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Parental Confidence in U.S. Government and Medical Authorities, Measles (Rubeloa) Knowledge, and MMR Vaccine Compliance

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Abstract

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by

Wendy Lynn Leonard

MPH, Walden University 2009

BS, Clark University, 1985

Dissertation Submitted in Partial Fulfillment

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Abstract

Parents' refusal to immunize their children with the measles, mumps, and rubella (MMR) vaccine has resulted in a surge of measles outbreaks in the United States. The purpose of this correlational study was to examine the relationships between parental knowledge and trust of the MMR vaccine, and their trust in government and medical authorities. The theoretical foundation for this study was the health belief model (HBM). This study determined if there was any relationship between general trust in doctors/governments (i.e., the predictor variable) and attitudes toward MMR vaccine (i.e., the sole dependent variable), and whether gender, age group, or level of education moderated that general trust. A Survey Monkey subscriber database and researcher-developed survey was used to identify and email 2,500 parents of immunization-aged children, resulting in 237 respondents who met the required parameters. The analysis revealed a significant, positive relationship between the criterion and predictor variables, $R = .32$, $R^2 = .10$, $F(1, 235) = 26.39$, $p. < .001$, regardless of gender, age, or education, suggesting an association between higher trust and greater likelihood of a parent allowing vaccination. This study offers significant insights for positive social change by providing pediatricians, primary health care providers, and vaccine educators, with information for communicating with vaccine-hesitant parents: It is not enough to address parental concerns of vaccine safety, efficacy, and necessity. It is also not enough to provide evidence-based scientific data, as doing so has been proven to be ineffective–and for some parents counter-productive– when government and medical authorities are sited as the source. What we need to do is start focusing upon the role of parental trust, including how to best establish that trust, and equally important, what steps are necessary to sustain that trust.

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Dedication

For my dad, Dr. Jerry Fink, who taught me: The harder you work the luckier you will become; and, that all things are possible if you are willing to work hard enough.

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From my heart, I'd like to sincerely thank everyone who supported me through this journey, including my wonderful family (especially my brother, Steven), my dearest friends (especially Linda), and my unconditionally supportive husband, Dr. Chris Leonard. I would also like to offer my deepest gratitude to Dr. Jack Nemecek, whose support and belief in me went above and beyond all expectations. Lastly, I'd like to thank Walden University, for making it possible for people like me to receive an outstanding graduate level education, no matter where we live in the world.

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Chapter 1: Introduction to the Study

While endemic measles *(rubeloa)* was declared eradicated in the United States in the year 2000 (Katz & Hinman, 2004, p. 327), importation of measles into the United States is on the rise (CDC, 2013a; MMWR, 2008; Zipprich et al., 2014). In the past 16 years, there has been an 870% increase in measles (i.e., 74 cases in 1999; 644 cases in 2014). Between January 1, 2014 and December 31, 2014, there was 644 confirmed measles cases in 27 states triggered by 23 outbreaks (CDC, 2014c). According to MMWR the majority of outbreaks were the result of unvaccinated travelers who caught the measles abroad, then upon their return, spread the highly infectious virus primarily to children living in communities and geographic areas where school vaccine exemption rates are high (Schuchat, 2013), and where children were unvaccinated by parental choice (CDC, 2014c; Gastanaduy et al., 2014).

Prior to the widespread acceptance and implementation of the measles vaccine in the United States approximately 500,000 people would contract the measles annually; 48,000 cases being severe enough to require hospitalizations, and 500 people would die-mostly children under the age of 5 (McLean, Fiebelkorn, Temte, & Wallace, 2013). Since endemic measles was declared eradicated in the year 2000, the average number of measles cases in the United States had been reduced to 60 cases, annually (CDC, 2014d).

In the United States, prevaccine era, it was considered normal and expected to bury at least half of one's children due to virulent infectious diseases, including measles and small pox (Turnock, 2004). This study contributes to the literature as to why measles continues to cause outbreaks in a nation that has historically high immunization rates for

MMR. Importation of the measles virus is only a plane ride away. Worldwide, >1 billion people travel by commercial aircraft every year (CDC, 2012).

Background

Spread by an infected person simply coughing or sneezing mucous droplets, the measles virus is "so contagious, that if one person has it, 90% of the people close to that person who are not immune will also become infected with the measles virus" (CDC, 2009). Approximately 1 out of every 3 people who contract the measles will have one or more complications (The Pink Book, 2012). Those most at risk for serious complications include children under the age of 5, adults 20-years and older, pregnant women, and the immuno-compromised, although severe complications can happen to anyone (HHS, 2014). Complications include encephalitis (swelling of the brain), neurological damage, blindness, seizures, pneumonia, coma, and death; if pregnant, a woman may miscarry the unborn child (The Pink Book, 2012).

Despite these complications, there continues to be a growing perception among U.S. parents that vaccines in general, and the MMR vaccine in particular, are not safe when first administered and have deleterious, long-term consequences that outweigh the benefits of being vaccinated (Allred, Shaw, Santibanez, Rickert, & Santoli, 2005; Danovaro-Holliday, Wood, & LeBaron, 2002; Gust et al., 2004; Smith, Chu, & Barker, 2004; Sporton & Francis, 2001). Additional barriers to vaccinations include the belief that vaccines overwhelm a child's immature immune system, are not responsible for the significant decline in infectious childhood diseases, and that mandatory vaccination policies infringe upon a person's civil liberties (Donovan & Bedford, 2013; Kata, 2010).

There has been no shortage of research and interventions designed to investigate and combat the downward trajectory of parental vaccine compliance, including encouraging physicians and health care providers to (a) provide parents with educational materials appropriately tailored to address parental concerns of safety, efficacy, and necessity; (b) offer information in a balanced format when addressing risks versus benefits; (c) establish trusting relationships; and (d) actively solicit parents to share their vaccine concerns (Glanz et al., 2013; Gust, Darling, Kennedy, & Schwartz, 2008; Gust, Kennedy, et al., 2008; Gust et al., 2004; Leask, 2009). However, factors associated with how a physician might establish and secure parental trust–or potentially lose it–with regard to dispensing vaccine information has not been discussed in any actionable detail. Glanz et al. (2013) suggested "that physicians may need additional training on risk-communication strategies during and after residency to help hesitant parents with their vaccination decisions" (Glanz et al., 2013).

Providing scientific, evidence-based information tailored for parental understanding and acceptance is essential, but it is not sufficient. According to Larson et al. (2011), "It is not enough to redress the gap between current levels of public confidence in vaccines and levels of trust needed to ensure adequate and sustained vaccine coverage" (p. 526). More studies need to be conducted regarding what factors are involved in obtaining (and ultimately sustaining) parental trust in vaccine information.

In Europe, a link has been shown to exist between parental vaccine acceptance and issues of trust in government and medical authorities (Casiday, Cresswell, Wilson, & Panter-Brick, 2006; Evans et al., 2001; Gardner, Davies, McAteer, & Michie, 2010; van

der Weerd, Timmermans, Beaujean, Oudhoff, & van Steenbergen, 2011). To date in the United States this potential link between trust, authorities, and MMR vaccine compliance has not been well investigated. Understanding if, and to what extent, public trust in vaccine information provided via U.S. government and medical authorities (either directly or as a source of credibility), such as the citing the CDC and the American Pediatric Association (APA) has meaningful impact as to how information, both verbal and printed, may need to be delivered. Rising vaccine refusals has the potential to tip the balance of sustaining herd immunity (Bellaby, 2005), as demonstrated in the 2015 Disneyland outbreak where an unvaccinated woman returning from overseas travel vacationing at the amusement park inadvertently spread the measles to 70 other people, mostly unvaccinated children, in six states; the total of measles cases triggered by this one woman, and the states from which the newly infected cases hail, is expected to continue to rise (Scabo, 2015).

Recognized as an emerging threat worldwide, in Dec 2010, "global health leaders committed to making the next 10 years, the Decade of Vaccines—to ensure discovery, development, and delivery of lifesaving vaccines globally" (Savulescu, 2011, p. 1). Additionally, the IID-1.4 of the Healthy People 2010 (and continuing into Health People 2020) objective requiring a reduction in U.S. measles cases annually has not been met and is trending the wrong direction (HHS, 2000, 2015).

Parents who choose to not vaccinate their children are primarily dichotomous (i.e., they either vaccinate or they do not; (Falagas & Zarkadoulia, 2008; Smith et al., 2004; Zipprich et al., 2014). However, like any large group of people, such binary

distinctions are rarely simple (Larson, Cooper, Eskola, Katz, & Ratzan, 2011); this misnomer is further discussed in Chapter 2.

This public health threat is not limited to the unvaccinated: The measles vaccine has a 2% failure rate (CDC, 2011) as opposed to those who are not vaccinated, whereby their chance of measles transmission is 90% (CDC, 2009). Nine out of 10 unvaccinated people will get the measles if exposed to the virus (author, year). For every 100 children in the United States who are infected with measles, six will get pneumonia; for every 1,000 children, one will develop encephalitis (inflammation of the brain); for every 1,000 children infected with measles, two will die even with the best care (CDC, 2011).

The purpose of this study was to investigate whether citing government and medical authorities may be contributing to undermining parental trust in the credibility of vaccine information being provided in the United States, as found by Casiday et al. (2006) in the United Kingdom. Guided by the health belief model, in this quantitative correlational research study, I collected data via SurveyMonkey from parents (ages 18 and older) with children residing in the United States; a nonrandom sampling technique was used to collect attitudes toward MMR vaccine, medical, and governmental authorities. A knowledge gap exists as to whether referencing governmental and medical authorities as credible sources may be counter-productive for certain groups of parents, inadvertently undermining parents' trust in the information communicated by their pediatrician.

If this trend of vaccination refusal is not reversed, the numbers of severe illness and deaths due to measles could mirror that of the rest of the world, which currently

averages “330 deaths every day or about 14 deaths every hour” (CDC, 2014b) representing 20 million measles cases and 122,000 deaths, annually. Gleaning a better understanding as to why parental doubt in the MMR continues, despite the preponderance of evidence-based science to the contrary–is essential for positive social change, the nation’s health, and the welfare of the world.

Problem Statement

Parent’s refusal to immunize with the MMR vaccine, has resulted in record-breaking measles outbreaks with cases in 23 states in 2014/2015. In the United States, immunizing children for measles is at an all-time high estimated at approximately 91.1% for all children 2-years of age and under. As evidenced by these outbreaks, some parents are still not routinely getting their children immunized with the MMR vaccine. There is a lack of parental trust in the U.S. government and medical authorities. Although past researchers have investigated U.S. parental preferences concerning safety, efficacy, necessity, and the manner in which they would prefer vaccine information be communicated to them, as well as who parents say they generally trust to provide medical information (which is primarily their own pediatrician), there is evidence to suggest while parents do indeed trust their pediatrician above all other sources, that may not be the case with certain parents when it comes to vaccine information dissemination (Gardner et al., 2010; Hilton, Petticrew, & Hunt, 2007; van der Weerd et al., 2011) even when the information is dispensed by their own pediatrician (Casiday et al., 2006).

While it is accurate to suggest providing evidence-based scientific documentation to quell parental fears as to the safety, efficacy, and necessity of a vaccine is prudent

(Duclos, 2004), if parents do not trust root sources to have their child's best interest, the information provided has been shown to not only be not trusted, but also may buoy parental resistance (Nyhan & Reifler, 2015; Nyhan, Reifler, Richey, & Freed, 2014). According to Nyhan et al. (2014), countering parental beliefs with science provided by government authorities such as the CDC "may actually increase misperceptions or reduce vaccination intention" (p. 835).

This study provided insight as to how future vaccine information and materials are developed and sourced so that parental trust as to the credibility of the information is perceived as not suspect. Failure to do so has potentially life-threatening consequences, as fatal vaccine-preventable diseases such as the measles may again become the norm in the United States.

Purpose of the Study

The purpose of this quantitative study was to examine the relationships between parental knowledge of the MMR vaccine, their trust in U.S. government and medical authorities, and parental attitudes towards having their child receive the MMR vaccine. Five variables were identified in this study: a single dependent variable, a single predictor variable, and three moderators. The dependent variable was parents' attitudes toward MMR. The predictor variable was general trust in medical authority, and the moderators were gender, age group, and education.

Information gained from this study has the potential to alter the way vaccine information is provided to certain populations of parents, which may help with reversing a dangerous trend of parents choosing to not have their children receive the MMR

vaccine, and other vaccines, as well. Severe illness and death from measles is not uncommon across the globe. If recent events of imported U.S. measles outbreaks are any indicator of future outcomes, buoying parental trust in MMR vaccine information is essential.

Research Questions and Hypotheses

1. What is the relationship between general trust in doctors/governments and attitudes toward MMR vaccine?

$H_0$1: There is no significant relationship between general trust in doctors/governments and attitudes (belief) toward MMR.

$H_1$1: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR.

- Dependent variable (DV): attitudes toward MMR
- Independent variable (IV): general trust in doctors/governments
- Statistical analysis: multiple regression

2. RQ2: How does gender moderate the relationship between general trust in doctors/governments and attitudes (belief) toward MMR?

$H_0$2: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by gender.

$H_1$2: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by gender.

- DV: attitudes (belief) toward MMR
- IV: general trust in doctors/governments
- Moderator: gender (male, female)
- Statistical analysis: multiple moderated regression

3. How does age group moderate the relationship between General trust in doctors/governments and attitudes toward MMR?

$H_0$3: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by age group.

$H_1$3: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by age group.

- DV: attitudes toward MMR
- IV: general trust in doctors/governments
- Moderator: age group (< 40 years, >= 40 years)
- Statistical analysis: multiple moderated regression

4. How does education moderate the relationship between General trust in doctors/governments and attitudes toward MMR?

$H_0$4: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by education.

$H_1$4: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by education.

- DV: attitudes toward MMR
- IV: general trust in doctors/governments
- Moderator: education (< bachelors, >= bachelors)
- Statistical analysis: multiple moderated regression

Theoretical Framework

In this study, I used the HBM as the theoretical framework. The HBM is a psychological model that attempts to explain and predict health behaviors. Focusing upon the attitudes and beliefs of individuals does this. The HBM was first developed in the 1950s by Hochbaum, Rosenstock, and Kegels (Rosenstock, 1974). The model was developed in response to the failure of a free tuberculosis (TB) health screening program (Rosenstock, 1974). Since then, the HBM has been adapted to explore a variety of long- and short-term health behaviors, including sexual risk behaviors and the transmission of HIV/AIDS (Champion, 1984).

The HBM is based upon the understanding that a person will take a health-related action (e.g., MMR vaccination) if that person (a) feels that a negative health condition (e.g., measles) can be avoided, (b) has a positive expectation that by taking a recommended action, he or she will avoid a negative health condition (e.g., takes MMR vaccination to prevent future illnesses), and (c) believes he or she can successfully take a recommended health action given available resources.

The HBM includes four constructs representing the perceived threat and net benefits: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Becker, Radius, & Rosenstock (1978). These concepts were proposed as accounting for an individual's readiness to act. A recent addition to the HBM is the concept of self-efficacy-or a person's confidence in his or her ability to successfully perform an action. This concept was added by Rosenstock and others in 1988 to help the HBM fit the challenges of changing habitual unhealthy behaviors, such as being sedentary, smoking, or overeating (Andersen, 2008).

Nature of the Study

A quantitative correlational research design was used to guide this study. Correlational research is used to determine existing relationships among groups (Creswell, 2009). The design is used to investigate theoretical relationships, meaning the dependent variable may vary as a result of the independent variable. Quantitative research is more appropriate for answering deductive questions about relationships between specific variables (Creswell, 2009). Further, quantitative research was best suited for this study because numerical values were used to represent variables that were summarized and correlated amongst dependent and independent variables.

Four hypotheses were used to test the specified research questions. Each question was drawn from theory and was supported by the HBM. The sole dependent variable was attitudes toward MMR vaccine, while the predictor variable was general trust in doctors and government. The three specified moderators were gender (male, female, age group (< 40 years, >= 40 years), and education (< bachelors, >= bachelors).

SurveyMonkey Inc., an online survey collection program with an extensive database of individuals living in the United States, was used to acquire the sample from the population and to deploy the survey and collect data. The population for this study was operationalized as all parents living in the United States. Parents had to be at least18-years-old to participate. Parents all had access to a computer and the Internet and were willing to honestly report their feelings about trust in doctors/government and the MMR vaccine.

A nonrandom purposive sampling technique was used to extract data from the population. A nonrandom sampling technique means that participants were not randomly obtained to statistically ensure a representative sample (Lucas, 2014). A sample size of 200 was calculated to be representative of the specified population of parents in United States. The Statistical Package for Social Science (SPSS—22.0) was used to perform descriptive and statistical analyses. Specific details of sampling methods and procedures employed, power analyses, instrumentation, operationalization of constructs, and the data analysis plan, as well as information concerning ethical procedures and security, are addressed in Chapter 3.

Definition of Terms

Attitude: An "underlying inclination to respond to something either favorably or unfavorably" (Myers, 2012).

*Contagious***:** A "very communicable disease capable of spreading rapidly from one person to another by contact or close proximity" (CDC, 2014e).

