THE BUTTERFLY EFFECT OF DECEPTIVE SCIENCE: HOW MEDIA INFLUENCE MAY HAVE SPREAD THE ILLUSORY LINK BETWEEN VACCINES AND AUTISM

By

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THESIS

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ABSTRACT

The Butterfly Effect of Deceptive Science: How Media Influence May Have Spread the Illusory Link between Vaccines and Autism

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Delaying or refusing childhood vaccinations can increase a community's risk of vaccine-preventable diseases. Agenda-setting theory demonstrates that media can influence people's attitudes and opinions. One study in 1998 asserted that a vaccine/autism link existed, giving birth to one of the longest held myths in modern medicine. Shortly after its publication, the study was thoroughly discredited, and hundreds of subsequent studies have failed to find any link. Many parents who refuse vaccinations remain unconvinced by traditional science and favor anecdotal, pseudo-scientific accounts of the cause of and treatments for autism. Given the recent resurgence of once-eradicated vaccine-preventable diseases, it is possible that the mass media helped introduce and proliferate the false vaccine/autism link ideology. Fear learning can prompt persistent, irrational beliefs and behaviors. Thus, if news reports about autism were perceived as a threat to the health and/or safety of people's children, the media might have been a factor in scaring people about autism, steering them toward the perceived

safety of refusing vaccinations. Earlier media messages used more fear terminology than did later reports. Language expressing uncertainty about autism and the risk of developing it have remained equal through the years.

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Finally, I am thankful to Shelley Wigley for agreeing to serve on my committee sight unseen. She provided keen insight at my prospectus defense that ultimately defined

the time span for this study. Additionally, she along with Dr. Chatterjee prompted me to key in on a crucial theoretical perspectives that led to my more interesting findings.

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DEDICATION

I dedicate this work to several people. First, this is for my father, as he is a survivor of a polio infection in 1951. Polio tore through much of the world from the 1920s through the 1950s and was the number one killer of children in the 1950s. Polio robbed my dad of the use of his legs; it denied him a normal childhood, and now continues to present new challenges as he ages into his 70s. He is a constant reminder of why vaccination is important. My father also inspired this work because he persevered despite enormous odds. Polio may have caused him enormous pain, suffering, and isolation, but he emerged strong, independent, and with a will made of iron. By modeling those qualities, he instilled in me the belief that if he could reach his goals, so could I. Thus, I became the first in my family to earn a college degree, and god willing; I will eventually earn a Ph.D.

None of this would be possible without the persistent sacrifice and support of my husband. He keeps our family on an even keel, no matter how many ‘hard-lefts’ I take in my career and education. He does it with love and grace that most people on this earth lack—including me. He listens to me, reads my work, and always encourages. Over the past two years, he has done more than his share of domestic duties; he took on additional work responsibilities so we could afford my educational pursuits, and does more than his share of parenting. He is even going to move 3 hours south from where he has lived his entire life in support of my goals. I often wonder what I did to deserve him.

My children sacrifice more than their share as well; they wish I could play with them more and missed many evenings with mom while I completed my coursework.

However, they also inspire me. Post-secondary education is very important to me, and I want them to become the second generation of college graduates in our family.

My mother, who is brilliant, gave up her academic pursuits to be a mother. She remains my most adamant cheerleader, encourager, and helps me balance the responsibilities of school and parenthood by helping with the children at a moment's notice. She is the shoulder I cry on when I am overwhelmed and is an example of unconditional love.

Last but not least, I dedicate this to my sister. She, like my mother, supports me with encouragement and confidence, and helps with my children. After graduating with my Bachelor of Science degree, she enrolled in college and earned her BBA. She credits me for the inspiration, but it is she that inspired me. She did it with a full-time job, while raising two children, and because she realized (like me) that some mountains should be climbed because they are there. If we never stretch ourselves, challenge ourselves, or try new things… we will never know what all we might have accomplished.

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Chapter One

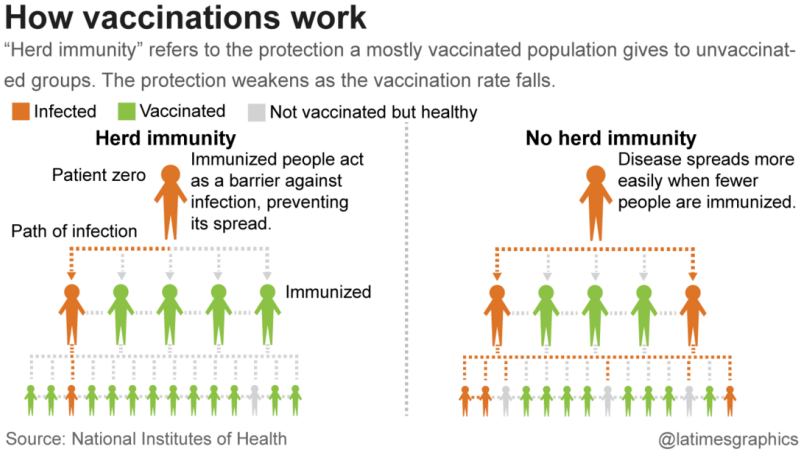
Background

Delaying or refusing childhood vaccinations is associated with an increased risk of preventable diseases (Lieu, Ray, Klein, Chung, & Kulldorff, 2015). While vaccination rates vary across states, a recent report that compiled data from the National Immunization Survey in 2013, found that 17 states had measles vaccination rates below 90 percent (Trust for America's Health, 2015). The likelihood of disease outbreak increases significantly if a community dips below the optimal vaccination threshold (commonly 90%). Immunizing a critical majority of a community, known as herd immunity, increases the effectiveness of individual vaccines, and extends protection to unvaccinated people. Because diseases have little chance of spreading through a densely vaccinated group, outbreaks are quickly contained. When a community falls below this threshold, everyone is a greater risk for vaccine-preventable infections, especially those who are unvaccinated (Fine, 1993). Unfortunately, many who bear the greatest risk are ineligible for vaccination and rely on herd immunity. Not unlike the animal kingdom, vulnerable people rely on the herd for safety. The calculation for herd immunity is highly complex and varies according to disease strain and population characteristics (Fine, 1993). Nonetheless, the higher the vaccine uptake within a community, the more robust is the herd immunity (Clarke, 2008; Meszaros et al., 1996). For a simplistic depiction of how herd immunity works within a population, see Figure 1. In the United States, a significant number of states are not meeting the goal of a 90% vaccination rate set forth

by the National Center for Health Statistics (U.S.) (2012). Therefore, many people within U.S. communities are more vulnerable to preventable diseases.

This study will investigate the construction and presentation of news stories and mainstream media profile pieces about autism and vaccines. The media may have inadvertently framed autism as a threat to children's health, and proliferated the erroneous idea that a link exists between vaccines and autism. In turn, these messages may have galvanized the vaccination attitudes of a substantial number of people, which may be a contributing to the recent resurgence of vaccine-preventable diseases. However, insomuch as the media may have been part of the initial problem, it may likewise be part of the solution. Sheikh et al., (2013) found that the media was the single largest positive influence on vaccination behaviors in a polio-prone country—offering a recent affirmation of the voluminous literature that demonstrates the magnitude of influence that the mass media wields over the public agenda and attitudes (McCombs, 2014). Importantly, Sheikh et al., (2013) provide a timely demonstration that media influence can positively affect vaccination behavior.

Figure 1



Literature Review

Throwing the baby out with the bathwater

Despite significant ongoing advances in science and medicine, suspicions of many institutions associated with government or pharmaceutical companies are high (Henrich & Holmes, 2011). Fisher, Kohut, Salisbury, and Salvadori (2013) observed that the politicization of science is a widespread phenomenon in general. As people have come to believe that the government and large pharmaceutical companies have a common, profit-driven agenda, people have cited this as a reason to reject previous healthcare initiatives (Henrich & Holmes, 2011). While political/state/corporate bodies may indeed have a heavy hand in defining public health problems as well as the solutions, it is important to note the implausibility that any of those entities would benefit from the outbreak of a vaccine-preventable pandemic. It is also notable to consider that the mass media are the main conduit through which the public are familiarized with emerging health concerns, and perhaps how those concerns are appraised.

Permutations of Fear in the Media

Altheide (1997) notes that the public's perception of problems are linked to the mass media and argues that a communication format, dubbed the "problem frame," has in essence promoted the overuse of fear in news production. He found the term "fear" substantially increased in the mid-1990s compared to the mid-1980s. While this research was primarily centered on reports related to criminal activity, it is among the few studies that specifically looked at fear as a distinct element in news stories. Altheide and Michalowski (1999) observed fear as a compelling factor driving the evolution of news

stories. They remarked that within the 1990s decade, news stories shifted to focus on people's fear of something, rather than the thing itself. This timeline and topic are both relevant to the present study because it will measure fear references used in mainstream news stories featuring autism from1999 through the end of 2014. Also, the increase in the use of fear words (or references to fear) might be reflected in topics other than crime in which a perceived threat is present — including stories about autism. The routine association of fear and news topics eventually result in the topic itself signifying fear (Altheide & Michalowski, 1999). Altheide (1997) suggests that through frequent connection, fear becomes absorbed into the meaning of many news topics as well as with the words commonly associated those topics. Media stories can eventually provoke fear using fear-associated topics or words, thus dawning the use of fear in the news without using the traditional synonyms or words associated with fear (Altheide & Michalowski, 1999, p. 497). They say,

> Fear is increasingly substituted for such words with much different connotations from fear, as "concern," "relevance," "trouble," "query," "issue," "item," and many others.

Messages that stir fear can be useful for targeted public health campaigns (Witte, 1992). Yet, Altheide (1997) contends that fear is also an entertainment mechanism used in news stories that have gradually contributed to cultural changes whereby fear narratives are more prominent in day-to-day life. Similarly, Brashers (2001), believes that a deluge of fear appeals in combination with improved monitoring and screening for a disease has created a culture of the "chronically ill and worried well," p.487. Fear heightens arousal and attention; therefore, it is not surprising that in competition for readers/viewers,

journalists might use it as a powerful story-telling tool. If fear narratives indeed became more prominent in the general culture, perhaps new communication technologies became conduits that helped channel and amplify fear appeals into the collective consciousness of the public.

Google Effects

New communication platforms and technologies hastened the dissemination of news and increased the availability of information sources, but increased convenience and quantity are independent of quality. In short, more is not necessarily better. Science and health literacy are waning in the United States (Kahan et al., 2012), further limiting the population's skills necessary to understand healthcare decisions (Schillinger et al., 2002). While there has not been any documentation suggesting that search engines are reducing science and health literacy, it is affecting memory (Sparrow, Liu, & Wegner, 2011). Though science and medicine journalists may remain well versed in complex science and medicine topics, they must also consider the audience who will receive their messages. Waning public science and numeracy ability may affect the quality of health and medical reporting. Meanwhile, the contemporary communication landscape provides unprecedented access to a swarm of information online. Sparrow, Liu, and Wegner (2011) suggest that people are developing symbiotic relationships with their devices, as they have become what amounts to an external drive that stores our memories. Like human memory, however, online information can be distorted and flawed. Volumes of assorted evidence-based, anecdotal, and pseudo-scientific health information are available with astounding convenience. While medical providers remain a primary source

of patient education (Schillinger et al., 2002), many seek health advice from online sources (Baker, Wagner, Singer, & Bundorf, 2003; Bratucu et al., 2014; Larson, Cooper, Eskola, Katz, & Ratzan, 2011). According to the Pew Research Center, 72% of internet users say they have looked online for health information (Pew Research Center, 2013).

Extended Parallel Processing Model

Goodall and Reed (2013) point out that uncertainty is a dominant feature of emerging health issues in the news. Reporting of novel diseases or disorders depends on incomplete science that can change rapidly and sometimes negate previous information (Goodall & Reed, 2013). While journalists strive to tell stories that are free from bias, reporting of health threats is influential by nature. People will be interested in averting personal risk. The Extended Parallel Process Model (EPPM) put forth by Witte (1992) provides a framework to study fear references in the context of this study. Essentially, fear is defined as a negative emotion elicited by a perceived substantial threat with personal relevance. A threat is an external feature that is independent of a person's awareness, but can elicit anxiety when perceived as such. Messages can inadvertently elicit a fear or threat response regardless of the intention of the content. Response efficacy is related to the recommended response and associated effectiveness. It provides a context for various adaptive and maladaptive ways that people might behave when confronted with fear appeals. In essence, Witte (1992) argues that people who respond adaptively to messages, accept the message and follow recommended actions. The maladaptive forms are defensive avoidance (denial) or reactance (rejection of the message for fear of manipulation). EPPM posits that the presence of poorly understood

threats to health when solutions are absent or inaccessible are more likely to produce maladaptive fear-control behavior. However, if a fear message conveys high levels of response efficacy (e.g., a solution), EPPM predicts that the message will more likely influence people to adopt healthy behaviors Witte (1992). Usually applied to health campaigns with intentionally persuasive messages, EPPM can inform messages with incidental influential components—such as emerging news about a public health issue. Given that EPPM asserts that uncertainty and fear are strongly associated, it is important to articulate what uncertainty means to the casual consumer of health news. According to Brashers (2001, p. 478), "Uncertainty exists when details of situations are ambiguous, complex, unpredictable, or probabilistic; when information is unavailable or inconsistent; and when people feel insecure in their state of knowledge or the state of knowledge in general." A related theory specifically addresses how uncertainty might mitigate the fear response as well as other behaviors.

Uncertainty Management Theory

A person's appraisal of their state of knowledge and actual state of knowledge are not always concordant. As such, the same holds true for the lack thereof (Brashers, 2001). This concept is a double-edged sword of sorts that can work both ways. If someone has a great deal of information (corroborated by peers or experts), this person may still 'feel' uncertain. Likewise, a person may be missing information that is glaringly obvious to others, but they may still feel certain. Lacking knowledge and uncertainty are independent (Brashers, 2001). Uncertainty Management Theory goes beyond the assumption that the only response to uncertainty is the desire to reduce it; indeed, it

argues that some may seek to perpetuate it. It also predicts behavioral responses that are dependent on perceived personal relevance, which ~~agrees with~~ like EPPM, states that perceived severity and susceptibility govern threat perception. For example, Uncertainty Management Theory proposes that individuals judge events based on self-relevance (Brashers, 2001). This is also highly concordant with Need for Orientation (NFO) predictions described by Weaver (1977), which state that relevant topics are inherently more influential. Both Weaver (1977) and Basher (2001) describe how uncertainty and relevance interact to drive behavior. Weaver (1977) finds that individuals that are high in both dimensions are more likely to seek further information from media. Thus, the increased exposure to media messages amplify the susceptibility to their influence. Later this study will examine differential information-seeking paths that may arise from relevance and uncertainty dimensions. However, Brashers (2001) argues that the desire to reduce uncertainty is among an indeterminate number of responses to events that run the spectrum of predictability. While this broader Uncertainty Management Theory describes multifaceted behaviors with different levels of motivation to reduce uncertainty—it (like EPPM and NFO) argues that affective appraisals are a chief determinant. In essence, if an emerging health topic is highly relevant, highly uncertain and appraised negatively, a strong desire to reduce uncertainty will likely result. This is particularly true if the perceived probability of personal involvement with the health threat is high. The negative emotional responses (e.g., anxiety and/or fear) result from the uncertainty that represents danger or a threat (Brashers, 2001). Such responses could include delaying or refusing vaccination.

