PUBLIC ATTITUDES TOWARD VACCINATION:
INFLUENCES OF MESSAGE FRAMES, PARENTING ATTITUDES, AND CULTURAL WORLDVIEWS

A Dissertation
submitted to the Faculty of the
Graduate School of Arts and Sciences
of Georgetown University
in partial fulfillment of the requirements for the
degree of
Doctor of Philosophy
in Psychology

By

Anna Karin Mikulak, M.A

Washington, DC
May 11, 2012
PUBLIC ATTITUDES TOWARD VACCINATION: INFLUENCES OF MESSAGE FRAMES, PARENTING ATTITUDES, AND CULTURAL WORLDVIEWS

Anna K. Mikulak, M.A.

Thesis Advisor: Deborah A. Phillips, Ph.D.

ABSTRACT

The capacity of developmental science to inform effective policies and decision-making on behalf of children depends, in part, on the public messages that accompany these issues. Increased understanding of the importance of how scientific evidence is presented has led to a growing alliance between experts in strategic framing and developmental scientists. One developmental issue for which strategic communication may play a particularly important role is that of childhood vaccination. Over the last two decades, increased skepticism about the safety and necessity of vaccines has led to decreases in vaccination uptake and increases in vaccine-preventable disease. The fact that parents are refusing vaccinations for their children has been a major cause for concern among scientists and healthcare providers, for whom the benefits of vaccination are generally unassailable.

With this in mind, the aim of this dissertation was to go beyond demographic factors in trying to understand the mechanisms – including message frames, parenting attitudes, and cultural worldviews – that might explain people’s attitudes toward both individual vaccination uptake and vaccination policy. Participants completed an online survey about ‘children’s health and well-being’ and were randomly assigned to one of three message groups: no message, community-oriented thematic message or family-oriented episodic message. After reading a message about vaccination, participants answered questions about their support for individual
vaccination decisions and vaccination policy. Participants also completed items that assessed their parenting attitudes and cultural worldviews.

Findings suggest that there was no effect of experimental message frame on vaccination attitudes, as there were no significant differences in support for vaccination decision or for vaccination policy among the message conditions. However, structural equation analyses do suggest that both parenting attitudes and cultural worldviews play an important role in shaping vaccination attitudes, through direct and indirect pathways. These two factors may help to explain previously reported associations between certain demographic characteristics – like race, income, and education – and vaccination refusal.

It is our hope that by illuminating some of the factors that influence people’s attitudes toward vaccination, this research will contribute to communications efforts that help bridge the gap between scientific and public opinion and that ultimately promote children’s healthy development.
ACKNOWLEDGEMENTS

I owe a huge debt of gratitude to the many people at Georgetown University who have helped me to reach this point. To my advisor, Dr. Deborah Phillips, for helping me to realize my own ambitions and for giving me the tools that I needed to achieve them. To Dr. Fathali Moghaddam, for helping me to think critically about my own work and its place in the broader scientific world. To Dr. Rusan Chen, for guiding me through the analytic process and teaching me many statistical and methodological things along the way.

I am also grateful to my committee members Dr. Matthew Nisbet and Dr. Tiffany Manuel for encouraging me to see science communication as a process that is just as important and worthwhile as the scientific process itself.

I would like to thank the National Science Foundation and Psi Chi for providing me the funds that allowed me to turn my dissertation proposal into an actual line of research.

Finally, I would like to thank my family for providing me constant inspiration and support, both academic and non. To my parents, Dr. Robert Mikulak and Gunnel Porelius, for making sure that I use every day to “work hard and learn something.” To my sister, Lena Mikulak, for showing me what it means to be a Hoya (and for being an excellent chauffeur, to boot). And to my husband, Trevor Holland, for being a true partner. Part minder, part entertainer, part therapist, and full friend, you keep me healthy and happy.

Thank you.
# TABLE OF CONTENTS

CHAPTER I: INTRODUCTION..................................................................................... 1

Public Engagement on Scientific Issues: Rethinking the Deficit Model................. 3

Interpretative Schemas, Frames, and Public Understanding of Science............... 5

The MMR Controversy as a Case Study of Public Engagement on Science.............. 7

Understanding Vaccination Behavior to Improve Public Health........................... 12

Cultural Worldviews as Interpretative Schemas .................................................... 13

Parenting Attitudes as Interpretative Schemas ...................................................... 19

Framing as a Tool for Public Engagement on Vaccination .................................... 23

Dissertation Goals .................................................................................................. 26

Specific Aims and Hypotheses ............................................................................... 29

CHAPTER II: METHODS ............................................................................................ 31

Participants ............................................................................................................. 31

Procedure ............................................................................................................... 32

Survey Instrument and Measures ........................................................................... 32

Missing Data ........................................................................................................... 37

Data Analyses ......................................................................................................... 37

CHAPTER III: RESULTS ............................................................................................ 39

Descriptive Statistics ............................................................................................. 39

Latent Variable Constructs .................................................................................... 39
LIST OF TABLES

Table 1. Participant Characteristics (N = 830) ................................................................. 95

Table 2. Zero-Order Correlations, Means, and Standard Deviations for Study Variables ................................................................. 96

Table 3. Standardized Coefficients for Direct Pathways to Vaccination Attitudes .... 97

Table 4. Unstandardized Coefficients for Indirect Paths ............................................. 98

Table 5. Zero-Order Correlations, Means, and Standard Deviations for Study Variables, Parent Subsample .................................................................................................................. 99

Table 6. Zero-Order Correlations, Means, and Standard Deviations for Study Variables, Non-parent Subsample ......................................................................................................... 100

Table 7. Zero-Order Correlations, Means, and Standard Deviations for Study Variables, Community Message Group ................................................................. 101

Table 8. Zero-Order Correlations, Means, and Standard Deviations for Study Variables, Family Message Group ........................................................................................................ 102
LIST OF FIGURES

Figure 1. Unstandardized coefficients for model of vaccination attitudes ..................  103

Figure 2. Unstandardized coefficients for model of vaccination attitudes comparing parents and non-parents ................................................................. 104

Figure 3. Unstandardized coefficients for model of vaccination attitudes comparing message treatment groups (Community message versus Family message)................. 105
CHAPTER I: INTRODUCTION

The capacity of developmental science to inform effective policies and decision-making on behalf of children depends, in part, on the public messages that accompany these issues. Increased understanding of the importance of how scientific evidence is presented has led to a growing alliance between experts in strategic framing and developmental scientists (e.g., Gilliam & Bales, 2001; Shonkoff & Bales, 2011). This appreciation for strategic communication is, however, a relatively recent development within the scientific community. There have always been scientists who have recognized the importance of communicating their findings to the public (Welch-Ross & Fasig, 2007), but they have often been researchers whose work is applied in nature (McCall & Groark, 2007). Academic researchers, on the other hand, have historically viewed communication of scientific findings as not only outside their purview, but, even more, as fundamentally counter to the objective nature of the scientific process and, therefore, tantamount to pandering (Bertenthal, 2002; Haste, 1994; Hilgartner, 1990; Weigold, 2001). Those researchers who do seek to communicate with the public have often suffered the criticism of their colleagues, having been labeled ‘un-academic’ or, worst of all, ‘popular’ (Bertenthal, 2002; Cooper, 1994; Gascoigne & Metcalfe, 1997; Haste, 1994; Miller, 2001). Among scholars, the general sentiment has often been that science communication is simply “not something respectable scientists [do]” (McCall & Groark, 2007, p.15).

As scientists have gained experience in dealing with the media and the public, they have become much more open to communication as a valuable activity (Gascoigne & Metcalfe, 1997). Today, many scientists are aware of and concerned with issues surrounding science communication and public understanding of science. However, because science communication has only recently been accepted by the scientific community, there is little guidance or training
for scientists who want to learn how to communicate their findings and engage with the public on scientific issues (Welch-Ross & Fasig, 2007). While researchers seem ready and willing to improve their communication skills (Weigold, 2001), many continue to have naïve expectations about what effective science communication really involves (Welch-Ross & Fasig, 2007). Indeed, the sentiment prevails that scientists are generally ineffective at communicating with the public (Weigold, 2001).

Recently, several scientific issues, including embryonic stem cell research, global climate change, evolution, and vaccination, have become major public controversies. These public controversies make it painfully clear that the scientific community still has considerable progress to make in being able to communicate with the public in ways that are not only engaging but also productive. Indeed, the ongoing controversy over the measles-mumps-rubella (MMR) vaccine provides a perfect example of what can happen when an important scientific issue is not thoughtfully communicated. As will be discussed in greater detail below, interactions between scientists, the media, and the public seem to have created a perfect storm of distrust, misinformation, and misunderstanding on all sides that has had noticeable effects on individuals’ vaccination decisions and overall public health.

As such, the purpose of the present research was to use the MMR controversy as a case study to explore and understand the various factors, including communication efforts, that come together to influence decision-making on issues related to developmental science. The rest of this chapter will delve into the scholarly literature on several factors that are likely to play an influential role in this kind of decision-making. First, I will examine the deficit model of public understanding of science as a potential reason why science communication may have failed in the past. I will then explore two different factors that must be considered in order to achieve
more successful public engagement on scientific issues: *interpretative schemas* and *frames*. I will discuss the individual-level factors, specifically people’s *interpretative schemas*, that are likely to influence public attitudes toward science. I will also explore how frames function as communication devices that can play a significant role in guiding the way people interpret public messages. I will then take these various factors and apply them to the specific case of the MMR controversy in order to better elucidate the reasons why there is still a significant gap between scientific understanding and public understanding on this issue. I will explore the role of cultural worldviews and parenting attitudes as specific types of interpretative schemas that may have particularly influential roles in shaping people’s attitudes toward vaccination. And I will look at frames as communication tools that may help to open up more productive public conversations about vaccination. Finally, I will lay out the scope of the present research, discussing the specific aims and hypotheses that drive the research and the novel contributions that I hope it will make in understanding the factors that affect opinion and decision-making on issues related to developmental science.

**Public Engagement on Scientific Issues: Rethinking the Deficit Model**

One reason that efforts at science communication may have been ineffective in the past, especially in regards to public controversies like vaccination, is because they have often been based on a ‘deficit model’ of public understanding of science. The deficit model essentially maintains that the reason people do not understand a particular scientific concept – like the relationship between vaccines, immunity, and disease – is because they do not have sufficient information to do so (Bauer, Allum, & Miller, 2007; Burns, O’Connor, & Stocklmayer, 2003; Miller, 2001; Sturgis & Allum, 2004; Weigold, Triese, & Rausch, 2007). Since laypeople do not have the expert knowledge that scientists have, they cannot understand science and form
scientific opinions in the way that scientists do. This lack of information is what supposedly leads to many of the public debates on scientific issues that are more socially than scientifically controversial (e.g., stem cell research, global warming, MMR-autism link) (Nisbet & Goidel, 2007).

If, according to the model, the problem is truly a matter of a deficit of information, then the solution to the problem is clear: provide laypeople with the additional information they need to come to the correct understanding or opinion. Serpell and Green (2006) note that much of the MMR vaccination literature rests on the deficit model, under the assumption that the provision of better information will lead parents to vaccinate their children. According to this model, the scientific facts speak for themselves – scientists simply have to fill in the gaps in people’s knowledge (Miller, 2001; Nisbet & Goidel, 2007) and any controversy will naturally disappear (Nisbet and Goidel, 2007; Nisbet & Mooney, 2007).

While some scientists may believe that providing a science-illiterate public with more information will turn them into a science-literate and science-appreciative public, the relationship is not quite so simple. Many science communication scholars agree that the deficit model falls short because it fails to account for people’s attitudes, values, and experiences, or for their cognitive biases. For this reason, many scholars argue for a new model of public understanding of science in which understanding arises from a two-way negotiation of meaning between expert approaches to knowledge and lay approaches to knowledge (Bauer, Allum, & Miller, 2007; Cobern, 1996; McMurray et al., 2004; Miller, 2001; Nisbet, 2009; Turney, 1996; Wagner, 2007; Yearley, 2000; Zehr, 2000).

This negotiation of meaning is based on the premise that expert and lay approaches to knowledge differ in fundamentally important ways, especially in regards to how they
conceptualize what kind of information constitutes evidence and who qualifies as an expert on a given topic. This model focuses specifically on the contributions of many different factors in the public understanding of science, including moral, social, and political values; trust; personal interests and preferences; alternative forms of knowledge; and culture (Burns, O'Connor, & Stocklmayer, 2003; Casiday, 2007; Cobern, 1996; McMurray et al., 2004; Nisbet, 2009; Nisbet & Goidel, 2007; Pardo & Calvo, 2004; Senier, 2008; Sturgis & Allum, 2004; Turney, 1996; Zehr, 2000). As Turney (1996) notes, after one recognizes the influence of these various factors on public understanding of science, “the impulse to try and bring people's opinions into line with what scientists think they ought to be by insisting that they must understand the same facts in the same way dies hard” (p.190).

**Interpretative Schemas, Frames, and Public Understanding of Science**

We can better understand the roles that these different individual-level factors play in shaping opinion and decision-making by examining them through the lens of schema theory. Schema theory holds that the information we are exposed to in our everyday lives is not stored in discrete pieces in our memory but is organized into general, associative models called *interpretative schemas*. These schemas emerge out of the patterns and regularities in our cumulative experiences and serve as cognitive models of what we know about the world. Incoming information is automatically evaluated in the context of our existing schemas, allowing us to interpret large amounts of information with ease and efficiency (Bartlet, 1932). These interpretative schemas serve as mediators between values, beliefs, experiences, conventions, and cultural narratives on the one hand and incoming information on the other hand (e.g., Strauss & Quinn, 1997). As such, these schemas allow people to categorize and evaluate information in relation to their personal characteristics (Nisbet & Goidel, 2007; Nisbet & Mooney, 2007).
While people may not actively seek out information about science-related topics (National Science Board, 2008), research suggests that whatever science information individuals are exposed to most likely comes from the media – “[w]hen formal education in science ends, media become the most available and sometimes the only source for the public to gain information about scientific discoveries, controversies, events, and the work of scientists” (Nisbet et al., 2002, p.592). When people have little or no personal experience relevant to a particular issue, they may depend on information presented by mass media to form an opinion. This dependence, in turn, allows the media significant potential to influence public thinking (Iyengar, 1991). Communications research suggests that there are certain communication practices or conventions that endow media messages and other public communications with the power to influence public discourse. Specifically, these conventions or ‘frames’ help to organize thought by “packaging complex issues in persuasive ways by focusing on certain interpretations over others” (Nisbet & Huge, 2007, p.200). These frames signal what information is important and what information is irrelevant (Dunwoody, 2007).

It is important to note, however, that media consumers can also play more active roles in media consumption, depending on the contextual factors that come into play at any given time (Potter, 2009). As Iyengar (1991) points out, mass media often reinforce the beliefs and opinions viewers already hold, as people tend to select (confirmation bias) and interpret (assimilation bias) information in ways that confirm their existing beliefs. Thus, the extent to which media messages and other public communications influence public thought about how an issue should be defined is determined by how well the frames embedded in the messages align with the interpretative schemas that media consumers already possess (Nisbet & Mooney, 2007). In the case of embryonic stem cell research, for example, a person’s religious beliefs, moral values, political
leanings, and personal experiences with health- and science-related issues are all likely to guide which sources of information she trusts and how she interprets the information and messages she receives from scientists and the media. Ultimately, a frame is only effective in shaping public thought if it is relevant “to a specific, existing interpretative schema acquired through socialization processes or other types of social learning” (Nisbet & Scheufele, 2009, p.4). When the scientific information does not fit neatly into existing schema, people tend to discount the science (McCall & Groark, 2007).

The MMR Controversy as a Case Study of Public Engagement on Science

Since the advent of mass vaccination programs, vaccines have saved countless lives, and they continue to play a critical role in protecting and preserving health at the population level. While the majority of public health and medical professionals considers vaccination to be a necessary tool for maintaining healthy and safe communities, it seems that this sentiment is not as deeply held among ordinary citizens, as reflected in declining vaccination rates over the past decade or so. A certain level of public skepticism about vaccines has existed ever since vaccines were first introduced as a public health measure, but concern about vaccines seems to have become a much more prominent theme in the public discourse about child development and health over the last 15 years (Poland & Jacobson, 2001; Poland & Jacobson, 2011; Wolfe & Sharpe, 2002). This is likely due, in large part, to the MMR-autism controversy that emerged in the late 1990s.

Andrew Wakefield and the MMR-autism hypothesis. In 1998, Andrew Wakefield and colleagues published a study in the prestigious medical journal *The Lancet* in which they investigated the co-occurrence of bowel disease and developmental disorder in twelve children (Wakefield et al., 1998). The authors noted that for eight of the twelve children studied, parents
reported that behavioral symptoms of developmental disorder emerged shortly after MMR vaccination. Based on this reported correlation alone, the authors speculated that the MMR vaccine may play a causal role in the onset of autism spectrum disorders. The article received considerable coverage in the media and spawned a highly publicized debate between scientists, who uniformly found no empirical evidence for the MMR-autism link (see, for example, Offit & Coffin, 2003), and advocates and parents, who cited anecdotal evidence for the relationship.