*Communicable***:** An "infectious disease that is contagious and which can be transmitted from one source to another by infectious bacteria or viral organisms" (CDC, 2014e). An "example of noncommunicable is disease caused by toxins from food poisoning or infection caused by toxins in the environment, such as tetanus" (CDC, 2014e). A person cannot catch food poisoning or tetanus from another person; however, the communicable measles virus is "so contagious, that if one person has it, 90% of the people close to that person who are not immune will also become infected with the measles virus" (CDC, 2009).

Efficacy: A measure used to describe how good a vaccine is at preventing disease (CDC, 2013b).

Endemic: An interruption of continuous transmission lasting >/=12 months (Zipprich et al., 2014); the continual, low-level presence of disease in a community (CDC, 2013b).

Herd immunity: The reduction of "infection or disease in the unimmunized segment as a result of immunizing a proportion of the population" (John & Samuel, 2000); a situation in which

> A sufficient proportion of a population is immune to an infectious disease (through vaccination and/or prior illness) to make its spread from person to person unlikely. Even individuals not vaccinated (such as newborns and those with chronic illnesses) are offered some protection because the disease has little opportunity to spread within the community. (CDC, 2013b)

Immunization: The process by which "a person or animal becomes protected against a disease. This term is often used interchangeably with vaccination or inoculation" (CDC, 2013b).

Infectious: A disease "caused by a microorganism and therefore potentially infinitely transferable to new individuals. May or may not be communicable" (CDC, 2014e).

Measles: A highly infectious, contagious viral disease (The Pink Book, 2012).

Vaccination: An "injection of a killed or weakened infectious organism in order to prevent the disease" (CDC, 2013b).

Vaccine: A product "that produces immunity therefore protecting the body from the disease. Vaccines are administered through needle injections, by mouth and by aerosol" (CDC, 2013b).

Virus: A tiny organism "that multiplies within cells and causes disease such as chickenpox, measles, mumps, rubella, pertussis and hepatitis. Viruses are not affected by antibiotics, the drugs used to kill bacteria" (CDC, 2013b).

Assumptions

While a sample size of 200 was calculated to be representative of the specified population of parents in United States, the findings may not be applicable to the entire U.S. population. This is because of variables unknown, including the possibility of the survey being made known on social networks, which could spur volumes of survey participants not representative of the U.S. population, but instead, those with an agenda. That agenda might be influenced by the recent Disneyland outbreak, current U.S. measles

outbreaks, and the ongoing MMR vaccine controversy. These outbreaks have been receiving a higher than usual degree of media attention. The online survey was self-administered; thus, I assumed that the person responding to the survey did fit the required parameters of participation and was answering truthfully.

Scope and Delimitations

The design of this study was quantitative given the nature of the problem and research questions asked. The study was delimited by design given that only quantitative data were collected from parents. Parents were not asked to answer open-ended questions and were not subjected to face-to face interviews. The survey was confidential in that no personally identifiable information was collected.

The scope of the project as it pertains to population included parents living the United States who had at least one child 6 years of age or under. Parents were delimited by their ages to ensure consistency and continuity of responses.

The population sample was extracted from a national database sample owned by SurveyMonkey. This strategy provided a means to capture responses from parents across the national landscape to ensure a sufficient representation of the population. Only parents from the United States, age 18 or older, with at least one child 6 years of age or younger were targeted to limit the scope of the project.

Limitations

This was a quantitative study; thus, numerical values were used to represent variables that were summarized and correlated amongst dependent and independent variables. It is possible that numerical values did not fully capture parental attitudes.

However, while a qualitative study may have provided more in-depth information, it would not have been as scientifically rigorous. Quantitative research is more appropriate for answering the deductive questions about relationships between specific variables being sought (Creswell, 2009). A possible confounding variable may have included parental lack of focus while taking the survey, if they were also actively parenting simultaneously. However, this possibility was taken into account by emphasizing that the survey can be completed in a matter of minutes, limiting that possibility. Additionally, limiting the size of the instrument reduced the scope, thereby diminishing confounding variables. Whether a parent responds honestly cannot be determined for certain, although the survey instrument, the Parental Attitudes toward MMR Vaccine and Trust in Medical Authority Amended survey (PA-MMR-TMA-A), was validated using SPSS-21 Cronbach's alpha reliability and factor analysis equations. The population surveyed, and for the purpose of optimal generalizability to parents residing in the United States, did not include parents younger than the age of consent, which is 18.

Significance

There is a gap in the literature with respect to how parental trust in government and medical authorities may impact a parent's reluctance or compliance to have the MMR vaccine administered to their children. Larson et al. (2011) concluded:

> The vaccine community demands rigorous evidence on vaccine efficacy and safety and technical and operational feasibility when introducing a new vaccine, but has been negligent in demanding equally rigorous research to understand the

psychological, social, and political factors that affect public trust in vaccines. (p. 526)

Additionally, not all infectious viruses are contracted equally. According to Goodman (2007), "The proportion of the population that has to be immune to provide this "herd immunity" varies according to the infectiousness of the agent" (p. 264). For example, to keep polio (*poliomyelitis*) at bay, 80% of the population must have immunity (author, year). The Ebola virus is highly infectious but not particularly contagious, due in no small part to Ebola-infected persons not being contagious until they have symptoms. However, measles is highly contagious; it can live on surfaces and in the air where an infected person coughed or sneezed for upwards of 2 hours after the infected person has left the premises (CDC, 2009). People with the measles are highly contagious 4 days prior to the onset of the rash "and 4 days after the rash appears" (CDC, 2009, p. 1). Once symptoms do emerge, it initially presents with a cough, fever, runny nose, and runny, watery eyes, called conjunctivitis (CDC, 2009). Infants often also get diarrhea and swollen lymph nodes prior to rash onset, but such signs and symptoms (e.g., fever, runny eyes and nose, cough etc.) could be indicative of many illnesses or disease. Thus, for the herd immunity to be maintained against the measles in the United States, a minimum of 90% of the U.S. population must be vaccinated (Goodman, 2007; Schlenker, 1994) or have had the disease before, which confers immunity.

Include a topic sentence. Prior to 1963, before there was the MMR vaccine, "nearly everyone in the U.S. got the measles, and hundreds died from it each year" (CDC, 2014f). Because of the county's historic widespread success of the MMR vaccine,

"most practicing doctors today have never seen a case of the measles" (CDC, 2014f). As a result, doctors have not been inclined to consider the measles or look for the telltale tiny Koplik's spots (highly contagious tiny bluish white spots inside the mouth) as early symptoms when patients (be they babies, children, or adults) present early on with fever, runny nose, cough, and runny eyes (CDC, 2014a).

As delineated by Andre et al. (2008) of the World Health Organization (WHO), the implications for positive social change are vast, as vaccination reduces disease, disability, death, and inequity worldwide (Andre et al., 2008). Robust vaccination implementation lowers morbidity and mortality, reduces health care costs, and "can save billions of US dollars for communities and countries" (Andre et al., 2008, p. 140). Measles can also be weaponized (SIU School of Medicine, 2014); thus vaccines, in general, and the MMR vaccine in particular are "considered indispensable against bioterrorism" (Andre et al., 2008, p. 140). According to the Southern Illinois University School of Medicine (2014):

> Historically, outbreaks (wars) of microbial species against the human species have killed far more people than war itself. Examples include i) killing of 95% of Pre-Columbian Native American populations by diseases like small pox, measles, plague, typhoid and influenza; ii) death of 25 million Europeans (a quarter of the population) caused by Bubonic Plague in the 14th century and 21 million deaths due to the influenza pandemic of 1918-1919. (p. 1)

Further, in developing countries–where U.S. travelers are most likely to contract the measles–the benefits go beyond disease reduction, having a positive impact on

women's empowerment, as women can choose to "opt for fewer children as the need to have many children to ensure that some will reach adulthood is reduced. This has significant health, educational, social and economic benefit" (Andre et al., 2008).

Moreover, vaccinations have been shown to be a source of promoting peace. Countries such as Liberia and Afghanistan have allowed "vaccine-mediated ceasefires during civil conflicts" (Andre et al., 2008, p. 140). Hotez (2001, p. 862) observed that vaccines have been shown to be "instruments of foreign policy" as well a correlation between "childhood death rates from vaccine-preventable infections and the probability of a nation becoming engaged in armed conflict" (Hotez, 2001).

Gleaning a better understanding as to why parents in the United States are increasingly refusing vaccines in general, and the MMR vaccine in particular, is vital to the nation's health and that of the world. If evidence of the science and medicine play little role in the decision of parents (McMurray et al., 2004), not only what and how vaccine information needs to be communicated to parents needs rethinking, but also certain populations of parents from whom the information is sourced. Hopefully, this research has furthered the understanding of this complex and emotionally charged, controversial public health issue.

Summary

In the past 16 years, there has been an 870% increase in measles cases in the United States. In this study, I investigated whether a lack of parental trust in the U.S. government and medical authorities, and parental attitudes towards their child receiving the MMR vaccine, are correlated. If providing vaccine-hesitant parents with information

they believe was supplied by the medical establishment or government authorities is ineffective, citing such sources may be counterproductive. In Chapter 2, I will review the existing literature spanning 40 years, beginning in 1975 and concluding in the first quarter of 2015.

Chapter 2: Literature Review

Introduction

There may be a lack of parental trust in the U.S. government and medical authorities, which influence parental attitudes towards their child receiving the MMR vaccine. Understanding if, and to what extent, public trust in vaccine information provided via U.S. government and medical authorities (either directly or as a source of credibility) has meaningful impact as to how information–both verbal and printed–may need to be delivered as rising vaccine refusals has the potential to tip the balance of sustaining herd immunity.

The literature search strategy began with the earliest mention of measles in the 900 BCE, through the Disneyland measles outbreak that began in 2014, and concludes in February 2015. The literature was evaluated in descending publication date order with particular attention paid to study design, number of study participants, independent and dependent variables, results/analyses, conclusions, and journal identification. Spanning a 40-year period (1975 to 2015)–plus one seminal study from 1823–the literature search included use of the electronic databases PubMed, MEDLINE, as well as other U.S. government sources including the CDC, the WHO, the National Institutes of Health, and MMWR. The following search terms were used in the databases: *antivaccine, children, measles, autism, distrust, vaccine, parents, government, MMR, controversy, childhood vaccine, concern, belief, fear, hesitance, United States, trust, physician*, and *Wakefield.*

The primary start date of 1975 was chosen as this was the year a seminal study–which reviewed the literature of the previous 2 decades–reported that psychosocial elements, such as perceived risks, benefits, and the doctor-patient dynamic, should be considered critical information to understand patient noncompliance to medical advice. This set the stage for the 1979 study that first investigated the vaccine uptake decision-making processes via a questionnaire based upon the HBM, which is the theoretical foundation upon which this study was based.

Theoretical Foundation

The theoretical framework for this study was the HMB. As early as 1979, Rundall and Wheeler (2009), using a mailed questionnaire, tested the HBM in the "context of the swine flu vaccination" (p. 191), finding it useful in identifying key psychosocial determinants of accepting preventive health services. In a 1990 TB vaccination uptake study, the HBM was chosen as the theoretical foundation for the questionnaire investigating African American parental concerns, intentions, and perceptions of their child receiving the TB vaccine (Steyn & Viljoen, 1990). In a study of over 11,000 parents using data from the 2009 National Immunization Survey, Smith et al. (2011) used the HBM as the theoretical basis upon which to investigate issues of parental hesitancy with regard to their childhood vaccine decision-making processes. Smith et al. identified safety concerns and a lack of perceived benefits as key determinants. Most recently, He, Liao, Huang, Feng, and Zhuang (2015) found that the HBM provided "a good theoretical basic for understanding factors associated with parents' decisions on their children's vaccination" (He, Liao, Huang, Feng, & Zhuang, 2015).

Rationale for Health Belief Model (HBM)

In this study, I investigated parental attitudes and beliefs. The HBM was well suited for such an investigation (Scheuner & Rotter, 2006). Not only has the HBM been chosen for similar studies, it has been identified as a reliable framework concerning parents and childhood vaccine concerns. Additionally, as stated by Scheuner and Rotter (2006), the HBM is a "widely accepted" model for quantifying health beliefs, "which theorizes that a person's behavior is the result of several factors that can facilitate compliance with preventive behaviors or treatment interventions, including perceived susceptibility, perceived severity, perceived efficacy and cues to action" (p. 141). Hence, HBM was the ideal choice for investigating parental decision-making processes with regards to this study.

Historical Perspective

1823: Foreshadow of the Future

In 1823, a scientific inquiry of measles and vaccine safety and efficacy first appears in the peer-reviewed literature. Gilder (1823) recounted the progression of an *ostensibly* healthy 14-month-old female baby, her un-inoculated brother, and another child, residing quite a distance away, who was inoculated with the same serum as the infant girl (Gilder, 1823). The girl's brother came down with the measles the day after she was inoculated; 4 days later, she came down with the measles as well–which Gilder characterized as resembling her brother's case. Meanwhile, the child across town had experienced no ill effects due to the shot beyond its "natural course" and did not come down with the measles (p. 186). Gilder posited that perhaps the accepted theory at that

time (put forth by Hunter), that, "two processes cannot go on at the same time in the same part of any substance" (p. 188) may not always be the case or may not be the case at all. Instead, Gilder suggested that the little girl had surely been exposed to the measles virus just prior to being vaccinated, but had not yet presented with symptoms (p. 189). The concept that a vaccine might not be efficacious in a seemingly previously healthy child (no apparent symptoms *a priori)* was a groundbreaking insight; Gilder's interest in differentiating correlation from causation would foreshadow the linchpin igniting the parental upsurge in vaccine hesitancy and noncompliance 175 years later.

Decade of the 70s

Beginning in 1975, 4 years after the combination MMR vaccine was shown to be safe and effective in inducing measles immunity in 96% of vaccinated children, in a 20-year systematic review, (Becker & Maiman, 1975) revealed how the past 2 decades of studies did not provide the much needed insights as to predicting patients' future preventive health compliance. Becker and Maiman (1975) found that the majority of previous studies "tended to focus upon easily measured characteristics of the patients, regimen, or illness" (p. 10) rather than predictive indicators. This insight that social, emotional, and psychological measurements should be included in the scientific method was groundbreaking. Further, Becker and Maiman also found people's health beliefs, including people's estimate of the likeliness of contracting any given disease, its potential seriousness if contracted, and whether they believed the recommendations would be effective, were highly predictive of future compliance. These determinants directly

reflected the HBM construct, which states that a person's perception of susceptibility, severity, benefits, barriers, and self-efficacy are paramount factors.

In 1975, vaccine challenges, including the need for clear guidance, were not confined to the patient population. Letonturier (1975) addressed multiple physician challenges. For example, Letonturier stated that the guidelines upon which a vaccine should not be given were too vague; it was unclear if and when certain populations, such as pregnant women and the elderly, should be vaccinated. Letonturier was also concerned that as infectious diseases waned due to the widespread success of vaccination effort, the importance of preemptive care would diminish. Letonturier stated that vaccine challenges and concerns experienced by physicians were not the exception, but rather, a daily happening that needed to be addressed.

In 1978, thanks to the significant success of the measles vaccine, the CDC (year) officially declared the national goal of total U.S. measles eradication within 4 years. The following year, Rundall and Wheeler (1979) investigated whether the HBM might be a tool for predicting a person's likelihood of vaccine compliance as a preventive measure. (Rundall & Wheeler, 1979) used a mailed questionnaire format and achieved just under a 50% response rate (232 responses out of 500 mailed). Not only did Rundall and Wheeler find that the HBM was indeed predictive of future vaccine compliance behaviors, they also found that for their study population, "the most important determinants" were twofold: One, the seniors' level of concerns as to the perceived safety of the vaccine, and two, how strongly they believed the possibility was of their contracting the swine flu in the first place (p. 191). This cost/benefit analysis was 20 years prescient of people's

MMR vaccine concern, as death and debilitation caused by measles became uncommon–and worries of an autism link grew. This study approach is much in line with the online questionnaire format.

Decade of the 80s

Based upon the success of smallpox eradication worldwide, (Hopkins, Koplan, Hinman, & Lane, 1982) argued that the same success would be attainable for the measles (p. 1396). Citing the enormity of deaths annually and the tens of thousands of children who continue to become afflicted with serious measles complications, Hinman et al. contended that the measles vaccine was a readily available "heat-stable, cheap, and effective vaccine" (p. 1396), which would result in immediate health benefits, reduce future ongoing health care expenses, and would result in overall significant long-term financial savings.

While the CDC's measles eradication goal of 1982 had yet to be met, the incidence of measles was trending precipitously in the right direction. Down from an annual 3 to 4 million cases (pre-vaccine) to 1,497 cases reported in 1983–which would explain the lack of germane studies published in the peer reviewed literature during that period; however, that trajectory reversed. Between 1985 and 1988, 68% of school-age children who contracted the measles had been vaccinated; approximately 8% had been vaccinated prior to their first birthday–thus again, the relevant literature returned a population based study entitled, "Delays in the primary vaccination of children" (Allard, Guy, Durand, Hudon, & Robert, 1985) investigating why parents were delaying vaccines in general, and the MMR vaccine, in particular. Citing their concern for the "fragility

immunity" of measles (p. 108), Allard et al. (1985) mailed a questionnaire to the parents of 204 children, achieving an 88% response rate (p. 109). Those who did not respond were called by telephone. The study results indicated while 10% of the children had not received the MMR vaccine, "only one parent was known to be opposed to vaccination" (p. 109). In an attempt to increase compliance, Allard et al. (1985) extended their randomized controlled study to include a mailed MMR measles reminder letter to arrive one month prior to a child's first birthday. It "failed to show any influence" on the "proportion of children who received the MMR vaccine at 12 months" (p. 110).