The Curious Case of the Anti-Vaccination Movement

Studies have identified a clustering of communities who delay, under-vaccinate or refuse vaccination (Lieu et al., 2015). Ironically, the community of parents who delay or refuse vaccination become even less likely to vaccinate their children as a function of higher educational attainment. For instance, parents with a graduate-level education are the least likely to immunize their children among all who refuse immunization (Lieu et al., 2015). This supports an earlier study that discovered non-vaccinators are educated, financially secure, high efficacy individuals (Smith, Chu, & Barker, 2004). High self-efficacy individuals have confidence in their ability to employ endorsed actions to avert the threat (Goodall & Reed, 2013). Outwardly, this would seem to be a paradox. Credible scientists have unequivocally debunked the vaccination/autism link over a decade (Griffith-Greene, 2014; Jain et al., 2015). Even studies that call for higher disclosure of rare vaccination side effects find that safety concerns are minimal (Demicheli, Rivetti, Debalini, & Di Pietrantonj, 2012). The autism/vaccine myth, nevertheless, persists. It is interesting to note that information does not necessarily need to be correct to reduce uncertainty, but it must seem plausible to a person considering the information (Brashers, 2001).

Unfortunately, vaccine-preventable diseases are much more dangerous in the modern era. People who contract vaccine-preventable diseases in the present, as opposed to the pre-vaccination era, face extremely virulent strains that lead to the "most severe possible outcomes," (Fefferman & Naumova, 2015). Ostensibly, the ongoing vaccination resistance among some parents is perplexing given the preponderance of the evidence

that supports the efficacy and safety of childhood vaccination, (Jain et al., 2015). To examine this phenomenon, mass communication, health communication, and cognitive theories relevant to the neurophysiological processes underlying learning, attitudes, and behaviors will guide this study.

A Cautionary Tale

Vaccination refusal has not always been tied to a suspicion of autism (Baron, 1992; Meszaros et al., 1996). Yet, as autism awareness increased during the 1990s and 2000s, parental fears of children developing autism also rose (Clarke, 2008; Holton, Weberling, Clarke, & Smith, 2012). With no clear etiology of autism, many were uncertain how to protect their children from developing the disorder. Was this something a child was born with? Was it something a child could catch from an unknown environmental toxin or another agent? Growing suspicions about vaccine safety began to focus on a possible vaccine/autism link (Holton et al., 2012; Plotkin, Gerber, & Offit, 2009). In hindsight, experts believe that the increase in autism prevalence was most likely driven by expanded diagnostic criteria coupled with an increase in awareness (Plotkin et al., 2009). Yet, early on, it became customary to refer to autism as an epidemic, and such messaging remains prominent (Roithmayr, 2012). Interestingly, Lundström, Reichenberg, Anckarsäter, Lichtenstein, and Gillberg (2015) found that actual phenotypical presentation of autism remains stable and conclude there is no growing incidence of autism (i.e., no epidemic). The increased prevalence of autism is not associated with any factors other than awareness. Ironically, the term "epidemic" aptly describes the very thing vaccines are proven prevent. Witte (1992) might predict that such a threat message

‘epidemic’ coupled with the ‘solution—refuse vaccination’ could be highly influential, particularly if it came from a trusted source (e.g., celebrities, family, friends, a news story, etc.).

After facing media coverage of the rumors that the Measles, Mumps, Rubella (MMR) vaccine might trigger autism, health officials were later confronted with new theories that implicated vaccination in autism: thimerosal (a vaccine preservative in use for 70 years—not present in the MMR vaccine) (Clarke, 2008; Holton et al., 2012; Larson et al., 2011; Plotkin et al., 2009). Thimerosal contains ethylmercury, not methylmercury that is a known neurotoxin. Methylmercury can build up in the body, making repeated exposure dangerous. However, ethylmercury is eliminated from the body rather quickly, and there is no evidence that it causes harm (Centers for Disease Control, 2015). Despite this, the CDC ordered the removal of thimerosal from early childhood vaccinations by 2001 purely as a precaution. Ironically, this further cemented growing views that vaccines were not safe (Larson et al., 2011; Plotkin et al., 2009). Simultaneously, a parent-led movement emerged and departed from the view that autism was a congenital condition caused by extant neurobiological developmental differences. Rather, this movement supported an environmental toxins-hypothesis (Clarke, 2008; Larson et al., 2011). According to Clarke (2008), many parents concluded that the dangers of vaccines outweighed their risks.

Wolf in Sheep's Clothing

These parental concerns were heightened when in 1998 Andrew Wakefield et al. published a paper in the Lancet, a top-tier high impact medical journal, which purported a

possible link between the combined MMR vaccine and autism (Clarke, 2008; Holton et al., 2012). The study proposed a relationship between autism and inflammation of the intestinal lining. Nine of the study's children had autism, eight of whom had parents who recalled symptom onset shortly after the MMR injection (Plotkin et al., 2009). The study made extravagant inferences given the small number of children participants. Considering the obvious methodological flaws of the study, its publication was surprising. Equally perplexing, the study was not fully retracted by the Lancet until February of 2010—a full 12 years after its publication. Its complete retraction occurred one month after the UK General Medical Council (GMC) concluded an investigation and found Wakefield guilty of data-tampering, avoidance of oversight by an ethics committee, conflicts of interests, and undisclosed financial interests (Clarke, 2008; Holton et al., 2012).

The GMC discredited Wakefield and stripped him of his medical license. Afterward, subsequent news organizations and other stakeholders charged Wakefield for establishing the false autism/vaccine controversy (Holton et al., 2012). Nonetheless, the more serious offense, one may argue, was that the media continued to relay stories that included pro-link narratives (even if it was done in an attempt to balance the story). To be fair, the majority (41%) of the U.S. news coverage from 1998-2006, according to Clarke (2008), implied that no link between vaccines and autism existed. However, 38% of the stories presented a pro-link frame either alone or with an anti-link point of view (Clarke, 2008). With a very serious public health matter hanging in the balance, the mere mention of a 'controversy' or presentation of a pro-link frame may be damaging given that a

scientific consensus was reached relatively quickly after the Wakefield paper, and no real controversy existed. After the study was discredited, the continuation of publications and broadcast stories that present a pro-link frame juxtaposed with an anti-link frame may have served to strengthen existing frames regardless of the story's intent (Lakoff, 2004). Given this logic, it is important to examine news stories that mention a link irrespective of the journalists' assessment of the merits of the opposing point of views. It is also important to ascertain if stories framed autism as something to be feared, which might have influenced how individuals responded to allegations of a link between vaccines and autism.

This study will examine the prominence of fear references in news stories about autism. Mainstream newspaper sources from 1999 through the end of 2014 will be sampled. If stories about autism emphasized fear and uncertainty early on, it is possible to conceive that the negative affective nature of the messages might elicit stronger influences on individuals who deemed this information relevant (Coleman & Wu, 2010; Wu & Coleman, 2009). Thus, it is plausible that people were motivated to seek information that would reduce the associated uncertainty (Brashers, 2001; Rains, 2014). Media reports of increasing autism prevalence coupled with coverage of claims purporting that there existed 'proof' of an autism/vaccination link may have appealed to people desperate to reduce uncertainty and reclaim perceived control over the neurological fate of their children. Highly educated individuals may be especially equipped to rationalize unsubstantiated evidence when properly motivated (Kahan et al., 2012).

A Noisy Paradox

During the years of 1995-2014, journalists frequently reported on autism. Thus, it was a highly salient topic that was relevant to a large portion of the public. Additionally, a cacophony of conflicting information surrounding autism abounded in the news coverage (Clarke, 2008). The public was confronted by the juxtaposition of highly vocal fringe groups backed by popular celebrities purporting that vaccines caused autism and scientists who denied a causal link, but offered convoluted theories that claimed no clear etiology of autism. In short, the channels were flooded with static from the clamor of discordant messages. This high uncertainty in concert with high relevance provided the essential criteria to impose a strong motivation to seek additional information first described by Weaver (1977). Dubbed a need for orientation (NFO), Weaver (1977) demonstrated that those with high NFO were more susceptible to media influence. Given that The 2008 Pew Research Center Project for Excellence in Journalism listed autism as one of the 5 most reported health topics (based on an analysis of 3,500 health stories in news outlets in 48 states in the U.S.), agenda-setting theory would predict that it was likely on the public agenda (Pew Research Center, 2008). McCombs (2014) argues that when the public resonates with the frames provided by the media, it can play a major role in the public's opinion and subsequent understanding of the message (p.62). What began as a suspicion on the radar of a small group of people exploded into a lasting myth (Holton et al., 2012).

A recent Gallup poll asked parents how important childhood vaccinations were in 2015 and compared them to responses to the same questions posed in 2001. Surprisingly,

this poll revealed that more people endorsed the necessity of vaccines in 2001 than in 2015 (Newport, 2015). Ironically, 2001 was the year that the CDC removed thimerosal from childhood vaccines. The 2015 poll also probed if people believed there to be a link between autism and vaccines, 6% of respondents answered: "yes," and 52% of respondents indicated that they were "unsure," with only 41% responding "no, not a cause," (Newport, 2015). This is consistent with McCombs (2014) notion that agenda-setting effects can be the result of collective media messages (p. 22). This trend suggests that the effects can accumulate and become even stronger over time (in this case over a decade).

How the Wolf Got In

Larson et al. (2011) cite research studies from other countries that demonstrate reduced vaccination rates occur after dissemination of anti-vaccination messages. Online health information seeking behavior can help reduce uncertainty, provide comfort and affirmation, and be perceived as a meaningful act by individuals (Bratucu et al., 2014). Yet a high prevalence of inaccurate information lurks throughout the web and other media channels from both internet (Slater & Zimmerman, 2003) and traditional media (Ecker, Lewandowsky, Chang, & Pillai, 2014; White, 2012; Young, King, Harper, & Humphreys, 2013). Social networking sites offer explicit support and cite anecdotal evidence around several health topics. Likewise, these online communities can also transfer social norms and peer influence (Bratucu et al., 2014).

Vaccination rates in the United States declined after the broad media coverage of the Wakefield study (Holton et al., 2012), lending strong evidence for 2nd level agenda-

setting effects—yet these effects were not a transient phenomenon for all those influenced, and simply providing new facts have not deterred those convinced of the autism/vaccine link. After the publication of the Wakefield study and subsequent media coverage, the MMR vaccination rates in the United States dropped low enough for measles outbreaks to re-emerge (Holton et al., 2012) with a record number of measles cases reported in 2014 ("Measles cases and outbreaks," 2015). Presently, vaccination rates continue to remain steady or decline further in some areas (Lieu et al., 2015) amid the present trend where a majority of traditional media delivering are pro-vaccination messages attributed to researchers, scholars and experts (Holton et al., 2012). Interestingly, this suggests a long-lasting version of agenda-setting effects—different from second level agenda-setting effects. This paper will also explore a possible avenue to expand current agenda-setting agenda-setting theory as one possible explanation for this durable yet enigmatic type of agenda-setting. Uncovering the factors and course that led to persistent vaccination refusal among some parents is important because it is clear that merely correcting the record via a flood of facts is not sufficient to reverse the trend.

Studies of agenda-setting continue to find that media go beyond informing the public of salient issues and may influence people's attitudes and opinions (McCombs, 2014, p. 62). Given the enduring trend among a significant minority to forgo immunizations for their children, one may argue that health and science reporting can play a larger, quite significant role in public health. Many parents who refuse vaccinations remain unconvinced by science. Beliefs that vaccines cause autism persist

and these beliefs subsequently subdue vaccination rates (Demicheli et al., 2012; Jain et al., 2015).

Chapter Two

Agenda-setting: The history of an evolving theory

This research centers on the concept of agenda-setting and the many attributes and factors and that influence and coincide with this phenomenon. Walter Lippmann first introduced the concept of agenda-setting in 1922 in a chapter in his book, Public Opinion (Lippmann, 1922). Although, Lippmann never used the phrase "agenda-setting," McCombs and Shaw, trace the origins of their ideas that led to agenda-setting theory to many of Lippmann's concepts. McCombs and Shaw named agenda-setting theory in 1968, during an election in Chapel Hill, North Carolina (McCombs & Shaw, 1972). They found evidence that the agendas of undecided voters were highly correlated with the media's agenda (that covered the elections).

Since the seminal McCombs and Shaw (1972) agenda-setting study, hundreds of papers have supported their findings and expanded the theory into different directions and depths. Originally, agenda-setting refuted the prevailing communication theory that existed in the 1950s and 1960s credited to Paul Lazarsfeld. The limited effects model of that era claimed that the media exerted only limited effects on people. Agenda-setting quashed this concept by illustrating that the news indeed established the most salient topics that people talked about, yet did not initially measure any evaluative, attribute or behavioral properties. It was noted, however, that people were differentially influenced. Thus, Weaver (1977, 2008) described some contingent factors (e.g., NFO) individuals possess that predicts the level of media influence. Later, a second level of agenda-setting was proposed, which stated that attributes or qualitative information could be transferred

from the media agenda to the public agenda. These effects have been firmly established in the literature as scholars have carefully detailed under what circumstances and contingencies attribute agendas are transferred (McCombs, 2014). More currently, scholars have looked at how first and second level effects work together and influence one another. As the theory continues to evolve, there exists some theoretical space to explicate further if third level effects are occurring through different mechanisms and exert influence differently.

First level agenda-setting tells the public "what to think about." The public assumes that because an issue gets airtime (that it is salient)… it must be important. Second level agenda-setting tells the public "how to think about" an issue. This takes the concept a step further, proposing that based on how a message is framed or what attributes are emphasized or ignored will have an even greater effect on the publics' opinion of the issue (Entman, 1993). Third level agenda-setting is perhaps the least understood area of agenda-setting research but potentially holds great relevance to this inquiry. Third level agenda-setting posits that news media not only tell people what and how to think about an issue, but how to feel about an issue as a whole concept (McCombs, 2014). Perhaps the agenda transforms from a salient issue that garners one's attention for a time, to a permanent feature (perhaps trait) fully assimilated into the cadre of a person's psyche. The issue may embed so deeply that it becomes as intractable as beliefs, culture and personality—which all guide behavior. Cognitive neuroscience scholarship illuminates the mechanisms by which new learning can create changes in the structure of a brain. These structures can be temporary (like with working memory–or a

passing salient agenda). However, with increased reception, repetition, and reinforcement… new learning can produce physiological changes, creating permanent structures that shift the neural organization of the neural networks, and ultimately the ideas, thoughts, perceptions and behaviors that arise from their activity (Kalat, 2004, pp. 411-415). None of this would be possible, however, without the antecedent of attention, which is heavily influenced by a person's desire for information, or their need for orientation (Gazzaniga, 2011, p. 184).