Subsequent to the publication of the study and the media attention it received, MMR vaccination rates declined in some areas of the United Kingdom (Jefferson, 2000; O’Dell & Brownlow, 2005; Serpell & Green, 2006; Speers & Lewis, 2004). In Dublin, Ireland, the decrease in MMR vaccination led to an outbreak of measles that resulted in the hospitalization of over 100 children and the death of three children (McBrien et al., 2003). As a result of the measles outbreak, thirteen children were placed in intensive care, seven required mechanical ventilation, and three children died (McBrien et al., 2003).

At the conclusion of a three-year public inquiry led by the UK General Medical Council, Wakefield and two of his colleagues were found to have engaged in ‘dishonest,’ ‘irresponsible,’ and, ultimately, unethical conduct in carrying out the research reported in their 1998 study (General Medical Council, 2010). As a result of the hearing, Wakefield and another colleague were ‘struck’ from the medical register and were barred from practicing medicine in the United Kingdom. In February, 2010, The Lancet formally retracted Wakefield et al.’s paper (The Editors of The Lancet, 2010).

Despite this, the MMR-autism controversy continues to have considerable effects in the United Kingdom today. As a consequence of low MMR vaccination coverage, measles is once again considered endemic to the United Kingdom (Health Protection Agency, 2008). In 2011,
MMR coverage in the United Kingdom reached 90% for the first time in over 13 years, but there were still twice as many cases of measles in 2011 as there were in 2010 (Health Protection Agency, 25 November 2011). Furthermore, measles outbreaks continue to be a problem throughout continental Europe. Through October of 2011, there were 30,200 reported cases of measles in Europe that year, resulting in eight measles-related deaths and 23 cases of acute measles encephalitis (Health Protection Agency, 24 June 2011). There were 956 reported cases of measles in England and Wales alone.

Vaccination in the United States. While the decline in vaccination has not been so dramatic in the United States – where vaccination is often a requirement for school entry – vaccination rates alone do not tell the whole story (Kennedy, LaVail, Nowak, Basket, & Landry, 2011). Research indicates that many parents are, in fact, delaying or foregoing vaccinations for their children due to concerns about allegedly adverse outcomes such as autism (e.g., Bardenheier et al., 2004; Dempsey et al., 2011; Freed, Clark, Butchart, Singer, & Davis, 2010; Gellatly, McVittie, & Tilipoulos, 2005; Senier, 2008). In June 2011, the Centers for Disease Control and Prevention (CDC) issued an official health advisory regarding a noticeable increase in measles outbreaks in the United States (CDC, 22 June 2011). And in April 2012, the CDC issued a report that shows that in 2011, there were 222 confirmed cases of measles, the highest number of cases reported in the United States since 1996 (CDC, 20 April 2012). These cases were the result of at least 17 distinct outbreaks. Of the total 222 cases, 196 were U.S. residents; of these 196, 141 cases (85%) occurred in persons who were eligible for the MMR vaccine but who were unvaccinated.

Research suggests that vaccine refusal and requests for exemptions from mandatory vaccination requirements have increased over the last few years (Kempe et al., 2011). According
to data gathered from private health care plans, MMR vaccine coverage dropped from 93.5% in 2008 to 90.6% in 2009; diphtheria, tetanus, and pertussis (DTaP) vaccine coverage dropped from 87.2% to 85.4%; and varicella vaccine coverage dropped from 87.2% to 85.4% (National Committee for Quality Assurance, 2010). DTaP coverage recovered somewhat in 2010, increasing to 86.3%, but MMR coverage remained about the same, at 90.8% (National Committee for Quality Assurance, 2011). While all 50 states have mandatory vaccination requirements, 48 states allow for religious exemptions from those requirements and 20 states allow for additional ‘personal belief exemptions’ on philosophical or other grounds (Institute for Vaccine Safety, 2012). In states that allowed personal belief exemptions, the exemption rate rose about 6% per year between 1991 and 2004, from 0.99% to 2.54% (Omer et al., 2006).

Allowing for such philosophical exemptions appears to have a direct effect on parents’ vaccination decisions: data suggest that states that allow philosophical exemptions do indeed have higher estimated rates of unvaccinated children. In 2001-2002, seven of the ten states with the highest rates of unvaccinated children allowed philosophical exemptions (Smith, Chu, & Barker, 2004). Estimates generated in 2004 suggest that in states with no philosophical exemptions, fewer than 300 per 100,000 children were unvaccinated, whereas in states that allow philosophical exemptions, more than 500 per 100,000 children were unvaccinated (Smith, Chu, & Barker, 2004). Despite generally high levels of vaccine uptake in the United States, research suggests that so-called ‘exemptors’ – those individuals who have not received certain vaccinations due to philosophical and/or religious exemptions – are in fact at greater risk of contracting a vaccine-preventable disease (Feikin et al., 2000; Salmon et al., 1999). The increase in vaccine refusals and requests for exemptions in recent years may help to explain the geographic clusters of unvaccinated people that have led to an increase in outbreaks of vaccine-
preventable disease in the United States despite state-level mandatory vaccination requirements (Fiebelkorn et al., 2010; Kempe et al., 2011).

This decline in vaccination has been an obvious cause for concern in the public health community, since vaccination levels must remain high in order to protect community immunity. There is reason to believe that the hypothesized link between MMR and autism is a major reason that parents refuse the MMR vaccination. Indeed, many of those who were infected with measles in a 2005 outbreak in Indiana were unvaccinated due to concerns about the vaccine that were “particularly related to media reports of a putative association between vaccinations and autism and of the dangers of thimerosal” (Parker et al., 2006, p.452-453). Furthermore, research suggests that 25% of American parents continue to believe that some vaccines can cause autism in otherwise healthy children (Freed, Clark, Butchart, Singer, & Davis, 2010). About 2% of the parents surveyed in the study had refused the MMR vaccination for their children. The parents explained their decision to refuse the vaccine on the grounds that they had “heard about problems with [the] vaccine” and that the “risk for adverse effects from [the] vaccine is too great” (Freed et al., 2010, p.657).

A recent outbreak of measles within a community of Somali immigrants in Minneapolis, Minnesota provides concrete evidence that many parents still hold these strong concerns (CDC, 8 April 2011). The CDC report for this outbreak notes that undervaccination in this community was due in part to parents’ concerns about the safety of the MMR vaccine. Many worried that the vaccine may have been the underlying cause of a purported increase in autism diagnoses in the community. In the middle of the measles outbreak, some of these parents had private meetings with Andrew Wakefield to discuss their concerns about the potential link between the MMR vaccine and autism (Karnowski, 2 April 2011). The public reaction to the MMR controversy in
the United Kingdom and the United States is a dramatic reminder of the very real influence that this issue has on individual-level decision-making and the larger impact that the controversy has on matters of public health.

**Understanding Vaccination Behavior to Improve Public Health**

In response to the controversy and its unanticipated effects, researchers have investigated various aspects of the MMR-autism debate, emphasizing the complex relationship between science, media, and public opinion formation and decision-making. Particular criticism has been directed at the media coverage that the debate has received, specifically in light of the fact that there has never been any empirical evidence to support Wakefield et al.’s speculation, while empirical evidence has accumulated that directly challenges the link (see Speers & Lewis, 2004 for a thorough critique on the media coverage of the MMR-autism controversy). Some scientists consider media coverage of the Wakefield study to have been a driving influence in parents’ decisions not to immunize their children with MMR (Speers & Lewis, 2004). Regardless of who is considered to be ‘at fault,’ the MMR controversy highlights significant differences in the ways that scientists and non-scientists understand and talk about issues such as vaccination. Most importantly, the MMR controversy provides clear evidence that such gaps can have real consequences for both individual-level decision-making and public health.

Research suggests that parents tend to have limited knowledge about vaccines and may be particularly vulnerable to the ever-increasing presence of anti-vaccination groups in public debates over vaccination (Gellin, Maibach, & Marcuse, 2000). With this in mind, many in the public health and medical communities have argued for the need to disseminate more and better information about vaccines to parents. Certainly, making high-quality information easily accessible to members of the public should always be a high priority for scientists, researchers,
and physicians. However, it is unlikely, for reasons discussed above, that more information will be sufficient to bridge the gap between lay and expert beliefs about vaccines. Commenting on the MMR controversy specifically, Leask, Chapman, and Hawe (2000) observe that “there is little empirical support for the hope that decision making about vaccination is based on ‘facts’ alone” (p. 108).

As discussed above, converging evidence from multiple fields suggests that factual information is only one of the many factors that influence individual attitudes and decision-making on a given topic (e.g., Evans et al., 1997). The experiences, values, beliefs, and social norms that people hold in relation to issues like parenting, medicine, and government likely coalesce into the interpretative schemas that filter incoming information (Evans et al., 1997; Evans et al., 2001; McMurray et al., 2004; Reyna, 2011). These interpretative schemas help them to evaluate the risks and benefits associated with accepting or refusing vaccination and make decisions accordingly. This means that all incoming information about vaccination that comes from scientists and the media, and the frames embedded therein, are matched up against these interpretative schemas. The match, or mismatch, between schemas and information thus promotes particular interpretations of the information (i.e., true or not true) and ultimately promotes particular evaluations based on that information (i.e., vaccination does or does not cause vaccine-adverse events, such as autism).

**Cultural Worldviews as Interpretative Schemas**

A growing literature on the cultural cognition of risk suggests that cultural worldviews serve as particular types of interpretative schemas that influence attitudes and decision-making on matters of risk (Kahan & Braman, 2006; Kahan, Braman, & Jenkins-Smith, 2010), including vaccination. Several studies indicate that, unlike parents who miss or delay vaccinations due to
structural barriers like income or access to health services, parents who refuse vaccinations by choice tend to be white, upper middle class, and/or well-educated (e.g., Gellin et al., 2000; Gust, Darling, Kennedy, & Schwartz, 2008; Gust et al., 2004; Lawrence, Hull, MacIntyre, 2004; Parker et al., 2006; Pearce et al., 2008; Salmon et al., 2005; Smith, Chu, & Barker, 2004; Sugerman et al., 2010; Wightman, Opel, Marcuse, & Taylor, 2011; although see Cunningham, 2012; Gaudino & Robsion, 2012; and Keane et al., 2005 for some contrary evidence). These associations suggest that people who refuse vaccinations by choice may share underlying cultural worldviews that motivate their decision-making.

Research on cultural worldviews emerges from the theoretical framework set forth by Douglas and Wildavsky (1982) in which they proposed that people evaluate environmental and technological risks according to specific cultural orientations. These cultural orientations, or worldviews, are characterized along two dimensions: group and grid. Along the first dimension, people who value a low group or *individualistic* way of life place individual goals over collective goals, whereas those who value a high group or *communitarian* way of life value the collective over the individual. Along the second dimension, people who value a low grid or *egalitarian* way of life believe every person to be equally entitled to goods, status, and wealth, whereas those who value a high grid or *hierarchical* way of life believe in maintaining hierarchy that is based on skill and status.

According to this cultural orientation to risk perception, egalitarians and communitarians are more likely to support government policies aimed at reducing social inequality and minimizing risk. Individualists and hierarchists, on the other hand, are less likely to support any attempt at risk reduction that impinges on the free market economy or any established hierarchical order (Gastil, Braman, Kahan, & Slovic, 2005). Since this theoretical framework
was set forth by Douglas and Wildavsky, several studies have investigated whether the essential relationships posited between the group-grid typology and perceptions of risk do in fact hold. These studies not only confirm this relationship, but further find that group-grid typology provides greater explanatory power for variability in risk perception in relation to various policy issues than do many other individual characteristics, including education, race, income, political party identification, and political partisanship (see Gastil et al., 2005 for a discussion of this research).

In the context of vaccination specifically, cultural cognition theory suggests that individuals who hold communitarian worldviews are more likely to support policies like mandatory vaccination as a means of addressing the risks of vaccine-preventable disease than those who hold more individualistic worldviews (e.g., Kahan, Braman, Cohen, Gastil, & Slovic, 2010). As will be discussed below, several recent studies seem to support the association between cultural worldviews and vaccination attitudes, providing evidence that suggests that many parents who are skeptical about vaccines, or who delay or refuse vaccinations for their children, have specific beliefs about the authority and appropriate role of science and government in society. As predicted by cultural cognition theory, these beliefs seem to be closely aligned with an individualism-oriented worldview.

**Beliefs about science.** In general, trust in science and scientists acts as a powerful schema for citizens who are constantly confronted with information on scientific topics that they know little about (Office of Science and Technology, 2001; Sturgis & Allum, 2004; Turney, 1996; Yearley, 2000). In the MMR controversy, vaccine supporters were not the only ones who touted the objectivity of scientific findings as support for their position; in fact, vaccine opponents relied heavily on the notion that scientific research provided clear evidence of a link
between MMR and autism and thereby 'disproved' the safety of the MMR vaccine (O'Dell & Brownlow, 2005). This strategy had the effect of pitting scientist against scientist, spurring a debate over which side was actually right. According to Nisbet and Scheufele (2009), when different groups argue over what constitutes 'sound science,' as in the case of the MMR controversy, they reduce scientific knowledge to a political bargaining chip, sacrificing its claim to objectivity. This kind of debate, one that pits a scientist (in this case, Andrew Wakefield) against other scientists, threatens both the authority and perceived integrity of science.

Scientists' independence and lack of vested interest are critical for maintaining public trust (Office of Science and Technology, 2001; Yearley, 2000). The issue of trust has proven to be a particular sticking point in the public debate over vaccination safety and efficacy. Some citizens question whether scientists who argue for the safety of vaccinations might have ulterior motives, such as ties to pharmaceutical companies that produce vaccines (Benin et al., 2006; Kata, 2010; Kirkland, 2012; O'Dell & Brownlow, 2005). These concerns over scientific integrity are particularly interesting in light of the fact that Andrew Wakefield, the foremost proponent of the link between MMR receipt and autism, was found to have been developing his own vaccine at the same time that he was advocating against the use of the MMR ‘triple jab.’

Beliefs about government. Due to the government’s role in promoting vaccination and/or establishing vaccination requirements in many countries, schemas related to government also influence public decision-making regarding vaccination. Schemas about government and its role in citizens' lives take on similar forms to schemas about science – that is, citizens' conceptions of government range from positive notions of government as protector and caretaker to negative notions of government as mismanager and even intruder (e.g., government as “Big Brother”). For many who are unsure or skeptical of vaccines, it seems that a negative
government schema has largely overshadowed any positive government schema.

In the United Kingdom specifically, the 'bad government' schema was solidified for many Britons by their experience with a previous public health controversy: the bovine spongiform encephalopathy (BSE), or mad cow disease, epidemic (Bellaby, 2003; Casiday, 2007; Cunliffe, 2004; Evans et al., 2001; Hilton, Petticrew, & Hunt, 2007; Raithatha, Holland, Gerrard, & Harvey, 2003). According to the independent inquiry into the government's handling of BSE (Lord Phillips of Worth Maltravers, Bridgeman, & Ferguson-Smith, 2000), BSE had been identified as a disease in late 1995, but, because it was thought that BSE posed little risk to humans, the government waited six months before alerting the public about the extent of the BSE epidemic. The British government delayed communications to the public in an attempt to avoid prompting fears of a crisis that the government did not believe was imminent. However, as the authors of the report acknowledge, it has since been demonstrated that consumption of meat contaminated with BSE can cause a variant of Creutzfeld-Jakob disease (vCJD) in humans. The report concludes that vCJD has been linked to at least 80 deaths in the United Kingdom and observes that many of those who died were children.

As the government continued to push for the regular vaccination of children at the height of the MMR-autism controversy, some Britons questioned the intentions behind the MMR immunization program. British citizens reported a distrust of government, based on speculations that the government was engaged in some kind of conspiracy (Casiday, 2007; Cassell et al., 2006; Hilton et al., 2007; O'Dell & Brownlow, 2005; Leask, Chapman, & Hawe, 2000). The fact that both the vCJD and MMR public health crises largely affected the health of young children, a particularly vulnerable population, undoubtedly reinforced these concerns. Distrust of government continues today as many parents consider government involvement in vaccination
mandates to be an intrusion into the everyday lives of ordinary citizens and an encroachment on individual civil liberties (Bean, 2011; Evans et al., 2001; Casiday et al., 2006; Gullion, Henry, & Gullion, 2008; Kata, 2010; Kirkland, 2012; Petts & Niemeyer, 2004). They worry that government officials might be trying to cover up any vaccine-related adverse events in order to maintain the vaccination rates necessary to ensure herd immunity (Bean, 2011; Bellaby, 2003; Kata, 2010; O'Dell & Brownlow, 2005).

The specific juxtaposition of government representatives against anti-vaccination advocates further elicits a negative government schema. As Serpell and Green (2006) note, it is probably not difficult for ordinary citizens to view government as having a “self-interested investment” in engaging in a cover-up, but they have less reason to question the motives of a parent of a child with autism (p.4043). During the MMR-autism controversy, the chief medial officer in England refused to allow parents to administer the single vaccines for measles, mumps, and rubella to their children on the basis that they would be much less likely to complete the series of vaccinations if the vaccines were given individually, thus compromising population-level immunity to measles in Britain. The fact that Andrew Wakefield publicly supported the single vaccine solution at the same time that the chief medical officer stood against it provided further support for the notion that the British government was acting against citizens' best interests (Bellaby, 2003).