Falling 27% short of the 90% immunization rate required to achieve herd immunity, a United Kingdom study entitled, "Parents' attitudes to measles immunization" (Morgan, Lakhani, Morris, Dale, & Vaile, 1987) investigated why parents were failing to give their children the MMR vaccine, but readily permitted other vaccinations. A randomized controlled study of 174 in-person interviews were conducted. Both pre-coded and open-ended questions were used. Of note, so as to not "unduly influence" the outcome, the questions were not confined to the measles (p. 26). Morgan et al. (1987) found that "Parents made a clear distinction between the different types of immunizations" (p. 26). For example, while 99% of parents thought favorably about DTP vaccine (diphtheria, tetanus, polio), 25% of parents raised questions and concerns about the measles vaccine. Further, 67% of parents said they knew very little about the measles or the measles vaccine; however, 76% believed the measles was a serious disease (p. 26). Nonetheless, 93% of parents said they would have their child receive the measles vaccine, 3% said they were undecided and 3% did not plan on having their child receive

the vaccine. Of note, approximately 33% of the parents who were either delaying or rejecting the MMR vaccine had not been advised by any health care provider to get their child vaccinated (p. 27).

Decade of the '90s

A study with the rather self-explanatory title, **"**Reasons for non-uptake of measles, mumps, and rubella catch up immunization in a measles epidemic and side effects of the vaccine" (Roberts, Sandifer, Evans, Nolan-Farrell, & Davis, 1995), Roberts et al (1995) conductive a randomized retrospective cohort study utilizing a mailed questionnaire. Approximately 10% of parents reported, "Their general practitioner had said that measles, mumps, and rubella immunization was not needed" (p. 1631), despite the 1989-1991 upsurge in measles, which resulted in exposing that a percentage of the population required two doses of MMR for lifelong immunity. The main reasons parents shared for not having their child receive the second dose of the MMR vaccine was either their child had already received one vaccine (and they believed that to be sufficient) or their child had already the measles, and thus indeed had immunity. Roberts et al (1995) concluded physicians needed to explain to parents that one dose of MMR does not confer immunity to a certain percentage of the population, and in so doing this parental objection "could be overcome by providing clear and consistent professional advice" (p. 1632).

In 1998, the study, "Ileal lymphoid nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children" (Wakefield et al., 1998) was published. In this study, Wakefield et al. (1998) claimed to have investigated 12 children referred to

him by the Royal Free Hospital and School of Medicine, all of who were suffering from gastrointestinal issues and a regressive development disorder (i.e., autism). Wakefield et al. (1998) further documented that he and his team conducted a multitude of tests on his 12 subjects (ranging in age from 3 to 12), which included "Ileocolonoscopy and biopsy sampling, magnetic-resonance imaging (MRI), electroencephalography (EEG), and lumbar puncture were done under sedation" (p. 637). Their study concluded that the MMR vaccine was possibly causative of the autism, based upon their observation that the co-morbidities presented in the general timeframe the children were vaccinated. Of note, this study is best known for being the one that lead to the precipitous drop in MMR vaccinations in the United Kingdom (and then later negatively impacting the United States); the journal *Lancet* retracted the study in 2010.

The following year, Taylor, Miller, Farrington, Petropoulos, Favot-Mayaud and Waight (1999) conducted a study titled, "Autism and measles, mumps, and rubella vaccine: no epidemiological evidence for a causal association" to investigate Wakefield's contention that the MMR possibly caused autism. Spanning a 20-period starting in 1979–the MMR was introduced to the United Kingdom in 1988–Taylor et al. (1999) found no increase incidence or trend of autism and found, "There was no difference in age at diagnosis between the cases vaccinated before or after 18 months of age and those never vaccinated" (Taylor et al., 1999). In other words, in their sample of 498 cases of autism, which included cases of core autism, atypical autism, and Asperger's syndrome (p. 2027), as stated by Taylor et al. (1999), "Our results do not support the hypothesis that MMR vaccination is causally related to autism, either its initiation or to the onset of

regression—the main symptom mentioned in the paper by Wakefield and others" (p. 2029).

Later in 1999, in the June issue of the *Lancet*, spurred in part, by a flurry of media attention, DeStefano and Chen (1999) investigated the alleged association between autism and MMR put forth by the Wakefield study. Entitled, "Negative association between MMR and autism" (DeStefano & Chen, 1999), their article evaluated the methodology of the aforementioned Taylor et al. (1999) study, and one other study conducted by the Working Party on MMR of the UK's committee on Safety of Medicine. DeStefano and Chen (1999) found the two studies negating the 1998 Wakefield study findings were academically rigorous, and concluded the Wakefield study should be considered scientifically flawed. Of note, DeStefano and Chen (1999) pointed out the Taylor et al. (1999) study's closing comments: "We hope our results will reassure parents and others who have been concerned about the possibility that MMR vaccine is likely to cause autism and that they will help restore confidence in MMR vaccine" (Taylor et al. 1999, p. 2029). In DeStefano and Chen's closing comments, they hypothesized that the spurious association, now debunked, would likely not garner the "media frenzy" attention that the Wakefield study enjoyed.

Decade of the 2000s

Citing the 1998 Wakefield study as possibly what caused the reduction in MMR vaccine uptake, Evans, Stoddart, Codon, Freeman, Grizzel and Mullen (2001) conducted a qualitative study of 48 parents, gleaned through a purposive sampling strategy; half of whom had given their child the MMR and half that had not. Their study, "Parents' perspectives on the MMR immunization: a focus group study" (Evans et al., 2001) revealed that all of the parents–regardless of their child's MMR vaccine status–had been fearful and experienced anxiety concerning the MMR vaccine decision process. Key factors associated with MMR refusal included parents not trusting government issued statements concerning safety, efficacy, and necessity, their belief that health care providers could be swayed by financial incentives, rather than have the best interest of their child at heart, and, a parent's overall "degree of parental trust and confidence in medical recommendations and their attitudes towards compliance" (p. 905) was of significant importance.

The study, "Choosing not to immunize: are parents making informed decisions?" (Sporton & Francis, 2001), investigated the decision-making processes of parents who chose not to immunize their children. A qualitative, semi-structured interview of 13 parents, who had chosen to not vaccinate at least one of their children, Sporton and Francis (2001) identified a number of key findings which included–but went beyond safety, efficacy and religious beliefs. Usually citing more than one reason for vaccine noncompliance, Sporton and Francis (2001) found parents perceived measles as a "mild disease" (p. 183); they questioned the veracity of the educational information provided–

believing it “exaggerated the efficacy of vaccines” (p. 184); were concerned that there was a lack of research concerning the long-term effects of vaccines–which included specific mention of autism, among other diseases; and, parents questioned whether their health care provider had provided “balanced information,” and questioned whether there were financial incentives that diminished a doctors objectivity (p. 187).

In a 1992 study entitled, “Anti-vaccination activists on the world wide web” (Davies, Chapman, & Leask, 2002), the study authors investigated what results would be yielded using the Internet search terms “vaccination" and "immunization" and analyzed the quality of the information provided. Of the 100 websites Davies et al. (2002) studied, not only were 43% of the sites antivaccine oriented, but also, 100% of the first ten Googled results were antivaccine. In terms of content, the authors found multiple similarities in the antivaccine message framing. For example, “Nearly all sites referred to the anti-vaccination struggle as a search for truth against a background of cover up and denial. Anti-vaccinationists portrayed themselves as crusaders excavating hidden truths” (Davies et al., 2002, p. 23). Additionally, tactics included creating an “us versus them” paradigm, such as portraying themselves (anti-vaccinationists) as “caring and concerned friends and allies of parents, together pitted against the collusive interests of uncaring doctors and government” (p. 23). Davies et al. (2002) also identified common themes including, being privy to information the government did not want parents know, claimed vaccines caused autism and other injuries, and that only parents know what is best for their own child. The authors conclude since using facts to refute such false claims

will likely be “insufficient”, Davies et al, (2002) suggested embracing a more “emotive” tone and using fear appeals–as the vaccine websites did–might prove more successful.

The study, “Vanishing vaccinations: why are so many Americans opting out of vaccinating their children?” (Calandrillo, 2004), characterized the rise of parents not vaccinating their children the ironic result of vaccination success. Calandrillo (2004) discussed the challenge of balancing personal freedom and civil liberties with the need to protect public welfare; the challenge of combating antivaccine misinformation on the Internet; the continued pall of the spurious MMR and autism connection; a general lack of the public’s risk perception capabilities; and, how “parents opting out has caused the AMA grave concern, with many experts decrying the rise of so-called ‘exemptions of convenience’” (Calandrillo, 2004, p. 1).

Further, citing the 1904 U.S. Supreme Court case of Jacobson v. Massachusetts, Calandrillo (2004) discussed the Supreme Court decision, which concluded, “that when the health concerns of the larger community are at stake, the state may indeed infringe upon individual rights” (p. 13); adding, “individual rights cannot themselves intrude upon other people's rights” (p. 13). Of particular note, Calandrillo (2004) said that part of the anti-vaccinationists success was how they strategically used “the classic American values of freedom and individualism as grounds for their objections to compulsory vaccination law” (p. 16). Calandrillo (2004) also highlighted how the strategy of equating resisting mandatory vaccination with “the noble fight against government oppression” (p. could be found on 80% of the antivaccine websites (p. 16), concluding that “the state must

disseminate accurate data to the public in order to ensure that parents affirmatively desire to immunize their children" (p. 32).

The study, "Children who have received no vaccines: who are they and where do they live?" (Smith et al., 2004), investigated whether there were demographic and socioeconomic differences between children who were under-vaccinated versus those who were unvaccinated. The purpose of the study was to identify what types of custom-tailored vaccine educational information would be advantageous to best resonate with each audience. Based upon a nationally representative sample of 151,720 children's vaccination records spanning from1995 to 2001–and gleaned from the National Immunization Survey (NIS) as well as used the NIS Parental Knowledge and Attitudes topical module (PKAM)–Smith et al. (2004) found marked differences. Those children who were under-vaccinated tended to come from homes where the mom was a young (between 20 and 29-years of age), unmarried, widowed, divorced or separated Black women with, at most, a high school education, lived at or near the poverty level in urban communities, and 22.1% of these moms expressed that a doctor's opinion had no influence upon their vaccination decision (Smith et al., 2004). Unvaccinated children tended to come from homes where the mom was 30-years of age or older, White, married, with a college degree, a household income of at least $75,00, lived in the affluent suburbs, and 70.9% expressed that a doctor's opinion bared no weight upon their vaccination decisions. Of particular note, Smith et al. (2004) found 47.5% of White moms chose to not have their child vaccinated citing safety concerns, whereas only 5.1% of Black moms had vaccine safety concerns. In short, the White moms primarily made a

conscious decision to not vaccinate their child, whereas the Black moms whose children were under-vaccinated was a function of circumstance, rather than choice.

The American Academy of Pediatrics (AAP) clinical report, "Responding to parental refusals of immunization of children" (Diekema, 2005) provided "practical guidelines" to help pediatricians navigate the challenges of reassuring parents who are reluctant or refuse to vaccine their child (p. 1428). The "first and most important" recommendation of the AAP report, advised pediatricians to "listen carefully and respectfully to the parent's concerns, recognizing that some parents may not use the same decision criteria as the physician and may weigh evidence very differently than the physician does"; and, to talk honestly–within a clear context–when discussing known and unknown risks (Diekema, 2005, p. 1430). For example, Diekema (2005) suggested when candidly discussing with parents the one in one million chance that the MMR vaccine could cause encephalopathy (swelling of the brain), physicians should be sure to explain that the risk of encephalopathy from catching the measles is 1000 times greater. Other recommendations included referring parents to reputable websites, and for parents concerned about their child receiving multiple injections in one visit, to point out that spreading the injections out over time only adds to the number of days a child experiences pain due to injections. Of note, for parents who completely refuse vaccinations, Diekema (2005) suggested pediatricians revisit the issue at subsequent visits, "As respect, communication, and information build over time in a professional relationship, parents may be willing to reconsider previous vaccine refusals" (p. 1430).

The study, “Factors associated with refusal of childhood vaccines among parents of school-aged children: a case-control study” (Salmon et al., 2005) usedd a mailed survey with a total of 2,435 parents of children who were either fully vaccinated or had claimed nonmedical exemption status. Concerned that nonmedical exemptions were not evenly distributed across the United States, but rather were clustered in geographic areas of certain states more than others–which resulted in increased likelihood of outbreaks; and noting that between 1985 and 1992, children “in the United States with nonmedical exemptions were 35 times more likely to contract measles than vaccinated children” (Salmon et al., 2005, p. 470)–the most common reason parents gave for not vaccinating their children included questionable safety, the potential harm the vaccine could cause in the future, and concern that vaccines might overload a children’s immune system. Additional notable differences for parents of exempt children included their increased likelihood to choose complementary and alternative medicine for their family; the belief that their child was unlikely to catch an infectious disease; and, had “a low level of trust in health care professionals and the government compared with parents of vaccinated children” (Salmon et al., 2005, p. 473).

The 2005 study, “Vaccine beliefs of parents who oppose compulsory vaccination” (A. M. Kennedy, Brown, & Gust, 2005), using data from the 2002 Health Styles survey of 4,397 parents (of which 1,527 met the criteria) revealed 12% of the respondents were opposed to compulsory vaccination policies. Proportionately compared to vaccine supportive parents, vaccine opposed parents believed the human body could protect itself without vaccines; that vaccines were only somewhat important; that vaccine safety was

questionable; that children receive too many vaccines before the age of two; felt that the diseases were mostly not serious; and, indicated their child would receive only some or none of the childhood vaccines recommended in the future (Kennedy et al., 2005). Kennedy et al. (2005) used the theoretical framework of the Health belief model to explain their findings. Of note, in their survey, lower income households were more likely to be opposed to vaccines than higher income households. The study authors concluded that educating parents about vaccine preventable diseases, vaccine and about vaccines in general, would be prudent.

The study, "Between the demands of truth and government': health practitioners, trust and immunization work" (Brownlie & Howson, 2006), focused upon the practitioners' perspective, as opposed to the more common focus upon the parents' perspective, with specific regard to the MMR in a "post Wakefield" world (p. 439). While pediatricians generally appreciated being provided standardized MMR vaccine safety, efficacy, and necessity information from the government, they felt it lacked academic rigor and solid data, which gave many practitioners pause both in terms of its veracity, and in terms of its usefulness when discussing MMR concerns with parents (p.439). Additionally, parents had begun presenting their own Internet research to their pediatrician, and based upon those own findings, some parents would pronounce that they would not allow their child to receive the MMR. This declaration would commonly result in pediatricians offering to look at the parent's Internet findings–most of which was unvetted, sensationalized, media-fueled coverage that tended to amplify health risks. Brownlie and Howson (2006) concluded trusting the government, as an unbiased source

of scientifically sound vaccine information was essential. Pediatricians would then, in turn, feel better prepared to successfully address parents' MMR vaccine concerns.

The study, "Trusting blindly can be the biggest risk of all: organized resistance to childhood vaccination in the UK" (Hobson-West, 2007) analyzed the activities and discourse of contemporary organized parental groups and conducted interview with the leaders of ten groups. Hobson-West (2007) argued that antivaccine groups–united by their vaccination disdain and a general mistrust of government–collectively should be categorized as "Vaccine Critical groups" and further sub classified as "Reformist" and "Radical" as their objectives are not the same. Reformists are led by parents who believe they have experienced a child injured by a vaccine, who focus upon educating the public about the dangers of vaccines, and are interested in issues of financial compensation; radicals question big pharma, prefer alternative medicine, may or may not have experience with vaccine injury, and are not likely to be concerned with compensation (Hobson-West, 2007). Of note, Hobson-West (2007) found while the bulk of pro-vaccine education literature discussed risk in terms of large-scale epidemiological studies and the importance of protecting the herd, vaccine critical groups reframe it, rendering the risk/benefits argument irrelevant. Instead, the cast doubt upon the historical success of vaccines, warn that vaccines cause problems more severe than the illness (e.g., autism), and casts doubt on all risk information as invalid (e.g., big pharma, in collusion with big government, has not conducted adequate safety and efficacy trials, therefore, any arguments that uses facts derived from such studies and sources are not viewed as authoritative) (Hobson-West, 2007). While understanding these distinctions have far

reaching implications for public health efforts, Hobson-West (2007) stated, “Critical concerns will not necessarily be resolved by strategies aimed at restoring trust in professional experts” (p. 212).