Need for Orientation

Need for orientation (NFO) plays an important role in agenda-setting function and likely a foundational role in individuals' susceptibility to influence by anti-vaccination messages as well. As briefly mentioned, NFO first introduced by (Weaver, 1977), can be explained as an individual's need to orient or seek information about a topic. Weaver's concept of NFO described a cognitive process that progressed sequentially from first perceiving an issue as relevant and then moderated that issue by the level of uncertainty. Overall, a high NFO increases susceptibility to agenda-setting effects (Weaver, 1977). In fact, McCombs himself called the selection of research subjects for the Chapel Hill study a stroke of luck. He said that he and Shaw accidentally picked the best population in terms of being most likely to be influenced by the news media. Voters wanted to vote (high relevance) but were undecided (high uncertainty) (McCombs, 2014).

Provisional Factors Affecting Need for Orientation

Matthes (2006) described a three-dimensional scale that moderates NFO. According to this framework, individuals seek information from the news media about an

issue for one of three reasons. This can be simplified by the idea that there different motivating factors driving a need for orientation: The issue itself, specific facts or aspects (frames) of an issue, and journalistic evaluations. Likewise, the more of these motivating factors that a person possesses, the more likely they will be influenced. In addition to issues, frames and evaluations, previous experience with an issue can shape attention, attitudes, and ultimately behavior.

Personal Experience

Later came discovery of other contingent conditions such as the obtrusiveness or personal experience of issues. Gross and Aday (2003) found that obtrusiveness mitigated agenda-setting (as well as cultivation) effects. Applied to the present study, unobtrusive messages received by people (i.e., no personal experience with autism) would predict a higher level of media influence. However, it is plausible that individuals may employ motivated reasoning, seeking out specific media, in response to obtrusive issues (i.e., having a close relationship with an autistic individual). In this case, relevance is high, therefore, the need for orientation would also be especially pronounced, albeit much more selective. This logic pairs well with the Camaj (2012) typology for NFO, which refined Weaver's predictions. She promoted the concept of 'uncertainty' to be as important as 'relevance.' Uncertainty can be considered even when relevance is low. This yields more precise predictions about the sorts of information individuals seek depending on variable levels of subjective relevance and uncertainty. Its predictions are also in accord with EPPM described by Witte (1992) and emerging news stories about public health concerns (Goodall and Reed, 2013).

Seek and Ye Shall Find

Camaj (2012) predicts that individuals with high relevance (e.g., parents with small children) and low uncertainty (e.g., high obtrusiveness, or standing beliefs that vaccines are related to autism) would most likely seek out media that confirm previous biases. Brashers (2001) would describe this behavior as avoidance or maladaptive behavior in response to a health concern. To escape distress, things like selective attention, selective ignoring, and discrediting the source are common avoidance tactics (Brashers, 2001). Broadly speaking, the population most likely to be influenced by the news media would indeed be significant. People who might find the prevalence of autism-relevant would likely include existing parents, expectant parents, people seriously considering parenthood, guardians, adoptive parents, involved family members (e.g., grandparents). Taken together, that is a weighty proportion of the populace. Furthermore, the persistence of vaccine myths, social, cultural norms of small groups, and the ongoing presentation of stories about the 'autism controversy' in the news media, suggest there may be a cumulative agenda-setting effect that over time has contributed to the resurgence of vaccine-preventable diseases.

Lasting Effects

The stubborn persistence of myths surrounding vaccination safety presents a tantalizing possibility that the depth and longevity of media influence may be more enduring on high-stakes health messages. Shannon MacDonald, an adjunct assistant professor at the University of Alberta, may have said it best, "It's hard to unscare people," (Griffith-Greene, 2014). If news stories presented fearful and uncertain frames about

vaccinations, perhaps the fear increased salience and the negative nature of the messages played to individuals' emotions and were more likely to influence attitudes (Coleman & Wu, 2010). Further, news stories that contain highly *compelling arguments* can cause second level agenda-setting effects without a high frequency of messages (McCombs, 2014).

Toward a Clarification of Third Level Agenda-setting

Perhaps the present case is an example of the heretofore vague, but latest agenda-setting proposition, whereby a network of objects and attributes are transferred together as a system—third level agenda-setting (McCombs, 2014). Each level of agenda-setting might be analogous to the depth in which an individual cognitively processes a message. The first level garners attention. The second level invokes deeper contemplation that can affect attitudes and behaviors for a time. Finally, the third level might delve deeper still, engaging cognitive processes through which individuals interpret information and give rise to stable attitudes, beliefs, and behaviors. Indeed, meaningful and emotional experiences form strong memories instantaneously and are much less vulnerable to decay or retrieval failures (Kalat, 2004, p. 394).

Balance and Bias in the Media

If relevance and uncertainty are high, people are more likely to seek information from unbiased, credible sources like the news media (McCombs & Stroud, 2014). If in the interest of balance, a media outlet gives equal coverage to evidence-based sources and extremist groups, this could result in a disproportionate amount of coverage of erroneous ideas (Larson et al., 2011). Given that news media confer legitimacy to subjects (Iyengar

& Kinder, 2010; Kennamer, 1994), the media may have inadvertently traded accuracy to achieve the façade of balance (Clarke, 2008). Perhaps the outlier views might reduce uncertainty (i.e., this is how you avoid autism) and influence the attitudes people adopt. Indeed, there is a significant divide between scientists' and the public's attitudes on several science-centered issues (Pew Research Center, 2015). A poll released by the Pew Research Center in January 2015 demonstrates that the public beliefs about health topics are considerably different that scientists' opinions (see Figure 2). Not surprisingly, Gauchat (2012) found a general trend toward the politicization of science.

Figure 2

Opinion Differences Between Public and Scientists

Biomedical Sciences	**U.S. Adults**	**AAAS Scientists**	**Percentage Gap**
Safe to eat genetically modified foods	37%	88%	51 points
Favor use of animals in research	47%	89%	42 points
Safe to eat foods grown with pesticides	28%	68%	40 points
Humans have evolved over time	65 %	98%	33 points
Childhood vaccines such as MMR should be required	68%	86%	18 points

Survey of U.S. adults and scientists belonging to the American Association for the Advance of Science (AAAS)

Other media agenda-setters

Although traditional agenda-setting research focuses on mainstream media, its concepts and effects can be carried over into multiple platforms. Traditional newspapers and television programming to a lesser extent (Atwater, Fico, & Pizante, 1987; Golan, 2006; Miller, Andsager, & Riechert, 1998; Roberts, Wanta, & Dzwo, 2002) still predominately convey the media's transfer of salience. However, daytime talk shows have demonstrated significant agenda-setting effects (Huge, Hardy, Glynn, Reineke, &

Shanahan, 2007). While shows like Oprah, Saturday Night Live, Ellen, and many others are not considered sources for news, they still regularly cover many of the salient issues in the news (Huge et al., 2007). Anecdotal and emotional stories relayed by famous or relatable sources may add to the cumulative influence of the news media (Cialdini, 2001).

While later emerging technologies (like Social Media) may have influenced the perpetuation of the anti-vaccination agenda, it is unlikely the initial transfer of salience originated for early adopters of this attitude. However, these social groups may be helping to perpetuate and grow the influence because the internet was not as widely used or populated in the mid-1990s. Guided by the latest NFO construct conceived by Camaj (2012), it is possible that these issues remain highly relevant, but have low uncertainty for groups who have already decided that vaccines are harmful-therefore they will only seek information that confirms this existing bias. Thus, the cycle of influence continues.

Making Sense of the Noise

Miller et al. (1998) argue that public relations professionals can shape news coverage in preliminary political races, which can influence behavior. Hindman (2012) posits that the media coverage of contentious topics can transmit social identification cues that can override knowledge and prompt confirmation bias of previously held beliefs. At the same time, science literacy and numeracy are declining in the United States (Kahan et al., 2012), which may affect how journalists cover science and health topics. In general, low health literacy limits the skills necessary to understand healthcare decisions (Schillinger et al., 2002), but people choosing not to vaccinate do not fit this category. In the past decade, the media have reported several thousands of stories on the

safety of vaccinations, and when taken together, one would be challenged to find cohesion among the competing narratives (Clarke, 2008; McKeever, 2013). One potential explanation of the Pew Research Center's poll results might be attributed to people accessing health advice from assorted online sources (Baker et al., 2003; Bhandari, Shi, & Jung, 2014; Bratucu et al., 2014; Larson et al., 2011). The vast amounts of pseudo-scientific health information available on the internet and the stories told on the evening news may be a driving force in the science / public divide.

Were Vaccination Proponents… eh, Framed?

Media Frames and Vaccines

Framing sensational headlines are one such tactic to rise above the noise. Framing can include the selection, emphasis, or omission of the features of a story, and can do so to promote interpretive evaluations or recommendations (Entman, 1993, 2007). Indeed, subtle distortions in news headlines can bias readers toward a particular interpretation (Ecker et al., 2014). Even if a story is balanced, thoughtful, and devoid of editorial interpretation, depending on the need for orientation or route of message processing (central vs. peripheral), the headline could negate it all. The consensus among communication researchers is that embellished headlines do more harm than good when any amount of uncertainty about public health is involved (Chatterjee, 2014; Holton et al., 2012; White, 2012; Young et al., 2013).

Matthes (2006) suggests that engaging in information seeking behaviors is innately human; as such, a tremendous number of factors drive the direction and degree of the behavior. Pseudo-scientific claims appear to be scientific, but do not adhere to the

scientific method and cannot be reliably tested. However, the assertions may seem legitimate and seem plausible. Likewise, captivating narratives that resonate with people may provide compelling arguments that are persuasive and mitigate uncertainty. The need for orientation explains why some people are more susceptible to agenda-setting effects than others. As mentioned before, the media are particularly influential when relevance and uncertainty are high (Camaj, 2012; McCombs & Stroud, 2014; Weaver, 1977). Again the Camaj (2012) topology provides a reasonable explanation for why a person with NFO characterized by high relevance and low uncertainty (i.e., one believes that vaccines cause injury) may look for sources that confirm extant opinions (McCombs, 2014, p. 87; McCombs & Stroud, 2014).

The Realities of Contemporary Media

The creation of innumerable platforms and stories are not only available to the public but to journalists and editors as well. Clayman and Reisner (1998) found that news selection is usually a social and collaborative process that is influenced by institutional and cultural environments, rather than traditional news values. Quick, short and simple seems to be the style du jour (Neveu, 2014). It is possible that the pressure to produce has contributed to the observation of Secko, Amend, and Friday (2013) that science journalists rely heavily on biased press releases as sources when reporting complex topics. Likewise, health communications containing high levels of complexity are often bereft of third party expert opinions (Chatterjee, 2014). The frightening implication from the present literature suggests a trend in science, medical, and health communication that is waxing simple over accurate and is vulnerable to bias either through framing or

insufficient independent verification of the facts. Many traditional print stories are immediately available online and solicit commentary from the public. Not only are the stories easily shared and discussed on social media, but the commentary is fair game also. It might quickly transform a story after being passed through multiple filters—not unlike the game telephone where the resulting message bears almost no resemblance to the original.

From Conjecture to Conviction

At some point, the media messaging shifted to become increasingly inclusive of fringe opinions and anecdotal evidence touting certainty that vaccines were related to autism (Clarke, 2008; Holton et al., 2012). Early vaccination attitudes may have formed partly due to the media's portrayal of autism as a frightening epidemic in which pressure groups linked vaccinations to autism. For many people who were first learning of autism, a lack of first-hand experience with the disorder may have intensified the fear of giving birth to a child who might eventually develop autism. Remember that if an issue is unobtrusive, meaning that people lack personal experience from which they can derive their own estimation of threat posed by a health topic, it may intensify the media effects (Lasorsa & Wanta, 1990). In addition, when relevance and uncertainty about a topic are both high, people are more inclined to seek out more information, possibly to reduce uncertainty, and are thus more influenced by the media's agenda (McCombs & Shaw, 1993). When relevance and uncertainty are undergirded by fear, the resultant anxiety may intensify the need to reduce uncertainty and possibly supplant the need for accuracy. Media presentations often juxtaposed evidence that no link existed between autism and

vaccines with anecdotal, compelling personal stories that suggested that there was a link (Clarke, 2008). Therefore, the media may have inadvertently elevated the credibility of fringe groups. Thus, people might have evaluated merits of anecdotal accounts as an equivalent alternative to the scientific evidence. Meanwhile, celebrities also made highly emotional appeals in a variety of media outlets, which can be persuasive (Cialdini, 2001; Myers & Evans, 2002, pp. 250-251). Also notable, attempts to negate anti-vaccination claims are tenuous (Betsch & Sachse, 2013), and such negation messages may inadvertently reinforce the unintended message, simply by invoking the anti-vaccination frame in a story.

No Good Deed Goes Unpunished

General public distrust in vaccines may have been boosted by the CDCs decision to remove thimerosal, the Wakefield study, pressure groups and more recently social networking with like-minded people (Larson et al., 2011). Researchers continue to find no link between autism and vaccines, but a significant minority of people remain unconvinced (Jain et al., 2015; Lieu et al., 2015). As Leon Festinger observed, "A man with conviction is a hard man to change…" (Festinger, Riecken, & Schachter, 1956). It seems that simply reporting facts is ineffective and potentially causing more polarization (Betsch & Sachse, 2013). Perhaps a better approach will require a holistic communication campaign involving well-designed public service announcements, news media, medical practitioners, and policy makers. California policymakers responded to its measles outbreaks by changing vaccination policy, which compels all school-aged children to receive vaccination regardless of parental choice or religion.

Moving target

The tone of the media in response to key revelations over time is also of interest. It is possible that news stories about autism prominently featured fear or themes emphasizing elements of the conjured controversy. Possibly shifts away from previous tones were subtle and continued to reinforce the original message. Those behind the movement against vaccinations have cited numerous rationales for anti-vaccination behaviors (Clarke, 2008). However, it is remarkable that when given the same risk/benefit information that top experts use to justify wide-scale vaccination, non-vaccinators become more polarized, and further convinced of their decision (Meszaros et al., 1996). It appears that the axiom 'Negating the frame evokes the frame,' holds up.