When viewed as a whole, the above research detailing citizens’ attitudes about science and government in the context of vaccination suggests that recent events such as the BSE scandal and the MMR-autism controversy have served to reinforce individualistic schemas for many parents. These parents believe that science and government should have a limited role in society, especially where it concerns individual- or family-level issues. They are concerned about the
safety and necessity of vaccination and believe that scientists and public officials are not trustworthy sources of information on these issues. Furthermore, they feel that government, because of its vested interest in limiting the occurrence of vaccine-preventable disease, largely interferes with parents' ability to make the vaccination decisions that are right for their children and their family (e.g., Gullion et al., Kata, 2010; Kirkland, 2012; Parker et al., 2006; Sugerman et al., 2010). According to Reich (2010), these parents strongly believe that “they know their own children best, are best qualified and most motivated to protect their children, and find that political corruption or negligence can inadvertently cause harm or undermine their goals” (p.178)

Research suggests that community-based clusters of such individualism-oriented parents in specific geographic areas may be a contributing factor in recent outbreaks of VPD in the United States (Sugerman et al., 2010).

**Parenting Attitudes as Interpretative Schemas**

Parenting attitudes, in combination with cultural worldviews, are likely to serve as an especially powerful kind of interpretative schema in vaccination decision-making. Parenting attitudes are of particular relevance to the issue of vaccination because parents are the ones making vaccination decisions on behalf of their children. While the majority of parents do continue to vaccinate their children, data clearly show that a sizable subgroup of parents have lost confidence in vaccines, are delaying vaccines, or are abstaining from vaccination altogether (e.g., Cassell et al., 2006; Dempsey et al., 2011; Gust et al., 2008; Keane et al., 2005; Kempe et al., 2011; Kennedy, Basket, & Sheedy, 2011; Omer et al., 2009; Smith et al., 2008; Smith et al., 2010; Smith et al., 2011; Speers & Lewis, 2004; Woo et al., 2004; Wightman et al., 2011). For example, Dempsey et al. (2011) found that as many as 1 in 10 parents in the United States were not following the vaccination schedule recommended by the Centers for Disease Control and
Prevention.

The fact that many parents seem to make the ‘irrational’ decision to delay or refuse vaccinations is likely to be seen as a principal-agent problem by those in the public health community – that is, parents who choose to delay or refuse vaccinations (i.e., the agents) might be viewed as pursuing their own goals at the expense of their children (i.e., the principals) (cf Brauner, Gordic, & Zigler, 2004). But regardless of parents' specific attitudes toward vaccination – whether it is good or bad, safe or unsafe – it seems likely that most, if not all, parents want to make decisions that are in their children’s best interests (Reich, 2010). As discussed above, there are simply many different considerations beyond the purported risks and benefits associated with vaccines that ultimately influence the decisions they make. As Reich explains, parents “must decide how they can best protect their children from future harm while remaining true to their (the parents’) values, beliefs, and understandings of risk” (p.178).

Making the 'correct' vaccination decision is often seen as an explicit manifestation of being a 'good' parent (Brown et al., 2012; Casiday, 2007; Leask et al., 2006). In a qualitative study of parents who refused vaccination, Senier (2008) found that the parents often reject the recommendations of government and public health officials because they do not align with their own parenting philosophy. The parents interviewed were willing to commit to time- and effort-intensive practices, such as those prescribed by the ‘attachment parenting’ approach, because they believe these practices will provide the best opportunity for encouraging their children’s healthy development. Ultimately, parents believe that they alone bear sole responsibility for protecting their child and ensuring the child's well-being (Bond & Nolan, 2011; Brown et al., 2012; Casiday, 2007; Cassell et al., 2006; Kata, 2010; Kirkland, 2012; Parker et a., 2006; Petts & Niemeyer, 2004; Senier, 2008; Sugerman et al., 2010). Research exploring parents’ attitudes
suggests that their interpretative schemas in regards to parenting are likely to play an instrumental role in shaping their opinions and, ultimately, their decisions regarding vaccination.

**Beliefs about parental responsibility.** Because parents often believe that they alone are responsible for ensuring their child’s well-being, they engage in personal risk calculations to determine which things are safe for their children and which things might be harmful (e.g., Reich, 2010). Thus, risk-benefit calculations are an essential part of everyday parenting. In North America and Western Europe, immunization programs have been so successful at reducing the rate of vaccine-preventable disease (VPD) that many citizens do not have any personal experience with VPD and have a hard time remembering ever hearing of any cases of VPD (Owens, 2002; Serpell & Green, 2006). The fact that cases of VPD are not visible enough for parents to consider these diseases to be a significant health risk seems to play a major role in their vaccination decisions. Several studies have found that parents who are skeptical of vaccinations are much less likely to consider vaccine-preventable diseases as serious health risks (Benin et al., 2006; Bardenheier et al., 2004; Bond & Nolan, 2011; Brown et al., 2012; Cassell et al., 2006; Kennedy, Brown, & Gust, 2005; Kennedy et al., 2011; Meszaros et al., 1996; Mills, Jadad, Ross, & Wilson, 2005; Salmon et al., 2005; Smailbegovic, Laing, & Bedford, 2003; Woo et al., 2004). As a result, some parents believe that they have enough control over their child's exposure and response to diseases that immunizations are simply unnecessary (Serpell & Green, 2006). Often these parents believe that vaccines actually pose a greater risk to their child’s health than the diseases the vaccines are designed to prevent (Bedford & Lansley, 2001; Gaudino & Robison, 2012; Gellatly et al., 2005; Kata, 2010; Kirkland, 2012; Meszaros et al., 1996; Smailbegovic et al., 2003).

Highly-publicized anti-vaccination campaigns, organized by groups like JABS (Justice,
Awareness, and Basic Support) in the United Kingdom and Generation Rescue in the United States, further activate a schema of parental responsibility, making cases of autism particularly memorable by highlighting emotional stories about parents who have 'vaccine-damaged' children (Hilton et al., 2007; O'Dell & Brownlow, 2005). O'Dell and Brownlow argue that the public discourse on autism, including the JABS media coverage, portrays children with autism as 'damaged' and 'faulty,' thereby implying that someone needs to 'fix' these children. For parents of autistic children, this implicit message directly implicates them as the ones responsible for their children's autism. They consciously decided to have their children vaccinated with MMR and the children were 'damaged' as a result of that decision (O'Dell & Brownlow, 2005). For parents of 'normal' children, this message underscores their responsibility for ensuring their children's health.

Working from this schema of parental responsibility, parents recognize that, unlike measles, the course of autism is not easily managed or controlled. These parents do believe, however, that they have control over their children's exposure and response to VPDs (e.g., Brown et al., 2012; Meszaros et al., 1996; Serpell & Green, 2006). They believe that they can avoid increased risk for autism by refusing vaccinations for their children and they will simply deal with any cases of VPD that may result (Bond & Nolan, 2011; Brown et al., 2012; Casiday, 2007; Meszaros et al., 1996; Serpell & Green, 2006). In fact, many parents believe that homeopathic or alternative treatments and natural or holistic approaches to medicine will adequately protect their child’s health (Bean, 2011; Cassell et al., 2006; Duffell, 2001; Evans et al., 2001; Fredrickson et al., 2004; Gellin et al., 2000; Gullion et al., 2008; Hobson-West, 2003; Kata, 2010; Kennedy et al., 2005; Kirkland, 2012; Salmon et al., 2005; Senier, 2008). Many parents believe that so-called ‘natural’ immunity is preferable to immunity conferred by
vaccination and a recent news article notes that some parents will go so far as to organize or seek out chicken pox parties in an attempt to ensure that their children contract varicella (Tanglao, 7 November 2011). This preference for natural immunity among some parents is significant enough that it even elicited a mail-order scheme: one company supposedly advertised varicella-containing lollipops that parents could give to their children to ensure natural immunity against the disease.

It is clear, then, that parents’ sense of responsibility and need for control are incredibly influential factors in the vaccination decision-making process. What is not clear, however, is how these parenting-related factors fit into the broader developmental framework of parenting attitudes. Since at least some of the parents who delay or refuse vaccinations seem to value a ‘natural’ lifestyle and approaches like attachment parenting, it seems plausible that they might also adopt more ‘progressive’ attitudes toward parenting (along the lines of the progressive parenting attitudes measured by the Parental Modernity Scale; Schaefer & Edgerton, 1985). Unfortunately, explicit links to developmental theory are noticeably lacking in the literature on parents’ vaccination decision-making.

Framing as a Tool for Public Engagement on Vaccination

One important method of promoting public support for developmental science is through the creation and dissemination of communications that reframe the public discourse and open up more productive conversations about developmental issues. Media framing of issues related to child development has become particularly important in the context of vaccination. In a recent editorial, Ash (2010) highlighted the importance of communicating the benefits of vaccination, arguing that it is critical that we “maintain a public consensus about the extraordinary value of vaccination to individuals and society” (p.2).
As Ash’s commentary implies, when it comes to issues of child health including vaccination, there are two levels of target outcomes: individual-level outcomes (e.g. behavior) and societal-level outcomes (e.g., policy). Framing research indicates that different kinds of messages promote thinking on these two levels (Iyengar, 1991). Messages that feature episodic frames – focusing on specific individuals and incidents – encourage people to attribute responsibility for an issue to the individual. Messages that feature thematic frames – focusing on societal, political, and structural factors – encourage people to consider policy options that hold society accountable for addressing the issue. For example, Iyengar (1991) found that in the context of the social issue of poverty, respondents were more likely to hold the poor themselves responsible for their situation after exposure to news reports that featured episodic treatments of poverty; on the other hand, when they were exposed to news reports with thematically-framed stories about poverty, respondents were more likely attribute responsibility to societal institutions. In the specific context of child development, episodic messages predispose people to hold individual parents and families responsible for a child’s development, while thematic messages allow people to see how broad-based policies can help to promote healthy child development (Shonkoff & Bales, 2011).

Typical vaccination promotion messages focus on the negative health outcomes a child may suffer as a result of his or her parents’ decision to forego vaccination. These messages seem to be based on the idea that employing this kind of episodic frame - emphasizing an individual child's risk of contracting a VPD- will encourage perceptions of individual responsibility among parents. This type of message assumes that parents will engage in 'rational' cost-benefit analysis and conclude that the risk of a VPD is greater than that of a vaccine-adverse event (VAE) (e.g., Senier, 2008). As a result, parents will feel it is their responsibility to ensure their child's health
by vaccinating the child. However, the current understanding of risk-oriented decision-making suggests that such episodic, risk-oriented messages may have the unintended effect of reinforcing parents’ concerns about the risk of their child experiencing a VAE and even lead to the avoidance of vaccination (Alaszewski & Horlick-Jones, 2003; Betsch, 2011; Senier, 2008). This is likely due to the fact that vaccines have been so successful in reducing the spread of VPD in developed nations that stories of VAE may be more available and more memorable than stories of VPD, regardless of the fact that the true risk of contracting a VPD is greater than the risk of experiencing a VAE (Owens, 2002; Serpell & Green, 2006).

Concerns regarding individual risk of VPD and VAE play a clear role in parents' decisions to vaccinate, but some argue that ‘collective’ values are also important in the decision-making process (Leask & McCartney, 2008). Studies have found that people do consider social responsibility and societal benefits of vaccination when making vaccination decisions (Casiday, 2007; Hershey et al., 1994; Leask, Chapman, Hawe, & Burgess, 2006; Petts & Niemeyer, 2004; Skea, Entwistle, Watt, & Russell, 2008; Vietri, Galvani, & Chapman, 2011). Indeed, the majority of people consider elimination of VPD to be a “community responsibility” in that it cannot be achieved on an individual basis; elimination of VPD requires the collective effort of citizens in the community (Jenkins-Smith, Silva, & Song, 2010).

Although framing theory suggests that episodic messages are more likely to be effective in promoting a sense of individual responsibility, some authors (e.g. Hobson-West, 2003; Leask et al., 2006; Reyna, 2011; Skea, Entwistle, Watt, & Russell, 2008) have wondered whether more thematic messages about social responsibility might increase support for the decision to vaccinate among those who are concerned or unsure about vaccination. There is very little existing research investigating the influence of the framing of such messages on attitudes toward
vaccination. The few studies that do exist have focused primarily on the impact of gain-loss frames, or frames that highlight either the specific risks or benefits that result from vaccination (Abhyankar et al., 2008; Bartels, Kelly, & Rothman, 2010; Donovan & Jalleh, 2000; Ferguson & Gallagher, 2007; Gerend & Shepherd, 2007; Gerend et al., 2008) (see O’Keefe & Nan, 2012 for a review of gain-loss studies related to vaccination). As such, the potential influence of episodic and thematic frames on attitudes toward vaccination has yet to be examined.

**Dissertation Goals**

The overarching objective of this research is to examine the factors that influence people’s attitudes toward vaccination as a way of elucidating the factors that might ultimately influence people’s decisions to vaccinate their children and their support for mandatory vaccination policy. This research is important to the advancement of science because it bridges several scientific domains in examining the interactions between individual-level interpretative schemas, as derived from cultural worldviews and parenting attitudes, and message frames on the important developmental and public health issue of childhood vaccination. Due to its interdisciplinary nature, this research has the potential to contribute to domains as diverse as developmental science, decision-making, risk perception, communication, and public health.

This research will extend existing theory on cultural cognition by examining the ways in which cultural worldviews relate to issues of parenting and child development. Furthermore, the examination of parenting attitudes in the context of decision-making will begin to fill in a noticeable gap in the decision-making literature. Vaccination decisions are made by parents on behalf of their children, and these decisions reflect parents’ beliefs about not only healthy development but also about their roles as parents. Previous work on vaccination decision-making has examined the schema of parental responsibility, but has failed to examine parenting as it is
conceptualized in developmental theory. As such, this dissertation will aim to bridge the vaccination decision-making literature and the developmental literature by looking specifically at how people view parenting and childrearing. From the child development literature, we know that parents’ progressive and traditional childrearing attitudes, such as those measured by the Parental Modernity Scale (Schaefer & Edgerton, 1985), are correlated with various measures of child development, including cognitive, language, and academic outcomes (e.g., Dearing, 2004; McCartney, Dearing, Taylor, & Bub, 2007; Shears & Robinson, 2005). Understanding how these same attitudes relate to decision-making on issues related to children’s well-being is, however, a completely neglected area of research.

While several studies have employed qualitative methods, such as in-depth interviews, to understand the decision-making process that parents go through when it comes to vaccination (e.g., Benin et al., 2006; Brown et al., 2012; Evans et al., 2001; Fredrickson et al., 2004; Gullion et al., 2008; Senier, 2008), there has been little examination of this process using quantitative methods that are able to model the pathways that underlie attitude formation and decision-making. The proposed study will begin to fill this gap in knowledge, using structural equation modeling, to examine whether and how interpretative schemas, like cultural worldviews and childrearing attitudes, shape attitudes toward both individual-level vaccination and vaccination policy.

This research will also add to the relatively small existing literature on message framing in the context of vaccination. While framing is commonly seen as an effective communications tool, there is little existing research that indicates which kinds of frames might be effective or productive in the context of the public discourse on vaccination. Previous framing studies on vaccination have primarily investigated the effect of gain-loss frames on attitudes toward
vaccination. Furthermore, the existing research does not investigate the impact of framing on individual-versus policy-level outcomes. As such, the proposed research represents a novel investigation of message framing in the context of vaccination, examining the potential influence of episodic and thematic frames on people’s attitudes toward both individual-level support for vaccination uptake and policy-level support for mandatory vaccination.

This research also has the potential to make significant contributions to policy- and practice-oriented domains. Findings from this research will have implications for efforts to promote vaccination decision-making and policy in a manner that better reflects the scientific consensus on vaccination. Specifically, this research may provide guidance to public health specialists and science communicators on how the scientific understanding of vaccination can be communicated to the public. This research is designed so that it will be possible to identify the influence that the experimental message frames have on support for vaccination decisions and vaccination policy. It will also be possible to examine the potential mediating role of cultural worldviews and parenting attitudes in shaping vaccination-related attitudes and decision-making. As such, the proposed research will provide guidance on how to communicate about vaccination to the public.

More broadly, this research has implications for research-based communications that effectively promote the well-being of children and families. This research will bring a developmental perspective to research questions that are typically examined within the domain of public health. By integrating these two perspectives, the proposed research will provide guidance on how issues at the intersection of these perspectives (e.g., obesity, child mental health, vaccination) can successfully be communicated.
Specific Aims and Hypotheses

The first aim of the proposed research is to investigate whether different message frames can influence people’s attitudes toward vaccination decisions and vaccination policy. Furthermore, this aim serves to examine whether the effects of episodically- and thematically-framed messages depend on the outcomes that are being measured, as suggested by framing theory. The first research question and associated hypotheses can be formally stated as:

*RQ1.* Do episodic and thematic message frames influence support for vaccination decisions and vaccination policy when compared to controls? If so, do the effects observed differ between vaccination decisions and vaccination attitudes?

*H1.* It is hypothesized that the frame effects will vary by outcome measure such that the effect of the message frame conditions will be different for support for individual-level vaccination decision and support for vaccination policy. It is hypothesized that participants exposed to an episodic family-oriented frame will demonstrate greater support for the decision to vaccinate than those exposed to no frame or to a thematic community-oriented frame, while participants exposed to the thematic frame will demonstrate greater support for vaccination policy than those exposed to no frame or the episodic frame.