A 2007 study provided new insights as to the impact of the Wakefield study and issues of trust. Entitled, “Parents' champions vs. vested interests: who do parents believe about MMR? A qualitative study” (Hilton et al., 2007), the study authors used purposive sampling, and conducted 18 focus groups consisting of 72 parents. Hilton et al. (2007) pointed out that “unlike other health scares” which fall from the headlines in short order, the association of autism with MMR remained in the headlines for years, thus, garnered ongoing attention of politicians, health care professionals and parents. Hilton et al. (2007) found parents stated they did not know whom they could trust for unbiased, accurate information. Parents were most swayed by anecdotal stories from other parents; and were suspicious of data from scientists or government sources. Parents were also suspect of their health care providers as a reliable source because of possible financial incentives; and when it came to matters of health, politicians were deemed clearly untrustworthy. Hilton et al. (2007) also found those who cited facts and data specifically contrary to Wakefield’s study were not only often an unsuccessful, it had a buoying effect, as parents and media likened the struggle to David and Goliath (Burgess, Burgess, & Leask, 2006)– with Wakefield being the champion of truth. Hilton et al (2007) concluded health care providers should focus more upon building trust with their patients, rather than “just providing factual information about immunization” (p. 8).

In the study, “Children's health and the social theory of risk: insights from the British measles, mumps and rubella (MMR) controversy” (Casiday, 2007) the author drew upon her 2005 focus group study of 87 parents who discussed their views on MMR, and further investigated their beliefs within the theoretical guidelines of cultural theory, risk society, psychometric models of risk perception. Casiday (2007) found a key determinant in parental decision-making processes weighed heavily upon trust. Casiday (2007) stated, “Clearly, the role of risk in late modernity is related to the erosion of trust in governments and science” (p. 1062). Further, Casiday (2007) pointed out that for people to trust others the information shared by others, an inherent belief that both parties share the same values, boundaries and belief systems is required. Additionally, Casiday (2007) suggested the belief that government policymakers were in collusion with the pharmaceutical industry–with the health of children taking a backseat to financial gain–was partially responsible for parents to want to evaluate the information for themselves.

In June of 2008, the study, “Developing tailored immunization materials for concerned mothers” (Gust, Kennedy, et al., 2008) was published. The 129 mothers who participated in the Gust et al. (2008) study were selected through purposive sampling, and had met specific inclusion criteria which included being identified as a mom who was either “worried” about vaccines or were “sitting on the fence” about their decision (p. 500). Gust et al (2008) provided the mothers with different versions of vaccine educations materials from three different sources. Parents did not like pro-vaccine information delivered by a chiropractor, as parents felt they lacked the necessary expertise; parents did not like fear appeal tactics, such as discussing how a child died

because they were not vaccinated; mixed reviews were garnered concerning including a statement of parents culpability for keeping their child safe (accompanied by a photograph of a child with chickenpox)–ranging from finding the tactic coercive to appreciating seeing the consequences of non-vaccination; and, the materials that included the CDC logo were perceived by parents "as believable and the use of statistics made mothers feel as though their intelligence was respected" (p. 506). Lastly, while trusting and respecting their main health care provider, most of the parents had concerns about the safety and necessity of vaccines, but felt "dissatisfied with information they received from them" (Gust et al., 2000, p. 506).

Four months later, Gust, Darling, Kennedy and Schwartz (2008) published a second study, titled, "Parents with doubts about vaccines: which vaccines and reasons why" (Gust, Darling, et al., 2008). Utilizing data from the NIS (2003-2004), a total of 3,924 parents were interviewed who had been identified as "unsure" if vaccinating their child had been the right thing to do, parents who "delayed" their child being vaccinated, and parents who "refused" vaccination altogether. Citing the increase in states allowing philosophical exemptions–and with the knowledge that not all parents who doubt vaccines are the same–Gust et al. (2008) found that the majority of "unsure" and "refused" parents had safety and side effects as primary concerns, while the "delayed" parents said the child had been reportedly ill. Parents from the "delayed" and "refused" groups who changed their minds and ultimately had their child vaccinated, responded that **"**information or assurances from health care provider" were the principal reasons (p. 720). Gust et al. (2008) concluded the next step should be, "encouraging children's health

care providers to solicit questions about vaccines, to establish a trusting relationship, and to provide appropriate educational materials to parents" (p. 718), as well as incorporate communication training in medical schools, residencies, and to the health care provider field, in general.

A study entitled, "Identification and characteristics of vaccine refusers" (Wei et al., 2009) analyzed the data of 1,239 children born between 1993 and 2001, ages 0 to 6. The data were obtained from health plans that participated in the CDC-sponsored Vaccine Safety Datalink Project. Wei et al. (2009) found vaccine refusers were more likely to come from families whose parents were more educated and had higher household incomes than non-refusers. Wei et al. (2009) suggested that providing the well-educated parents with information that usedd the most recent vaccine research, explained herd immunity, and clarified that all vaccines (except the flu vaccine) were now thimerosol free, could improve immunization compliance. Of note, in addition to vaccine refusers being more likely to doubt the safety, efficacy, and necessity of vaccines, they also reported a "low level of trust in the government" (p. 2).

The study, "How do general practitioners persuade parents to vaccinate their children? A study using standardized scenarios" (Leask, 2009), investigated how 11 general practitioners (GPs)–from both inner-city and urban areas–communicated information about vaccine risks and benefits to parents. Using a prewritten script based upon common concerns of vaccine hesitant parents, GPs were asked to role-play, via telephone, how they would respond. Leask (2009) stated the GPs tended to discredit parent's research source (primarily the Internet) and pointed out spurious causal thinking.

Further, Leask (2009) found that GPs would attempt appealing to a parent's sense of social obligation, including providing the hypothetical appeal, "How would you feel if your child got something? Say your child got measles and another child caught it from your child and that child died?" (p. 122). Leask (2009) concluded that strong persuasion was counter-productive and could erode trust, and instead recommended the framework of shared decision-making be considered.

Decades ranging from 2010-2015

The study, "Parental vaccine safety concerns in 2009" (Freed, Clark, Butchart, Singer, & Davis, 2010) investigated the parental concerns and obtained vaccine refusal status of 1552 parents drawn from a survey vendor to ensure a nationally representative sample of the U.S. population. Freed et al. (2010) found while 90% believed vaccines were "a good way to protect their children," and while 88% said they followed the advice of their physician concerning vaccines, 17.7% of the parents surveyed selectively refused the MMR vaccine. Further, >1 in 5 of parents surveyed by Freed et al. (2010) believe vaccines can cause autism. Freed et al. (2010) highlighted their data supports the notion that parents trust their pediatrician for vaccine information, and thus, they concluded, "Public health officials should construct and redesign vaccine information programs to address current safety concerns in a manner that is more targeted and tailored to specific subgroups of parents" (p. 658).

The study, "Parental delay or refusal of vaccine doses, childhood vaccination coverage at 24 months of age, and the Health Belief Model" (Smith et al., 2011), investigated the delay or refusal decisions and thinking processes of 11,206 parents of

children 24-35 months, using data from the NIS, framed within the HBM constructs. Smith et al. (2011) stated that similar to earlier study findings, those parents most likely to delay or refuse vaccines were primarily white, college educated, earned incomes >400% of the poverty level, had private insurance, and who were at least 30-years-old. Compared with parents who delayed or refused with those who vaccinated their children on schedule, the more vaccine hesitant the parent, the more likely there were to delay or refuse vaccinating their children which Smith et al. (2011) states was in line with the HBM's four constructs of severity, susceptibility, benefits and barriers. Of note, parents who delayed or refused were significantly more likely to report that autism concerns or having "heard or read negative things about vaccines in the media" guided their decision, as compared to parents who vaccinated their children (Smith et al., 2011, p. 143).

The study, "A postmodern Pandora's box: Anti-vaccination misinformation on the Internet" (Kata, 2010) conducted an Internet Google search on a single day (May 21, 2009) using the search terms "vaccine", "vaccination", and "immunization or immunization" (p. 1710) to analyze the content, information provided, and discourse used on anti-vaccination websites. Noting that 74% of Americans use the Internet, and 52% believed all, or almost all, of what they read online to be true, Kata (2010) found specific themes and content throughout the anti-vaccination websites analyzed. For example, stating that vaccines were poisons, caused diseases, infringed upon a person's civil liberties, employed emotive appeals (e.g., how their perfectly healthy child was permanently damaged), and alleged collusion between the regulatory agencies and the pharmaceutical industry were found on all the websites. Kata (2010) pointed out

providing educational information to counter anti-vaccinators false beliefs has been historically unsuccessful–since those opposed to vaccinations are unlikely to trust medical and government authorities. Kata (2010) concluded, “Given this lack of trust, providing more ‘education’ will be ineffective” (p. 1714). Instead, Kata (2010) suggested that gleaning a better understanding of the ideologies that support their belief systems could prove to be more productive.

The study, “Googling children's health: reliability of medical advice on the internet” (Scullard, Peacock, & Davies, 2010), analyzed the first 100 Google sources concerning five common pediatric concerns of parents; one being, “Is there a link between MMR and autism” (p. 581). Scullard et al. (2010) discovered while three out of five questions were mostly answered accurately, the MMR query was inaccurately answered nearly have the time (48%)–which the authors described as “poorly”. Scullard et al. (2010) found government websites gave accurate information every time; educational websites were accurate 80% of the time; and, 100% of sponsored websites (such as those offering single vaccines for sale) failed to provide accurate information. To mitigate parents spending time on questionable websites, Scullard et al. (2010) suggested that providing parents with a list of “approved” websites would be prudent (p. 582).

The study, “Factors underlying parental decisions about combination childhood vaccinations including MMR: a systematic review” (Brown et al., 2010) used the Grounded Theory and accessed 440 studies under specific inclusion criteria; 31 studies–both qualitative and quantitative–were selected. Brown et al. (2010) found parents, who did not trust the government “and/or” the health care system, were more likely ($p < .05$)

to be vaccine refusers; and, parents who felt their health care provider did not spend sufficient time, nor provide an adequate level of content, were also more likely ($p < .05$) to be vaccine refusers (Brown et al. 2010). Further, Brown et al. (2010) reported parents who were more likely ($p < .05$) to not vaccinate their child included: those who believed disease severity was minimal; had a positive opinion of information provided the media; expressed a preference for natural immunity; and, those most concerned they would regret having vaccinated their child. Brown et al. (2010) suggested specific vaccine information training for health care providers would be prudent, including how to foster "trusting relationships with parents in the context of immunization" (p. 4246).

In 2011, Freed, Clark, Butchart, Singer and Davis published the study, "Sources and perceived credibility of vaccine-safety information for parents" to further investigate which sources of vaccine information parents trusted, and if those levels of trust differed between certain populations. Utilizing a 4-point Likert-type survey of how much parents trusted certain sources, specifically, "A Lot, Some, Not At All, Did Not Use/View", 76% of parents said their own doctor was their most trusted source ("A Lot") for vaccine safety and information, as compared to 23% of parents stating they trusted Government/Officials "A Lot"; and, the study found, "Celebrities were trusted a lot for vaccine-safety information by 2% of the respondents, and some by 24%" (p. 109). Of particular note, 73% of parents said they had "Some Trust in" those parents "who believe their own child was harmed by a vaccine"; and, characterized by Freed et al. (2011) as sobering information, "The finding that only 74% of our respondents reported that they do not trust celebrities for vaccine-safety information is sobering" (p. 110). In terms of

custom-tailoring vaccine information, Freed et al. (2011) also found some rather divergent differences between black, white, and Hispanic parents. For example 40% of Hispanic parents place “Some” or “A Lot” of trust in celebrities as a source; and black parents were found to feel more negatively about vaccinations, in general, as well as in their own child’s health care provider, as compared to white parents. Freed et al. (2011) suggested exploring the effectiveness of social media to better inform parents.

The study, “Confidence about vaccines in the United States: understanding parents' perceptions” (Kennedy, Lavail, Nowak, Basket, & Landry, 2011) focused upon understanding parental vaccine confidence and vaccine hesitancy using data from the mailed 2010 Health Styles survey. Of the 4,198 responses, 376 fit the selection criteria of being a parent with children age 6 or under (Kennedy et al., 2011). Kennedy et al., (2011) reported while more than half of parents stated they “strongly agree” to having a successful, high quality relationship with their health care provider, 31% “somewhat agreed” and 3% “strongly or somewhat” disagreed. Kennedy et al. (2011) reported 24% of parents said the Internet was one of their top three sources for health information; the CDC and the American Academy of Pediatrics were ranked 26% and 28%, respectively. Of note, Kennedy et al. (2011) found parents who were intending on not fully vaccinating their child were most concerned about autism and the total number of vaccines recommended.

The study, “Anti-Vaccination Movement and Parental Refusals of Immunization of Children in USA” (Ołpińsk, 2012) sought to understand–despite the successful eradication of endemic measles in the United States–why there was an upsurge in parents

having antivaccine sentiments and refusal. Ołpińsk suggested vaccines were the victims of its own success, stating that historically, parents would "often know victims of the disease, who either died or suffered from the complications" (p. 382). Ołpińsk (2012) stated today, a combination of people's lack of trust in government (nationally and internationally), conspiracy theories suggesting government collusion with Big Pharma, questionable financial motives of doctors, and the strong online presence of antivaccine movement, are collectively culpable for the increase in parental vaccine hesitancy and refusal. Ołpińsk (2012) emphasized "hard core" antivaccine activists would not be swayed by education (p. 384).

The study, "A pilot study on the effects of individually tailored education for MMR vaccine-hesitant parents on MMR vaccination intention" (Gowda, Schaffer, Kopec, Markel, & Dempsey, 2013b) recruited 77 parents with children under age 6 from pediatric clinic waiting rooms, and a clinical trial recruitment website. Unaware of the study purpose, parents (who were first screened for levels of vaccine hesitancy) were randomly assigned to view either custom tailored or untailored information online. While both groups increased in their positive vaccine intentions following the intervention, the difference in increase between the two (i.e., tailored, untailored) was not statistically significant, 58% and 46%, respectively. Of note, there were parents with previously positive vaccines intentions that dropped to negative or neutral after viewing the untailored information. Gowda et al. concluded that custom tailored messaging might positively impact parental hesitancy of the MMR, and warrants further study; however, care must be taken to not further alienate some populations.

The study, “Talking with parents about immunization” (Donovan & Bedford, 2013), advised health care professionals not underestimate the power and influence of the antivaccine position, and provided suggestions as to how to counter the anecdotal stories and misinformation–which Donovan and Bedford (2013) acknowledged can be difficult to parse for health care professionals and parents alike. Additionally, Donovan and Bedford (2013) advised being knowledgeable was not enough: Having a trusting relationship was the biggest predictor of parental compliance. Donovan and Bedford (2013) provided brief responses to common parental concerns, including why vaccinate a baby so young, vaccine components unease, why vaccines are necessary, safety and efficacy doubts, and the fears that too many vaccines would overwhelming the immune system. Donovan and Bedford (2013) concluded while providing accurate information was important, having a trusting relationship was critical to success, and advised when not knowing the answer to a parent’s question, to find it, and revisit the query at the next office visit. Of note, Donovan and Bedford (2013) provided a multitude of germane, credible websites to aid the health care provider in their information seeking.

The study, “Does the relative importance of MMR vaccine concerns differ by degree of parental vaccine hesitancy? An exploratory study” (Gowda, Schaffer, Kopec, Markel, & Dempsey, 2013a), explored vaccination barriers of 79 vaccine positive, negative or hesitant parents via a cross-sectional exploratory survey analysis. The top two barriers were the same all groups: concern of the too many vaccines, and overloading a child’s immune system (Gowda et al., 2013). Negative and hesitant parents specifically cited MMR vaccine safety concerns; negative parents doubted the risk of their child

contracting measles, and preferred their child attain immunity naturally; positive parents placed MMR autism concerns as one of their top two concerns and questioned MMR efficacy, while negative and unsure parents believed the vaccine to be efficacious (Gowda et al., 201); and the relative importance of perceived risks versus benefits "depended upon the degree of MMR vaccine intention" (p. 436) to a level statistical significance. Gowda et al. (2013) suggested that a preemptive screening process to determine level of parental vaccine hesitancy would assist health care providers in providing improved educational information.

The study, "Practical approaches to vaccine hesitancy issues in the United States: 2013" (Domachowske & Suryadevara, 2013), stated while total vaccine refusal is not a common occurrence in most practices, vaccine hesitancy is seen frequently. Domachowske and Suryadevara (2013) surmised the first step to overcoming parental objections was to understand the history and rationale for their beliefs. Further, for the successful conveyance of evidence-based information, Domachowske and Suryadevara (2013) advised, "establishing trusting relationship with parents was essential" (p. 2654). Domachowske and Suryadevara (2013) recommended carefully listening to individual parental concerns, and cautioned, "Don't assume that the questions and concerns brought by a family are the same" (p. 2656). For "Internet prepared parents," Domachowske and Suryadevara (2013) suggested multiple conversations over time would likely be required p. 2656). Lastly, Domachowske and Suryadevara (2013) advised that keeping abreast of the current and evolving issues was paramount.

The study, “Ready or Not: Responding to Measles in the Post-elimination Era” (Sammons, 2014), discussed shortcomings and some solutions for which hospitals, clinics and pediatric offices needed to be cognizant, such as mitigating waiting room transmission, wearing surgical masks, and the likelihood that suspecting measles was neither top of mind nor a disease that most health care providers had experienced in-person. Sammons (2014) also discussed the rising urgency in maintaining herd immunity, pointing out the 15 states had dropped below the necessary 90% level. Sammons (2014) recommended that she and her fellow clinicians had a “vital role to play” that required explaining to patients the critical importance of maintaining herd immunity, social responsibility to one’s community, and protecting those “too young or ineligible” to be vaccinated (p. 146).