Over the years, the reasons to refuse vaccinations have shifted from fear of side effects to fear of specific vaccines, to fear of vaccine preservatives to the fear of the expanded vaccination schedule (Plotkin et al., 2009). Once fear gains a stronghold, it is exceedingly difficult to reverse. While the scientific messaging has remained consistent, it is possible that each new reason to fear harm from vaccines becomes a newsworthy event-prompting additional coverage.

Something has influenced public opinion and subsequent vaccination behaviors over the past generation. It is plausible that media priming, framing, and presentation of compelling arguments may have originated this behavior. If the tone of message frames shifted because of critical moments over the last several years, it is possible that those reports simply reinforced harmful vaccination claims, or undermined positive assertions. This may provide tantalizing evidence of agenda-setting effects accumulating over time

and transforming from transient attitudes to staunch beliefs. Do generation-long agenda-setting effects create third level agenda-setting—an intractable network of objects and attributes forever linked in the minds of the audience?

Chapter Three

The Neuroscience of Fear: Effecting Enduring Changes

The observation that it is difficult "to unscare people," may be remarkably relevant to how agenda-setting effects may influence and cement enduring attitudes toward vaccinations. A compelling argument can exert robust second level effects without message redundancy—it may just take one (McCombs, 2014). Indeed, if media messages linked vaccinations to autism and/or other injuries, it could have evoked fear among many parents, particularly when autism incidence was perceived as an epidemic on the rise. Fearful messages (conceived as a negative emotion) are highly persuasive (Coleman & Wu, 2010), particularly in health campaigns (Witte & Allen, 2000). Additionally, cognitive neuroscience provides further evidence and a biological framework to support the lasting effects of fearful learning (LeDoux, 2003).

Arousal hormones are released during or shortly after a stressful event, and these strengthen the formation of associative fear memory traces (Soeter & Kindt, 2011). If vaccines evoke a fear of injury to one's child, tapping into instincts to protect one's young, the resultant attitudes may be especially tenacious and difficult to reverse. Given that medical reporting is prominently framed to emphasize the individual's ability to influence the problem; people will most likely conceive health issues as a matter of individual choice rather than the concern of the larger society (Coleman, Thorson, & Wilkins, 2011). Lakoff (2004) argues that long-term concepts are etched deep within the very structure of the brain, and help organize thought. He says, "Concepts are not things that can be changed just by someone telling us a fact," (Lakoff, 2004, p. 17). Indeed,

neuroscientists have known for quite some time that the weight of evidence demonstrates that emotions are critical for decision-making (Damasio, 1994; LeDoux, 2003, 2012). This is consistent with Wu and Coleman (2009) findings, which posit that highly contemplated decisions, can arise from the arousal that results from negative emotions. One possible explanation is that fear may prompt more central processing of information, yet may not make the decision a rational one. Coleman et al. (2011) adroitly discuss the curious case of smoking persistence despite decades of enormous efforts to stop smoking behaviors through public health campaigns and policy changes. Perhaps antivaccination behaviors parallel this paradoxical pattern, in that a few negation messages bubbling to the top of all the noise may not be sufficient to change behavior.

Small effects and have big consequences

Behaviors or attitudes that are very close to some tipping point or threshold can exert extreme consequences with just a slight movement to one or the other side of a line. Just as a single vote can decide an election, it is also possible that losing a small percentage of vaccination uptake can increase a community's vulnerability to disease by dropping below the critical level of herd immunity that is protective of unvaccinated individuals (Fefferman & Naumova, 2015). Additionally, while traditionally large agenda-setting effects tend to decay rapidly (McCombs, 2014), the persistence of vaccination refusals and delays in the face of overwhelming substantiation of their safety may indicate an extremely long lasting effect. It is known that the strength of opinions can affect attitudes and even change behavior. Also, there are many variables that can moderate agenda-setting effects; social, psychological, cultural, obtrusiveness, and

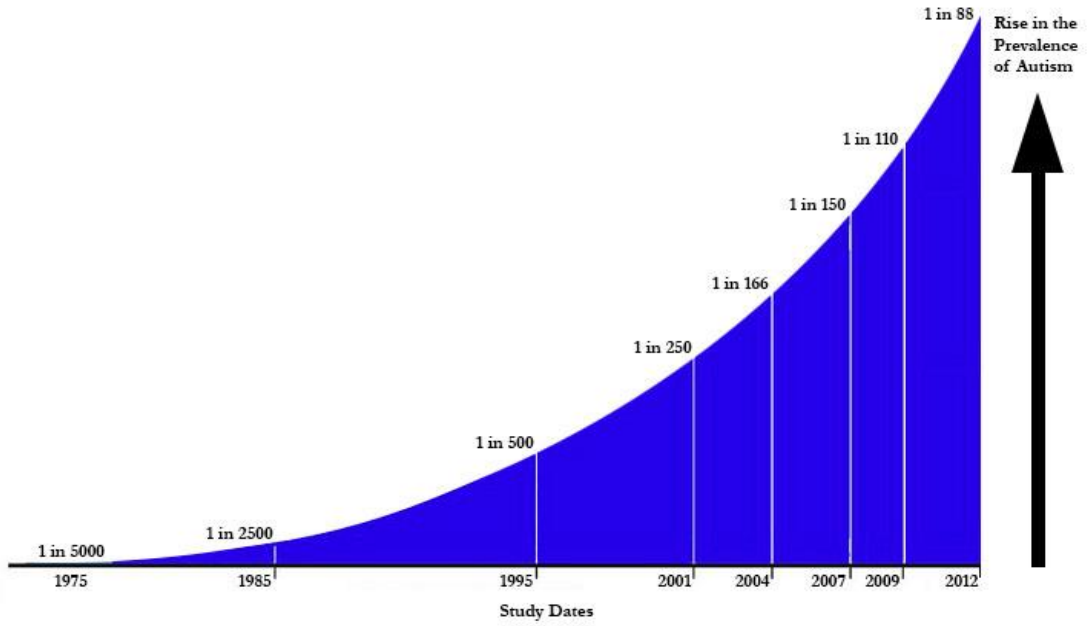
proximity. All these characteristics play a role in one's perceived relevance to an issue. Although none of the peer-reviewed medical research suggests that vaccinations are unsafe, there has still been a significant decline in vaccination rates within certain communities and geographic areas over the last 10-15 years (Lieu et al., 2015).

The Two Faces of Autism: Scary Disorder vs. Normal Variant

The reported growth in autism prevalence became a stalwart of news cycles in the 1990s-2000s. The news reported extensive increases in autism prevalence (see Figure 3). Prevalence rose from 1 in 5000 births in 1975 to 1 in 500 births in 1995 ("Autism Spectrum Disorders: Data and Statistics," 2015) to 1 in 68 births in 2015 ("Autism Spectrum Disorders: Data and Statistics," 2015). Simultaneously, empirical studies offered no clearly delineated pathological cause for autism nor an unequivocal account for the increase in prevalence (Jain et al., 2015). Many experts attributed the increased prevalence to the expansion of diagnostic criteria in the Diagnostic and Statistical Manuel (DSM), increased awareness of the disorder (e.g., the Academy Award winning 1988 movie, Rain Man featured a main character with autism), and expansions of the concept (Wing & Potter, 2002). More recent studies continue to find support for this explanation (Fombonne, 2009; Lundström et al., 2015). Children exhibit symptoms for autism Spectrum Disorders around the same time that the MMR vaccine is given (Jain et al., 2015), and many parents (frightened of harming their children) interpreted the temporal relationship also to be causal (e.g., my child received the vaccine, and then started showing symptoms).

Figure 3:

Prevalence reported by the Centers for Disease Control



Interestingly, beginning in the 1990s, a growing number of people began converging around the perspective that autism was a unique cognitive trait, rather than a disorder. A movement dubbed 'neurodiversity' rejects the notion that autism is a disorder and argues that it results from natural human variation (Owren, Thomas, & Trude, 2013). Many credit the origins of this movement to a presentation given by Jim Sinclair at the International Conference on autism in Toronto (Owren et al., 2013). Sinclair says, "autism is a way of being. It is not possible to separate the person from autism." Essentially, he argues that a person with autism is a uniquely valuable person, albeit not the person that parents expected (Sinclair, 1993, para.6). Robinson (2013) maintains that

autism (and other 'disorders' such as ADHD) not be diseases to be cured. From this perspective, autism is not nearly as foreboding. It is ironic that in trying to prevent autism by refusing vaccination, some parents exponentially increased their child(ren)'s chances of contracting a potentially devastating disease, including Rubella, which *can cause non-congenital autism* (Office of Technology Assessment, 1980). It is possible that over time, framing autism as a neurological difference rather than disorder decreased the associated fear and uncertainty. In addition, the framing of news that reported increased autism prevalence might have changed over time as it became more evident that the increase in autism incidence was an artifact due to increased awareness and diagnoses. A disorder of the brain sounds scarier than a normal variant in human development. This changing perspective may have applied pressure to reduce fear-laden descriptions about autism in the media.

When fear really is the only thing to fear

Svendsen (2008) proposes that fear prompts people to act irrationally to minimize risk. Rationality aside, emotions are inseparable from normal human cognition and integral in healthy decision-making (Damasio, 1994), It stands to reason that logical appeals about the safety of vaccines are inadequate because emotion trumps pure reason (Coleman & Wu, 2010). LeDoux (2012) postulates that the survival functions innate to the human brain integrate arousal, emotion, motivation and reinforcement that when faced with a challenge; those components act as a unified process. Lakoff (2004) argues that long-term concepts deep within the brain's structure help organize thought. He says, "Concepts are not things that can be changed just by someone telling us a fact," (Lakoff,

2004, p. 17). Perhaps the Wakefield study ripened the early suspicions of some parents into enduring concepts, sustained by fear and the innate desire to protect one's child. Unfortunately, the resurgence of these diseases is affecting communities as a whole. People with cancer, those on immunosuppressive therapies, individuals with egg allergies and newborn infants with no choice in the matter bear a high risk of infection when herd immunity is low. Beyond that, even those who are vaccinated are also at increased risk as well. The choices of a seemingly small group of people are exerting incredibly deleterious consequences for entire communities.

The Burden of Truth

An important question that communication scholars and professionals must address is if there is an ethical obligation to learn from and take preventative measures to avoid similar phenomena in the future. Kennamer (1994) asserts that agenda-setting arises from gatekeeping (p.8) and that the news media confer legitimacy on issues (p.9). This notion places a heavy burden on the news media to ensure that the public is given the relevant information to make wise health decisions that have the potential to reverberate throughout the community, or the United States, and through time for that matter. The sensational stories may sell, but the accurate ones can make the difference between life and death.

When taken together, the craft and ethical challenges of science and medical journalism are increasingly important and may require a more conscientious and meticulous approach. This is a tall order given the present communication climate. Lead times are shorter, staffs are smaller, and the general format of most news platforms do not

lend themselves to long, complex narratives (Neveu, 2014). Millions of unique voices flood multiple channels with astonishing speed, yet despite the explosion of communication conduits, Groshek and Groshek (2013) have noted a trend toward hominization rather than diversity of information.

The Tip of the Iceberg

One thesis will not reveal all of the vital lessons surrounding this intricate topic; indeed, it will barely scratch the surface. It will likely take a career and many collaborators to investigate all of the essential questions intrinsic to this phenomenon fully. This primary investigation should uncover some valuable insights to lay a fruitful foundation on which to build further investigations. This case requires multiple theoretical perspectives from mass media, health communication, cognitive psychology, and neurophysiology. Agenda-setting, framing, and the need for orientation intersect with health communication theories such as Uncertainty Management Theory management and the extended parallel processing model. Cognitive psychology and neurophysiology also bring to bear important elements that might explain how people may have responded to mass media coverage of autism as well as vaccines. Other relevant factors include educational attainment, science literacy, and numeracy, and socio-cultural dynamics, medicine, science journalism, the rise of the information age, and the increase of autism prevalence. All sorts of factors converged that proliferated and sustained the erroneous belief in a fallacious link between autism and vaccinations. This study hopes to begin unraveling the origin of this phenomenon through a systematic analysis of the media messages through which many people first learned of autism, its increasing prevalence,

and its mysterious etiology. With the benefit of hindsight, health communication, and mass media theory provide some predictions about the nature of media messages that might have influenced people into believing a link exists, and explain how the nature of that initial influence might explain why the false belief endures despite overwhelming evidence to the contrary.

What Now?

While traditional newspapers still tend to have a heavy hand in shaping the media and public agendas (Atwater et al., 1987; Golan, 2006; Miller et al., 1998; Roberts et al., 2002; Walgrave & Vliegenthart, 2008). The process of evaluating, validating, and transforming esoteric science content into lay-friendly pieces that are engaging, entertaining and educational does not lend itself to producing quick copy. However, Ellman and Germano (2009) demonstrate that increased accuracy in reporting may be financially beneficial to newspapers in a heavily competitive market. Likewise, Frewer (2004) asserts that people want well-defined messages and want to know what information is disputed between the ranges of experts concerning risks to human. Nevertheless, when a subject is perceived as controversial, pre-existing biases from the public may play a role in how messages are interpreted (Kahan et al., 2012). Indeed, McCombs and Stroud (2014) delineate robust predictions about how individuals' need for orientation along with motivated reasoning may also come to bear on the attitudes of people after exposure to media messages. What role (if any) can the media take in reversing the damage?

Chapter Four

Theoretical Underpinnings and Summary

Despite the evolving media landscape and opportunity for the individual to employ selective attention to suit their own interests, agenda-setting concepts may prove quite useful to discover the source of influence over individuals choosing not to vaccinate their children. While oft used to describe the media and public's convergence around a political agenda, it is a useful theoretical perspective in the public health domain (McKeever, 2013). The agenda-setting framework explains how the boundaries of mass media connect to the public agenda (McCombs & Shaw, 1993). Over the years, multiple experimental studies have provided supplemental support for agenda-setting and demonstrated a causal relationship between the mass media's agenda and the public's opinion (McCombs & Stroud, 2014).

Agenda-setting appears to be less influential in reporting on obtrusive public health events (Rim, Hong Ha, & Kiousis, 2014). However, scholars across the disciplines have employed and extended agenda-setting with concepts in a diversity of fields such as psychology, sociology, and interpersonal communication fields (McCombs & Stroud, 2014). Agenda-setting has demonstrated profound effects in public health matters viewed as crises, and may subsequently influence how the public will behave as a result (Lasorsa & Wanta, 1990; Lowrey, 2006). Especially when threat perception is shrouded with uncertainty, and the subject is unobtrusive (people do not have direct experience with the subject), media effects can be even more pronounced (Lasorsa & Wanta, 1990).