The second aim of the proposed research is to investigate the underlying relationship between various individual-level and demographic characteristics and attitudes toward vaccination decisions and vaccination policy. The second research question and associated hypotheses can be formally stated as:

*RQ2:* Is there a relationship between individual-level and demographic characteristics and people’s attitudes toward vaccination decisions and
vaccination policy?

$H2$: Specific factors, including education, income, race, political party affiliation, born-again identification, and previous adverse experiences with vaccines will significantly predict attitudes toward vaccination decisions and vaccination policy.

The third aim of the proposed research is to examine the relationship between additional individual-level factors, like cultural worldviews (e.g., Kahan, Jenkins-Smith, & Braman, 2010) and parenting attitudes (e.g., Schaefer & Edgerton, 1985), and people’s attitudes toward vaccination decisions and vaccination policy. This aim serves, in part, to confirm existing findings on the correlation between cultural worldviews and attitudes toward risk, as reviewed above. This aim also expands on the existing literature on vaccination decision-making by investigating the relationship between parenting attitudes and attitudes toward vaccination. The third research question and associated hypotheses can be formally stated as:

$RQ3$: Is there a relationship between individual-level factors, such as parenting attitudes and cultural worldviews, and people’s attitudes toward vaccination decisions and vaccination policy?

$H3$: Participants’ scores on the traditional parenting beliefs and progressive parenting beliefs subscales of the Parental Modernity Scale and their individualism scores on the Cultural Worldviews scales will be significant predictors of attitudes toward vaccination decisions and vaccination policy.

The fourth aim of the proposed research is to investigate whether parenting attitudes and cultural worldviews mediate the relationships between demographic characteristics and vaccination attitudes. The fourth research question and associated hypotheses can be formally
stated as:

*RQ4.* Are the indirect pathways from demographic characteristics to vaccination attitudes through parenting attitudes and cultural worldviews statistically significant?

*H4.* Several indirect pathways between demographic characteristics, for example from political party affiliation to vaccination attitudes through cultural worldviews, will be statistically significant.

**CHAPTER II: METHODS**

**Participants**

This study was conducted with a nationally representative sample of 830 U.S. adults (age 18 or older). The participants were drawn from the YouGovPolimetrix PollingPoint panel, an existing opt-in survey panel that is comprised of 1.5 million U.S. residents who have agreed to participate in YouGovPolimetrix web surveys. PollingPoint panel members are recruited through a number of methods, including web advertising campaigns, permission-based email campaigns, partner sponsored solicitations, telephone-to-Web recruitment, and mail-to-Web recruitment. Participants are not paid to join the PollingPoint panel. By participating in PollingPoint surveys, participants are awarded “PollingPoints” that are redeemable for small gifts described on the panel portal website. In general, survey reward policies and incentives are intended to be unattractive to professional survey takers but serve as a token of appreciation for PollingPoint panelists.

A total of 2,211 PollingPoint panel members were sent an invitation to complete the online survey. Of those, 1,048 did not respond to the survey invitation. Of the respondents who started or opened the survey, 931 completed the survey, 111 started but did not complete the
survey, and 121 refused to complete the survey. In sum, the overall response rate to the survey was about 42.11%. The respondents for the 931 completed surveys were then matched to demographic characteristics, including gender, age, race, education, and party identification, to create a nationally representative sample of 830 participants.

Of the final sample of 830 participants, just over half (52.7%) were female and almost three-quarters (71.7%) were white. Participants ranged from 19 to 85 years of age, with an average age of about 49.8 years. The three major political parties were fairly equally represented across the participants: Democrat (35.7%), Republican (25.7%), Independent (32.4%). Close to two-thirds of participants in the study were parents (61.6%). In general, the sample was heterogeneous in terms of both education and income (see Table 1 for a full description of sample characteristics).

**Procedure**

The researcher provided YouGovPolimetrix with the survey instrument for this study (see Appendix A), which was then programmed as an online survey.

Eligible participants were asked to participate in a public opinion research study. Because no identifying data was to be collected from participants, the study was deemed exempt by the Georgetown University IRB. All participants were, nonetheless, provided a brief, general description of the survey and the potential risks involved and were asked to opt in to the survey by pressing a button so as to ensure participants’ informed consent (see Appendix B).

All data for this study were collected by YouGovPolimetrix and then forwarded to the researcher (Anna Mikulak) in an SPSS document that was purged of any identifying information.

**Survey Instrument and Measures**

The online survey that participants completed consisted of the following sections: (1)
message with experimental frame; (2) items measuring vaccination attitudes; (3) questions about individual characteristics; (4) items measuring parenting attitudes; and (5) items measuring cultural worldviews.

**Message treatment.** The first section of the survey consisted of a message that participants were asked to read. Participants were randomly assigned to receive no message (control, n = 274), a family-oriented episodic message (family, n = 268), or a community-oriented thematic message (community, n = 283). As there are no existing studies that have examined the impact of episodic and thematic frames in the context of vaccination, the experimental messages used in this study were developed by the researcher following consultation with staff at the FrameWorks Institute. The FrameWorks Institute is a non-profit organization that conducts communications research focused on the strategic framing of public policy issues as informed by the literature on episodic and thematic frames (e.g., Iyengar, 1991).

The family message read as follows: “Lately there has been a lot of talk about health in families. Every parent has a stake in making sure that their children are healthy and they have a lot of choices to make when it comes to promoting their children’s health. One way that parents keep their children healthy is to obtain vaccinations for their children to stop the spread of disease in the family. Parents, for example, send their children to be vaccinated before they enroll in school. By making this decision, parents ensure the health of their children and the benefits are shared by the whole family. Have you heard of this explanation for why families have a major role to play in children’s vaccinations?”

The community message read as follows: “Lately there has been a lot of talk about public health in communities. Every community has a stake in making sure that its residents are healthy and they have a lot of choices to make when it comes to promoting the public’s health. One way
that communities keep their residents healthy is by encouraging vaccinations for all children to stop the spread of disease. Schools, for example, in communities often require children to be vaccinated before they enroll in school. By making such policies, communities ensure the health of their residents and the benefits are shared by everybody. Have you heard of this explanation for why communities have a major role to play in children’s vaccinations?”

**Vaccination attitudes.** The second section of the survey was designed to measure participants’ support for the decision to vaccinate and support for vaccination policy. Participants were asked to answer the questions in this section as if they were parents of an infant who has not yet been vaccinated. The use of a hypothetical scenario was necessary in this study because vaccination decisions, unlike decisions about other preventive health behaviors (e.g., diet, sun protection), are made at specific time points over childhood and are not reversible. Recruiting a large, nationally representative sample of parents who are considering vaccination but whose children have not yet been vaccinated is not feasible in the scope of most research programs. As such, previous studies examining vaccination decisions have made use of hypothetical scenarios as a means of measuring behavioral intention to vaccinate (e.g., Abhyankar, O’Connor, & Lawton, 2008; Donovan & Jalleh, 2000).

In the proposed research, support for the decision to vaccinate was measured using eight items including: “My child should be vaccinated against diseases,” “If my child was not vaccinated, I would get my child vaccinated,” “Vaccinations are safe for my child,” “Vaccines are necessary to preserve my child’s health,” “Vaccines are important for ensuring my child is healthy” (adapted from existing literature, e.g., Abhyankar, O’Connor, & Lawton, 2008; Kahan et al., 2010).

Support for vaccination policy was measured using eight items including: “All children
should be vaccinated against diseases,” “Vaccinations are safe for children,” “Children should be vaccinated to preserve their health,” “Vaccines are important for ensuring children are healthy,” “Universal vaccination is important for ensuring children’s health” (adapted from existing literature, e.g., Kahan et al., 2010; Manuel & Gilliam, 2008).

Items assessing support for vaccination and vaccination policy were measured on a four-point Likert scale (1 = strongly disagree, 4= strongly agree). The scores reported for the items were summed to create an overall scale for each construct (i.e., one scale measuring support for vaccination decision and one scale measuring support for vaccination policy). These scales were internally consistent (Support for vaccination decision $\alpha = .93$; Support for vaccination policy $\alpha = .94$). Presentation of these items was randomized so as to eliminate any order effects.

**Individual characteristics.** The third section contained questions about individual characteristics. Participants were asked whether they had any children and whether they, or anyone they knew, had ever experienced an adverse effect of vaccination. Participants were also asked about their attentiveness to news and interest in science, using items drawn from the National Science Board’s most recent Science and Engineering Indicators report (National Science Board, 2010), although these questions were not examined in the present study. Demographic information, such as level of education, family income, race, religious affiliation, and political affiliation, was provided by YouGovPolimetrix as part of the standard background information collected for all PollingPoint panel participants.

**Parenting attitudes.** The fourth section assessed participants’ childrearing beliefs using the Parental Modernity Scale (Schaefer & Edgerton, 1985). An abbreviated version of the Parental Modernity Scale has been developed and used in previous research to examine parents’ beliefs on two five-item scales: progressive beliefs and traditional beliefs (Administration for
Children and Families, 2012). The traditional beliefs scale contains items related to parent and teacher authority, including “Children should always obey the teacher,” “Children will not do the right thing unless they must,” “The most important thing to teach children is absolute obedience to authority.” The progressive beliefs scale contains items related to child autonomy and expression, including “When their child is pretending something, parents should go along with the game,” “Children should be allowed to disagree with their parents if they feel their own ideas are better,” and “A child’s ideas should be seriously considered in family decisions.” In previous research, the reported internal consistency of the two abbreviated scales (Traditional Beliefs $\alpha = .59$; Progressive Beliefs $\alpha = .58$) (Vogel et al., 2011) was below the commonly used cutoff of $\alpha = .70$. In the present study, however, the scales demonstrated greater internal consistency and approached or exceeded the .70 cutoff (Progressive Beliefs $\alpha = .69$; Traditional Beliefs $\alpha = .71$). As Schmitt (1996) cautions, relying on a strict cutoff to determine the adequacy of the coefficient alpha can be shortsighted and does not necessarily resolve issues of reliability. Given that these scales captured aspects of parenting attitudes not contained in other parenting-related measures, and given that scale length is a significant concern in the context of a multi-part survey, the abbreviated versions of the parenting attitudes scales were kept in the survey and used in later data analyses.

Each scale contains five items, with each item rated on a five-point Likert scale (1 = strongly agree and 5 = strongly disagree). For the present study, the scoring for the items on the Progressive scale was then reversed so that increasing numbers on the scale indicate greater agreement (i.e., 1 = strongly disagree and 5 = strongly agree). We kept the original scoring for the Traditional scale so that increasing numbers on the scale indicate less traditional parenting attitudes. This was done so that the parenting attitudes scales would be easily interpretable and so
that they would have the same directionality as the other scales used in this study. The scores reported for the five items were summed (with some items reverse-coded) to create the overall scale. Presentation of these items was randomized so as to eliminate any order effects.

**Cultural worldviews.** The fifth section assessed participants' cultural worldviews, adapted from the short forms of the individualism-communitarianism and hierarchism-egalitarianism scales, which have been found to internally consistent measures (Hierarchy scale $\alpha = .87$; Individualism scale $\alpha = .81$) (Kahan, Jenkins-Smith, & Braman, 2010). The individualism-communitarianism scale contains items like “The government interferes far too much in our everyday lives,” “Sometimes government needs to make laws that keep people from hurting themselves” (a reverse-coded item), and “The government should do more to advance society’s goals, even if that means limited the freedom and choices of individuals” (another reverse-coded item). The hierarchism-egalitarianism scale includes items like “We have gone too far in pushing equal rights in this country,” “Our society would be better off if the distribution of wealth was more equal” (a reverse-coded item), and “Society as a whole has become too soft and feminine.” Each scale contains six items, with each item rated on a four-point scale (1 = strongly disagree, 4 = strongly agree). The scores reported for the six items were summed to create the overall scale. These scales were internally consistent (Hierarchy scale $\alpha = .88$; Individualism scale $\alpha = .84$). Presentation of these items was randomized so as to eliminate any order effects.

**Missing Data**

To obtain overall scale scores for participants who did not complete all of the items in a given scale (i.e., Vaccination Decision, Vaccination Policy, Progressive Beliefs, Traditional Beliefs, Hierarchism, Individualism), the scale score was computed by taking the mean of the items that the participant did complete and multiplying it by the total number of items in the
scale. Five participants were removed from the study for not completing any of the items on two or more of the six scales. Thus, of the original 830 participants, 825 (99.40%) were included in subsequent data analyses.

**Data Analyses**

Descriptive statistics were calculated to examine the mean and standard deviation for each variable of interest, as well as the correlations among all variables of interest. Correlations were used to check the coherence of the three latent variables (vaccination attitudes, parenting attitudes, and cultural worldviews) that were to be included in subsequent structural model analyses (discussed below).

While the whole sample included both parents and non-parents, the items measuring support for vaccination decision were related to a hypothetical scenario in which participants were asked to think about making vaccination decisions for ‘their’ child. An analysis of variance (ANOVA) was used to examine whether there were any significant differences in parents’ and non-parents’ support for the decision to vaccinate and support for vaccination policy. This ANOVA was used to check whether the sample could be collapsed across parental status in subsequent group comparison and structural model analyses.

To address research question 1, ANOVAs were used to examine the main effect of message treatment group (no message, family-oriented message, or community-oriented message) on support for vaccination decision and vaccination policy.

To address research questions 2, 3, and 4, a structural model was hypothesized and structural equation modeling (SEM) was used to examine the direct and indirect pathways between individual characteristics, parenting, attitudes, cultural worldviews, and vaccination attitudes.
The structural model was also compared across parents and non-parents and across participants who received the family message and those who received the community message to examine whether the structural relationships specified in the model varied according to parental status or message treatment.

CHAPTER III: RESULTS

Descriptive Statistics

Intercorrelations among the variables, as well as their means and standard deviations are presented in Table 2. Of particular note, previous adverse vaccine reaction was negatively correlated with support for vaccine decision, \( r(823) = -.28, p < .01 \), and vaccine policy, \( r(823) = -.30, p < .01 \). Both cultural worldviews – individualism and hierarchism – were also negatively correlated with support for vaccine decision (individualism: \( r(823) = -.29, p < .01 \); hierarchism: \( r(823) = -.25, p < .01 \)) and vaccine policy (individualism: \( r(823) = -.33, p < .01 \); hierarchism: \( r(823) = -.26, p < .01 \)). Progressive parenting was weakly positively correlated with support for vaccine decision, \( r(823) = .10, p < .01 \), and support for vaccine policy, \( r(823) = .10, p < .01 \).

Most notably, support for vaccination decision and support for vaccination policy showed a high positive correlation with each other, \( r(823) = .92, p < .01 \).

Latent Variable Constructs

Simple correlations were used to determine whether the subscales for each construct comprised a single latent variable, since each of the latent constructs in the model (vaccination attitudes, parenting attitudes, and cultural worldviews) contained only two component scales. As discussed above, the two scales comprising the vaccination attitudes outcome variable, support for vaccination decision and support for vaccination policy, showed a strong positive correlation, \( r(823) = .92, p < .01 \). The two scales comprising the parenting attitudes mediating variable,
progressive parenting and less traditional parenting, showed a significant, though comparatively weak, positive correlation, \( r(823) = .16, p < .01 \). The two scales comprising the cultural worldviews mediating variables, individualism and hierarchism, showed a moderate positive correlation, \( r(823) = .65, p < .01 \). The fact that the correlations between the measures contained in each latent variable were significant suggests that all three latent variables signify coherent factors or constructs.

**Parental Status Comparison**

Because those participants with no children (referred to hereafter as non-parents) have not had to make a vaccination decision on behalf of their own child, it is possible that they might have trouble relating to the issue of vaccination decision-making and might, therefore, respond to questions about vaccination attitudes differently than would parents who have actually been through the process. As such, we compared support for vaccination decision and support for vaccination policy across parents and non-parents to examine whether they demonstrated any difference in their responses following the hypothetical scenario presented at the beginning of the survey. ANOVAs revealed no significant difference in support for vaccination decision, \( F(2, 822) = .038, p = .96 \), or support for vaccination policy, \( F(2, 822) = .111, p = .90 \) between parents and non-parents. As there was no main effect of parental status on support for vaccination decision or support for vaccination policy, we ran subsequent analyses on the full sample.

**Message Treatment Effect**

To address the first research question, we examined whether there was any effect of message treatment on vaccination attitudes by comparing support for vaccination decision and support for vaccination policy across the three message treatment groups to examine whether there was any effect of message treatment on vaccination attitudes. ANOVAs revealed no
significant difference in support for vaccination decision, $F(2, 822) = 1.137, p = .32$, or support for vaccination policy, $F(2, 822) = .787, p = .46$, between participants who received no message, participants who received a family message, and participants who received a community message. As there were no significant differences in vaccination attitudes across message treatment groups, structural equation models were run on the full sample.

**Hypothesized Structural Model**

To address research questions 2, 3, and 4, we hypothesized a structural model in which a set of individual-level and demographic indicators (education, income, race, parental status, self-identification as born again, previous adverse response to vaccines, and political party) are related to a vaccination attitudes outcome variable (latent construct comprised of both support for vaccination decision and support for vaccination policy) through two specific mediating variables: cultural worldviews (latent construct comprised of scales measuring individualism and hierarchism) and parenting attitudes (latent construct comprised of scales measuring less traditional parenting attitudes and progressive parenting attitudes). As such, the hypothesized model specified direct paths from each indicator variable to each of the mediating and outcome latent variables, indirect paths from the indicator variables to the outcome variable via the mediating variables, and direct paths among the mediating and outcome variables (see Figure 1).