The study, “Effective messages in vaccine promotion: a randomized trial” (Nyhan et al., 2014) tested the efficacy of four different MMR vaccine messages that addressed either vaccine safety or the dangers associated with contracting the diseases, via a two phase web-based survey of 1759 vaccine reluctant parents. The four approaches were autism/MMR link message correcting, discussing the disease of contracting MMR vaccine diseases, a fear appeal via disturbing photos of ill children, and an emotive story of a child who nearly died of measles. All language was drawn verbatim from CDC websites (Nyhan et al. 2014). Nyhan et al. (2014) found none of the interventions increased vaccine intention for any of the parents. Of particular note, the autism/MMR correcting message resulted in parents becoming even less inclined to vaccinate their child (Nyhan et al., 2014) and, both the disturbing photos approach and the emotive

narrative resulted in an increase in concern for serious side effects. Nyhan (2014) noted, "The best response to false beliefs is not necessarily correct information" (p. 15); instead suggesting that issues of trust with regards to the source may be germane and warranted further investigation.

The April 2014, *Morbidity and Mortality Report (MMWR)* published, "Notes from the Field: Measles — California, January 1–April 18, 2014" (Zipprich, Hacke, Murray, Xia, Harriman & Glase, 2014) which reported between January and April, "a total of 129 cases of measles were reported, the highest number reported for this period since 1996" (Zipprich et al., 2014). However, 58 of those cases were in California alone. Most of the California cases (93) were imported from outside the United States. Nonetheless, Zipprich et al. (2014) found 74% of the 58 cases were unvaccinated (43%) or of unknown vaccine status (31%) (Zipprich et al., 2014). Zipprich et al. (2014) stated that in addition to assuring those who travel outside the United States are fully vaccinated, that state and local MMR vaccinations rates must be maintained at a high level.

The study, "Addressing the anti-vaccination movement and the role of HCWs" (Tafuri, Gallone, Cappelli, Martinelli, Prato & Germinario, 2014) reviewed the antivaccine literature to glean a better understanding of the literature, including studies that reviewed YouTube, Twitter and Facebook sites; and, Tafuri et al. (2014) provided historical context with the intended audience of health care workers (HCW). Additionally the authors sought to identify what HCWs needed to understand to effectively counter the misinformation, fears, and concerns vaccine hesitant parents expressed (Tafuri et al.,

2014). Tafuri et al. (2014) stated while traditional "where, when, where and why" of vaccines information was still relevant, HCWs needed to build public trust and spend time understanding the issues specific to their communities (p. 4864). Tafuri et al. (2014) concluded:

> Building public trust is not about telling them what they need to understand better, and it is not merely about being clearer or decision-making. Trust is built through dialogue and exchange of information and opinion. The immunization community, including scientists, policy makers, and health providers, need to come to terms with the reality that individuals and groups will continue to question and refuse vaccines. (p. 4864)

Tafuri et al. (2014) additionally suggested health care workers be provided vaccination training to help improve communications skills and buoy the health care provider's enthusiasm and vaccine knowledge.

The study, "Vaccine message framing and parents' intent to immunize their infants for MMR" (Hendrix, Finnell, Zimet, Sturm & Lane, 2014) investigated whether citing social responsibility to one's community versus personal benefit would have an impact on parental intensions to vacate their child. A total of 802 parents with children 11 months and younger participated in the online intervention (Hendrix et al., 2014). Parents received one of four MMR vaccine messages: (a) the CDC Vaccine Information Statement (VIS), (b) VIS and MMR benefits to the child, (c) VIS and societal benefits, or (d) VIS and benefits for both the child and society; parents then reported their MMR vaccine intensions on a 100-point scale ranging from "extremely unlikely" to "extremely

likely" (Hendrix et al., 2014). Hendrix et al. (2015) found as long as the information provided included how the child would personally benefit, parental MMR vaccine intention increased; however, stating societal benefit alone had no effect on parental MMR intention–neither positive nor negative.

On February 16, 2015, the *Journal of the American Medical Association (JAMA)* published the *JAMA Patient Page* titled, "Measles in the United States"–with the subtitle, "Measles is a very contagious and serious disease. It is also very preventable" (Jin, 2015). In this online document, Jin (2015) explained the reason why two doses of the MMR are necessary, "1 MMR dose works 93% of the time, and 2 doses work 97% of the time. The 3% of people who are fully vaccinated and still get measles often have a milder illness than those who were not vaccinated"; and, that the CDC recommended all children receive two doses (p. 1). Jin (2015) stated additional reputable organizations, namely the World Health Organization (WHO) and the American Academy of Pediatrics (AAP), rigorously studied eight vaccines safety profiles and potential for harm as recently as 2014–including the MMR–and found severe side effects to be rare, and no causal relationship between the MMR and autism existed (Jin, 2015), noting the receiving the MMR was "safer than becoming infected with the measles" (p. 1). Jin's (2015) premise for the importance of the compliance was "Because the virus is so contagious, if there are clusters of people who are not vaccinated, an outbreak can easily occur" (p. 1).

Summary and Conclusions

Although much has been written about the effectiveness of the measles vaccine and the mistrust that parents have had for decades, good science has continually

supported the continued use of MMR to combat measles. In Chapter 3, I will discuss the methodology of this study.

Chapter 3: Methodology

Introduction

The purpose of this study was to examine the relationships between parental knowledge of the MMR vaccine, their trust in U.S. government and medical authorities, and parental attitudes towards having their child receive the MMR vaccine.

Research Design and Rationale

A quantitative correlational research design was used to guide this study. Correlational research is used to determine existing relationships among groups (Creswell, 2009). The design is used to investigate theoretical relationship, meaning the dependent variable may vary as a result of the independent variable. Correlational research is not a true experiment, meaning variables cannot be manipulated. For example, the variable gender cannot be manipulated because participants cannot be randomly placed into a gender group. Participants are either male or female.

Quantitative research is a numerical description of trends or attitudes of an isolated portion of a population (Creswell, 2009). Results are used to infer or generalize results to a larger sample of the same population (Creswell, 2009). It differs from qualitative research because the process of accepting or rejecting a particular hypothesis through research is implemented. Quantitative research is more appropriate for answering deductive questions about relationships between specific variables (Creswell, 2009). Further, quantitative research was best suited for this study because numerical values were used to represent variables that were summarized and correlated amongst dependent and independent variables.

Study Variables

Four hypotheses were used to test the specified research questions. Each question was drawn from theory and was supported by the HBM. The sole dependent variable was attitudes toward MMR vaccine, while the predictor variable was general trust in doctors and government. The three moderators specified were gender (male, female, age group (< 40 years, >= 40 years), and education (< bachelors, >= bachelors).

Research Questions/Hypotheses

These four research questions informed the study:

$H_0$1: There is no significant relationship between general trust in doctors/governments and attitudes (Belief) toward MMR.

$H_1$2: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR.

- DV: attitudes toward MMR
- IV: general trust in doctors/governments
- Statistical analysis: multiple regression

1. How does gender moderate the relationship between General trust in doctors/governments and attitudes (Belief) toward MMR?

$H_0$2: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by gender.

$H_1$2: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by gender.

- DV: attitudes (belief) toward MMR
- IV: general trust in doctors/governments
- Moderator: gender (male, female)
- Statistical analysis: multiple moderated regression

2. How does age group moderate the relationship between General trust in doctors/governments and attitudes toward MMR?

$H_0$3: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by age group.

$H_1$3: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by age group.

- DV: attitudes toward MMR
- IV: general trust in doctors/governments
- Moderator: age group (< 40 years, >= 40 years)
- Statistical analysis: multiple moderated regression

3. How does education moderate the relationship between General trust in doctors/governments and attitudes toward MMR?

$H_0$4: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by education.

$H_1$4: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by education.

- DV: attitudes toward MMR
- IV: general trust in doctors/governments
- Moderator: education (< bachelors, >= bachelors)
- Statistical analysis: multiple moderated regression

Methodology

Population

The population for this study was a database sampling of parents living in the United States. There were approximately 35 million families with children as of 2010 (US Department of Commerce, 2011). There were approximately 25 million families that formed a two-parent household, while the other 10 million had a single parent family environment. Thus, the population for the study consisted of approximately 35 million families and 65 million parents (2 x 25 million two parent families + 15 million single parent families). However, the population needed for this study was limited to the following.

Parents were at least 18-years of age; had access to a computer and the Internet, and were willing to honestly report their feelings about trust in doctors/government and

the MMR vaccine. Gender, ethnicity, family characteristics, or education were not conditions for participation.

Sampling and Sampling Procedures

A nonrandom purposive sampling technique was used to extract data from the population. A nonrandom sampling technique means that participants were not randomly obtained to statistically ensure a representative sample (Lucas, 2014). Rather, purposive sampling was used because random sampling was not feasibly possible given the nature of the sample and design of the study. Purposive sampling refers to the fact that participants were specifically targeted based upon itemized characteristics that fit inclusion criteria (Berg, 2006).

Participants were drawn from SurveyMonkey using its extensive database of individuals living in the United States. A sample size of approximately 200 was calculated to be representative of the specified population of parents in United States. An online survey collection program, SurveyMonkey Inc., was used to deploy the survey and collect data. The survey was designed and formatted to facilitate parent's responses. A sample of 243 parents throughout the United States responded to the survey. An informed consent form was used to ensure participants were aware of important information about the study purpose, participation requirements, and contact information of the principal researcher, as well as confidentiality concerns. Parents were required to provide consent prior to completing the survey by selecting a box that designates their agreement to the study parameters.

Power Analysis

A formal power analysis was employed to determine the minimum sample size for the study. Two power analysis were conducted, one for Hypothesis 1 and one for Hypothesis H2, H3, and H4 because two different statistical tests are used. A power analysis requires specifying *a priori* conditions to the statistical formula. These include a value for estimated power, estimated effect size, and confidence level. Power establishes the probability that a null hypothesis will not be rejected when it is indeed true. According to Kuehl (2000), a recommended power value for a correlational study is 80%. The second condition is an estimated effect size or relative strength of the relationship between specified variables. According to Cohen (1988), the effect size categories for a correlation analysis are small, medium, and large; thus, a small effect = .10, medium = .25, and large = .40. For this study, a medium effect size was selected to ensure an adequate sample size is used. I stopped reviewing here due to time constraints. Please go through the rest of your chapter and look for the patterns I pointed out to you. I will now look at Chapter 4.

The third condition needed to conduct a power analysis is *alpha*. Alpha, or confidence level, is the value representing the amount of risk the researcher is willing to take before being able to determine test significance (Kuehl, 2000). The conventional value in the social sciences is .05. Thus, for Hypothesis 1, with power set at .80, effect size set at .25 and *alpha* set at .05, the sample size required was 200 participants (Faul, Lang, & Buchner, 2009).

For Hypothesis 2, 3 and 4 a power analysis was conducted for the moderated multiple regression. Sample size was determined using the power table provided by Aguinis (2004) for a variety of slope differences for moderated multiple regression. For medium to large differences in regression slopes between two groups; a total sample size of approximately 200 was needed to achieve power at .80 or above. The necessary sample size to detect smaller differences in regression slopes is between 320 and 400 (Aguinis, 2004). Ideally the sample sizes for the groups should be equal. Given multiple power analyses were run, the largest minimum sample size was used as a target during data collection. That is, approximately 200 cases from original sources will be collected and analyzed.

Procedures for Recruitment, Participation, and Data Collection

Data were collected via SurveyMonkey from parents with children residing in the United States. A nonrandom sampling technique was used to collect attitudes toward MMR vaccine and attitudes toward doctors and government. An informed consent form was attached to the beginning of the survey, explaining confidentiality, and the purpose of the study, the use for the data being collected, and parental rights as a participant. Participants had to indicate their willingness to participate in the study based upon the terms of the informed consent form. Once agreement was obtained, participants were provided access to the survey. The Parental Attitudes toward MMR Vaccine and Trust in Medical Authority (PA-MMR-TMA) Amended was a 12-item survey that took approximately 10 minutes to complete. In addition, participants were asked to complete a

short 6-item demographic survey. No personal identifying information was collected to assure complete participant confidentiality.

Instrumentation and Operationalization of Variables

The original Parental Attitudes toward MMR Vaccine and Trust in Medical Authority (PA-MMR-TMA), was developed by Casiday, Cresswell, Wilson, and Panter-Brick in 2005. The questionnaire was developed and piloted in the course of extensive qualitative interviews with parents (*N*= 87). The 20-item questionnaire asked about (a) Safety of MMR (4-items), (b) Separate Vaccines, (3-items) (c) Importance of Immunization, (6-items) and (d) Trust in doctors and government (7-items).

The Parental Attitudes toward MMR Vaccine and Trust in Medical Authority Amended (PA-MMR-TMA-A) was developed and validated by Dr. James Baxter, an industrial organizational psychologist, to accommodate a United States population. Specifically, National Health Service (NHS) was changed to (Center for Disease Control and Prevention (CDC) for those populations that reside in the United States rather than Great Britain.

The PA-MMR-TMA-A was validated using SPSS-21 Cronbach's alpha reliability and Factor analysis equations. The original 20-item survey measured three dimensions associated with parent's attitudes toward MMR, and a single dimension about parent's attitudes toward doctors and governments (Baxter, 2014). The parent's attitudes toward MMR global dimension consisted of three sub-dimensions: Safety of MMR, Separate Vaccines, and Importance of Immunization. The three sub-dimensions are latent constructs that have four; three and six manifest variables associated with them

respectively. Each respective survey question employed a 6-point Likert-type response format to detect a range of attitudes from respondents. Low scores reflected more negative attitudes about the construct, while higher scores reflected more positive attitudes.

Initial reliability and validity tests on the original survey found poor internal consistency and weak convergence of factors. Based upon this information, dimensions were modified by dropping questions that did not support the construct; however, questions were not added or reworded since this might change the fundamental meaning of the construct itself. After analysis and modification, reliability and validity were obtained for the overall dimension of Attitudes toward MMR and the two sub-dimensions: Safety of MMR and Immunization Importance. Further, reliability and validity was found after modification for Trust in Doctors and Government (Baxter, 2014).

Specifically, for Safety of MMR, the four-item construct was modified by removing question 1 about evidence that supports the relationship between MMR and autism. Once the question was removed, the construct was found to be highly reliable at Cronbach's alpha $r = .779$. Further, using exploratory factor analysis, a single dimension was observed with an Eigenvalue of 2.09 accounting for 69.65% of the variance.

The construct, Separate Vaccines, was tested and found to be not reliable. In addition, modification was not possible, since removal of questions simply reduced the poor reliability further. Moreover, in the US, separate vaccines are not readily available

to the general public like they are in Great Britain; thus, the construct was completely removed from the survey.

For Importance of Immunization, the 6-item construct was reduced to 5-items by removing survey question 5. After modification, the 5-item survey was found to be highly reliable at Cronbach's alpha $r = .885$. Using exploratory factor analysis with Varimax rotation, a single dimension was observed with an Eigenvalue of 3.64 accounting for 72.96% of the variance.

The two sub-dimensions were combined to obtain an overall Parent's Attitudes toward MMR Vaccine construct. Total number of items in the overall construct included three questions from the safety construct and five questions from the immunization construct. Reliability was found to be fair at $r = .648$ and validity was strongly supported with two observed dimensions that accounted for 72.24% of the variance.

The final construct that was modified was Parent's Attitudes toward Doctors and Government. After removal of questions 1, 3, and 5, from the 8-item construct reliability and validity was observed where $r = .780$, and validity was strongly supported with a single observed dimensions that accounted for 55.29% of the variance (Table 1) (Appendix B).

Table 1

Reliability and Validity Coefficients for each Dimension of the PAT-MMR-TMA-A

			Reliability	Validity	
Construct	N	Items	Cronbach's Alpha	Total Eigenvalue	% Variance
Safety of MMR	103	3	0.795	2.13	71.00
Importance of Immunization	103	5	0.880	3.57	71.51
Total Attitudes Toward	103	8	0.648	N/A	72.24

MMR					
Total Attitudes Toward Doctors and Govt.	103	4	0.780	2.765	55.29

Demographic Questionnaire

A basic demographic questionnaire was created to profile participants' gender, age, level of education, number of children, and age of children. The data were used to provide summary descriptive statistics of the sample that willing participated. In addition, three of the demographic variables were as moderators in the hypotheses (Appendix C).

Operationalization of Constructs

Five variables were identified in this study: a single dependent variable, a single predictor variable, and three moderators. The dependent variable was Parents Attitudes toward MMR. The predictor variable was general trust in medical authority, and the moderators were gender, age group, and education level. The dependent variable and predictor variable were operationalized as:

Attitudes (Belief) toward MMR. Attitudes (Belief) toward MMR were measured at the interval level. Survey questions were scaled on a 6-point Likert-type scale rating ranging from strongly agree to strongly disagree. Specifically, 1 = *strongly disagree*, 2 = *disagree*, 3 = *disagree more than agree*, 4 = *agree more than disagree*, 5 = *agree and* 6 = *strongly agree.* Attitudes (Belief) toward MMR were extracted from primary sources, meaning individuals were directly surveyed; data were not archival.