The need for orientation (Weaver, 1977) uncovered cognitive factors that predicted an individual's susceptibility to agenda-setting effects. Camaj (2012) offered predictions about the types of information sought based on her topology of NFO. However, the present phenomenon appears to be something different—something more than agenda-setting effects as presently understood). There appears to be more enduring influences on a significant minority of people than typically observed around political campaigns or public health crises. This effect seems more durable, perhaps permanent.

Certainly, an inexplicable rise in a neurodevelopmental disorder (e.g., autism) would be relevant to a significant number of the population. They novelty of the disorder(s)' presentation and the mysterious etiology certainly fueled uncertainty in the collective public's mind. As people were more inclined to seek out information, a vastly growing and changing landscape was emerging that enabled non-journalists significant channels to provide information. As such, the media stories that featured enthralling narratives of anecdotal experience likely resonated with many people and provided compelling arguments that could be persuasive.

A compelling argument may resonate with a person on an emotional level that could then steer the direction of cognitive processing of messages. Many people offered personal testimonies proclaiming that vaccines caused autism, thus removing elements of uncertainty, ambiguity, and doubt that characterized most evidence-based reports. In short, people are more persuasive than statistics. The environment and the attributes were teaming with just about every known factor that can enhance agenda-setting effects on all three levels. This investigation seeks to uncover one aspect during the decade of the

1990s and explore how the explosion of autism stories were characterized in terms of fear, uncertainty, risk/threat perception, and efficacy. Efficacy in this context borrows from Goodall and Reed's (2013) definition primarily related to the "perception and feasibility" of a given solution and the accessibility of the remedy. Because this analysis looks only at the sender, response and self-efficacy (which can be mitigated by messages) are collapsed into one main idea or category.

One way to evaluate the media's role in setting the agenda and possibly influencing people's vaccination decisions is to analyze the content directly that the media presented. Little is known about fear attributes in media coverage that was about autism. Likewise, if fear was a salient attribute transferred by the media to the public regarding autism, it is not known if that may prompt long-term agenda-setting effects. While this study will investigate the former, the latter proposition (it would seem) would be dependent on the findings of this study.

Given the prevalence of autism stories that mentioned a link with autism between the years of 1995-2015 (nearly 12,000[1]), a large sample of stories should be easily accessible. Given the argument by (Kennamer, 1994, p. 9) that the media serve to confer legitimacy and perhaps credibility to its subjects, it is plausible that in an attempt to balance stories, journalists were inadvertently validating anecdotal and pseudo-science as appropriate foundations from which to make crucial health decisions.

[1] A LexisNexis® Academic Search utilizing the keywords, 'autism' and 'vaccine' occurring within 5 words of the other yielded 11,995 stories between the years 1995-2005.

Fear of a health threat, combined with perceived risk were likely included in stories about autism and perceived as highly relevant to people embarking on parenthood. These stories appeared quite often over a long period, so this investigation will examine stories beginning when the media cued audiences to the topic. The Wakefield article was published in 1998, prompting news organizations to cover the topics of vaccines and autism jointly. More feature stories were produced that focused on individuals, portraying the family hardship and troubling symptoms and consequences of autism, framing it as something one might want to avoid—or scary. Because the Wakefield finding was controversial, and swiftly debunked, news stories may have emphasized the mysterious cause(s) of autism. Over the years, multiple theories regarding the etiology of autism have been proposed. As time went on, stories would also feature CDC reports of rising prevalence of autism. Every year the prevalence went up; with the latest estimate that 1 in 68 children have or will develop autism. The investigation will utilize stories about autism beginning in 1999 so that a full year of stories can be included in the earliest portion of the sample after the Wakefield finding.

In summary, fear learning can occur very quickly, and have profound effects on subsequent behavior. Fear learning has largely proven to be intractable, as it changes the physical structure of the brain making it difficult to extinguish; it truly is 'hard to unscare people.' Vaccination attitudes of a significant minority of individuals may be putting a substantially higher number of people at risk. A dearth of research exists that empirically evaluates how fear references about autism in the mass media may have contributed to the origin of the vaccine/autism myth. Additionally, there are gaps in the literature that

explain why the vaccine/autism myth has endured in the face of a mountain of contrary evidence. Eventually, if scholars can understand the mechanisms through which these attitudes originated, and the reasons that they persist, perhaps that can inform how to mount a more successful pro-vaccination campaign, and potentially disrupt the resurgence of devastating vaccine-preventable diseases. One goal of this study is to shed new light on news stories about autism. If they contained elements of fear, uncertainty, and high perceived risk, it is possible that people could have responded in a maladaptive fashion. It is also possible that the messages scared parents (or those considering becoming parents). If fear learning occurred around the topic of autism, whatever attitudes, and beliefs formed at the time would likely be persistent and remain resistant to change.

A content analysis is an effective tool to examine how messages change over time. In this case, fear, uncertainty, perceived risk, efficacy, and explicit language linking vaccines and autism were analyzed. Because this is a relatively unexplored construct, methods to investigate were derived from Uncertainty Management Theory and interpreted using guidance from both agenda-setting and the extended parallel processing model. If fear was strongly associated with autism early on, that might explain why some people have doggedly held on to the myth that vaccines are related to autism.

One way to determine if the conditions were right would be to characterize the relative 'fearful' nature of the earlier autism messages, and explore if they changed significantly over time. It would also be interesting to examine if the media's overall mention of a vaccine/autism link has diminished over time. If this is the case, traditional

agenda-setting would predict that fewer people should have that belief—unless the emotion of fear can shift the agenda-setting influence from a transient one to a long-lasting version, that becomes impervious to subsequent influence. Given that negative messages about vaccines can lower vaccination uptake, it is logical to predict that vaccinate rates should decrease with fewer mentions of a vaccine/autism link—a negative message about vaccines. To answer these questions and test the theoretical predictions, the following questions and hypotheses were posed.

Research Questions and Hypotheses

R1a: Were fear references present in the traditional media messages that were about autism?

R1b: How did those messages with fear references change over time?

H1: Fewer fear references were present in autism messaging in the second eight years (defined as 2007-2014) compared to the first eight years (defined as 1999-2006).

H2: Fewer stories in traditional media featured the vaccine/autism link in the second eight years than in the first eight years.

R2: Did U.S. vaccination rates change as a function of the media fear references, if so, how?

H3: Vaccination rates will be negatively correlated with stories about autism containing vaccine references.

Chapter Five

Method

This investigation conducted a content analysis exploring major U.S. print media coverage about autism and the counterfeit vaccination/autism link. The first story that covered the Wakefield claim of an autism/vaccine link appeared in 1998, but parents had suspected a link before that time. People had filed claims with the Vaccine Injury Compensation Program blaming autistic behaviors on adverse reactions to vaccines (Holland, Conte, Krakow, & Colin, 2011). In the United Kingdom, attorneys who represented children in Wakefield's study hired him to find evidence to support their claims that vaccines caused their clients to develop autism (Holton et al., 2012). Enough parents had to have taken notice of an apparent temporal relationship between receipt of vaccinations and onset of autism symptoms before 1998 to pursue compensation. Autism symptoms typically appear around the same time as routine vaccinations ~ 18 months – 36 months (Clarke, 2008), so some people believed the relationship to be a causal one. Therefore, this study began by examining stories about autism beginning in 1995 through the end of 2014 to determine if any significant changes occurred in the reporting themes after the Wakefield article (as queried in R1b). Those results revealed that the most appropriate timeframe for this investigation begins in 1999 (the year after the Wakefield article) thru the end of 2014. This 16-year time span yielded an ample sample, revealing substantive changes in autism stories over time. To conduct the majority of the analyses, the investigator coded words that are associated with the following terms: fear,

uncertainty, prevalence (meaning the probability of being affected), efficacy (an effective *and* accessible solution), and mentions of autism/vaccine link.

The LexisNexis® Academic database was utilized to obtain newspaper articles covering stories about autism from 1995 - 2014. This date range was first considered because it covered a 20-year span, but very few relevant stories were available in the first four years, so it was decided to utilize data *after* the Wakefield article. The first query in LexisNexis® limited the search to newspapers only, and then further limited the search to *The New York Times, The Washington Post*, and *USA Today*. These newspapers have a wide circulation and long history of being considered traditional agenda setters, and intermedia agenda setters (Atwater, Fico, & Pizante, 1987; Golan, 2006; Walgrave & Vliegenthart, 2008). Indeed, public and intermedia agenda-setting has remained a relatively stable trait among these top newspapers; therefore, the analyses will examine only newspapers. Furthermore, articles from these sources would be widely regarded as a legitimate source of information. The search will contain the variants of the word **autism** utilizing the wildcard feature (e.g., autis!). Only news stories with variants of autism in both the headline and lead of articles that were over 150 words were included in the sample. This search yielded **647** total articles.

The investigator then read each of the stories and removed editorials, opinion pieces, and stories that mention autism but were not about autism. Any duplicate or brief articles (less than 150 words) that were not filtered automatically from LexisNexis were also removed from the sample manually. This process yielded **473** articles that were included in the analysis. Afterward, the investigator removed all of the extraneous

information generated by LexisNexis from each story, so that only the headline, lead, and story (with an identifier) remained. Then the stories were separated into individual documents since the unit of analysis is the news article. Next, the maximum number of stories were loaded into WordStat for analysis (it will allow 20 cases at a time). WordStat is a content analysis and text-mining tool that enables extraction of themes and trends. Twenty-four (24) runs were required to include the entire sample of articles. Each WordStat analysis (run) measured 20 articles from the sample for the words that occurred most frequently. Each output file was converted into an SPSS file, and then merged into one SPSS file containing **473** articles (cases) and **1,892** high-frequency words. The high number of words resulted in (several cases) variants of the same word to be recorded as multiple words. Nevertheless, each word was evaluated individually.

Each word was coded into one of five categories based on the frequency of co-occurrence and statistically significant co-occurrence (Jaccard coefficient) with other words that together fit into one of the 5 categories. The possible codes available for each word were: 1=fear, 2=uncertainty, 3=prevalence (like threat or perceived risk), 4=efficacy (combing response efficacy and self-efficacy), and 5=exclude. Words that did not have a coherent theme, common words used to describe neutral themes, or words that had such a low overall frequency that the impact would be negligible were all excluded. See Table 1 for complete definitions, and examples for each category. The definitions for each category were based on the review of relevant literature about EPPM and Uncertainty Management Theory, and the nature of the present inquiry. Stories about autism in this large sample revealed that fear words were associated with a threat to

health, safety, and quality of life. Uncertainty words were primarily concerned the mysterious etiology of autism. Perceived risk was commonly expressed in rising **prevalence** of the disorder (1 in 250, 1 in 88, 1 in 66, etc.), intimating a risk for a child developing autism. Efficacy was associated with therapies, which claimed effectiveness, accessibility, and educational programs that reduce or eliminate troubling deficits or symptoms. After coding, the author recruited a second coder (non-expert) who double coded **13%** of the words (**245**). The recorded and provided the rationale for each code to provide the second coder with the same context. The second coder indicated agreement or disagreement with each of the codes. After a discussion of the divergent codes, the two coders came to accord on each one, and thus achieved 100% agreement. The final coding resulted in the inclusion of **595** words, and exclusion of **1,297** words. There were **352** coded as 'fear', **118** words coded as 'uncertainty', **64** words coded as 'prevalence,' and **61** words coded as efficacy. All of the data were collapsed and labeled into the above categories in SPSS. See Table 2 for a top ten list of words in each category.

Table 1

Definitions and examples for each category:

Fear: Words associated with negative symptoms of autism, poor outcomes, poor prognosis, or a threat to physical or mental health, and impeded quality of life, high expenses, treatment inaccessible.

Arrested: associated with poor outcomes, impeded quality of life

Engage: associated with negative symptoms of autism (flapping, repetitive actions, socially withdrawn, difficult interaction, abnormal conversation, abnormal affection) as well as a threat to health (bullying), and poor outcomes and impeded quality of life (sentence, violent, and victims)

Uncertainty: Words associated with the unclear etiology, course, outcome and 'cure' for autism

Toxins: Associated with possible causes, environmental cause, infections during pregnancy, exposure, central nervous system, gastrointestinal, inflammation, exposed, diet, harmful, trigger, suspected, driving

Prevalence: Words associated with the prevalence or increased incidence of autism

Reported: Associated with study, report released, researchers, cases, increase, incidence, percent, rise

Efficacy: Words associated with positive messages about successful treatments and symptom reduction or reversal. Treatment is accessible, if expensive (insurance or another player available). Mainstreaming (indicates student can be successful in a regular classroom).

Intervention: Associated with early treatment (better outcomes), free, effective, safe, rigorous, reach, critical, also mentions gluten, diagnosis and investigating

Exclude: Common words and/or words not associated with a clear theme, proper names, may have a low overall frequency (compared to the entire sample), thus negligible impact.

Agreed: Excluded because a common word with no discernable theme.

Broccoli: Excluded because a common word with no discernable theme.