**Model Fit**

Several measures of model fit were examined as there is no one statistic that definitively evaluates the fit of a model in structural equation modeling. Due to its sensitivity to sample size, chi-square was deemed an inappropriate measure of model fit in this study. Instead, three other fit statistics – the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA) – were used to assess model fit. According to generally
accepted criteria, a structural model is deemed to have a ‘good’ fit if the CFI is greater than .95, TLI is greater than .95, and/or RMSEA is less than .06 (Hu & Bentler, 1999). With these criteria in mind, the structural model hypothesized in this study fit the data well ($CFI = .984$, $TLI = .967$, $RMSEA = .042$).

**Direct Pathways**

The unstandardized coefficients and statistical significance of all direct pathways in the structural model are depicted in Figure 1 and are discussed below.

**From indicators to vaccination attitudes.** To address the second research question, we examined the direct pathways between the demographic indicator variables and the latent vaccination attitudes outcome variable to see whether there were any significant unmediated relationships with the outcome variable in the hypothesized model. This examination revealed that education ($B = .33, SE = .17, p = .047$), race (white versus other) ($B = 1.29, SE = .51, p = .01$), and parental status ($B = .88, SE = .36, p = .02$) were positively related to vaccination attitudes, while born-again identification ($B = -1.16, SE = .47, p = .01$) and previous adverse experiences with vaccines ($B = -2.89, SE = .47, p = .00$) were negatively related to vaccination attitudes. That is, those participants who had higher levels of education, who were white, and who were parents demonstrated greater support for the decision to vaccinate and for vaccination policy, while those who identified as born-again and who reported adverse effects from vaccines demonstrated less support for the decision to vaccinate and for vaccination policy. Of the various indicators, previous adverse reactions to vaccines accounts for the greatest amount of variance in vaccination attitudes (about 6%) (see Table 3).

**From indicators to parenting attitudes.** Next, we examined the direct pathways between the demographic indicator variables and the parenting attitudes construct to see whether
there were any significant direct relationships with this specific mediating variable in the hypothesized model. Examination of individual paths between the indicator variables and the parenting attitudes construct revealed that education ($\beta = .53, SE = .10, p = .00$), income ($\beta = .07, SE = .03, p = .04$), race (white versus other) ($\beta = .77, SE = .29, p = .01$), and political party (Independent versus other) ($\beta = .61, SE = .24, p = .00$) were positively related to parenting attitudes. That is, those participants who had higher levels of education, higher levels of family income, who were white, and who identified as Independents espoused less traditional, more progressive parenting attitudes. Self-identifying as a born-again Christian, on the other hand, was negatively related to parenting attitudes ($\beta = -1.62, SE = .28, p = .00$). Thus, those who identified as born again espoused more traditional, less progressive parenting attitudes.

**From indicators to cultural worldviews.** We also examined the direct pathways between the demographic indicator variables and the cultural worldviews construct to see whether there were any significant direct relationships with this specific mediating variable in the hypothesized model. Examination of individual paths between the indicator variables and the cultural worldviews construct revealed that income ($\beta = .12, SE = .03, p = .00$), race (white versus other) ($\beta = 1.13, SE = .25, p = .00$), parental status ($\beta = 1.09, SE = .23, p = .00$), born-again identification ($\beta = 1.80, SE = .24, p = .00$), bad vaccine reaction ($\beta = .65, SE = .29, p = .03$), and political party (Independent versus other) ($\beta = .99, SE = .24, p = .00$) were positively related to cultural worldviews. That is, participants who had higher income, who were white, who were parents, who identified as born-again, who reported adverse effects of vaccination, and who identified as Independents reported more individualistic and hierachical worldviews. Education was negatively related to cultural worldviews ($\beta = -.38, SE = .08, p = .00$); thus, those who had higher levels of education reported less individualistic and hierarchist worldviews.
**Between mediating variables.** We examined the path between parenting attitudes and cultural worldviews to see if there was a significant direct relationship between the two mediating variables in the hypothesized model. Examination of the path between parenting attitudes and cultural worldviews revealed that the two latent variables were negatively associated ($B = -2.25, SE = .42, p = .00; \beta = -.44, SE = .12, p = .00$). That is, those participants who had less traditional, more progressive parenting beliefs demonstrated less hierarchical, less individualistic worldviews.

**From mediating variables to outcome variable.** To address the third research question, we examined the path from parenting attitudes to vaccination attitudes and from cultural worldviews to vaccination attitudes to see whether there were significant direct relationships between each mediating variable and the outcome variable. This examination revealed that parenting attitudes ($B = -.62, SE = .31, p = .04$) and cultural worldviews ($B = -.70, SE = .13, p = .00$) were both negatively related to vaccination attitudes. Participants who had less traditional, more progressive parenting attitudes and more individualistic, more hierarchical worldviews reported less support for the decision to vaccinate and for vaccination policy. Parenting attitudes account for about 10% of the variance in vaccination attitudes, while cultural worldviews account for about 21% of the variance (see Table 3).

**Indirect Pathways**

In relation to the fourth research question, examination of the model suggested that several indirect pathways may also exist between the indicator variables and vaccination attitudes as mediated by the latent variables of parenting attitudes and cultural worldviews (see Table 4).

**Mediation through parenting attitudes.** The indirect pathway from education ($B = -.33,
$SE = .17, p = .05$) to vaccination attitudes as mediated by parenting attitudes was significant. That is, higher education was associated with lower support for vaccination when mediated by parenting attitudes, due to the negative relationship between parenting attitudes and vaccination attitudes. The indirect pathway from identification as born-again ($B = 1.00, SE = .52, p = .055$) to vaccination attitudes as mediated by parenting attitudes was marginally significant.

**Mediation through cultural worldviews.** The indirect pathways from education ($B = .27, SE = .07, p = .00$), income ($B = -.08, SE = .03, p = .001$), race ($B = -.79, SE = .22, p = .00$), parental status ($B = -.76, SE = .21, p = .00$), born-again identification ($B = -1.26, SE = .28, p = .00$), bad vaccine reaction ($B = -.45, SE = .22, p = .04$), and political party ($B = -.69, SE = .21, p = .00$) to vaccination attitudes as mediated by cultural worldviews were all significant. That is, higher education, lower income, other race, not having children, not identifying as born again, not having experienced previous adverse vaccine reactions, and not identifying as an Independent were associated with greater support for vaccination, when mediated by cultural worldviews.

**Structural Model Comparisons**

**Parental status.** We looked at the structural model across parental status to see whether the pathways between variables specified in the hypothesized model displayed the same relationships for parents and for non-parents. Intercorrelations among the variables, as well as their means and standard deviations are presented for the subsample of parents in Table 5 and for the subsample of non-parents in Table 6. The structural model hypothesized still fit the data well ($CFI = .981, TLI = .964, RMSEA = .047$).

Examining the relationships between parenting attitudes, cultural worldviews, and vaccination attitudes between parents and non-parents revealed only one statistically significant
difference in the pathways between the two groups. The relationship between parenting attitudes and cultural worldviews was significantly different between parents and non-parents, $\chi^2 (1) = 3.95, p < .05$ (see Figure 2). Specifically, the relationship between these two mediating variables was more strongly negative for parents than for non-parents, suggesting that, for people do not have children, individualistic worldviews are more strongly related to less progressive parenting attitudes than for people who have children.

**Message treatment.** We also looked at the structural model across message treatment to see whether the pathways between variables specified in the hypothesized model showed the same relationships for participants who received the family message (n = 268) and participants who received the community message (n = 283). Intercorrelations among the variables, as well as their means and standard deviations are presented for group that received the community message in Table 7 and for the group that received the family message in Table 8. The structural model hypothesized still fit the data well ($CFI = .981$, $TLI = .964$, $RMSEA = .045$).

Group comparisons across participants who received a community message and participants who received a family message revealed no significant differences for the three pathways between parenting attitudes, cultural worldviews, and vaccination attitudes (see Figure 3). That is, the experimental message received showed no discernible effect on the relationships among these three variables.

**CHAPTER IV: DISCUSSION**

The overarching goal of this dissertation was to gain a clearer picture of the various contextual factors that influence people’s attitudes toward vaccination as a way of elucidating the factors that might ultimately influence people’s decisions to vaccinate their children and their support for mandatory vaccination policy. This dissertation draws upon existing strands of
research from various domains, including developmental science, decision-making, risk perception, and communication, and aims to integrate them within one empirical study. Specifically, this research is designed to go beyond mere demographic associations to examine and model the various beliefs and attitudes that may underlie parents’ vaccination decision-making.

In general, the findings reported above support the idea that the causal story underlying vaccination decision-making is perhaps more complex and nuanced than has been assumed in previous quantitative research. While our findings did not support the hypothesis that episodic and thematic message frames would differentially affect vaccination attitudes (H1), the findings did confirm our three subsequent hypotheses. Specifically, the structural model in this study provided evidence for significant direct pathways between specific individual-level characteristics and vaccination attitudes (H2). The model also provided evidence for significant direct pathways between parenting attitudes and vaccination attitudes and between cultural worldviews and vaccination attitudes (H3). Finally, the model provided evidence for the fact that many of the relationships between individual-level factors and vaccination attitudes are mediated by parenting attitudes and cultural worldviews. These findings are discussed in greater detail below.

**Message Treatment**

One of the main questions that motivated this research was whether message framing – in this case, episodic and thematic message frames – might have an effect on people’s attitudes toward vaccination, both on the individual behavioral level and on the policy level. We did not, however, find any significant differences in support for vaccination decision or support for vaccination policy across the three message treatment groups (no message, family message,
These results clearly suggest that the particular framing manipulations used in this study did not significantly influence participants’ attitudes toward vaccination, as evidenced by the lack of a significant difference between the control group, who received no message, and the two treatment groups, who received either the family message or the community message. The reasons for the lack of any noticeable effect of the experimental message frames, however, are less clear.

The most basic explanation is that episodic and thematic messages may simply be ineffective in moving public attitudes in the particular context of vaccination. We know from previous research (e.g., Iyengar, 1991) that episodic and thematic frames do have an impact on how people perceive certain social problems, including crime, terrorism, and poverty: episodic frames tend to encourage support for individual-level solutions to these problems, while thematic frames tend to encourage support for policy-based solutions. With this in mind, we hypothesized that the episodic family frame might lead participants to express greater support for individual-level vaccination uptake, while the thematic community frame would lead participants to demonstrate greater support for vaccination policy. Mandatory vaccination policies, however, are already in place in all 50 states and have been for quite some time. If people view vaccination as the default option on either the behavioral level or the policy level, it is perhaps less likely that our one-time framing manipulation could have enough of an impact to actually sway their attitudes toward vaccination. If this is the case, we could speculate that people’s attitudes may begin to shift and demonstrate the hypothesized differences after repeated exposure to the messages.

Another possible explanation for the lack of a treatment effect is that our particular
versions of the episodic and thematic message frames were ineffective at influencing people’s vaccination attitudes. For example, it is possible that longer messages may have had a more noticeable impact. We deliberately chose brief one-paragraph messages, however, because we believed these to be the kind of messages parents would be most likely to encounter in the real world. Parents would only come across such longer messages – for example, in the context of health promotion materials – if they were interested enough to invest the time to read lengthier informational materials provided by a health care professional or if they actively sought them out through the course of their own research on the issue.

Finally, it is also possible that there was no treatment effect because the two experimental messages that participants read presented vaccination in terms of its benefits, either to the family or the community. Previous research suggests that while benefits-oriented messages seem to be effective in increasing support for most preventive behavior, this might not be true for vaccination. Unlike many health behaviors that are repeated and ongoing – for example, brushing your teeth, putting on sunscreen, watching your diet – childhood vaccination takes place over the course of a few discrete events, typically in the first few years of life. As such, people seem to be more oriented to the potential risks of vaccination behavior and may be more likely to support vaccination when they are reminded of the risks of not vaccinating. In reviewing research on gain- and loss-framed messages in promoting vaccination, O’Keefe & Nan (2012) speculate that loss-framed messages may be more effective at encouraging parents to vaccinate their children because of their affective impact: such loss-framed messages may specifically evoke feelings of anticipated guilt or regret.

As discussed above, there are definite risks associated with not vaccinating, especially when non-vaccinators cluster together in specific communities. However, these risks are very
difficult to present to parents in a way that is both meaningful and truthful. Because vaccination rates are typically already high, the risks of non-vaccination to a child’s individual health, and even to community health, are very low. Furthermore, as discussed above, the risk-benefit calculus that parents engage in when deciding whether to vaccinate involves much more than statistical risk ratios. Because parents’ beliefs and values about science, government, and parental responsibility are an important part of this decision-making process, we specifically chose to focus on the differences between episodic/thematic frames, which focus on differences in assigning responsibility, as opposed to risk/benefit frames, which focus on differences in probabilities.

**Structural Model**

Another one of the overarching goals underlying this study was to gain a better understanding of the various factors that influence vaccination attitudes and the relationships among these factors. Specifically, we wanted to be able to elucidate the pathways that lead people to express support for both individual-level vaccination decisions and vaccination policy. We hypothesized a structural model in which parenting attitudes and cultural worldviews served as latent mediating variables between individual-level demographic indicators and vaccination attitudes. The fact that the model fit as well as it did without any further modifications suggests that it is a robust model that provides a good description of the pathways that lead to vaccination attitudes.

**Direct pathways.** In examining the direct, unmediated pathways between the demographic indicator variables and the latent vaccination attitudes outcome variable, we found that education, race (white versus other), and parental status were positively related to vaccination attitudes. That is, those participants who had higher levels of education, who were
white, and who were parents demonstrated greater support for the decision to vaccinate and for vaccination policy. These direct relationships make sense in the context of some research that has shown that non-white respondents are more likely to report concerns about vaccines (Gust et al., 2004; Gust et al., 2008; Shui et al., 2006) and that white respondents are more likely to rate vaccination as ‘extremely important’ (Gellin et al., 2000). Existing data on the relationship between education and vaccination attitudes is somewhat mixed. For example, Gellin et al. (2000) found that respondents with a high school degree or less were more likely to rate vaccination as ‘extremely important’ than respondents who had attended college. However, some research does suggest that less educated parents are more likely to have concerns about vaccine safety (Shui et al., 2006) and to be unsure about the vaccination decision, indicating that they do not have the information they need to make a good decision (Gust et al., 2005).

On the other hand, we found that born-again identification and previous adverse experiences with vaccines were negatively related to vaccination attitudes. That is, those who identified as born-again and who reported adverse effects from vaccines demonstrated less support for the decision to vaccinate and for vaccination policy. It is completely logical that previous adverse experiences with vaccines would lead participants to have less favorable attitudes toward vaccination. Indeed, many researchers have noted that this personal, anecdotal kind of information about vaccines seems to have a very important role in vaccination attitudes and decision-making. To the extent that born-again Christians may have alternative health beliefs or more libertarian (i.e., individualistic) views, it also makes sense that born-again Christians would express less favorable attitudes toward vaccination.

In examining the direct pathways between the demographic indicator variables and the parenting attitudes construct, we found that those participants who had higher levels of
education, higher levels of family income, who were white, and who identified as Independents espoused less traditional, more progressive parenting attitudes. On the other hand, those who identified as a born again Christian espoused more traditional, less progressive parenting attitudes. To the extent that the parenting attitudes scale measured how much people believe that children should be free to express themselves and that parents and teachers are not always the ultimate authority in child-adult relationships, these relationships seem rather logical. In regards to the associations between education, income, and race and vaccination attitudes, it is possible that people who come from advantaged backgrounds have the ‘luxury’ to consider children’s freedom of expression and autonomy to be a particularly important aspect of child development. In regards to political party affiliation, it is impossible to know exactly how participants interpreted the label of ‘Independent.’ However, to the extent that this label encompasses some sense of libertarianism, we could speculate that notions of freedom of expression and autonomy would resonate with Independents. Similarly, it is difficult to know how participants interpret the label of ‘born again.’ But to the extent that the label encompasses values related to fundamentalist Christianity, it seems logical that born again respondents would be less likely to espouse progressive parenting attitudes.

The positive associations described here, particularly in light of the inclusion of identification as a political Independent, call to mind the kind of parents who seem particularly likely to be non-vaccinators. As discussed above in the context of cultural worldviews, several studies have found that parents who come from advantaged backgrounds and who have more libertarian attitudes about the role of government in society are more likely to delay or refuse vaccination for their children. Because all the pathways hypothesized in a structural model are modeled simultaneously, alternative pathways are effectively controlled for when you examine
the significance of an individual pathway. This means that the significant positive associations between education, income, white race, and Independent political party and vaccination attitudes are not mere proxies for the relationship between cultural worldviews and parenting attitudes. In fact, as will be discussed in more detail below, the relationship between parenting attitudes and cultural worldviews is strongly negative in the hypothesized model.

In examining the pathways between the indicator variables and the cultural worldviews construct, we found that participants who had higher income, who were white, who identified as born-again, who identified as Independents, who reported adverse effects of vaccination, and who were parents reported more individualistic worldviews, while those who had higher levels of education reported less individualistic worldviews. To the extent that the individualism scale measured people’s attitudes in regards to the appropriate role of government in society, the associations with income, race, religion, political party, and education are not at all surprising as they are supported by cultural cognition theory. In regards to the association between previous adverse vaccine reaction and cultural worldviews, it is possible that experiencing an adverse reaction to a government-mandated vaccination may lead people to become more wary of the role of government in society. It is not clear why being a parent might be associated with more individualistic worldviews, but we could speculate that becoming a parent and recognizing one’s responsibility for the welfare of another human being leads people to be more wary of outside influence in their private lives.