General Trust in Medical Authority. General Trust in Doctors/Governments was measured at the interval level. . Survey questions were scaled on a 6-point Likert-type scale rating ranging from strongly agree to strongly disagree. Specifically, 1 =

strongly disagree, 2 = *disagree*, 3 = *disagree more than agree*, 4 = *agree more than disagree*, 5 = *agree and* 6 = *strongly agree.* General Trust in Doctors/Governments was extracted form primary sources, meaning individuals were directly surveyed; data were not archival.

Data Analysis Plan

The Statistical Package for Social Science (SPSS—22.0) was used to perform descriptive, and statistical analyses. The descriptive statistics were used to report demographic data. Two statistical tests were used to test H1, H2, and H3. Specifically, a regression test was used to test hypotheses 1, while moderated multiple regression was used to test hypothesis 2, 3, and 4. The dependent variable was parent's attitudes toward MMR vaccine. The predictor variable specified in all four hypotheses was trust in medical authority. The moderator for H3 was gender, age group, and education.

For Research Question 1, a simple regression analysis was specified. Regression analysis is a statistical method used to study the relationship between a single dependent/criterion variable, and one independent variable. For this analysis, alpha was set at $p = .05$ provided parametric assumptions are met. Specifically, the assumptions included independence of error, normality, linearity, and homoscedasticity. Independence of error means the occurrence of a set of data does not affect the probability of the other. Normality was tested to ensure the distribution of the sample is normally distributed. Linearity was tested to ensure there was a linear rather than a nonlinear relationship between the variables. Homoscedasticity was tested by determining if the variances of the variables were equal.

The equation used in the regression model was $Y = \beta 0 + \beta 1\ X_1 + €$. The predictor variable was represented with "X" and the criterion variable was represented with "Y." The regression coefficient for the model (βn) represented the strength of the regression line for a specified variable. The symbol € represented an error term that is normally distributed around a mean of zero. The measures of effect for the regression model included *R*, *R-squared*, and *p* where *R* represented the strength of the relationship and ranges from 0 to 1. *R-squared* represented the amount of shared variance between the predictor variable and the criterion variable and ranges between 0 and 1. Probability of error (*p*) equals the calculated error associated with the test.

Moderated Multiple Regression

For Research Question 2, 3, and 4, a moderated multiple regression analysis were used. Multiple regression examines the relationship between multiple predictor variables and a dependent variable. Multiple regression is thought to be a more sophisticated approach of analysis when compared to bivariate correlation (Keith, 2006). The aim of regression is to determine if a relationship exists between variables, and whether a particular variable can predict an outcome. Each regression model, however, contained a dependent variable, predictor variable, and a moderator.

The moderation variables for hypothesis 2, 3, and 4 were gender, age group, and education. A moderation variable assesses whether there is an interaction between the predictor variable and moderator variable upon the dependent variable (Keith, 2006). Thus, the test determined if the moderator affects the relationship between parent's attitudes toward medical authority and parent's attitudes toward MMR vaccine.

Results are presented in three discrete sections in Chapter 4. These sections include the demographic, detail of analyses, and summary of results sections. The demographic section includes a profile of participants responding to the survey. The detail of analysis section includes a complete breakdown of the analysis conducted by hypothesis – including evaluation of appropriate assumptions and final inferential results. The summary of results section include a recap of the study, study design, results by hypothesis and what the reader will find in chapter 5. This data analysis includes descriptive statistics, means, standard deviation, and frequency where applicable. In addition, histograms are presented, as well as z-scores and plots, to support assumptions of normality if necessary. Further, a regression table, and supporting figures are provided where a relationship or effect is found. For this analysis, alpha was set at $p = .05$.

Threats to Validity

All research methods have potential threats that might render the data invalid. Threats to validity for the Parental Attitudes toward MMR Vaccine and Trust in Medical Authority Amended (PA-MMR-TMA-A) are few and simple to understand, as is for the demographic survey. However, they can be problematic nonetheless; thus, care is taken to guard against the following potential threats:

External Validity

1. More than one child living in the household eligible for MMR, thus skewing parental answers based on confusion.
2. Parent or guardian has no shot card to read from and has to respond to survey questions from memory (does not remember MMR being administered).

3. A parent might have a language barrier that interferes with question understanding and intent.
4. A child has received MMR immunizations but got the measles anyway.

If any of the above external threats materialize, these data collection results will be discarded, and data collection will continue until the desired number of respondents is achieved.

Internal Validity

1. Potential for skewing of data based on assumption that SurveyMonkey works as intended (data collection works as designed).
2. There is always potential for not getting enough of a desired population sample because you must rely on SurveyMonkey subscribers to respond in a timely manner.
3. Might be a mismatch in number of respondents who answer the SurveyMonkey invite vs. those who might choose not to answer the accompanying demographic survey.

If any of the above external threats had materialized, those data collection results would have been discarded. However upwards of 243 individuals responded to primary survey and completed the demographic, all within the time allotted.

Ethical Procedures

The application of ethics is an important component when conducting social research. Confidentiality tenets of Title 13 of the U.S. Code will be followed to protect respondent's personal data. Participants were targeted and contacted via email through

SurveyMonkey. Those participants that agreed to participate were presented an informed consent form for their review and acceptance. This form was part of the survey package delivered electronically to ensure anonymity and confidentiality.

The principal protection requirement for researchers is to avoid collection of personal information. This was be managed by giving non-descriptive alphanumeric labels to prevent names from being known. There was no direct personal contact. Participants were chosen from the SurveyMonkey's database, which the researcher does not have direct access to, with the exception of data collection for the purposes of this study. The procedures of the online survey system, SurveyMonkey, were designed to ensure there is no person-to-person interaction among participants or with the researcher, so participants responded in private and with anonymity.

Security measures were applied to all computers and communication processes. Computers were managed with password protection schemas and were updated as the study progressed. The data were averaged and findings were presented in summary terms to ensure participant protection from identification.

Participants had the right to withdraw from the study at any given time and all data will be purged from the records. The study was anonymous and followed standard rules for record keeping. The study focused on parents of children; therefore, the application of ethics comply with the ethical principle codes of conduct, as described by at least two institutions: the American Psychological Association (APA.org) and the American Sociological Association (Creswell, 2009).

All recorded information has been stored securely in a safe in the researcher's home for five years, with the researcher being the only person having access to study data. All recorded data and information will be shredded and destroyed after five years. All data results are presented in summary format, and no individually identifiable information will ever be available, as none was collected.

Summary

In Chapter 3, I explained the study methodology and statistical testing used. A quantitative correlational research design was used to guide this study. Four Hypotheses were used to test the specified research questions. Each question was drawn from theory and supported by the Health belief model. The sole dependent variable was attitudes toward MMR vaccine, while the predictor variable was general trust in doctors and government. Three moderators are specified, which were: Gender (male, female, Age group (< 40 years, >= 40 years), and Education (< bachelors, >= bachelors).

In Chapter 4, I will explain the results, and in Chapter 5, I will summarize the entire study and make recommendations for the future.

Chapter 4: Results

Introduction

The purpose of this study was to examine the relationships between parental knowledge of the MMR vaccine, their trust in U.S. government and medical authorities, and parental attitudes towards having their child receive the MMR vaccine.

In Chapter 4, I discuss the data collection and analysis procedures, descriptive and demographic characteristics of the sample population, the reliability analysis, data cleaning, tests of normality, the results of Research Questions 1–4, and, a summary.

Data Collection

A nonrandom purposive sampling technique was used to extract data from the population. A total of 2,500 requests were e-mailed via the SurveyMonkey database. Achieving nearly a 10% response rate in a 15-day period, 243 people completed the survey, which is 43 more respondents (i.e., 200 versus 243) than required to provide a representative sample based upon the power analysis discussed in Chapter 3. As discussed previously, an informed consent form was used to ensure that participants were aware of important information about the study purpose, participation requirements, and contact information of the principal researcher, as well as confidentiality concerns.

Sample Representativeness

In terms of the representativeness of the sample, as previously discussed Chapter 3, all required criteria were achieved. These criteria included using a power value of 80%–as recommended for correlations studies (Kuehl, 2000); the effect size of .25–to

ensure an adequate sample size was used (Cohen, 1988); and the confidence (alpha) value of .05, which is the conventional value used in the social sciences (Kuehl, 2000).

Data Analysis Procedure

Inferential statistics were used to draw conclusions from the sample tested. The SPSS 22.0 was used to code and tabulate scores collected from the survey and provide summarized values where applicable including mean, standard deviation, variance, and central tendency. Regression analysis was used to evaluate Research Question 1 and moderated multiple regression analyses were used to evaluate Research Questions 2-4. The research questions were

1. What is the relationship between General trust in doctors/governments and attitudes toward MMR vaccine?
2. How does gender moderate the relationship between General trust in doctors/governments and attitudes (Belief) toward MMR?
3. How does age group moderate the relationship between General trust in doctors/governments and attitudes toward MMR?
4. How does education moderate the relationship between General trust in doctors/governments and attitudes toward MMR?

Prior to analyzing the research questions, data cleaning and data screening were undertaken to ensure the variables of interest met appropriate statistical assumptions. Thus, the following analysis was assessed using an analytic strategy in that the criterion and predictor variable constructs were first evaluated for reliability to determine the scales' internal consistencies. Next, parametric assumptions of the variables were

evaluated including univariate outliers, normality, linearity, and homoscedasticity. Subsequently, regression and moderated multiple regression analyses were run to determine if any significant differences existed between variables of interest. Table 2 displays the variables and statistical analyses used to evaluate Research Questions 1-4.

Table 2

Summary of Analyses used to Evaluate Research Questions 1-4

Research Question	Criterion Variable	Predictor Variable	Moderator	Type of Analysis
1	Attitudes toward MMR	General Trust in Medical Authorities		Regression
2	Attitudes toward MMR	General Trust in Medical Authorities	Gender	Moderating Multiple Regression
3	Attitudes toward MMR	General Trust in Medical Authorities	Age	Moderating Multiple Regression
4	Attitudes toward MMR	General Trust in Medical Authorities	Education	Moderating Multiple Regression

Demographics

Data were collected from a valid sample of 243 parents in the United States who had at least one child 6-years of age or younger. Specifically, 64% of the participants were female (n = 156) and the remaining 36% were male (n = 87). Additionally, 74% of the participants were 40 years and older (n = 180), and the remaining 26% were less than 40-years-old (n = 63). Displayed in Table 3 are the frequency and percent statistics of participants' gender and age groups.

Table 3

Frequency and Percent Statistics of Participants' Gender and Age Groups

Demographic	Frequency (*n*)	Percent (%)
Gender		
Female	156	64.2
Male	87	35.8
Age Group		
Less than 40 years	63	25.9
40 years and older	180	74.1

Note. Total $N = 243$

The majority of participants had a bachelor's degree or higher ($n = 132$, 64%), and the remaining 46% of participants' level of education was less than a bachelor's degree ($n = 111$). Further, 65% of the participants were married ($n = 159$), 16% were divorced ($n = 39$), 11% were single ($n = 27$), and the remaining 7% were separated/widowed ($n = 18$). Displayed in Table 4 are the frequency and percent statistics of the participants' level of education and marital status.

Table 4

Frequency and Percent Statistics of Participants' Level of Education and Marital Status

Demographic	Frequency (*n*)	Percent (%)
Level of Education		
Less than bachelor's degree	111	45.7
Bachelor's degree and higher	132	54.3
Marital Status		
Single	27	11.1
Married	159	65.4
Divorced	39	16.0
Separated/Widowed	18	7.4

Note. Total $N = 243$

Reliability Analysis

Reliability analysis was run to determine if the criterion (attitudes toward MMR) and predictor variables (attitudes toward doctors and government) were sufficiently reliable. Reliability analysis allows a researcher to study the properties of measurement scales and the items that compose the scales (Tabachnick & Fidell, 2007). Cronbach's alpha reliability analysis procedure calculates a reliability coefficient that ranges between 0 and 1. The reliability coefficient is based on the average interitem correlation. Scale reliability is assumed if the coefficient is ≥ .60. I found that both criterion and predictor variable constructs did not violate the assumption of reliability and were sufficiently reliable. See Table 5 for the summary details of the reliability analyses.

Table 5

Summary of Reliability Analyses for the Criterion and Predictor Variables

Variable	*N*	# of Items	Sig. (*p*)
Attitudes toward MMR	237	13	.63
General Trust in Medical Authorities	237	7	.83

Research Questions 1-4

Research Question 1 was analyzed using regression analysis to determine if a significant relationship existed between participants' general trust in doctors/governments and their attitudes toward MMR vaccine. The criterion variable for Research Questions 1-4 was participants' attitudes toward MMR vaccine as measured by 13 items on the PA-MMR-TMA-A. The criterion variable consisted of three subscales including safety of MMR (four items), separate vaccinations (three items), and importance of immunization

(six items). Response parameters were measured on a 6-point Likert-type scale where 1 = *strongly disagree*, 2 = *disagree*, 3 = *disagree more than agree*, 4 = *agree more than disagree*, 5 = *agree*, and 6 = *strongly agree*. Composite scores were calculated across the three subscales by averaging case scores across all 13 items. Composite scores were used to evaluate Research Question 1.

The predictor variable for Research Questions 1-4 was participants' general trust in medical authorities. The predictor variable was measured by 7-items on the PA-MMR-TMA-A. Response parameters were measured on the same 6-point scale used by the criterion variable. Composite (average) scores were calculated across the seven items for each participant, and the composite scores were used as the predictor variable for Research Questions 1-4. I stopped reviewing here due to time constraints. Please go through the rest of your chapter and look for the patterns I pointed out to you. I will now look at Chapter 5.

Research Questions 2-4 were evaluated using moderated multiple regression to determine if the relationships between participants' general trust in doctors/governments and their attitudes toward MMR vaccine were significantly modified by gender, age group, or level of education. The modifying variables for Research Questions 2-4 were participants' gender (male, female), age group (less than 40-years-old, 40 years and older), and level of education (less than bachelor's degree, bachelors' degree and higher), respectively.

Data Cleaning

Before research questions were evaluated, the data were screened for missing data, univariate outliers, and reliability. Missing data were investigated using frequency counts and no cases were found within the variable distributions. The data were screened for univariate outliers by transforming raw scores to z-scores and comparing z-scores to a critical range between - 3.29 and +3.29, $p < .001$ (Tabachnick & Fidell, 2007). Z-scores that exceed this critical range (e.g., -4.05 or +3.85) are more than three standard deviations away from the mean and thus represent outliers. The distributions were evaluated and six cases with univariate outliers were found and were removed from the analyses. Thus, while 243 valid responses from participants were received, 237 were evaluated by the regression models for Research Questions 1-4 ($n = 237$). Displayed in Table 6 are descriptive statistics of the criterion and predictor variables.

Table 6

Descriptive Statistics of the Criterion and Predictor Variables

Dependent Variable	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
General Trust in Medical Authorities	2.29	5.00	3.80	0.54	-0.42	0.60
Attitude toward MMR	2.94	5.44	4.34	0.53	-0.15	0.02

Note. Total $n = 237$

Test of Normality

Before Research Question 1 was analyzed, basic parametric assumptions were evaluated. That is, for the criterion (attitudes toward MMR) and predictor variables (general trust in medical authorities) assumptions of normality, linearity and homoscedasticity were tested. Linearity and homoscedasticity were evaluated using

scatterplots, and the distributions did not violate the assumptions. To test if the variables were normally distributed, the skew and kurtosis coefficients were divided by the skew standard error/kurtosis standard error, resulting in z-skew/z-kurtosis coefficients. This technique was recommended by Tabachnick and Fidell (2007). Specifically, *z*-skew/z-kurtosis coefficients exceeding the critical range of -3.29 to +3.29 may indicate non-normality ($p < .001$). Thus, based upon the evaluation of the z-skew and z-kurtosis coefficients, no distributions exceeded the critical range. Since the distributions did not violate the assumption of normality, the criterion and predictor variables were assumed to be normally distributed. See Table 7 for skewness and kurtosis statistics of the criterion and predictor variables.

Table 7

Skewness and Kurtosis Statistics of the Criterion and Predictor Variables

Dependent Variable	Skewness	Skew Std. Error	z-skew	Kurtosis	Kurtosis Std. Error	z-kurtosis
General Trust in Medical Authorities	-0.42	0.16	-2.63	0.60	0.32	1.90
Attitude toward MMR	-0.15	0.16	-0.93	0.02	0.32	0.07

Note. Total $n = 237$

Results of Research Question 1

$H1_{Null}$: There is no significant relationship between general trust in doctors/governments and attitudes (Belief) toward MMR.

$H1_{Alternative}$: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR.

Research Question 1 was evaluated using regression analysis to determine if a significant relationship existed between participants' general trust in doctors/governments

and their attitudes toward MMR vaccine. Results revealed that there was a significant, positive relationship between the criterion and predictor variables, $R = .32$, $R^2 = .10$, $F(1, 235) = 26.39$, $p. < .001$. That is, 10.0% ($R^2 = .10$) of the variance observed in the criterion variable (attitudes toward MMR) was due to the predictor variable (general trust in medical authorities). Thus, null hypothesis 1 was rejected in favor of the alternative hypothesis. A model summary of the regression analysis was displayed in Table 8.