Silverman: Excluded because it is a proper name

Snow: Excluded because of low overall frequency; common word

Table 2

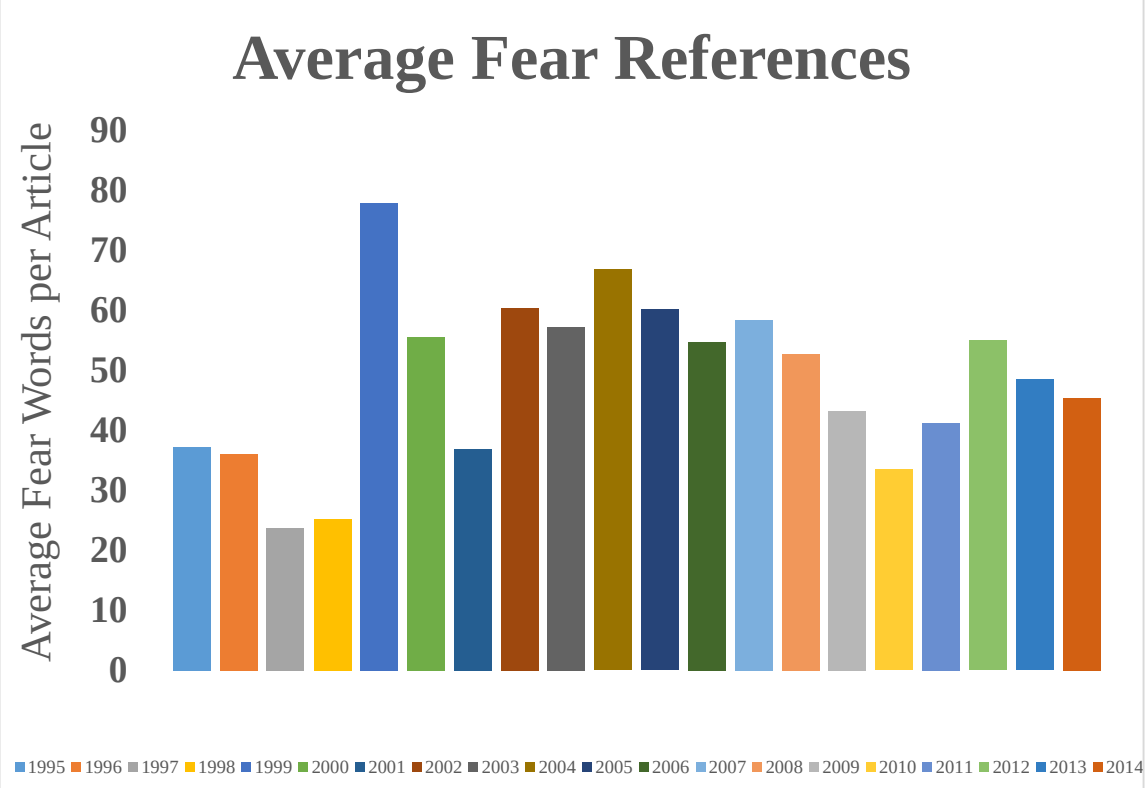
Top ten words by category

Number	Fear	Uncertainty	Prevalence	Efficacy
1	children	study	group	school
2	parents	research	high	services
3	child	vaccines	cases	early
4	disorder	vaccine	risk	program
5	son	researcher	percent	special
6	social	studies	center	education
7	brain	medical	number	make
8	diagnosis	thimerosal	case	therapy
9	age	evidence	national	treatment
10	family	scientist	federal	schools

For R1a: *Were fear references present in the traditional media messages that were about autism?* The investigator calculated the mean number of fear references that occurred in each article, then calculated the average number of fear references per article in each year from 1995-2014. For R1b: *How did those messages with fear references change over time?* The author utilized the averages calculated for R1a, and created a histogram that visualizes how the average number of fear references per article changed over the twenty years of data 1995-2014 (see Figure 4). Additionally, the author noted significant milestones relevant to stories about autism, which are detailed also in Figure 4.

Figure 4:

Yearly Average Fear References per Article



1998: The Lancet article was published purporting a line between the MMR vaccine and autism.

- 1999: Large spike in fear references (average fear references rose from 25 to 78 per story)

2001: The CDC removes thimerosal from childhood vaccines

- 2002: Another spike in average fear references (rose from 37 to 60 per story)

2006: The CDC reports that prevalence rose from 1 in 50 children to 1 in 110 children

- 2007: A modest spike after a downward trend

2010: The CDC reports that autism prevalence has grown to 1 in 68 children

- 2011: Another modest spike after trending downward

For H1: *Fewer fear references (determined by statistical significance) were present in autism messaging in the second eight years (defined as 2007-2014) compared to the first eight years (defined as 1999-2006).* The author utilized SPSS to conduct an independent t-test comparing the average number of fear references used per story in each decade to determine if the second decade featured statistically significantly fewer fear references regarding autism than did the first decade.

For H2: *Fewer stories in traditional media featured the vaccine/autism link in the second eight years than in the first eight years.* The author identified stories within the sample that contained words that are variants of vaccine, immunization, inoculation, shot or jab. A 'link' variable was created to record each article that mentioned the link. Those data were entered as present (1) or absent (0) per story. Over time, it makes sense that less reporting would feature any stories that mentioned the false link between autism and vaccines. While this would superficially appear to contradict traditional agenda-setting influence (given the persistent refusal of vaccines among some people), it may also lend support to the idea that once a fear attitude is formed, it is impervious to messages that contradict those attitudes, which could be evidence of a long-lasting form of agenda-

setting (perhaps the third-level of agenda-setting). Utilizing SPSS, a t-test was performed to compare the two eight year time periods. As time when on, it became increasingly apparent to scientists that autism is a genetic disorder not related to environmental factors.

For R2: *Did U.S. vaccination rates change as a function of the media fear references? If so, how?* The data available to the author were not ideal to explore this question (vaccination rates summed by year, yielding a low number of data points for a correlation). Nonetheless, it was interesting to explore if any detectable relationship existed between these two variables. The vaccination data was obtained from the National Immunization Survey published by the Centers for Disease Control and Prevention providing yearly vaccination rates among infants and young children from 19-35 years of age. The author then summed and averaged all the categories under investigation by year, and conducted a Person's correlation for each category to probe for any relationship.

For H3: *Vaccination rates will be negatively correlated to stories about autism that mention vaccine messages.* The author quantified the absolute number of stories that make any mention (including a negation) of a vaccine link by year. Again, the data are somewhat crude for this query, because of the low number of data points (16 years). Since it has been demonstrated that negative messages about vaccines can reduce vaccination rates in other countries (Larson, 2011), however, it was worthwhile to examine if 'link' messages might be negatively related to vaccination uptake. The author again utilized the national vaccination rates for infants and children between the ages of

19-35 months. Many vaccines require multiple doses to be effective, so the author will assume that children complete uptake of several multi-dose vaccines (including the MMR and vaccines with thimerosal) are more likely to be fully compliant with the recommended vaccination schedule. Therefore, vaccine rates will be defined as the percentage the children who have completed the full series of several vaccines (see Appendix 4 for a complete explanation of vaccines included, and completion rates). The author conducted a Person Correlation tests to examine if the yearly vaccination rates were negatively correlated with the number of autism/vaccine (link) messages in each year. For clarity, the prediction was that as mentions of vaccine within the context of autism grew, so too grew the proportion of individuals choosing not to vaccinate their children.

Finally, the author recruited a colleague familiar with Communication Theory in both Mass Media and Health Communication as a blind coder. After training on the codebook, a random sample of the coded words was drawn equaling 10% of the 1,892-word sample. The blinded coder then evaluated each of the 189 words using the same information available to the author and independently assigned each to a category (fear, uncertainty, prevalence, efficacy, exclude). The coder was blinded to the author's codes, rationale, and any other information that might influence how the subset of data were coded. The blinded coder completed the task during two separate times. The first time she completed 108 codes, and immediately discussed discrepant codes with the author. The second time she completed the remaining 81 codes. These codes were not discussed, only recorded for interrater reliability analysis (IRR). An IRR analysis was performed to

assess the degree of consistent categorical assignment (see Table 3). The results indicated near perfect agreement according to Cohen (1960). A Krippendorff Alpha test was also performed and yielded an identical result. Krippendorff (1980) proposed a statistic that accounts for disagreement between coders as well as the probability for disagreement. The Krippendorf Alpha test is considered by many as the preeminent statistic for measuring interrater reliability because it can account for missing data, can be performed in an assortment of study designs, and yields a more conservative estimate of IRR. Krippendorf's interpretation of good reliability are more stringent than other methods (.67 - .80 for tentative conclusions, and >.80 for definite conclusions. Both the author and rater had 1 of 5 choices for each word that we coded, thus we had 2 coders and 5 categories. The Krippendorff test in SPSS was made possible by a macro written for SPSS by Andrew Hayes (Hayes & Krippendorff, 2007). Our results yielded a high IRR result $\alpha = .828$, 95% CI [.747, .909], $p < .001$.

Table 3.

Coder Crosstabulation Table

	Coder 2					
Coder 1	Fear	Uncertainty	Prevalence	Efficacy	Exclude	Total
Fear	37	0	0	0	1	39
Uncertainty	1	7	7	0	0	8
Prevalence	0	1	1	4	1	12
Efficacy	0	1	1	3	0	4
Exclude	3	0	0	2	119	126
Total	41	9	9	9	121	189

Results

Findings regarding R1a demonstrated that fear references were present in stories about autism, and provided a foundation to justify the predictions and subsequent questions in this study. R2b lent support for the appropriateness of the timeframe examined in the main hypotheses and other study questions (1999-2014). Fear references in news coverage about autism were relatively low until *after* 1998 when the Wakefield study was published. Significant spikes are visualized surrounding four major historical milestones (1998 – false MMR/autism link reported, 2001- thimerosal removed from vaccines, 2006 – autism prevalence up to 1 in 110, 2010 – prevalence up to 1 in 68). The first two milestones link autism etiology to vaccines while the last two were around the time of major CDC announcements of a jump in prevalence. Interestingly, much larger spikes follow the first two milestones than follow the last two milestones (see Figure 4). Additionally, according to uncertainty management theory, negative frames that cast autism, as an increasing danger that had deleterious effects on behavior predicts that some people will see this as a problem needing resolution and engage in uncertainty reduction efforts while others would simply avoid additional troubling confrontations with the topic. This theory agrees with the differential ways in which people responded to the messages, some buckled down to find answers regardless of their validity, and others chose a path to maintain uncertainty.

H1 predicted that more fear references were present in the first decade compared to the second decade. A *t*-test looking at fear references supported this hypothesis $t(438) = 3.35$, $p < .001$. Given that the presence of uncertainty with fear can amplify the

perception of an emerging health concern as dangerous, it seemed logical to collapse those variables and explore if a similar result would be obtained. This also revealed a significant result, $t(438) = 3.55$, $p < .001$. Likewise, when fear, uncertainty and prevalence (perceived threat) were collapsed, it was also significantly higher in the first eight years compared to the second eight years $t(438) = 3.58$, $p < .001$. Interestingly, when examined in isolation, neither uncertainty nor prevalence was significantly different in the two periods examined (see Table 4 for a summary).

Table 4

	Time Period			
	1999-2006	2007-2014	*t*	*df*
Fear	59.06	46.48	3.35*	438
Big Fear (Fear + Uncertainty)	80.98	63.03	3.56***	438
Super Fear (Fear + Uncertainty + Prevalence)	94.83	73.75	3.59***	438
Efficacy	18.19	9.99	4.60***	438

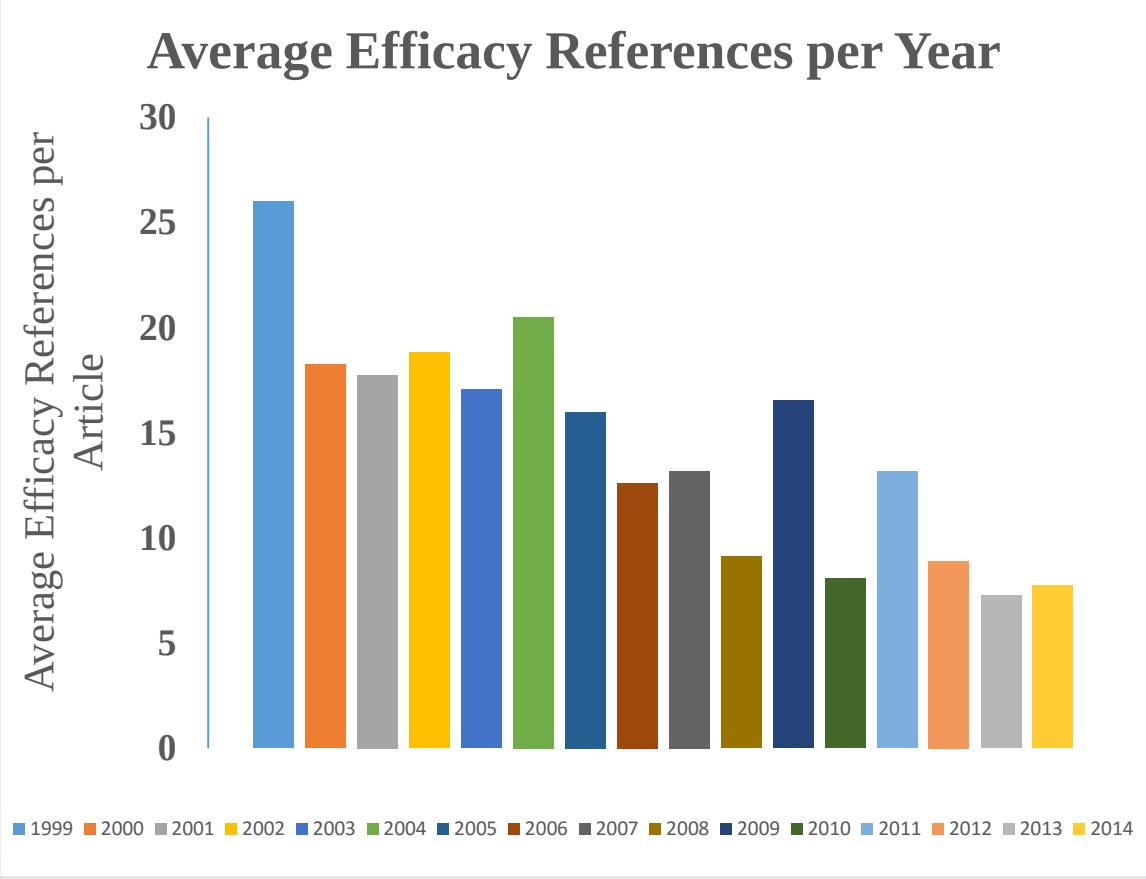
*$p < .05$ **$p < .01$ *** $p < .001$

News reports of the mysterious etiology of autism remained stable over time, as were reports of increasing prevalence, but with less fear in the latter years. Surprisingly, this sample demonstrated ***higher efficacy*** in the first decade compared to the second 4.60, $p < .001$ (See Figure 5). It is important to note that in the case of autism, efficacy words co-occurred with words or phrases that claimed effective treatments and/or

symptom reduction or extinction. These messages were not evaluated for the legitimacy of efficacy claims. In fact, most alternative therapies that had (or still have) anecdotal claims for success, have been found by the subsequent scientific studies to be ineffective or even dangerous in some cases (Levy & Hyman, 2015). Therefore, it is possible that people who responded 'adaptively' by seeking more information could have encountered fringe organizations that purported a vaccine/autism link. If the media were any indication, H2 would support this idea.

Figure 5

Yearly Average Fear References per Article



H2 proposed that more news stories mention vaccine/autism link in the first eight years than in the second. A *t*-test was utilized to compare the average number of link mentions per story between the two time periods and yielded the support for this prediction: $t(438) = 3.20$, $p < .001$.

R2 sought to determine and characterize if/how vaccination rates changed as a function of fear references. Person correlations compared all the permutations of fear messages to vaccination completion rates reported by the CDC. No relationships were detected. However, because efficacy messages were higher in the first decade, the investigator performed a correlation comparing it to vaccination completion rates. Interestingly, it came close to having a significant negative relationship ($r = –.480$, $p < .06$). Given the low number of data points N=16, the finding might have been significant if more data points were available (like looking by month instead of by year). If efficacy messages prompted people to seek more information, this might have also increased their chances of exposure to anti-vaccination groups. While this is consistent with EPPM predictions, perhaps the interpretation of adaptive and maladaptive responses may *depend* on the type of information that is available for a given health concern.