As mentioned earlier, we also examined the relationship between parenting attitudes and cultural worldviews mediating variables and found that those participants who had less traditional, more progressive parenting beliefs demonstrated less hierarchical, less individualistic worldviews. In light of the fact that other factors like political party are already taken into
account, we could interpret this to mean that those people who value children’s ability to express themselves and have their opinions be valued also tend to value a more egalitarian, communitarian societal structure.

Finally, we examined the pathways from the two mediating variables to the vaccination attitudes outcome variable and found that participants who had less traditional, more progressive parenting attitudes and more hierarchical, more individualistic worldviews expressed less support for the decision to vaccinate and for vaccination policy. Again, in light of the fact that other individual-level and demographic factors are taken into account, these associations suggest that people who value children’s freedom of expression and autonomy and people who value individual autonomy over government authority are less likely to support vaccination. These associations may make sense in the context of government interference in individual decision-making. The fact that more hierarchical cultural worldviews were also associated with less support for vaccination remains a bit of a puzzle. Ropeik (2011) argues that the relationship should actually work in the opposite direction – that egalitarianism should be associated with less support for vaccination. He reasons that because egalitarians view major institutions, including big corporations, as major contributors to broader societal inequality, egalitarians should therefore be skeptical of any products issued by those institutions (i.e., vaccines). This reasoning seems logical but is not borne out by the data presented here. To the extent that mandatory vaccination is, by definition, required for all individuals who are healthy enough to receive vaccines, it could be viewed as a particularly egalitarian policy. The fact that the policy is applied to everyone, regardless of status, may strike hierarchists as unnecessarily indiscriminate, but this explanation is completely speculative in nature.

**Indirect pathways.** To test whether parenting attitudes and cultural worldviews served as
mediators between individual-level factors and vaccination attitudes, we examined whether the indirect pathways in the model were significant. In examining parenting attitudes as a mediator, we found that only the indirect pathway from education to vaccination attitudes as mediated by parenting attitudes was statistically significant. This suggests that parenting attitudes, although directly related to vaccination attitudes, are unlikely to serve as a mechanism through which most individual-level and demographic factors influence vaccination attitudes. There are, however, limitations to the parenting attitudes measures used in this study that constrain the conclusions we are able to draw about the relationship between parenting attitudes and vaccination attitudes. These limitations are discussed in further detail below. In examining cultural worldviews as a mediator, however, we found that the indirect pathways between the indicator variables to vaccination attitudes as mediated by cultural worldviews were all significant. As such, it seems that at least some of the influence that these individual-level and demographic factors have on people’s attitudes toward vaccination can be explained by their cultural worldviews. Given that the direct pathways between income and vaccination attitudes and between political party and vaccination attitudes were not significant, it seems that these two indicators are related to a person’s vaccination attitudes only insofar as they relate to the person’s cultural worldviews.

 **Structural model comparisons.** We looked at the structural model across parental status and also across experimental message frame to see if there were any significant differences in certain pathways when comparing across the levels of the two variables in question. Despite the fact that prior analyses revealed no main effect of either parental status or experimental message frame on vaccination attitudes, it is possible that they may still have influenced the pathways specified in the hypothesized structural model.
Examining the relationships between parenting attitudes, cultural worldviews, and vaccination attitudes and comparing them across parents and non-parents, we found only one statistically significant difference. The relationship between parenting attitudes and cultural worldviews was significantly more negative for non-parents than for parents. This finding suggests that parenthood may attenuate the negative relationship between progressive parenting attitudes and individualistic worldviews; one possible explanation is that parenting attitudes become more salient and dampen the relative influence of cultural worldviews in opinion formation.

Examining the relationships between parenting attitudes, cultural worldviews, and vaccination attitudes and comparing them across experimental message frames (episodic family message versus thematic community message), we found no significant differences in the pathways across the two groups. This suggests that the experimental message frames did not significantly influence the hypothesized relationships among the mediating and outcome variables.

Limitations

There are some limitations of this study that should be noted. Perhaps the biggest limitation of this kind of research is that it relies on measures of attitudes as a proxy for actual behavior (cf Gallagher & Updegraff, 2012). Ultimately, we are really interested in how factors like demographic characteristics, parenting attitudes, and cultural worldviews interact to influence actual vaccination decisions. The fact that the study was not linked to a specific decision or behavior may have diminished the immediacy and relevance of the questions for some participants. Parents who are actively confronting vaccination issues may respond differently to questions about vaccination uptake and vaccination policy and could provide
evidence for attitudinal pathways other than those modeled in this study. While it would be possible to undertake a longitudinal study that identifies and surveys parents prior to making any vaccination decisions and then follows up with them later to discover the outcome of their decisions, such a study would have required time, funds, and personnel that far exceeded the scope of this dissertation. A longitudinal study of this kind would, however, make a very important contribution to the field and should be a goal for researchers who are interested in understanding the nature of vaccination decision-making.

Another limitation of this research is that we had to devise our own scales to measure support for individual vaccination decisions and support for vaccination policy as there were no previously validated measures available. We did pilot our vaccination attitudes measures and they showed high scale reliability in the pilot sample and the full sample, but we would have preferred to use measures that had been tested and validated by multiple researchers in the field. This limitation is borne out of the fact that much of the research on vaccination attitudes is descriptive in nature. To be sure, describing the levels of support among different groups of people is informative because it allows us, in a very basic way, to see where and when group-based disparities occur. However, this descriptive approach cannot provide much in the way of explanation to account for these differences. Those studies that do take an inferential approach often rely on logistic regressions or chi-square tests to examine the influence of various factors on single questionnaire items (e.g., safety of vaccines). It is unlikely that a single item will be able to capture the variability in people’s attitudes toward an issue like vaccination. As mentioned above, continuous scales measuring vaccination attitudes are lacking.

Although our hypothesized structural model demonstrated excellent fit, there is always the concern that there are additional variables that ought to have been included in the model. In
particular, we wonder whether using a different measure for parenting attitudes might have improved the model, at least theoretically. The major benefit of the Parental Modernity Scale is that it has been tested extensively in the developmental literature; as a result, we know certain things about what the scale represents in terms of actual parenting behaviors and how it relates to certain outcomes in the context of child development. Previous research on vaccination decision-making seems to have its roots primarily in cognitive psychology (i.e., risk-benefit analysis and decision theory) or in sociology. We specifically chose the Parental Modernity Scale as a measure of parenting attitudes so that our study would also have an explicit link to developmental psychology. A potential drawback of this scale, however, is that it may not fully tap into the schema of parental responsibility that seems to be so central to parents’ attitudes and decision-making in relation to childhood vaccination. Once again, this seems to be a limitation of the field more generally, as we are not aware of any other measures that index how feelings of parental responsibility translate into actual parenting attitudes and behaviors.

Finally, while the overall findings suggest that there was no main effect of message frame, there was no manipulation check included in the survey immediately following the experimental message. It is possible that the messages may have had a fleeting effect on participants’ opinions, momentarily shifting their attitudes toward vaccination, but that this effect was essentially washed out as participants answered the questions that followed regarding their attitudes toward individual vaccination and vaccination policy. Including a manipulation check in future research will help to dissociate the overall effect of the frame versus its effect on specific attitudinal measures.

**Implications for Future Research**

As discussed above, one of the most important future directions for research on
vaccination decision-making would be to take a prospective, longitudinal approach that follows
couples as they go through the decision-making process. This approach, though costly and time-
intensive, would provide the ecological validity necessary for creating evidence-based
recommendations that inform communications and engagement efforts on this topic. An added
benefit to this kind of approach is that it can examine, and account for, parent-healthcare
provider interactions as a potentially influential factor shaping parents’ vaccination decisions. As
will be discussed below, healthcare providers seem to be a primary source of information and
guidance for many parents when it comes to vaccines, but these healthcare providers are not
always primary care physicians. With this in mind, research that takes a longitudinal approach
can specifically examine the role that different kinds of healthcare providers – such as
physicians, chiropractors, and practitioners of complementary and alternative medicine – play in
parents’ vaccination decision-making (for an example, see Opel et al, 2012). This approach could
also help to account for the element of trust in the parent-provider relationship, examining
parents’ access to the healthcare system and their comfort (or discomfort) with their healthcare
providers.

Another potential benefit of the longitudinal approach is that it could allow for a closer
examination of the real-time dynamics of the vaccination decision-making process. Listening to
couples converse about their vaccination decision could elucidate the values, facts, and other
types of information that matter in guiding their decision as they are in the midst of making that
decision. For example, is science mentioned as an important consideration in the decision-
making process? If so, is science presented as an influential factor in and of itself, or is it invoked
in the context of some other value (such as fairness or common good)? Examining these kinds of
conversations may also tell us more about who is involved in the decision-making process.
While it is possible that mothers and fathers are equally involved, sharing joint responsibility for the vaccination decision, it is also possible that mothers, who are more likely to be the primary caretakers, wield more influence over the decision. Investigating the interpersonal dynamics of vaccination decision-making could help to inform future public engagement efforts with respect to vaccination.

Given recent work on the moral foundations on political beliefs, another potentially important individual-level factor that ought to be explored in the context of vaccination is that of purity. Converging evidence from Haidt and others suggests that the moral foundation of purity/sanctity can be especially influential in motivating decision-making on various political and social issues (e.g., Graham, Haidt, & Nosek, 2009; Haidt & Graham, 2007; Horberg et al., 2009; Koleva et al., 2012). As discussed above, for some people, the issue of vaccination is strongly linked to ideas about contamination and what constitutes a natural lifestyle. Including the moral foundation of purity in the overall vaccination attitudes model will help to show whether and how purity maps onto other important factors, such as cultural worldviews. The relationship between purity and cultural worldviews is especially interesting because previous research has associated purity and sensitivity to disgust with political conservatism (e.g., Inbar et al., 2011). It is worth exploring, then, whether cultural worldviews might mediate this association and whether purity, either directly or indirectly, predicts vaccination attitudes.

From a psychometric standpoint, another important area for future research is in the development and testing of measures relevant to vaccination decision-making. Validated measures of vaccination attitudes are noticeably lacking but are essential to unifying disparate types of research across various scientific domains. The development of attitudinal scales that go beyond single-item outcome measures to account for nuance and variation in participant
responses would be an incredible benefit to the field (for an example, see Opel et al., 2011). With these measures, researchers will then be able to build and test more sophisticated models with the reassurance that their models are capturing the concepts that they are designed to capture.

Surprisingly, there is little existing research that combines quantitative methods and psycho-social theory in the context of vaccination decision-making. Those studies that employ quantitative methods to examine vaccination decision-making tend not to focus on contextual factors beyond mere demographic characteristics, while those studies that focus on the contextual factors – like values, beliefs, and previous experiences – that influence vaccination decision-making typically rely on qualitative methods. Furthermore, explicit links to the developmental literature are difficult to find even in the research that takes a contextual approach. Clearly, this is an area of research that will require careful methodological and theoretical consideration in order for these various strands of inquiry to be brought together in a meaningful way. Analytical approaches like structural equation modeling offer the promise of being able to accommodate both quantitative methods and psycho-social theory (including developmental theory) and the present study represents a small first step in this direction.

Research suggests that not all pro-vaccination messages are created equal – those that lack a sound basis in communications research can ultimately backfire, leading people to become more skeptical of vaccination (Betsch, 2011). It is therefore critical that we continue to explore which communications tools are most effective in promoting the benefits of vaccination. In regards to framing as a possible communications tool, additional research is critical to understanding the various frame components (if any) that actually make a difference in shaping attitudes toward vaccination. While the episodic/thematic framing manipulation in this study had no discernible effect, it is not clear whether this result is limited to the particular experimental
frames used in the study or is generalizable to the episodic and thematic frames overall. As discussed above, it is possible that risk-oriented episodic and thematic frames might produce a different result. As such, a worthwhile future direction for framing research in the context of vaccination may be to examine the combination of risk/benefit and episodic/thematic framing. This kind of design would help to elucidate which frame elements, or combinations thereof, have the greatest impact in driving support for individual vaccination and support for vaccination policy.

**Implications for Public Engagement**

While it may be tempting to portray parents who refuse vaccines as uncaring or irrational, this is certainly not true. Parents who refuse vaccines for their children are often well-educated and have conducted significant background research on the issue (Gullion, Henry, & Gullion, 2008). They care very deeply about the well-being of their child and are willing to make difficult decisions on their child’s behalf (Bean, 2011). In the sense that these parents consider refusing vaccination as an expression of the belief that protecting their children is their foremost responsibility, they can be viewed as behaving quite rationally. These parents very clearly weigh risks and benefits associated with vaccination; their analyses, however, are informed by values, experiences, and attitudes related to health and parenting that are not traditionally considered to be part of ‘rational’ decision-making (Bellaby, 2003; Evans et al., 1997; Evans et al., 2001).

It is critical that we understand how best to communicate with parents who are unsure about or skeptical of vaccination or who have had an adverse experience with vaccination. We know that the traditional approach to risk communication – supplying parents with scientific information about relative risks – is simply ineffective and is unlikely to persuade these parents that vaccines are not only safe but also necessary (Gellin & Schaffner, 2001). Scientists are often
hesitant to go beyond the strict boundaries of their data, avoiding prescriptions for best practices for fear of ‘overgeneralizing’ (McCall & Groark, 2007); they are so accustomed to examining all the limitations and alternative explanations for their findings that they often resist efforts to create a seemingly unqualified bottom-line message from their data (McCall & Groark, 2007; Shonkoff, 2000; Weigold, 2001). If scientists want to be able to reach parents, however, they must be able to distill their research findings and create messages about vaccination that are clear, jargon-free, and easy for non-experts to relate to (e.g., Ash, 2010; Black & Rappuoli, 2010; Gascoigne & Metcalfe, 1997; Office of Science and Technology [OST] & the Wellcome Trust, 2001; Offit & Coffin, 2003; Serpell & Green, 2006).

As objective as scientists may think their findings are, it is a mistake to believe that scientific information is somehow ‘unframed.’ As Nisbet and Scheufele (2009) argue, “[f]raming is an unavoidable reality of the science communication process” (p.5). In shying away from taking a more active role in shaping science communication, scientists simply leave their findings open to framing and interpretation by media and the public. This is unfortunate, as no one is better positioned to interpret and disseminate a “murky and fragmented research literature than those who understand all of its limitations and qualifications” (McCall & Groark, 2007, p.24). Ignoring the lay audience’s “needs, roles, circumstances, knowledge, motivations, values, beliefs, ways of interpreting and processing information from science” (Welch-Ross & Fasig, 2007, p.5) is a critical mistake (Ropeik, 2011). Failure to take these ‘non-rational’ factors into account often results in science communications that are simply irrelevant to the public (McCall & Groark, 2007; Bond & Nolan, 2011; Gray & Ropeik, 2002 ). This results in a strongly biased selection effect, whereby “information rich science enthusiasts become even more informed while the broader American audience remains disengaged” (Nisbet, 2009, p.4).
In light of this, recent efforts at science communication have focused much more on a democratic model of public participation, dialogue, and engagement (e.g., “Going public,” 2004; Larson, Cooper, Eskola, Katz, & Ratzan, 2011; Leask et al., 2011; Nisbet, 2009; Wilsdon & Willis, 2005). These public engagement efforts have taken many different approaches, including the use of focus groups, consensus conferences, and stakeholder dialogues (e.g., Leask et al., 2011; Wilsdon & Willis, 2005). Research indicates, however, that these efforts may ultimately fall short of their goal and end up defaulting back to a deficit model of public understanding (Kurath & Gisler, 2009). Unfortunately for those who engage in science communications, genuinely mutual exchanges are difficult to achieve. Entrenched biases, including knowledge boundaries that are perpetuated by both scientists and non-scientists, can easily derail such open dialogue (Cuppen, Hisschemoller, & Midden, 2009).

Despite these obstacles, it is critical that we continue to try to establish true public dialogue or we risk perpetuating public fear and skepticism (Parsons, 2001). Trust is perhaps the most important component of effective dialogue, especially on controversial issues like vaccination. Research on cultural cognition suggests that when people have to make risk-related decisions, they trust the opinion of experts who share their cultural worldviews (Kahan, 2009). Thus, it is critical that parents receive accurate information about vaccines from the sources that they trust. Some parents may place considerable trust in online communities of vaccine skeptics, and it may be difficult for a physician or public health official to influence these parents. It is possible, however, that capitalizing on social networks in the local community may be an effective way to disseminate information and promote discussion about vaccines (Allen et al., 2010). These social networks may include community-based organizations and groups, including religious and political groups and organizations for women, parents, and children. Because many
vaccine-skeptical parents engage in alternative medicine practices, involving alternative medicine providers in public health alliances will no doubt enhance the persuasiveness and effectiveness of the communications efforts of such alliances (Benin et al., 2006; Busse, Walji, & Wilson, 2011).