Table 8

Model Summary of Regression for Hypothesis 1

Source	R	R^2	Standard Error	F	Sig. (p)	
Omnibus	0.32	0.10	0.51	26.39	< .001	

	Unstandardized Coefficients		Standardized Coefficients			
Source	B	Std. Error	Beta	t	Sig. (p)	Partial Correlation
(Constant)	3.15	0.03		13.47	< .001	
General Trust in Medical Authorities	0.31	0.06	0.32	5.14	< .001	0.32

Note. Criterion variable = attitudes toward MMR, Total $N = 237$

Figure 1 graphically displays the observed relationship between general trust in medical authorities and attitudes toward MMR. The regression line depicts a positive relationship, meaning that as general trust in medical authorities increases attitudes toward MMR also increases; specifically, for every one unit increase in general trust, attitudes towards MMR increases by .31 (based on the MMR Likert-type scale).

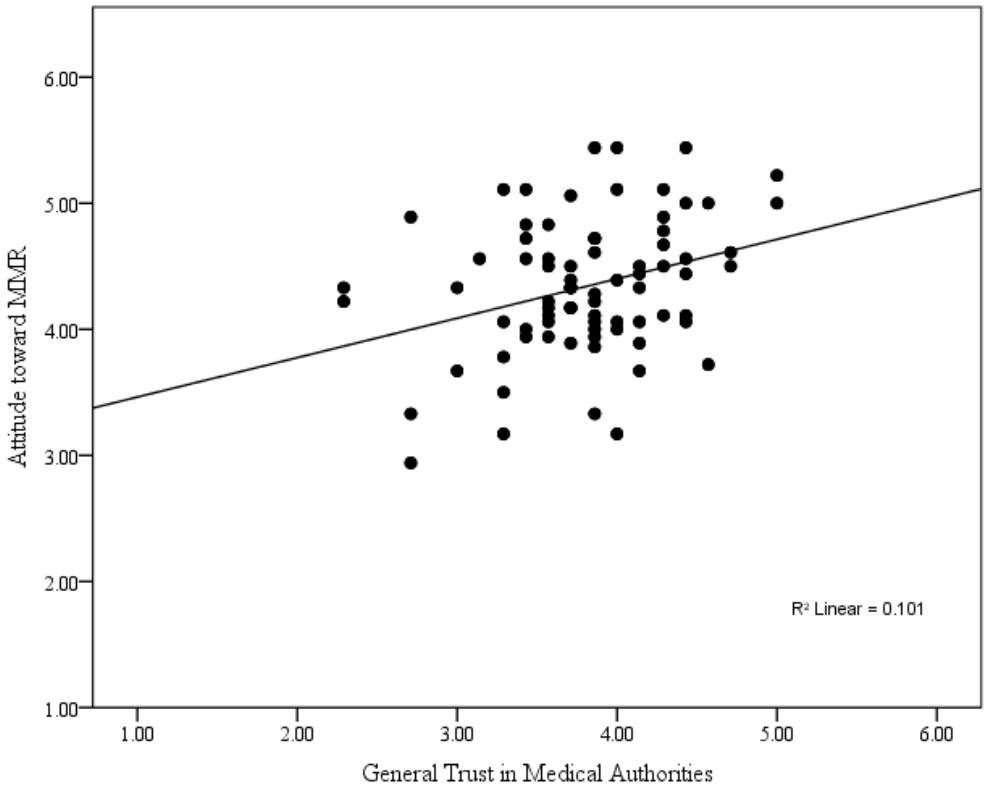

Figure 1. Scatterplot of participants' general trust in medical authorities and attitudes toward MMR scores

Results of Research Question 2

$H2_{Null}$: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by gender.

$H2_{Alternative}$: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by gender.

Hypothesis 2 was evaluated using moderated multiple regression analysis to determine if the relationship between participants' general trust in doctors/governments and attitudes toward MMR was moderated by gender (male, female). Results indicated

that the relationship was not moderated by gender, $\Delta R^2 < .001$, $\Delta F(1, 233) = 0.10$, $\Delta p. = .75$ (two-tailed). Thus, null hypothesis 2 was retained. A model summary of the moderated multiple regression analysis was displayed in Table 9.

Table 9

Model Summary of the Moderated Multiple Regression for Hypothesis 2

Source	ΔR	ΔR^2	Standard Error	ΔF	df1	df2	ΔSig. (p)
Model 1	0.32	0.10	0.51	13.35	2	234	< .001
Model 2	0.32	< .001	0.51	0.10	1	233	0.75

Source	Unstandardized Coefficients		Standardized Coefficients	t	Sig. (p)	Zero-order Correlation
	B	Std. Error	Beta			
Model 1						
(Constant)	3.21	0.26		12.60	< .001	
Gender	-0.04	0.07	-0.04	-0.62	0.54	-0.05
General Trust in Medical Authorities	0.31	0.06	0.32	5.11	< .001	0.32
Model 2						
(Constant)	3.42	0.71		4.84	< .001	
Gender	-0.21	0.52	-0.19	-0.40	0.69	-0.05
General Trust in Medical Authorities	0.26	0.18	0.26	1.39	0.17	0.32
Interaction 1	0.04	0.14	0.16	0.32	0.75	0.07

Note. Criterion variable = attitudes toward MMR, Total $N = 237$
Interaction 1 = general trust in medical authorities * gender

Results of Research Question 3

$H3_{Null}$: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by age group.

$H3_{Alternative}$: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by age group.

Hypothesis 3 was evaluated using moderated multiple regression analysis to determine if the relationship between participants' general trust in doctors/governments and attitudes toward MMR was moderated by age group (less than 40-years-old, 40 or more years old). Results indicated that the relationship was not moderated by age group, $\Delta R^2 < .01$, $\Delta F(1, 233) = 0.51$, $\Delta p. = .29$ (two-tailed). Thus, null hypothesis 3 was retained. A model summary of the moderated multiple regression analysis was displayed in Table 10.

Table 10

Model Summary of the Moderated Multiple Regression for Hypothesis 3

Source	ΔR	ΔR^2	Standard Error	ΔF	df1	df2	ΔSig. (p)
Model 1	0.32	0.10	0.51	13.17	2	234	< .001
Model 2	0.33	< .01	0.51	1.14	1	233	0.29

Source	Unstandardized Coefficients		Standardized Coefficients	t	Sig. (p)	Zero-order Correlation
	B	Std. Error	Beta			
Model 1						
(Constant)	3.18	0.25		12.51	< .001	
Age Group	-0.02	0.08	-0.02	-0.26	0.80	0.03
General Trust in Medical Authorities	0.32	0.06	0.32	5.11	< .001	0.32
Model 2						
(Constant)	4.09	0.90		4.56	< .001	
Age Group	-0.56	0.51	-0.47	-1.09	0.28	0.03
General Trust in Medical Authorities	0.07	0.24	0.07	0.28	0.78	0.32
Interaction 2	0.15	0.14	0.55	1.07	0.29	0.18

Note. Criterion variable = attitudes toward MMR, Total N = 237
Interaction 2 = general trust in medical authorities * age group

Results of Research Question 4

$H4_{Null}$: There is no significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is not moderated by education.

$H4_{Alternative}$: There is a significant relationship between general trust in doctors/governments and attitudes toward MMR and the relationship is moderated by education.

Hypothesis 4 was evaluated using moderated multiple regression analysis to determine if the relationship between participants' general trust in doctors/governments

and attitudes toward MMR was moderated by education (less than bachelor's degree, bachelor's degree or higher). Results indicated that the relationship was not moderated by education, $\Delta R^2 < .01$, $\Delta F(1, 233) = 0.39$, $\Delta p. = .53$ (two-tailed). Thus, null hypothesis 4 was retained. A model summary of the moderated multiple regression analysis was displayed in Table 11.

Table 11

Model Summary of the Moderated Multiple Regression for Hypothesis 4

Source	ΔR	ΔR^2	Standard Error	ΔF	df1	df2	ΔSig. (p)
Model 1	0.35	0.12	0.50	15.78	2	234	< .001
Model 2	0.35	< .01	0.50	0.39	1	233	0.53

Source	Unstandardized Coefficients		Standardized Coefficients	t	Sig. (p)	Zero-order Correlation
	B	Std. Error	Beta			
Model 1						
(Constant)	3.31	0.24		13.60	< .001	
Education	-0.14	0.07	-0.14	-2.18	0.03	-0.09
General Trust in Medical Authorities	0.33	0.06	0.34	5.42	< .001	0.32
Model 2						
(Constant)	2.90	0.71		4.11	< .001	
Education	0.15	0.48	0.14	0.31	0.75	-0.09
General Trust in Medical Authorities	0.44	0.19	0.45	2.37	0.02	0.32
Interaction 3	-0.08	0.12	-0.31	-0.62	0.53	0.03

Note. Criterion variable = attitudes toward MMR, Total $N = 237$
Interaction 3 = general trust in medical authorities * level of education

Summary

In summary, and expressed in Table 12, a significant relationship was found between the main constructs in hypothesis 1; namely, general trust in doctors/governments, and parental attitudes toward MMR ($p < .001$). However, no significant relationship was found in hypotheses 2, 3 and 4. Specifically, for hypothesis 1, the results revealed a significant, positive relationship between the criterion and predictor variables, $R = .32$, $R^2 = .10$, $F(1, 235) = 26.39$, $p. < .001$. Hypotheses 2 results indicated that the relationship was not moderated by gender, $\Delta R^2 < .001$, $\Delta F(1, 233) = 0.10$, $\Delta p. = .75$ (two-tailed). Hypothesis 3 results indicated that the relationship was not moderated by age group, $\Delta R^2 < .01$, $\Delta F(1, 233) = 0.51$, $\Delta p. = .29$ (two-tailed). And, for hypothesis 4, results indicated that the relationship was not moderated by education, $\Delta R^2 < .01$, $\Delta F(1, 233) = 0.39$, $\Delta p. = .53$ (two-tailed). In other words, based upon these study finding, it did not matter whether the individual was male or female, how old they were, nor their level of education attained: What did significantly impact parental attitudes towards having their child receive the MMR was associated with their level of trust in the U.S. government and medical authorities.

In Chapter 5, I will provide an interpretation of the study findings, including how it compares with previously published peer-reviewed literature and the theoretical framework. Additional areas to be addressed include limitations of the study, recommendations for further research, and, the possible implication for positive social change.

Table 12

Summary of Results for Hypotheses 1-4

Hypothesis	Criterion Variable	Predictor Variable	Moderator	Type of Analysis	Sig. (*p*)
1	Attitudes toward MMR	Attitudes Toward Doctors and Govt.		Regression	< .001
2	Attitudes toward MMR	Attitudes Toward Doctors and Govt.	Gender	Moderating Multiple Regression	0.75
3	Attitudes toward MMR	Attitudes Toward Doctors and Govt.	Age	Moderating Multiple Regression	0.29
4	Attitudes toward MMR	Attitudes Toward Doctors and Govt.	Education	Moderating Multiple Regression	0.53

Note. Total $N = 237$

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

A knowledge gap exists as to whether referencing governmental and medical authorities as credible sources may be counterproductive for certain groups of parents, thereby inadvertently undermining parental trust in the vaccine information being communicated. In this study, I sought to examine the relationships between parental knowledge of the MMR vaccine, their trust in U.S. government and medical authorities, and parental attitudes towards having their child receive the MMR vaccine.

A valid sample of 237 parents residing in the United States, aged 18 and older, with at least one child age 6 or younger, participated in this online survey. Data were entered into SPSS 22.0 and were then tested using regression and moderated multiple regression analyses to evaluate the research questions.

According to results from the regression analysis of Research Question 1, there was a significant, positive relationship between participants' general trust in doctors/governments and their attitudes toward MMR vaccine ($p < .001$). That is, 10.0% ($R^2 = .10$) of the variance observed in participants' attitudes toward MMR was due to their general trust in medical authorities. According to the results from Research Questions 2-4, the positive relationship between participants' general trust in doctors/governments and their attitudes toward MMR vaccine was not modified by gender ($p = .75$), age ($p = .29$), or education levels ($p = .53$). Thus, I did not find a significant relationship between parents' general trust in doctors/governments and their attitudes toward MMR ($p < .001$). Specifically, the higher the level of trust in

doctors/government, the more likely a parent was to vaccinate their child (for every one unit increase in general trust, attitudes towards MMR increases by .31; thus, the lower the level of trust, the less likely a parents was to vaccinate their child (decrease of .31) – regardless of parental gender, age, or education level.

Interpretation of the Findings

Based upon a robust review of the published peer-reviewed literature, there is a growing misperception among U.S. parents that vaccines in general–and the MMR vaccine in particular–are not safe when first administered and have deleterious, long-term consequences that outweigh the benefits of being vaccinated (Allred et al., 2005; Danovaro-Holliday et al., 2002; Gust et al., 2004; Smith et al., 2004; Sporton & Francis, 2001). These findings are in line with the HBM, the theoretical framework upon which this study was based.

Based upon my study findings, I both confirmed and extended the current state of knowledge published in the peer-reviewed literature discussed in Chapter 2, sans disconfirming two aspects of the Smith et al. (2004) study, who found that vaccine-hesitant parents were modified by age (age 30 and older) and by education level (had college degree or higher); an aspect of the Gust, Kennedy, et al. (2008) study, who found that the inclusion of the CDC logo on parental education materials increased parental belief that the content was credible; and disconfirmed an aspect of the Wei et al (2009) study, who found that vaccine refusers tended to be more educated than nonvaccinators. Regardless of parents' gender, age, or education level, I found that the parental level of trust in doctors/government was significantly associated with their vaccine attitudes.

Beginning in 1979 with the Rundall and Wheeler study, through 2015 with the He et al. (2015) study, the HBM identified key psychosocial determinants of attitudes concerning the preventive health service of vaccination. Parents opposed to vaccines believe the safety profile was questionable, young children receive too many vaccinations, the human body's immune system was capable of protecting itself without vaccines, and that vaccines were only somewhat important as the diseases were generally not serious (Glanz et al., 2013; Gust, Darling, et al., 2008; Gust, Kennedy, et al., 2008; Gust et al., 2004; Leask, 2009; Sporton & Francis, 2001).

While the importance of addressing the issues of safety, efficacy, and necessity, tailored to allay parental concerns is of vital importance (Glanz et al., 2013; Gust, Darling, et al., 2008; Gust, Kennedy, et al., 2008; Gust et al., 2004; Leask, 2009; Sporton & Francis, 2001), I found that thoughtful consideration concerning from whom the information is sourced is also critically germane for those parents who distrust government and medical authorities.

Sporton and Francis (2001) investigated why parents were choosing to not vaccinate their children for measles and found that in addition to issues such as questionable safety concerns, parents perceived measles as a "mild disease" (Sporton & Francis, 2001, p. 183); parents questioned the veracity of the educational information provided–believing it "exaggerated the efficacy of vaccines" (Sporton & Francis, p. 184); parents were concerned that there was a lack of research concerning the long-term effects of vaccines, which included specific mention of autism among other diseases; parents questioned whether their health care provider had provided "balanced information" and

questioned whether there were financial incentives that diminished a doctor's objectivity (author, year, p. 187).

Investigating the United Kingdom's MMR uptake decline, following the false autism association claim made by Wakefield et al. (1998), Casiday et al. (2006) concluded,

> Any government efforts to directly promote the MMR vaccine to parents are likely to belittle trusted and may undermine the efforts of practitioners, known to parents, to provide effective professional advice. Practitioners should continue to provide parents with accurate information, while communicating respect for parents' intentions to protect their children's health. (p. 183)

Thirteen years later, Nyhan et al. (2014) found that countering parental vaccination beliefs with science provided by government authorities such as the CDC "may actually increase misperceptions or reduce vaccination intention" (p. 835). Nyhan et al. recommended that further studies into the issues of trust were warranted.

As the HBM contends, whether someone will take a health-related action (in this case, have their child receive the MMR vaccine) depends upon their (a) perceived susceptibility (i.e., what are the chances their child will contract measles), (b) perceived severity (i.e., how serious is the measles and the possible complications), (c) perceived benefits (i.e., will vaccinating their child with the MMR reduce the risk onset and/or severity of the measles), and (d) perceived barriers (i.e., do the benefits of vaccination outweigh the potential physical and emotional consequences) (NIH, 2005). However, for those constructs to be fully realized, I found that the level of parental trust in

doctors/government as the source of the information significantly impacts the credibility of the information being communicated, which results in parents refusing their child receive the MMR vaccine.

Limitations of the Study

As is the case with all quantitative studies, numerical values were used to represent latent constructs. It is possible that numerical values did not fully capture parental attitudes. This fact limits inferences that can be made about the sample and population. A possible confounding variable may have included a lack of focus while taking the survey, given that the participant could have been actively parenting simultaneously. However, the survey was designed to be completed in a matter of minutes to limit that possibility. Additionally, the limited size of the instrument reduced the scope, thereby diminishing the possible effects of confounding variables. In a self-reported survey, whether a parent responded honestly cannot be determined for certain, although the survey instrument, the PA-MMR-TMA-A, was validated via Cronbach's alpha reliability and factor analysis equations using SPSS-21. In terms of response rate, a 10% response was achieved, meaning that approximately 240 participants responded out of 2,400 e-mail requests. Although this compares favorably to other online surveys, it does not mean that a true representative sample was obtained. The sample surveyed consisted of parents residing in the United States, aged 18 and older, with at least one child age 6 or younger. Although these results from the sample tested may statistically reflect the attitudes/differences within the overall population it by no means, suggest fact that it does.