H3 postulated that a negative relation existed between media mentions of a vaccine/autism link and vaccination rate. A Pearson correlation compared the percentage of on-time vaccination completion rates with the yearly number of stories that mention a link. However, the hypothesis not supported. However, the comparison yielded a significant *positive* correlation. Thus, more stories that mentioned links were associated with more vaccinations. $r(14) = .537$, $p < .05$.

Chapter Six

Discussion

Personal interests and psychological components are relevant to the differential agenda-setting effects on people (McCombs & Stroud, 2014). McCombs and Stroud (2014, p. 81) argue that the way agenda-setting is studied should be adapted "to consider niche audiences, as opposed to the general public." This may be particularly true when examining health and medical journalism and its impact on public health. The population of interest in this study could be described as a niche group, in that they do not represent the general population. In fact, the majority of the 'general' population follows vaccination recommendations. However, the people who refuse vaccines or deviate from the recommended inoculation schedule represent a large enough group to hinder the U.S. population from maintaining vaccination uptake at 90% or above. Falling below the threshold for herd immunity puts everyone at increased risks for vaccine-preventable diseases.

How to Frame a Lasting Myth – Not by Negation

Not one credible scientific study has linked autism with vaccines—not one. While parent groups often assert that the government and pharmaceutical companies cannot be trusted, and are responsible for *all* of the studies that refute the claim, this is not true. Many studies are unaffiliated with government and pharmaceutical organizations altogether. Multiple studies are independent, and several are conducted outside of the United States and in areas where vaccination uptake is low. The subject of the linkage of vaccination and autism has been studied exhaustively. Despite this fact, the myth

persists—a scary myth that claims that vaccines will neurologically injure children. Plenty of confirmation from online sources and parenting groups support the myth, but do not offer any credible evidence. What they *do offer*, however, are highly emotional, compelling arguments. Often these stories will resonate with personal experience, and seem plausible. Finally, rich media content, like powerful images are also employed to convince parents of these false claims. Most recently, a film masquerading as a documentary slyly presents a compelling case.

As recent as March 2016 a new film was set to air at the Tribeca Film Festival (for documentaries), which implicates vaccines in the development of autism. The film, "Vaxxed," accuses the Centers for Disease Control (CDC) of falsifying data to 'hide' the link. The film's director, Andrew Wakefield, claims that the film is not an anti-vaccination film, but rather a film about an elaborate fraud and cover-up within the CDC. Ironically, Wakefield's own practice of falsifying data and committing elaborate research fraud are not mentioned in the trailer. What is presented is a very compelling narrative with visuals that equate vaccinations with poison. It contains expert testimony (including that of Wakefield's), lamenting that unsafe vaccinations are victimizing innocent children. It also features parents giving anecdotal accounts of their children regressing after vaccination, and shows profoundly autistic children behaving in unflattering and disturbing ways. Although the film purports to be about the alleged CDC's fraud, one would likely take away that vaccines are poison. The urge to protect one's children is primal and quite vulnerable to emotional or scary stimuli. Vaccination refusals are born

of a desire to protect children. Given the serious allegation waged against the CDC, the author attempted to corroborate the claim with a credible source, but failed to find one.

Digging up the Roots

From a broad perspective, it is important to scrutinize how the media framed autism in news reports over time. To investigate this, theories in health communication help predict differential responses to message types. In addition to agenda-setting, Uncertainty Management Theory and Extended Parallel Processing Model provide predictions, shedding light on which reporting practices might have inadvertently prompted a collection of individuals to fear and refuse vaccinations. The mass media are powerful agenda-setters for the general population at the first and second levels. However, the enduring attitudes of a significant minority of people suggest that some were influenced by a mechanism that produced stable attitudes, immune to logical appeals.

This study is among the first to attempt to understand how this transfer of lasting influence might have *originated* from media messages about autism. Neurobiological studies have demonstrated repeatedly how fear can produce attitudes that are both irrational and persistent. Understanding the roots of this particular phenomenon are important for at least three reasons. One is to inform health campaign professionals with information helpful to promote pro-vaccination attitudes. Second, this study may inform best practices in medical and health journalism—words matter. One must weigh the bottom line with the overall effects on public health. Third, it may both help explain past

phenomena (to prevent similar public responses to emerging health concerns in the future.

Synthesis of Theory

This study reveals that the substance of mass media stories about autism changed over time, with fear as an early dominant feature. While traditional media might set the initial agenda, an individual's response largely determines how one responds to that information (McCombs & Stroud, 2014). When fear is on the public health agenda, it is important to consider the consequences that may follow. McCombs (2014) argues that the need for orientation, among other psychological considerations moderate agenda-setting effects, and that relevance is a central agent. The Extended Parallel Processing Model also acknowledges that perceived threat (also involving self-relevance) is a key to persuasion. Uncertainty Management Theory along with the Need for Orientation observed that uncertainty and relevance interact with other factors (like fear) to drive behavior.

The Power of Fear

Fear can be a powerful tool to motivate individuals to action. It taps into the deepest recesses of the brain, and human beings are wired to respond to it. Journalists can use fear to tell a more compelling story, policymakers can use it to garner support to change laws, and politicians can use it to gain advantages over rivals. When it is paired with an emerging health concern, it can initiate unreasonable and sometimes dangerous behaviors that are disproportionate to the actual threat (Vinton & Weems, 2015). When fear drives new learning, it can lead to permanent neurological structure changes that give

rise to altered and enduring attitudes. Once fear colors an experience, human beings are wired to learn quickly, and often bypass the logical brain as the new information is encoded. Once central processing is brought in to evaluate and analyze the messages, neuroscience would predict that this process would simply work to justify the fear learning (Gazzaniga, 2011). In many cases, the new knowledge becomes so deeply ingrained that attempts to change it may also be perceived as a threat to be feared.

This study has shown that fear language in stories about autism was higher in the first eight years compared to the second eight years. Awareness of autism grew exponentially after the Wakefield article appeared in the *Lancet*, and news articles about autism framed it as a disorder of dread. Combined fear and uncertainty messages were also higher in the first eight years. Goodall and Reed (2013) posit that uncertainty is a dominant feature of emerging health issues in the news and that a strong association exists between fear and uncertainty. The growing prevalence of autism posed an impossible challenge for parents who both feared autism and were determined to protect their children from developing the disorder. While many scientists pointed to congenital causes, they also acknowledged that the rising prevalence of children developing autism, and that it was perplexing. In short, scientists offered evidence and clues, but not certainty. For many, the idea of an environmental toxin or other agent acting as a causal factor made sense. It follows that arguments that questioned vaccine safety would resonate with some people.

NFO also predicts that relevant topics are inherently more influential. If the event is appraised negatively or perceived as a risk, it can interact with uncertainty and lead to fear-driven behavior. Findings from the first hypothesis support predictions consistent

with NFO and EPPM. Autism was an emerging health topic that was becoming highly relevant (because of increased prevalence), its cause was mysterious, and it was framed negatively. Both NFO and EPPM would support the notion that many people would have a strong desire to reduce uncertainty around autism.

The Missing Link

The efficacy finding was at the first glance a surprise. In general, when fear and efficacy messages are presented together, they result in adaptive responses. Is this finding a contradiction with current theory? On the surface, that appears the plausible conclusion. The higher efficacy in the first eight years challenges what EPPM theory predicts. However, EPPM theory is built on the premise that efficacy messages in medical and health communication lead to *adaptive* responses, which are largely defined by seeking more information. If the efficacy descriptions were not valid, then it begs the question; what would additional information seeking behavior yield? The public who responded adaptively may have become more likely to encounter compelling claims that vaccines could cause autism in an effort to seek more information. They were at risk for higher exposure to the parent groups providing compelling *and* plausible reasons that vaccines may be causing autism (albeit false). EPPM theory would predict that emerging health reports steeped in fear, uncertainty and a perceived risk of developing the disorder would yield more maladaptive responses, like the data in this project support. However, when fear and efficacy messages dominated the tone in the case of autism news reports, the quality of the efficacy messages might have been a key factor in transforming a healthy response into a maladaptive one.

Adaptive responses to fear messages about vaccinations could have inadvertently connected parents with fringe groups who provided so-called proof that vaccines were a cause of autism and reassurance that it was safer to forgo vaccines than to receive them. In this case, parent groups who promoted 'effective' treatment through alternative therapies, and continue to do so, also endorsed the vaccine/autism link theory. These are seductive concepts to concerned parents who long for control over the health and well-being of their children. Therefore, the fear-control response inherent to medical conditions with no efficacy recommendations may have also yielded the same outcome for those who exhibit higher self-efficacy by exercising danger-control.

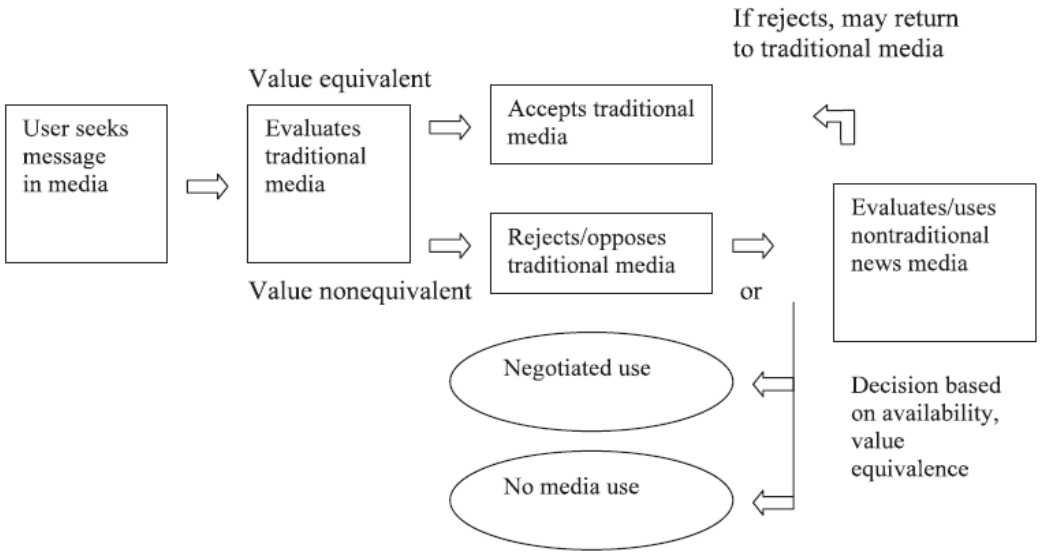
Double-edged Sword

Conversely, stories that lacked any real solutions could have left a vacuum so that people with high personal self-efficacy (i.e., danger control) might have sought out additional sources when few existed in the traditional media. The reason media consumers turn away from mainstream news and seek news information from non-traditional media. This may be due to the agreement of the alternative medium's belief systems (Christie, 2007). The degree of the medium's ideologies and cultures of both media and user—is recognized as "value equivalence," and people perceive a general value agreement with the medium. Alternatively, "value nonequivalence" underscores the differences between the user and the medium. In the case of availability and agreeability of other media sources in conjunction with value nonequivalence with traditional mass media, it makes sense that people would seek nontraditional news media consistent with one's beliefs (Christie, 2007). It is possible in the case of autism, that both a lack of

efficacy (later) and fallacious efficacy (earlier) could have funneled people into the waiting arms of fringe groups and their anti-vaccination rhetoric. The common denominator in this scenario presumes that the earlier efficacy messages were ineffective, but lured people into seeking more information. That seeking inevitably exposed them to the compelling propaganda of fringe groups. The following graphic illustrates how this process may have taken place with the presence of fallacious efficacy or a vacuum of efficacy as adapted by Christie (2007).

Figure 6

Model of Value Equivalence in the Use of Nontraditional News Media



Lack of Realistic Context

Without any cultural emphasis or recent collective memories of the horrors brought about by vaccine-preventable diseases, some parents may have viewed autism as a greater risk than the diseases that vaccines hold at bay. Most people today are unaware that the number one killer of children in the 1950s was Polio. Remarkably, with killer

bacterial infections held at bay, viral vaccinations proved nearly as deadly. In the present day, the biggest danger for children are accidents—not disease. Therefore, when a parent is given risk information about vaccinations, it does not mention the risks associated with vaccine-preventable diseases.

While EPPM considers information seeking to be an adaptive response, in this case, it may have been maladaptive depending on what information people encountered. This makes the efficacy finding very intriguing because EPPM would predict best outcomes when fear and efficacy are both present. It would be interesting to explore further if 'efficacy' messages were associated with pseudo-scientific treatments (e.g., chelation therapy, facilitated communication, etc.).

Traditional Agenda-setting

More stories in the first period mentioned the false autism/vaccine link. This finding lends support the idea that early attitudes formed about vaccines may have affected behavior despite a shift in later messaging. *Interestingly, more mentions of the vaccines in stories about autism were associated with higher vaccination rates*. While this appears to be somewhat of a contradictory finding, it does support traditional agenda-setting—the more vaccines are mentioned, vaccination uptake rises. A higher magnitude of vaccine mentions (regardless of link, etc.) are associated with higher vaccine uptake. It is plausible that some time lag would be present (mentions ~time passes, other intervening variables~ vaccine decision), yet lagging the data would yield an even smaller number of data points, making such an analysis problematic. Traditional agenda-setting relies in part on a high frequency of messages, whereas the third level of agenda-

setting may rely on just one compelling message that might scare someone into believing that vaccinations are dangerous. Considering that the vaccination rate is a percentage, the investigator re-ran the correlations using average link mentions per year (as opposed to the absolute number of stories); it did not yield a significant finding. It is possible that frequency of stories or salience is not directly related to vaccination behaviors. It may just take exposure to one compelling argument. Since the group of interest is a minority of the population, their influence on overall vaccination behaviors may be too small to detect with such a crude device as a small N correlation.

However, it is important to note that small changes in vaccination rates could have a deleterious effect on the health and safety of a large number of people. Given that the United States dances on the margins of the 90% vaccination uptake threshold that is recommended to maintain herd immunity. A single percentage point could mean life or death for people who might otherwise be safe with higher community vaccine uptake. To better explore this relationship, future studies might compare local vaccine rates to stories that have negative messaging about vaccines. It may also be worthwhile in the future to see if vaccination rates might be related to stories that mention a link *and* have a negative-vaccination perspective. It might also be useful to employ an experimental design to understand better how people's attitudes are impacted by stories containing a pro-link frame.

Additionally, fear references and other variables demonstrated no relationship with the CDC reported vaccination rates. Future studies might have better luck examining more focal geographical regions known for low compliance and those known for high

compliance. However, the efficacy messages did approach significance. With a higher N and better statistical power, it is possible that early efficacy messages are negatively related to vaccination rates. This relationship should be explored with more data in the future.

