.3 What is your highest level of completed education?

- ☐ Some high school (1)
- ☐ High school graduate (or equivalent) (2)
- ☐ Some College (3)
- ☐ Collge Degree (4)
- ☐ Graduate Degree (5)

Q13.4 In your own words, how would you describe your racial or ethnic identity?

Q13.5 How old are you?

Q13.6 Please select the option that best describes where you live.

- ☐ Rural (1)
- ☐ Suburban (2)
- ☐ Urban (3)

Q13.7 How do you identify your political views?

- ☐ Extremely Conservative (1)
- ☐ Conservative (2)
- ☐ Somewhat Conservative (3)
- ☐ Moderate, Middle of the Road (12)
- ☐ Somewhat Liberal (13)
- ☐ Liberal (14)
- ☐ Extremely Liberal (15)

Q14.1 If you are able to earn extra credit for completing this study, please enter the following information. If you are not receiving course credit, please skip to the next page.

Q14.2 Your name

Q14.3 Name of your instructor:

Q14.4 Course Number. For example - , COM 364

Q14.5 Course Name. For example - Media Metrics and Analytics

Q15.1 Thank you for completing our study. We appreciate your time.

APPENDIX E

IRB Approval Letter

RE: IRB-FY2017-173

Spiral of silence on Facebook: Vaccination Opinions

The IRB has reviewed and approved your application for the above named project, under the category noted below. Approval for use of human subjects in this research is for a one-year period as noted below. If your study extends beyond this approval period, *you must contact this office to initiate an annual review of this research.*

Approval Category: Expedited, Category 7

Approval Date: Feb 8, 2017

Expiration Date: Feb 7, 2018

By accepting this decision, you agree to notify the IRB of: (1) any additions to or changes in procedures for your study that modify the subjects' risk in any way; and (2) any events that affect that safety or well-being of subjects. Notify the IRB of any revisions to the protocol, including the addition of researchers, prior to implementation.

Thank you for your efforts to maintain compliance with the federal regulations for the protection of human subjects. Please let me know if you have any questions.

Sincerely,

Mary Jane Karpinski
IRB Analyst
Cleveland State University
Sponsored Programs and Research Services
[\(216\) 687-3624](tel:(216)687-3624)
m.karpinski2@csuohio.edu

APPENDIX F

Item Means Table

Table F.1.

Item Means Table

Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
ExpCond	1.00	3.00	1.9902	.82836
How likely is it that you would do the following behaviors in response to the Facebook post you s...-Leave a comment	0	5	2.05	1.183

How likely is it that you would do the following behaviors in response to the Facebook post you s...-'Like' the post	1	5	2.72	1.339
How likely is it that you would do the following behaviors in response to the Facebook post you s...-'Like' any of the comments	1	5	2.43	1.283
How likely is it that you would do the following behaviors in response to the Facebook post you s...-'Reply to any of the comments	1	5	2.00	1.140

How likely is it that you would do the following behaviors in response to the Facebook post you s...-Share the post	1	5	2.28	1.220
What do you think was the dominant opinion about vaccination in the Facebook post you just saw?	1	6	3.62	1.855
In general...-I worry about being isolated if people disagree with me.	1	5	2.20	1.020
Recoded FearIso2	1.00	5.00	2.7756	1.14976
In general...-I avoid telling other people what I think when there's a risk they'll avoid me if they knew my opinion.	1	5	2.38	1.081
In general...-I enjoy avoiding arguments.	1	5	3.19	1.150
Recoded FearIso5	1.00	5.00	2.8829	1.13585

Recoded FearIso6	1.00	5.00	2.8976	1.17333
In general...I try to avoid getting into arguments.	1	5	3.31	1.146
How important do you consider vaccines to yourself?	1	4	3.35	.793
How important do you consider vaccines to the nation?	1	4	3.59	.648
Online, I worry about being isolated if people disagree with me.	1	5	1.91	.991
Recoded FearIsoO2	1.00	5.00	2.4537	1.24225
Online, I avoid telling other people what I think when there's a risk they'll avoid me if they knew my opinion.	1	5	2.41	1.133