For parents who are conflicted or unsure about vaccines, the most influential messenger is likely to be the family physician. Parents routinely cite their physician as an important source of information about health and vaccines (Benin et al., 2006; Freed et al., 2011; Kennedy, Basket, & Sheedy, 2011; Kennedy, LaVail, Nowak, Basket, & Landry, 2011). Physicians can develop trusting, open relationships with parents by providing a nonjudgmental forum for parents to express their concerns and by taking into account parents’ specific circumstances and backgrounds (Bean, 2011; Fredrickson et al., 2004; Diekema, 2005; Kennedy et al., 2011; Leask et al., 2011). Parents must feel that they are partners with their physician in protecting their child’s health (Gullion, Henry, & Gullion, 2008). Research indicates that some physicians ask parents who refuse vaccinations to seek medical care elsewhere (Busse, Walji, & Wilson, 2011; Dempsey et al., 2011; Flanagan-Klygis, Sharp, & Frader, 2005), but this pressure may alienate some parents and make them even more resistant (Brown et al., 2012; Busse, Walji, & Wilson, 2011; Evans et al., 2001; Fredrickson et al., 2004). By maintaining open lines of communication, physicians not only allow parents to continue receiving medical care for their child, they also allow for continued discussions that may lead parents to accept vaccines in a later visit (Fredrickson et al., 2004; Diekema, 2005; Flanagan-Klygis et al., 2005). Recent research suggests that when physicians use an evidence-based communications approach that is tailored to individual parents’ information needs, they can help to reduce parents’ vaccination hesitancy over time (Jackson et al., 2011).
While it may be difficult to acknowledge, scientists, physicians, and public health experts must recognize that the goal of public engagement on the issue of vaccination is not necessarily about persuading skeptical parents that the science is ‘right.’ We already know that existing values, beliefs, and experiences serve as powerful heuristics that influence how people interpret information and inform their decision-making processes, so it is unlikely that public engagement efforts will ever result in absolute consensus about the safety and necessity of vaccination. Despite this, public engagement efforts are still critical to addressing these kinds of controversial issues, in that they can help to “generate new approaches to the governance of science that can learn from past mistakes, cope more readily with social complexity, and harness the drivers of technological change for the common good” (Wilsdon & Willis, 2005, p.12).

The goal of public engagement efforts, then, should be to make science more transparent and “to expose to public scrutiny the values, visions and assumptions [underlying science] that usually lie hidden” (Wilsdon & Willis, 2005, p.12). Efforts to communicate and disseminate information about vaccines must involve many diverse parties, including public health officials, scientists, parents, physicians, pharmaceutical representatives, advocacy groups, legal professionals, and members of the media (including those involved in online communities) (Francois et al., 2005; Larson et al., 2011). Rather than handing down scientific facts to the public, more effective communications efforts would likely center on deliberative discussions as a way to build trust. Communications that focus on information that is at once scientifically sound, personally compelling, and easy to understand have the greatest chance of effectively addressing parents’ concerns (Bean, 2011; Dempsey et al., 2011; Offit & Coffin, 2003). These kinds of public engagement efforts have the potential to open up productive and participatory conversations about vaccination in the public domain that will, hopefully, address how we can
best support the health of our children and our communities.
APPENDIX A

Survey Instrument

(Section 1)

(Community-oriented message)
Lately there has been a lot of talk about public health in communities. Every community has a stake in making sure that its residents are healthy and they have a lot of choices to make when it comes to promoting the public’s health. One way that communities keep their residents healthy is by encouraging vaccinations for all children to stop the spread of disease. Schools, for example, in communities often require children to be vaccinated before they enroll in school. By making such policies, communities ensure the health of their residents and the benefits are shared by everybody.

Have you heard of this explanation for why communities have a major role to play in children’s vaccinations?
Yes, no

(Family-oriented message)
Lately there has been a lot of talk about health in families. Every parent has a stake in making sure that their children are healthy and they have a lot of choices to make when it comes to promoting their children’s health. One way that parents keep their children healthy is to obtain vaccinations for their children to stop the spread of disease in the family. Parents, for example, send their children to be vaccinated before they enroll in school. By making this decision, parents ensure the health of their children and the benefits are shared by the whole family.
Have you heard of this explanation for why families have a major role to play in children’s vaccinations?
Yes, no

(Section 2)
If you had a young toddler who hadn’t received immunizations yet, how would you respond to the following statements?

1. My child should be vaccinated against diseases.
   Strongly disagree, disagree, agree, strongly agree
2. If my child was not vaccinated, I would get my child vaccinated.
   Strongly disagree, disagree, agree, strongly agree
3. Vaccinations are safe for my child.
   Strongly disagree, disagree, agree, strongly agree
4. I have no reservations about the safety of vaccines for my child.
   Strongly disagree, disagree, agree, strongly agree
5. I would get my own child vaccinated to preserve his/her health.
   Strongly disagree, disagree, agree, strongly agree
6. Vaccines are necessary to preserve my child’s health.
   Strongly disagree, disagree, agree, strongly agree
7. Vaccines are important for ensuring my child is healthy.
   Strongly disagree, disagree, agree, strongly agree
8. Vaccination will endanger my child’s health.
Strongly disagree, disagree, agree, strongly agree

9. As a parent, I should be able to decide whether or not my child should be vaccinated.
   Strongly disagree, disagree, agree, strongly agree

1. All children should be vaccinated against diseases.
   Strongly disagree, disagree, agree, strongly agree

2. Vaccinations are safe for children.
   Strongly disagree, disagree, agree, strongly agree

3. Children should be vaccinated to preserve their health.
   Strongly disagree, disagree, agree, strongly agree

4. Vaccines are necessary to preserve children’s health.
   Strongly disagree, disagree, agree, strongly agree

5. Vaccines are important for ensuring children are healthy.
   Strongly disagree, disagree, agree, strongly agree

   Strongly disagree, disagree, agree, strongly agree

7. Schools should be able to require that children are vaccinated before they enroll in school.
   Strongly disagree, disagree, agree, strongly agree

8. Universal vaccination is important for ensuring children’s health.
   Strongly disagree, disagree, agree, strongly agree

9. Public health policies, like universal vaccination, are important for reducing the spread of diseases.
Strongly disagree, disagree, agree, strongly agree

(Section 3)

Now please tell us a little bit more about yourself by answering these questions:

1. Do you have any children?
   Yes, no

2. If yes, how many children do you have?
   Please select the number from the drop-down menu

3. If yes, please list the age of each child.
   (This could just be an open text box for respondents to type in their responses.
   Alternatively, if possible, a number of small text boxes that corresponds to the number of
   children reported for the previous question could appear. The respondents would then
   type the age of each child, one per text box. So, for example, if they responded that they
   have 3 children in the previous question, 3 small text fields would then appear with the
   headings “Child 1,” “Child 2,” “Child 3”)

4. If you do not currently have children, do you plan to have children someday?
   Yes, no

5. Have you, a member of your family, or a friend ever experienced a negative reaction to a
   vaccine?
   Yes, no

6. If yes, how serious was this reaction?
   Very serious, somewhat serious, neutral, somewhat mild, very mild

7. Do you pay attention to news?
   A lot, somewhat, a little, not at all
8. Where do you get most of your news?
   TV, internet, newspaper, magazine, other source

9. Are you interested in science news?
   A lot, somewhat, a little, not at all

(Section 4)

Please answer the following questions to tell us your opinions on parenting and children.

1. When their child is pretending something, parents should go along with the game.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree

2. Children should always obey the teacher.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree

3. Children will not do the right thing unless they must.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree

4. The most important thing to teach children is absolute obedience to whomever is the authority.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree

5. Children should always obey their parents.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree

6. Children will be bad unless they are taught what is right.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree

7. Children should be allowed to disagree with their parents if they feel their own ideas are better.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree

8. Children have a right to their own point of view and should be allowed to express it.
9. It is alright for a child to disagree with his or her parents.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree
10. A child’s ideas should be seriously considered in family decisions.
   Strongly agree, mildly agree, not sure, mildly disagree, strongly disagree

(Section 5)

Please answer the following questions to tell us your opinions on society in America today.

1. The government interferes far too much in our everyday lives.
   Strongly disagree, disagree, agree, strongly agree

2. Sometimes government needs to make laws that keep people from hurting themselves.
   Strongly disagree, disagree, agree, strongly agree

3. It’s not the government’s business to try to protect people from themselves.
   Strongly disagree, disagree, agree, strongly agree

4. The government should stop telling people how to live their lives.
   Strongly disagree, disagree, agree, strongly agree

5. The government should do more to advance society’s goals, even if that means limiting
   the freedom and choices of individuals.
   Strongly disagree, disagree, agree, strongly agree

6. Government should put limits on the choices individuals can make so they don’t get in
   the way of what’s good for society.
   Strongly disagree, disagree, agree, strongly agree

7. We have gone too far in pushing equal rights in this country.
   Strongly disagree, disagree, agree, strongly agree
8. Our society would be better off if the distribution of wealth was more equal.
   Strongly disagree, disagree, agree, strongly agree

9. We need to dramatically reduce inequalities between the rich and the poor, whites and
   people of color, men and women.
   Strongly disagree, disagree, agree, strongly agree

10. Discrimination against minorities is still a very serious problem in our society.
    Strongly disagree, disagree, agree, strongly agree

11. It seems like blacks, women, homosexuals and other groups don’t want equal rights, they
    want special rights just for them.
    Strongly disagree, disagree, agree, strongly agree

12. Society as a whole has become too soft and feminine.
    Strongly disagree, disagree, agree, strongly agree
You are invited to participate in a public opinion research study.

**PRINCIPAL INVESTIGATOR:** Deborah Phillips  
**CO-PRINCIPAL INVESTIGATOR:** Anna Mikulak

**WHY IS THIS RESEARCH STUDY BEING DONE?**

This study is being done to investigate the attitudes that people have toward children’s health in the United States. This research will help scholars understand how people think and talk about these issues.

**WHAT WILL I BE ASKED?**

You will be asked to read a paragraph describing some people’s views about children’s health in America and to answer some questions about issues related to children’s health. You will also be asked to provide some information about yourself, including whether you follow news about current events. You do not need to have children to be eligible to participate in the study. The survey will take about 8 minutes to complete.

**ARE THERE ANY RISKS?**

There are few risks associated with this study. Any information you provide will be confidential and private. Your information will not be sold or disclosed to any third party at any time.

**WHAT ABOUT MY PRIVACY? WHO CAN GET INFORMATION ABOUT ME?**

We will take several precautions to keep your data private. Your personal information will be stored in the YouGovPolimetrix database which is protected by firewalls. The dataset that YouGov will provide to the investigators will not contain any identifying information; each participant in the dataset will be represented by a meaningless code.

**WHAT ARE MY RIGHTS?**

Being in this study is voluntary. You do not have to be in it. You do not have to answer every question. You can quit whenever you want to. You will not be penalized in any way.

**WHAT IF I HAVE QUESTIONS OR PROBLEMS?**

Call Anna Mikulak at 703-962-0542 if you have any questions or problems related to the study. Call the Georgetown University IRB Office at 202-687-1506 if you have any questions or concerns about your rights, or if you have a complaint.
References


children? *Archives of Pediatrics and Adolescent Medicine, 158*(6), 569-575.


Gerend, M., Shepherd, J., & Monday, K. (2008). Behavioral frequency moderates the effects of
message framing on HPV vaccine acceptability. *Annals of Behavioral Medicine, 35*, 221-229. doi: 10.1007/s12160-008-9024-0


Haidt, J., & Graham, J. (2007). When morality opposes justice: Conservatives have moral


Office of Science and Technology and the Wellcome Trust. (2001). Science and the public: A
review of science communication and public attitudes toward science in Britain. *Public Understanding of Science, 10*, 315-330. doi: 10.1088/0963-6625/10/3/305


Tanglao, L. (7 November 2011). Parents warned about mail order chicken pox lollipops. *ABC*


Table 1.
Participant Characteristics (N = 830)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>437</td>
<td>52.7</td>
</tr>
<tr>
<td>Male</td>
<td>393</td>
<td>47.3</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>595</td>
<td>71.7</td>
</tr>
<tr>
<td>Black</td>
<td>87</td>
<td>10.5</td>
</tr>
<tr>
<td>Hispanic</td>
<td>96</td>
<td>11.6</td>
</tr>
<tr>
<td>Asian</td>
<td>14</td>
<td>1.7</td>
</tr>
<tr>
<td>Other race</td>
<td>38</td>
<td>4.6</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No high school</td>
<td>33</td>
<td>4.0</td>
</tr>
<tr>
<td>High school graduate</td>
<td>330</td>
<td>40.0</td>
</tr>
<tr>
<td>Some college</td>
<td>193</td>
<td>23.4</td>
</tr>
<tr>
<td>2-year college graduate</td>
<td>52</td>
<td>6.3</td>
</tr>
<tr>
<td>4-year college graduate</td>
<td>143</td>
<td>17.3</td>
</tr>
<tr>
<td>Post-graduate education</td>
<td>74</td>
<td>9.0</td>
</tr>
<tr>
<td>Family Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 20,000</td>
<td>126</td>
<td>15.3</td>
</tr>
<tr>
<td>20,000-40,000</td>
<td>184</td>
<td>22.4</td>
</tr>
<tr>
<td>40,000-60,000</td>
<td>155</td>
<td>18.8</td>
</tr>
<tr>
<td>60,000-80,000</td>
<td>107</td>
<td>13.0</td>
</tr>
<tr>
<td>80,000-100,000</td>
<td>65</td>
<td>7.9</td>
</tr>
<tr>
<td>100,000-120,000</td>
<td>43</td>
<td>5.2</td>
</tr>
<tr>
<td>More than 120,000</td>
<td>66</td>
<td>8.0</td>
</tr>
<tr>
<td>Prefer not to say</td>
<td>79</td>
<td>9.6</td>
</tr>
<tr>
<td>Political Party</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Democrat</td>
<td>296</td>
<td>35.7</td>
</tr>
<tr>
<td>Republican</td>
<td>213</td>
<td>25.7</td>
</tr>
<tr>
<td>Independent</td>
<td>269</td>
<td>32.4</td>
</tr>
<tr>
<td>Born Again</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>287</td>
<td>34.6</td>
</tr>
<tr>
<td>No</td>
<td>543</td>
<td>65.4</td>
</tr>
<tr>
<td>Have Children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>511</td>
<td>61.6</td>
</tr>
<tr>
<td>No</td>
<td>315</td>
<td>38.0</td>
</tr>
<tr>
<td>Skipped</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Adverse Vaccine Reaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>147</td>
<td>17.7</td>
</tr>
<tr>
<td>No</td>
<td>680</td>
<td>81.9</td>
</tr>
<tr>
<td>Skipped</td>
<td>3</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Table 2.  
Zero-Order Correlations, Means and Standard Deviations for Study Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Educ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Inc</td>
<td>.32**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Race</td>
<td>.09**</td>
<td>.07*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Parent</td>
<td>.01</td>
<td>.09**</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. BA</td>
<td>-11**</td>
<td>-09**</td>
<td>-09*</td>
<td>.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. VR</td>
<td>.04</td>
<td>.06</td>
<td>.05</td>
<td>.04</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Indep</td>
<td>.06†</td>
<td>.06</td>
<td>.06</td>
<td>.04</td>
<td>.05</td>
<td>.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. LT</td>
<td>.26**</td>
<td>.17**</td>
<td>.13**</td>
<td>-01</td>
<td>-22**</td>
<td>.08*</td>
<td>.13**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Prog</td>
<td>.07*</td>
<td>.04</td>
<td>.05</td>
<td>.02</td>
<td>-.12**</td>
<td>-.03</td>
<td>-.04</td>
<td>.16**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Indiv</td>
<td>-.08*</td>
<td>.07*</td>
<td>.12**</td>
<td>.18**</td>
<td>.18**</td>
<td>.12**</td>
<td>.15**</td>
<td>-.10**</td>
<td>-.16**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Hier</td>
<td>-.13**</td>
<td>.11**</td>
<td>.13**</td>
<td>.18**</td>
<td>.26**</td>
<td>.07</td>
<td>.12**</td>
<td>-.17**</td>
<td>-.23**</td>
<td>.65**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. VD</td>
<td>.08*</td>
<td>.02</td>
<td>.01</td>
<td>-.01</td>
<td>-.15**</td>
<td>-.28**</td>
<td>-.10**</td>
<td>-.04</td>
<td>.10**</td>
<td>-.29**</td>
<td>-.25**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. VP</td>
<td>.07*</td>
<td>-.01</td>
<td>-.00</td>
<td>-.02</td>
<td>-.15**</td>
<td>-.30**</td>
<td>-.11**</td>
<td>-.06</td>
<td>.10**</td>
<td>-.33**</td>
<td>-.26**</td>
<td>.92**</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.20</td>
<td>9.11</td>
<td>.72</td>
<td>.62</td>
<td>.34</td>
<td>.18</td>
<td>.32</td>
<td>12.70</td>
<td>18.41</td>
<td>17.33</td>
<td>14.52</td>
<td>25.97</td>
<td>25.80</td>
</tr>
<tr>
<td>SD</td>
<td>1.45</td>
<td>4.08</td>
<td>.45</td>
<td>.48</td>
<td>.48</td>
<td>.38</td>
<td>.47</td>
<td>4.14</td>
<td>3.51</td>
<td>3.92</td>
<td>5.00</td>
<td>4.99</td>
<td>5.19</td>
</tr>
</tbody>
</table>