Methodological Contributions

This study employed a novel approach to study how the media may have affected vaccination behaviors. This methodology may prove useful for subsequent content analyses, which seek to investigate subjective constructs in a systematic and quantitative way. It is also highly specific to the sample, which can yeild rich data with high specificity to the content of interest. Thus, words categorized one way in this study may be characterized completely differently in another sample about a different topic. The constructs of fear, uncertainty, risk perception (prevalence) and efficacy were studied by first generating frequencies, then coding words based on associations rather than predefining which words will fit into codes. In this case, it was possible to capture *all* the language that support the specific elements of EPPM theory, and agenda-setting and associated theories. It provided a good foundation from which to explore further the idea of the third level agenda-setting, and what mechanisms may be involved. The media messaging contained the elements that this investigator believes might be important to forming long-term attitudes about vaccinations and autism. Third level agenda-setting posits that the news media can significantly influence how one conceives and feels about an issue as a whole concept (McCombs, 2014).

Future Directions

People driven to reduce uncertainty may have adopted outlier views in that effort. Fear can cause people to act irrationally in an effort to minimize risk. If fear spawned beliefs about a mythical vaccine/autism link, cognitive neuroscience explicates the mechanisms through which those ideas could result from permanent changes in the brain. That would help explain the stubborn persistence of myths surrounding vaccination safety.

Indeed, it is hard to 'unscare' people, because fear-learned behavior is very difficult to extinguish, especially if one is not motivated to do so. Also, logical appeals about the safety of vaccines have proven inadequate, because deep-seated attitudes cannot be transformed by reading or hearing different information that is presented as new facts. Additionally, fear is tied to the survival functions innate to the human brain. It unifies arousal, emotion, motivation and reinforcement to face challenges, which might explain why high-stakes health messages can be processed differently, and the depth and longevity of media influence may be more enduring in those circumstances. This explanation may also shed light on past phenomena, such as people flocking to Mexico to obtain FDA-banned drugs to fight cancer in the 1980s. The most famous case involved Steve McQueen, who sought help from a doctor in Mexico, who had been stripped of his medical license in Texas, for unproven alternative therapies. Despite the anecdotal claims, Mr. McQueen's case followed the predicted trajectory of the FDA. The treatment was ineffective. Despite this, many people followed in his footsteps in vain. McQueen was a celebrity who endorsed the treatment, and despite the ultimate outcome, claimed it

was ‘improving’ his condition for the term he was in Mexico. Nowadays, almost any ideas may be reinforced at will. Alternative media channels remain flooded with information and compelling narratives that essentially confirm whatever beliefs one holds.

What’s more, fear arises from cognition; it cannot be separated. The ‘Vulcan’ brain is not achievable within the human mind. Cognition and emotion are inseparable, and to do so for the purpose of science is invalid because it does not represent neurobiological realities. The innate desire to protect one's child is a strong one, and when autism was perceived as a threat to the health of a child, it is understandable that people were motivated to avoid it. Pseudo-scientific claims may have seemed plausible, and captivating narratives that reinforced the legitimacy of those claims may have provided people with relief from uncertainty.

This study is among the first to characterize and quantify fear, uncertainty, risk and efficacy references in news stories about autism. While it has shed new light on potential mechanisms through which that messaging may have inadvertently influenced people, it does no*t* test that directly. Subsequent longitudinal experimental studies may be able to provide further support for the propositions put forth in this study. It does, however, provide a foundation for future studies that could build on this to gain a better understanding how and why people are choosing the dangerous path of refusing vaccinations. While this methodology provides an interesting new quantitative tool to investigate subjective and abstract constructs, it is important to replicate it to ensure its validity. This line of study might eventually provide health communication scholars with

the appropriate tools to launch a successful pro-vaccination campaign, and reverse the hazardous trend of vaccination refusal.

Conclusion

Reality

Vaccines do not cause autism. Framing autism as an epidemic might unnecessarily scare people and also offend individuals who are on the autism spectrum and living perfectly fulfilling lives. No life is without its challenges. However, to say that developing autism is synonymous with a pandemic is a non-sequitur. The risk of developing an adverse reaction from a vaccine is approximately 1 out of one million doses, and the risk of death is approximately 1 in ten million doses. The risk of death from the diseases that CDC recommended vaccinations protect children from is exponentially higher. Hopefully, the return of the once-eradicated measles disease is not an indicator that our population is now vulnerable to even deadlier vaccine-preventable diseases. Otherwise, people from this generation might experience what a deadly epidemic really looks like. For now, the collective health destinies of children, other vulnerable populations, and the general population within the United States rests with the vaccination choices of parents.

Choice

The notion of choice is important to consider. Given that children are not autonomous agents, parents are compelled by law to protect them. When children are found to be put unnecessarily in harm's way, parents might face criminal charges. The law does not allow parents to choose to buckle children into automobiles because the

overwhelming evidence supports this activity. Parents are not allowed to leave children unattended because the risk of harm far outweighs any justification a parent might have to leave the child unprotected. Therefore, it is curious that many states *do* give parents a choice to leave their children unprotected from deadly diseases, despite the overwhelming evidence that vaccination is the safest alternative. Is a parent's right to make health choices for their children more important than children's right to have the best chance at survival?

Ethical considerations for journalists

Journalists have a duty to provide unbiased, complete, and truthful information to the public, such that the public can understand the essence of the subject and make informed judgments. However, the field of journalism is fraught pressures to publish quickly, and garner readership. Some even go so far to include it as a form of entertainment. However, medical information might provide a special case whereby sensationalism and inadequate fact checking or under sourcing, should never be acceptable. Given the potential hazards to public health, the gravity of responsibility is as serious as it is heavy. The media are influential. Emerging health concerns are influential. Fear garners attention and makes for more interesting narratives, but it very well may lead to irrational deleterious behaviors. Journalists have a right to know if scaring people about medical concerns could cause more harm than good. What follows is a choice. Do journalists write the words to secure more clicks or to ensure the health and well-being of the public? Maybe the two are not always mutually exclusive, but when they are, medical journalists should have the obligation to make the hard call.

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Appendix A

Results of applying inclusion/exclusion requirements to sample obtained from LexisNexis®

Years	LexisNexis Search Results	LexisNexis Auto Excluded Similarity	Manually Excluded due to Similarity	Manually Excluded because Story not about Autism	Manually Excluded because Opinion piece or Letter to Editor	Manually Excluded because Length of the article was <150	Total Stories used	Total Stories Excluded	Percentage of Stories Excluded
1999	10	0	0	1	0	1	8	2	20.00%
2000-2004	131	9	0	0	21	14	87	44	33.59%
2005-2009	169	6	0	10	19	6	128	41	24.26%
2010-2014	300	49	3	12	12	6	218	82	27.33%
Totals	610	64	3	23	52	27	441	169	27.70%
		10.49%	0.49%	3.77%	8.52%	4.43%	72.30%	27.70%	

Appendix B

Total number of terms in each year with ‘decade’ label identified

Year	Fear Total Ave	BigFear Total Ave	SuperFear Total Ave	Uncertainty Total Ave	Prevalence Total Ave	Efficacy Total Ave	Decade
1999	78.00	99.50	113.63	21.50	14.13	26.00	1
2000	55.58	68.50	80.50	12.92	12.00	18.25	1
2001	37.00	47.00	55.25	10.00	8.25	17.75	1
2002	60.44	83.56	99.00	23.11	15.44	18.83	1
2003	57.26	75.79	86.89	18.53	11.11	17.05	1
2004	66.81	105.69	125.62	38.88	19.92	20.50	1
2005	60.19	83.13	95.06	22.94	11.94	16.00	1
2006	54.77	64.38	77.00	9.62	12.62	12.62	1
2007	58.39	77.73	90.85	19.33	13.12	13.18	2
2008	46.50	63.56	74.06	17.06	10.50	8.06	2
2009	43.28	57.41	66.38	14.13	8.97	16.53	2
2010	33.48	51.81	60.06	18.32	8.26	8.06	2
2011	41.22	67.62	80.35	26.41	12.73	13.16	2
2012	55.00	72.39	88.58	17.39	16.18	8.89	2
2013	48.48	64.42	76.55	15.94	12.12	7.27	2
2014	45.38	56.03	63.32	10.64	7.29	7.73	2

Appendix 3

Coded terms or partial terms occurring most frequently in the sample

Fear Word	Absolute Frequency	Uncertainty Word	Absolute Frequency	Prevalence Word	Absolute Frequency	Efficacy Word	Absolute Frequency
children	2733	study	911	group	328	school	933
parents	1215	research	560	high	299	services	366
child	1024	vaccines	462	cases	298	early	358
disorder	616	vaccine	417	risk	295	program	336
son	500	resea_1	336	percent	271	special	334
social	442	studies	326	center	263	education	308
brain	416	medical	306	number	244	make	304
diagnosis	376	thimerosal	274	case	239	therapy	292
age	366	evidence	224	national	239	treatment	290
family	365	scientist	213	federal	186	schools	184
disor_1	362	government	150	control	184	programs	177
spectrum	360	wakefield	132	report	180	support	134
kids	327	doctors	129	increase	162	intervene	115
families	312	medicine	118	centers	125	district	111
behavior	256	journal	117	united	121	learn	98
diagnose	252	science	117	American	111	making	85
months	246	measles	112	advocacy	94	secretin	82
disease	246	professor	105	rates	90	treat_1	82
problems	226	data	104	groups	82	live	77
devel_1	220	question	101	reported	79	learning	71
development	216	scientific	94	million	78	classes	61
care	213	caused	93	prevalent	73	helped	54
skills	200	speaks	91	rate	70	earlier	47
symptoms	194	finding	88	advocate	67	art	45
mercury	191	environment	86	prevention	65	educa_1	45
behav_1	190	resea_2	86	numbers	59	oxytocin	45
boy	188	mmr	85	incre_1	57	charter	44
disability	179	findings	84	claims	55	effective	44
institution	173	factors	83	large	54	therapy	44
genetic	153	paper	80	CDC	51	teach	39
syndrome	150	pediatric	77	growing	51	music	36
room	150	information	75	average	48	grade	31
mental	145	cure	70	USA	44	therapies	31
genes	143	involved	70	population	42	require	30
community	137	hope	64	rise	36	classroom	26

Fear Word	Absolute Frequency	Uncertainty Word	Absolute Frequency	Prevalence Word	Absolute Frequency	Efficacy Word	Absolute Frequency
adults	137	psychiatry	62	decade	35	Medicaid	26
language	135	analysis	58	survey	35	instruct	23
link	132	result	53	awareness	33	interview	23
daughter	129	associated	52	estimate	25	apps	21
father	127	results	50	rising	22	potential	21
boys	127	theory	47	risks	22	means	20
childhood	125	vaccinated	47	America	20	progress	19
police	119	debate	45	increasing	19	goal	18
older	114	suggests	45	conducted	12	element	17
private	113	British	40	counts	12	inclusion	16
behav_2	112	rubella	40	screening	12	mandate	16
attention	110	lancet	39	ameri_1	11	thera_1	12
play	108	mice	38	ratio	11	helps	11
communicate	106	mumps	38	surveys	11	improve	11
related	101	envir_1	34	manual	10	policy	11
severe	100	panel	32	epidemiology	7	regular	11
problem	94	role	32	previ_1	7	legislation	10
eye	94	Andrew	31	widely	7	taught	10
babies	94	safety	29	incre_2	6	goals	9
speech	92	Britain	27	receiving	6	technique	8
coverage	92	criteria	27	sharply	6	independent	6
understand	89	fraud	25	epide_1	5	requires	6
difficult	89	major	25	figures	5	mainstream	5
develop	88	site	25	incident	5	required	5
twins	86	organize	24	NIH	5	occupation	4
money	85	trial	23	reports	5	placebo	4
drug	85	answer	22	decades	4		
diagn_1	84	proposed	22	estim_1	4		
developing	83	immune	21	odds	4		

Appendix 4

Vaccine-Specific Coverage Levels among Children Aged 19-35 Months in the United States

Vaccine-Specific Coverage Levels Among Children Age 19-35 Months in the United States by Survey Year, National Immunization Survey, 1995-2014*

Survey Year†	4+ DTaP	3+ Polio	1+ MMR	3+ Hib§	3+ Hep B	1+ Varicella¶	4+ PCV	4:3:1**	4:3:1:3††
1995	78.4	87.8	89.8	91.2	67.9	N.A.	N.A.	76	73.7
1996	81.1	91	90.6	91.4	81.8	12	N.A.	78.4	76.4
1997	81.5	90.7	90.4	92.5	83.6	25.8	N.A.	77.9	76.2
1998	83.9	90.8	92	93.4	87	43.2	N.A.	80.6	79.2
1999	83.3	89.6	91.5	93.5	88.1	57.5	N.A.	79.9	78.4
2000	81.7	89.5	90.5	93.4	90.3	67.8	N.A.	77.6	76.2
2001	82.1	89.4	91.4	93	88.9	76.3	N.A.	78.6	77.2
2002	81.6	90.2	91.6	93.1	89.9	80.6	N.A.	78.5	77.5
2003	84.8	91.6	93	93.9	92.4	84.8	N.A.	82.2	81.3
2004	85.5	91.6	93	93.5	92.4	87.5	N.A.	83.5	82.5
2005	85.7	91.7	91.5	93.9	92.9	87.9	53.7	83.1	82.4
2006	85.2	92.8	92.3	93.4	93.3	89.2	68.4	83.1	82.2
2007	84.5	92.6	93.2	92.6	92.7	90	75.3	82.8	80.1
2008	84.6	93.6	92.1	90.9	93.5	90.7	80.1	82.5	79.6
2009	83.9	92.8	90	83.6	92.4	89.6	80.4	81.5	73.4
2010	84.4	93.3	91.5	90.4	91.8	90.4	83.3	82	78.8
2011	84.6	93.9	91.6	94	91.1	90.8	84.4	82.6	81.9
2012	82.5	92.8	90.8	93	89.7	90.2	81.9	80.5	80
2013	83.1	92.7	91.9	92.8	90.8	91.2	82	81.5	81.1
2014	84.2	93.3	91.5	92.6	91.6	91	82.9	82.6	82

* Excludes the U.S. Virgin Islands, Guam, and Puerto Rico.

† Prior to 2011, estimates are single-frame, landline-sample estimates. From 2011 onward, estimates are dual-frame (landline plus cell-phone) estimates.
§ Beginning in 2009, the number of doses required to be up-to-date on Hib depends on the manufacturer of the vaccine. However, the figures shown here refer to 3 or more doses of Hib vaccine regardless of manufacturer.

¶ Varicella was added to the NIS in 1996.
** Four or more doses of DTaP, three or more doses of poliovirus vaccine, and one or more doses of MCV.
†† Four or more doses of DTaP, three or more does of poliovirus vaccine, one or more doses of MCV, and three or more doses of Hib.

Source: Centers for Disease Control