Online, I enjoy avoiding arguments.	1	5	3.39	1.273
Recoded FearIsoO5R	1.00	5.00	3.4585	1.14810
Recoded FearIsoO6	1.00	5.00	3.3659	1.24373
Online, I try to avoid getting into arguments.	1	5	3.54	1.262
How often do you use Facebook to...-Post your political message on your Facebook	1	5	1.69	1.056
How often do you use Facebook to...-Post your response on others' political view on others' Facebook	1	5	1.51	.872

How often do you use Facebook to...-Read others' political opinion on others' Facebook walls	1	5	2.49	1.312
How often do you use Facebook to...-Subscribe to a political newsfeed/magazine	1	5	1.90	1.264
How often do you use Facebook to...-Sign up to volunteer for a campaign/issue	1	5	1.56	.961
How often do you use Facebook to...-Send a political opinion to others using Facebook message	1	5	1.37	.810
Recoded VaxKnow1	1.00	3.00	1.8927	.85072
Without broadly applied vaccine programs, smallpox would still exist.	1	3	1.48	.820
The efficacy of vaccines has been proven.	1	3	1.43	.799
Recoded VaxKnow4	1.00	3.00	1.7951	.86147

Recoded VaxKnow5	1.00	3.00	1.8732	.91475
The immune system of children is not overloaded through many vaccinations.	1	3	2.00	.918
Recoded VaxKnow7	1.00	3.00	1.9512	.88426
The doses of the chemicals in vaccines are not dangerous for humans.	1	3	1.97	.885
Recoded VaxKnow9	1.00	3.00	2.1756	.90662
How important are SNS for... Keeping up with political news	1	4	2.14	.966

How important are SNS for... Debating or discussing political issues with others	1	4	2.80	.967
How important are SNS for... Finding other people who share your views about important political issues	1	4	2.66	.980
How important are SNS for... Recruiting people to get involved with political issues that matter to you	1	4	2.94	.913
It is difficult for me to express my opinion if I think others won't agree with what I say.	1	5	2.42	1.102

There have been many times when I have thought others around me were wrong but I didn't let them know.	1	5	3.13	1.086
When I disagree with others, I'd rather go along with them than argue about it.	1	5	2.57	.976
Recoded WillCensor4	1.00	5.00	2.8341	1.02508
I'd feel uncomfortable if someone asked my opinion and I knew that he or she wouldn't agree with me.	1	5	2.63	1.093
I tend to speak my opinion only around friends or other people I trust.	1	5	3.33	1.175
It is safer to keep quiet than publicly speak an opinion that you know most others don't share.	1	5	2.88	1.037

Recoded WillCensor8	1.00	5.00	2.5512	.99684
What device are you using to complete this survey?	1	4	2.28	.942
What is your biological sex?	1	2	1.60	.490
What is your highest level of completed education?	1	5	3.10	.659
Coded Race	1.00	4.00	1.5641	.99470
How old are you?	18	50	22.59	5.095
Please select the option that best describes where you live.	1	3	2.17	.598
How do you identify your political views?	1	15	9.94	4.814
Did they comment in the experiment?	0.00	1.00	.0302	.17143
School	0.00	2.00	1.5126	.58482
Recoded VaxEffic1	1.00	7.00	5.1707	1.62852
Recoded VaxEffic2	1.00	7.00	5.4976	1.46737
Recoded VaxEffic3	1.00	7.00	5.8488	1.26474
Recoded VaxEffic4	1.00	7.00	5.7561	1.35003
Recoded VaxSafe1	1.00	7.00	5.6000	1.38833
Recoded VaxSafe2	1.00	7.00	5.4732	1.41266

Recoded VaxSafe3	1.00	7.00	5.1756	1.58992
Recoded VaxSafe4	1.00	7.00	4.3951	1.51301
Recoded VaxSafe5	1.00	7.00	4.6488	1.52546
Summated scale of VaxAtt items	15.00	63.00	47.5659	10.01870