Note. Educ = Education; Inc = Income; Parent = Parental status; BA = Born again; VR = Bad vaccine reaction; Indep = Independent; LT = Less traditional; Prog = Progressive; Indiv = Individualism; Hier = Hierarchism; VD = Vaccination Decision; VP = Vaccination Policy.  
†p<.10. *p<.05. **p<.01
Table 3.
Standardized Coefficients for Direct Pathways to Vaccination Attitudes

<table>
<thead>
<tr>
<th>Path</th>
<th>$r$ (SE)</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>-.10 (.05)</td>
<td>.01</td>
</tr>
<tr>
<td>Income</td>
<td>.08 (.05)</td>
<td>.01</td>
</tr>
<tr>
<td>White</td>
<td>.13 (.05)</td>
<td>.02</td>
</tr>
<tr>
<td>Parental status</td>
<td>.09 (.04)</td>
<td>.01</td>
</tr>
<tr>
<td>Born again</td>
<td>-.12 (.05)</td>
<td>.01</td>
</tr>
<tr>
<td>Bad vaccine reaction</td>
<td>-.24 (.04)</td>
<td>.06</td>
</tr>
<tr>
<td>Independent</td>
<td>.00 (.05)</td>
<td>.00</td>
</tr>
<tr>
<td>Parenting Attitudes</td>
<td>-.32 (.13)</td>
<td>.10</td>
</tr>
<tr>
<td>Cultural Worldviews</td>
<td>-.46 (.08)</td>
<td>.21</td>
</tr>
</tbody>
</table>

*Note.* Standard errors are given in parentheses
Table 4.
*Unstandardized Coefficients for Indirect Paths*

<table>
<thead>
<tr>
<th>Path</th>
<th>Unstandardized Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education → Parenting Attitudes → Vaccination Attitudes</td>
<td>-.33 (.17)*</td>
<td></td>
</tr>
<tr>
<td>Income → Parenting Attitudes → Vaccination Attitudes</td>
<td>-.04 (.03)</td>
<td></td>
</tr>
<tr>
<td>White → Parenting Attitudes → Vaccination Attitudes</td>
<td>-.48 (.29)</td>
<td></td>
</tr>
<tr>
<td>Parental status → Parenting Attitudes → Vaccination Attitudes</td>
<td>.01 (.17)</td>
<td></td>
</tr>
<tr>
<td>Born again → Parenting Attitudes → Vaccination Attitudes</td>
<td>1.00 (.52)†</td>
<td></td>
</tr>
<tr>
<td>Bad vaccine reaction → Parenting Attitudes → Vaccination Attitudes</td>
<td>-.27 (.24)</td>
<td></td>
</tr>
<tr>
<td>Independent → Parenting Attitudes → Vaccination Attitudes</td>
<td>-.38 (.24)</td>
<td></td>
</tr>
<tr>
<td>Education → Cultural Worldviews → Vaccination Attitudes</td>
<td>.27 (.07)***</td>
<td></td>
</tr>
<tr>
<td>Income → Cultural Worldviews → Vaccination Attitudes</td>
<td>-.08 (.03)**</td>
<td></td>
</tr>
<tr>
<td>White → Cultural Worldviews → Vaccination Attitudes</td>
<td>-.79 (.22)***</td>
<td></td>
</tr>
<tr>
<td>Parental status → Cultural Worldviews → Vaccination Attitudes</td>
<td>-.76 (.21)***</td>
<td></td>
</tr>
<tr>
<td>Born-again → Cultural Worldviews → Vaccination Attitudes</td>
<td>-1.26 (.28)***</td>
<td></td>
</tr>
<tr>
<td>Bad vaccine reaction → Cultural Worldviews → Vaccination Attitudes</td>
<td>-.45 (.22)*</td>
<td></td>
</tr>
<tr>
<td>Independent → Cultural Worldviews → Vaccination Attitudes</td>
<td>-.69 (.21)**</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Standard errors are given in parentheses
†p<.10. *p≤.05. **p<.01. ***p<.001.*
Table 5.
Zero-Order Correlations, Means and Standard Deviations for Study Variables, Parent Subsample

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Educ</td>
<td>-</td>
<td>.40**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Inc</td>
<td>.06</td>
<td>.11*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Race</td>
<td>.09</td>
<td>.13**</td>
<td>-.08</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. BA</td>
<td>.05</td>
<td>.07</td>
<td>.06</td>
<td>-.07</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. VR</td>
<td>.06</td>
<td>.16**</td>
<td>.04</td>
<td>-.06</td>
<td>.12**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Indep</td>
<td>.07</td>
<td>.07</td>
<td>.06</td>
<td>-.10*</td>
<td>.04</td>
<td>-.03</td>
<td>.15**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. LT</td>
<td>.07</td>
<td>.17**</td>
<td>.11*</td>
<td>-.18*</td>
<td>.15**</td>
<td>.17**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Prog</td>
<td>.03</td>
<td>.00</td>
<td>.04</td>
<td>-.12**</td>
<td>-.26**</td>
<td>-.10*</td>
<td>-.09*</td>
<td>.12**</td>
<td>.27**</td>
<td>-.20**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9. Indiv</td>
<td>.03</td>
<td>.00</td>
<td>.04</td>
<td>-.28**</td>
<td>-.13**</td>
<td>-.12**</td>
<td>.14**</td>
<td>-.33**</td>
<td>-.24**</td>
<td>.94**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>10. Hier</td>
<td>.07</td>
<td>.07</td>
<td>.06</td>
<td>-.10*</td>
<td>-.26**</td>
<td>-.10*</td>
<td>-.09*</td>
<td>.12**</td>
<td>.27**</td>
<td>-.20**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>11. VD</td>
<td>.07</td>
<td>.07</td>
<td>.06</td>
<td>-.10*</td>
<td>-.26**</td>
<td>-.10*</td>
<td>-.09*</td>
<td>.12**</td>
<td>.27**</td>
<td>-.20**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>12. VP</td>
<td>.07</td>
<td>.07</td>
<td>.06</td>
<td>-.10*</td>
<td>-.26**</td>
<td>-.10*</td>
<td>-.09*</td>
<td>.12**</td>
<td>.27**</td>
<td>-.20**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.20</td>
<td>8.40</td>
<td>.73</td>
<td>.37</td>
<td>.19</td>
<td>.34</td>
<td>12.67</td>
<td>18.48</td>
<td>17.89</td>
<td>15.24</td>
<td>25.93</td>
<td>25.74</td>
</tr>
<tr>
<td>SD</td>
<td>1.45</td>
<td>3.98</td>
<td>.44</td>
<td>.48</td>
<td>.39</td>
<td>.47</td>
<td>4.07</td>
<td>3.55</td>
<td>3.84</td>
<td>5.00</td>
<td>5.00</td>
<td>5.28</td>
</tr>
</tbody>
</table>

Note. Educ = Education; Inc = Income; Parent = Parental status; BA = Born again; VR = Bad vaccine reaction; Indep = Independent; LT = Less traditional; Prog = Progressive; Indiv = Individualism; Hier = Hierarchism; VD = Vaccination Decision; VP = Vaccination Policy. †p<.10. *p<.05. **p<.01.
Table 6.
Zero-Order Correlations, Means and Standard Deviations for Study Variables, Non-parent Subsample

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Educ</td>
<td>-</td>
<td>.21**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. Inc</td>
<td>.15**</td>
<td>.01</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. Race</td>
<td>-.15**</td>
<td>-.05</td>
<td>-.11</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. BA</td>
<td>.03</td>
<td>.02</td>
<td>.04</td>
<td>.13*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. VR</td>
<td>.07</td>
<td>-.12</td>
<td>.10</td>
<td>-.04</td>
<td>-.06</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6. Indep</td>
<td>.07</td>
<td>-.12</td>
<td>.10</td>
<td>-.04</td>
<td>-.06</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7. LT</td>
<td>.22**</td>
<td>.18**</td>
<td>.17**</td>
<td>-.27**</td>
<td>-.03</td>
<td>.07</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8. Prog</td>
<td>.07</td>
<td>-.01</td>
<td>.03</td>
<td>-.16**</td>
<td>-.01</td>
<td>-.04</td>
<td>.17**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9. Indiv</td>
<td>-.14*</td>
<td>-.01</td>
<td>.04</td>
<td>.22**</td>
<td>.08</td>
<td>.13*</td>
<td>-.22**</td>
<td>-.14*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10. Hier</td>
<td>-.16*</td>
<td>.07</td>
<td>.03</td>
<td>.31**</td>
<td>.02</td>
<td>.15*</td>
<td>-.27**</td>
<td>-.27**</td>
<td>.59**</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11. VD</td>
<td>.13*</td>
<td>.02</td>
<td>.07</td>
<td>-.22**</td>
<td>-.32**</td>
<td>-.10</td>
<td>.05</td>
<td>.06</td>
<td>-.34**</td>
<td>-.32**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12. VP</td>
<td>.13*</td>
<td>-.03</td>
<td>.06</td>
<td>-.19**</td>
<td>-.33**</td>
<td>-.09</td>
<td>.05</td>
<td>.04</td>
<td>-.32**</td>
<td>-.31**</td>
<td>.90**</td>
<td>-</td>
</tr>
<tr>
<td>Mean</td>
<td>3.19</td>
<td>7.63</td>
<td>.70</td>
<td>.30</td>
<td>.16</td>
<td>.30</td>
<td>12.72</td>
<td>18.30</td>
<td>16.44</td>
<td>13.39</td>
<td>26.03</td>
<td>25.90</td>
</tr>
<tr>
<td>SD</td>
<td>1.43</td>
<td>4.21</td>
<td>.46</td>
<td>.46</td>
<td>.37</td>
<td>.46</td>
<td>4.25</td>
<td>3.45</td>
<td>3.88</td>
<td>4.77</td>
<td>4.99</td>
<td>5.07</td>
</tr>
</tbody>
</table>

Note. Educ = Education; Inc = Income; Parent = Parental status; BA = Born again; VR = Bad vaccine reaction; Indep = Independent; LT = Less traditional; Prog = Progressive; Indiv = Individualism; Hier = Hierarchism; VD = Vaccination Decision; VP = Vaccination Policy. 
†p<.10. *p<.05. **p<.01
Table 7.
Zero-Order Correlations, Means and Standard Deviations for Study Variables, Community Message Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Educ</td>
<td></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Inc</td>
<td>.31**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Race</td>
<td>.12</td>
<td>.12</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Parent</td>
<td>.03</td>
<td>.16**</td>
<td>-.03</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. BA</td>
<td>-.09</td>
<td>-.16**</td>
<td>-.11</td>
<td>.03</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. VR</td>
<td>.04</td>
<td>.004</td>
<td>.01</td>
<td>.09</td>
<td>.05</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Indep</td>
<td>.07</td>
<td>.04</td>
<td>.08</td>
<td>.00</td>
<td>-.04</td>
<td>.04</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. LT</td>
<td>.27**</td>
<td>.11</td>
<td>.15**</td>
<td>.01</td>
<td>-.20**</td>
<td>.16**</td>
<td>.15*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Prog</td>
<td>.01</td>
<td>.07</td>
<td>.08</td>
<td>-.08</td>
<td>-.20**</td>
<td>-.14*</td>
<td>-.05</td>
<td>.09</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Indiv</td>
<td>.03</td>
<td>.06</td>
<td>.09</td>
<td>.17**</td>
<td>.11</td>
<td>.15**</td>
<td>.24**</td>
<td>-.04</td>
<td>-.13*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Hier</td>
<td>-.07</td>
<td>.11</td>
<td>.11</td>
<td>.19**</td>
<td>.19**</td>
<td>.07</td>
<td>.19**</td>
<td>-.12*</td>
<td>-.12*</td>
<td>.61**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. VD</td>
<td>.04</td>
<td>.05</td>
<td>-.01</td>
<td>-.09</td>
<td>-.16**</td>
<td>-.24**</td>
<td>-.12</td>
<td>-.13*</td>
<td>.18**</td>
<td>-.33**</td>
<td>-.29**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>13. VP</td>
<td>.01</td>
<td>.02</td>
<td>-.002</td>
<td>-.06</td>
<td>-.17**</td>
<td>-.26**</td>
<td>-.14*</td>
<td>-.14*</td>
<td>.17**</td>
<td>-.38**</td>
<td>-.31**</td>
<td>.93**</td>
<td>-</td>
</tr>
<tr>
<td>Mean</td>
<td>3.13</td>
<td>7.79</td>
<td>.70</td>
<td>.61</td>
<td>.35</td>
<td>.32</td>
<td>12.58</td>
<td>18.46</td>
<td>17.36</td>
<td>14.50</td>
<td>26.11</td>
<td>25.99</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>1.37</td>
<td>4.01</td>
<td>.46</td>
<td>.49</td>
<td>.48</td>
<td>.36</td>
<td>.47</td>
<td>.434</td>
<td>3.56</td>
<td>3.85</td>
<td>4.98</td>
<td>4.97</td>
<td>5.29</td>
</tr>
</tbody>
</table>

Note. Educ = Education; Inc = Income; Parent = Parental status; BA = Born again; VR = Bad vaccine reaction; Indep = Independent; LT = Less traditional; Prog = Progressive; Indiv = Individualism; Hier = Hierarchism; VD = Vaccination Decision; VP = Vaccination Policy. †p<.10. *p<.05. **p<.01
Table 8.  
Zero-Order Correlations, Means and Standard Deviations for Study Variables, Family Message Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Educ</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Inc</td>
<td>.31**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Race</td>
<td>.07</td>
<td>.03</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Parent</td>
<td>-.04</td>
<td>.03</td>
<td>.08</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. BA</td>
<td>-.10</td>
<td>-.02</td>
<td>-.10</td>
<td>.04</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. VR</td>
<td>.06</td>
<td>.02</td>
<td>.04</td>
<td>.004</td>
<td>-.04</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Indep</td>
<td>.04</td>
<td>.03</td>
<td>.05</td>
<td>.11</td>
<td>-.09</td>
<td>.13*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. LT</td>
<td>.22**</td>
<td>.24**</td>
<td>.11</td>
<td>-.01</td>
<td>-.17**</td>
<td>-.002</td>
<td>.13*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Prog</td>
<td>.06</td>
<td>.04</td>
<td>.06</td>
<td>-.001</td>
<td>-.17**</td>
<td>-.01</td>
<td>-.06</td>
<td>.14*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Indiv</td>
<td>-.17**</td>
<td>.14*</td>
<td>.19**</td>
<td>.11</td>
<td>.27**</td>
<td>.12</td>
<td>.13*</td>
<td>-.11</td>
<td>-.16**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Hier</td>
<td>-.12</td>
<td>.15*</td>
<td>.17**</td>
<td>.16**</td>
<td>.29**</td>
<td>.11</td>
<td>.10</td>
<td>-.14*</td>
<td>-.31**</td>
<td>.69**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. VD</td>
<td>.10</td>
<td>-.04</td>
<td>.03</td>
<td>.04</td>
<td>-.07</td>
<td>-.39**</td>
<td>-.17**</td>
<td>.00</td>
<td>.10</td>
<td>-.26**</td>
<td>-.22**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>13. VP</td>
<td>.11</td>
<td>-.06</td>
<td>.01</td>
<td>.02</td>
<td>-.09</td>
<td>-.37**</td>
<td>-.16**</td>
<td>-.02</td>
<td>.12*</td>
<td>-.29**</td>
<td>-.26**</td>
<td>-.04**</td>
<td>-</td>
</tr>
<tr>
<td>Mean</td>
<td>3.11</td>
<td>8.37</td>
<td>.72</td>
<td>.65</td>
<td>.35</td>
<td>.21</td>
<td>.32</td>
<td>12.54</td>
<td>18.21</td>
<td>17.39</td>
<td>14.74</td>
<td>26.19</td>
<td>25.93</td>
</tr>
<tr>
<td>SD</td>
<td>1.43</td>
<td>4.14</td>
<td>.45</td>
<td>.48</td>
<td>.48</td>
<td>.41</td>
<td>.47</td>
<td>4.10</td>
<td>3.63</td>
<td>4.02</td>
<td>5.13</td>
<td>4.99</td>
<td>5.27</td>
</tr>
</tbody>
</table>

Note. Educ = Education; Inc = Income; Parent = Parental status; BA = Born again; VR = Bad vaccine reaction; Indep = Independent; LT = Less traditional; Prog = Progressive; Indiv = Individualism; Hier = Hierarchism; VD = Vaccination Decision; VP = Vaccination Policy.  
†p<.10. *p<.05. **p<.01
Figure 1. Unstandardized coefficients for model of vaccination attitudes. Because the pathway specified between parenting attitudes and cultural worldviews is not directional, the standardized coefficient is provided in parentheses. Latent constructs are shown in circles and observed variables are shown in rectangles.

*p<.05. **p<.01.
Figure 2. Unstandardized coefficients for model of vaccination attitudes comparing parents and non-parents. Only those pathways that were compared across groups are displayed in this figure for ease of interpretation. Latent constructs are shown in circles and observed variables are shown in rectangles. Significant differences in pathway coefficients across the two groups are denoted.

*p<.05.
Figure 3. Unstandardized coefficients for model of vaccination attitudes comparing message treatment groups (Community message versus Family message). Only those pathways that were compared across groups are displayed in this figure for ease of interpretation. Latent constructs are shown in circles and observed variables are shown in rectangles.