Recommendations

Grounded in both the strengths and limitations of this study, and based upon the literature discussed in Chapter 2, three recommendations for further study may be warranted. Understanding what specific factors may be contributing to varying levels of parental distrust in doctors/government officials (Brownlie & Howson, 2006; Nyhan et al., 2014) could help inform how to regain or increase vaccine compliance. Additionally, as the Internet has become an important source for health information (Calandrillo, 2004; Davies et al., 2002; Kata, 2010; Leask, 2009), repeating this study using self-described vaccine discussion social media groups as the study population, such as those found on Facebook or Twitter, could provide unique, actionable insights. Lastly, while this study met the required sample population size for generalizability (in fact, slightly exceeded it by 37 additional participants) and found a significant relationship existed between participants' general trust in doctors/governments and their attitudes toward MMR vaccine, specifically, $R = .32$, $R^2 = .10$, $F(1, 235) = 26.39$, $p. < .001$, repeating this online SurveyMonkey survey with a significantly larger SurveyMonkey population would be warranted. I stopped reviewing here due to time constraints. Please go through the rest of your chapter and look for the patterns I pointed out to you. I will now look at your references.

Implications

The implications for positive social change are profound. Vaccination compliance in general, and MMR vaccination compliance in particular, is a public health issue that spans from protecting the most vulnerable of individuals–who either are unable or should

wait to be vaccinated (e.g., medically contraindicated, has cancer, is undergoing cancer treatment, is pregnant, too young to be vaccinated)–to everyone, anywhere in the world where people visit or reside.

Robust vaccination implementation profoundly reduces disease, disability, death sand inequity worldwide, positively impacts women's empowerment, lowers morbidity and mortality, reduces health care costs, promotes peace, and saves billions of US dollars (Andre et al., 2008). The measles virus is also easily weaponizable (SIU School of Medicine, 2014), which is why the MMR vaccine is "considered indispensable against bioterrorism" (Andre et al., 2008, p. 140). Of particular note, and as discussed by Hotez (2001), there is a correlation between "childhood death rates from vaccine-preventable infections and the probability of a nation becoming engaged in armed conflict" (p. 862).

In terms of recommendations in practice, for pediatricians and other primary care providers, they should be cognizant that parental levels of trust in the originating source of the information presented varies, possibly requiring modifications in which materials they share or how they frame the argument in favor of a recommendation to vaccinate. For policymakers, they may want to investigate the legalities of promoting states to consider eliminating both philosophical and religious exemptions for the protection of all; of course, allowing medical exemptions is essential. For parents researching via the Internet, they consider the wisdom of Albert Einstein who said, "Information is not knowledge", and the wisdom of George Bernard Shaw, who said, "Beware of false knowledge; it is more dangerous than ignorance.

Conclusion

The United States has seen an 870% increase in measles over the past 16 years. An emerging public health threat (CDC, 2009), one–third of those infected with the measles will suffer one or more complications, including encephalitis (swelling of the brain), neurological damage, blindness, seizures, pneumonia, coma and death; and if pregnant, miscarriage of the unborn child (The Pink Book, 2012).

Most recently, in December 2014, an unvaccinated, measles-infected woman returning from travel abroad visited the Disneyland Resort Theme Park, inadvertently began a multi-state measles outbreak that spread beyond California, to Utah, Washington State, Oregon, Colorado, and Arizona. The majority of those infected were either unvaccinated or of unknown vaccine status; the age of those infected ranged from a 10-month old baby, to a 57-year-old adult; 15% required hospitalization (CDC, 2015).

This lack of parental trust in the U.S. government and medical authorities is negatively impacting parental attitudes towards their child receiving the MMR vaccine; selective MMR vaccine refusal and measles outbreaks are on the rise. This study, which surveyed 237 parents residing in the United States, revealed a significant, positive relationship between parental trust in doctors/governments and parental attitudes toward MMR ($R = .32$, $R^2 = .10$, $F(1, 235) = 26.39$, $p. < .001.$), regardless of parental gender, age, or education.

To combat this public health threat, it is not enough to provide custom-tailored educational information that clearly, honestly, and respectfully addresses parental concerns of safety, necessity and efficacy. Indeed, it has been demonstrated that

correcting a parents' false belief that the MMR causes autism with science, results in them becoming more unlikely to vaccinate their child (Nyhan et al., 2014).

Scientific evidence is increasingly playing less of role in parent's vaccine decision-making processes (McMurray et al., 2004). This appears to be due, in part, to parents questioning the motives of the originating sources of information, and thus, the accuracy of the content becomes suspect. Moving forward, it is reasonable to suggest that when developing future vaccine information materials that some proportion of those materials be designed to respect–and appeal to–the sensibilities of parents who reject government and medical authorities as credible sources.

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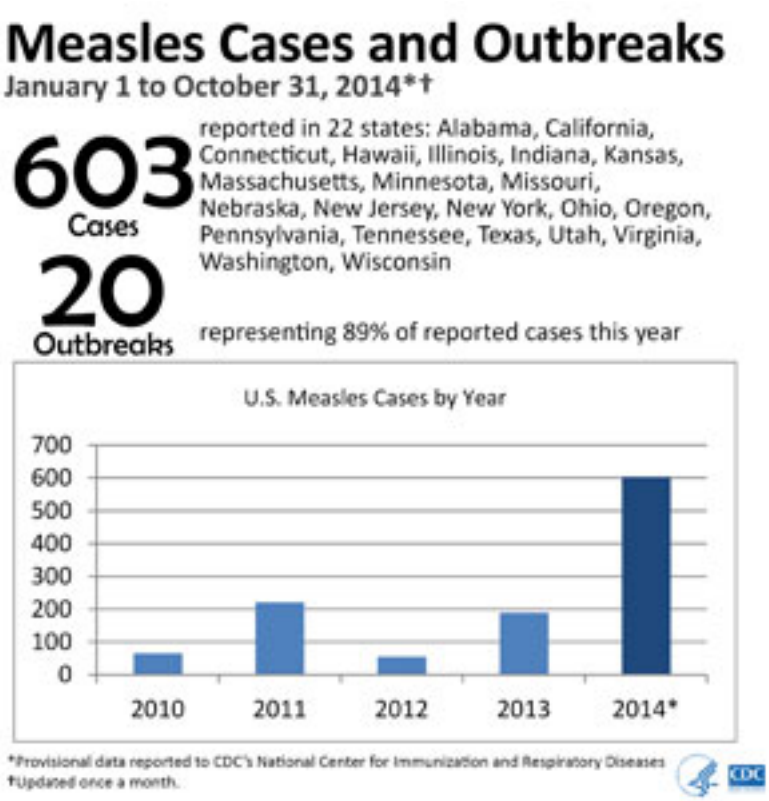
Appendix A: Measles Cases and Outbreaks by Year



- The majority of the people who got measles are unvaccinated.
- Measles is still common in many parts of the world including some countries in Europe, Asia, the Pacific, and Africa, travelers with measles continue to bring the disease into the United States
- Measles can spread when it reaches a community in the United States where groups of people are unvaccinated.

Source: CDC, Measles Cases

Appendix B: Parental Attitudes toward MMR Vaccine and Trust in Medical Authority

(PA-MMR-TMA-A)

This survey was modified from the Casiday et al. (2006) study, with the permission of Dr. Casiday.

Statement	Strongly disagree	Disagree	Disagree more than agree	Agree more than disagree	Agree	Strongly agree
(a) Safety of MMR:						
i. It cannot be proved with 100% certainty that the MMR vaccine is safe						
ii. More time is needed to be able to fully investigate the effects of the MMR vaccine						
iii. Possible complications of MMR vaccination can be very serious for children						
(c) Importance of immunization:						
i. Vaccination is one way that parents can make a positive contribution to their children's health						
ii. More kids should be vaccinated against measles, mumps and rubella so that outbreaks don't occur						
iii. I have a responsibility to have my child vaccinated for the protection of all children						
iv. People who don't vaccinate their kids put others at risk						
vi. My child is likely to get measles if he/she isn't vaccinated						
(d) Trust in doctors and government:						
i. If I have any concerns about MMR they are taken seriously by my doctor						
iv. The government is too defensive about MMR						
vi. The government would stop the MMR if there was evidence of a serious risk						
vii. The government does a good job of protecting us from risks to health						

Appendix C: Demographic Questionnaire

1. **What is your gender?**

    a. Male
    b. Female

2. **What is your marital status?**

    a. Married
    b. Single
    c. Divorced
    d. Widowed
    e. Separated

3. **What is the number of children in your family?**

    a. None
    b. One
    c. Two
    d. Three
    e. Four
    f. Five
    g. Six or more

4. **What is the age of your children in years? (If newborn, put 1 year; please round to the nearest year)**

    a. First Born _____
    b. Second Born _____
    c. Third Born _____
    d. Fourth Born _____
    e. Fifth Born _____
    f. Six Born _____

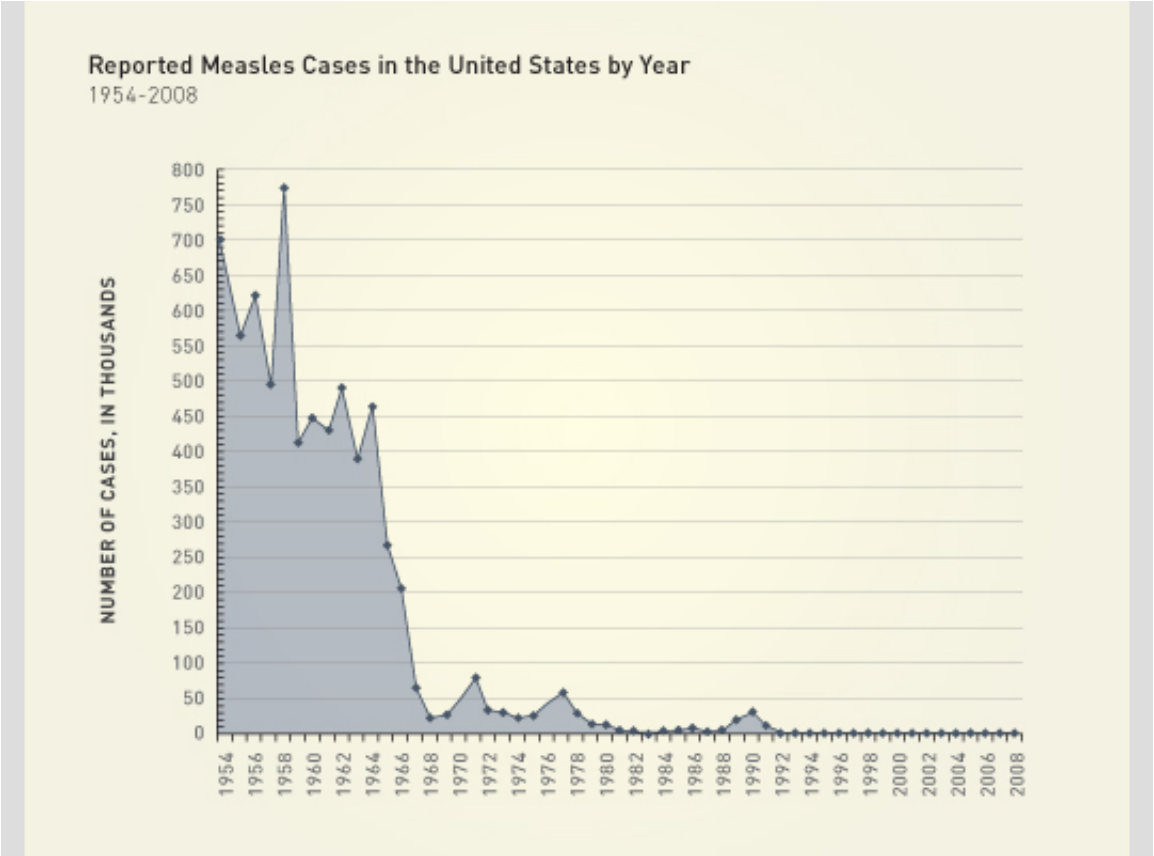
5. What is the highest level of education you have attained?

a. High School
b. Vocational/Technical Certification
c. Some College
d. Associates Degree
e. Associates Plus
f. Bachelor's Degree
g. Post graduate Degree
h. Graduate Degree
i. Doctoral Work
j. Doctoral Degree
k. Other (please specify) _____

6. Please specify your age category:

a. Less than 18 years
b. 18 to 24 years
c. 25 to 34 years
d. 35 to 44 years
e. 45 to54 years
f. 55 to 59 years
g. 60 to 64 years
h. 65 to 74 years
i. Greater than 75

Appendix D: Graph of U.S. Measles Cases 1954-2008



Source: CDC/MMWR Summary of Notifiable Diseases, United States, 1993; CDC/MMWR Summary of Notifiable Diseases, United States, 2008.

Appendix E: Instrument Permission

From: Rachel Casiday <r.casiday@tsd.uwtsd.ac.uk>

Date: December 11, 2014 4:43:56 AM EST
To: "wendythewriter@comcast.net" <wendythewriter@comcast.net>

Subject: RE: Permission Request for Dr. Rachel Casiday, from Doctoral Student, Wendy Leonard, MPH

Dear Wendy,

Many thanks for your email. Of course, I would be delighted for you to use the questionnaire in your research. However, the questionnaire was not designed as a single-dimension scale, so we did not feel it appropriate to compute Cronbach's alpha – each question was reported individually in our paper.

Best wishes,
Rachel

From: wendythewriter@comcast.net [mailto:wendythewriter@comcast.net]
Sent: 10 December 2014 20:36
To: Rachel Casiday
Cc: wendythewriter
Subject: Permission Request for Dr. Rachel Casiday, from Doctoral Student, Wendy Leonard, MPH

Dear Dr. Casiday,

I am a doctoral student from Walden University writing my dissertation tentatively titled "Parental knowledge of MMR and its relationship between general trust in doctors/government and attitudes/belief toward MMR," under the direction of my dissertation committee chaired by Jack Nemecek, Ph.D., MB; Dr. Nemecek is also the Public Health Advisor at Centers for Disease Control and Prevention (CDC) in Atlanta.

I am writing you to request your permission to use your survey instrument in my research study. Specifically, I am asking for written permission to reproduce a section of your instrument: The section I would like to use is Section D (pages 180-181, questions 1- 7), which you subtitled, "Trust in Doctors and Government." …And of course you will be cited and given full credit within text, as well as included in my Appendix.

Please see the attached letter to you, to read my request letter, in full (it's not long, barely 1-page). I have attached it as both a .PDF and a Word Doc. If you have any difficulty opening them (you need only read one), kindly advise me at your earliest convenience - as you/your survey instrument are essential to my dissertation and IRB approval.

Thank you so much for your consideration,

Wendy Leonard, MPH

Medical Writer
National Press Club Induction, 1994
International Silver Inkwell Award, 2003
National Public Service Fellowship Award, Doctoral Program, 2007
Science Writer, NewJerseyNewsroom.com, 2009-2015

Appendix F: Informed Consent Form

You are cordially invited to take part in a brief, anonymous, online research study about parental knowledge and attitudes concerning measles and vaccines. The researcher is specifically seeking parents (age 18 and older) who reside in the United States, and have at least one child age 6 or younger (≤6) to participate. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named Wendy Leonard, who is a doctoral student at Walden University.

Background Information:
The purpose of this study is to better understand how parents feel about vaccines, about vaccinating their own children, and the safety of the MMR (Measles Mumps Rubella) vaccine.

Anonymity:
You *will not* be asked to provide any personally identifiable information, such as your as name and address.

Procedures:
If you agree to be in this study, you will be asked to:

- Complete a 12 questions survey, which should take you less than 10 minutes.
- You will also be asked to complete a 6 question demographic survey (i.e., gender, marital status, number of children, ages of children, education and your age.

Sample Questions:
Here are some sample questions:

On a scale from Strongly Disagree to Strongly Agree:

- Possible complications of MMR vaccinations can be very serious for children.
- If I have any concerns about MMR they are taken seriously by my doctor.
-

Sample of a demographic questions include:

- What is your gender?
- What is the number of children in your family?

Voluntary Nature of the Study:
This study is entirely voluntary. Even if you decide to join the study now, you can still change your mind at any time while participating: You need only stop and simply exit the survey.

Benefits and Risks of Being in this Study:
By participating in this study, you will be assisting in the pursuit of gleaning a better understanding of what parents know, think, and feel about vaccines in general, and the MMR in particular; and in so doing, you will help contribute greatly to a body of knowledge the healthcare community very much needs.

That being, being in this type of study may involve some risk of minor emotional discomfort, if you are particularly sensitive to the topic of measles and/or vaccines. However, being in this study would not pose a risk to your safety or wellbeing.

Privacy:
As stated above, your anonymity is guaranteed – as no personally identifiable information is being asked. The anonymous data that is being collected will nonetheless be kept secure by the researcher, in a locked filing cabinet in her home, and shall be kept for a period of at least 5 years, as required by the university, and then shredded.

Contacts, Questions and Study Findings:
If you have any questions regarding this study, either now or later, you may contact the researcher directly via her private email: WendyTheWriterAtHome@gmail.com. Additionally, if you would like a copy of the study findings, you need only email the researcher and ask.

If you would like to talk privately about your rights as a participant, you may call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 612-312-1210 .

IRB Approval Information:
Walden University's approval number for this study is **04-29-15-0110365**, and it expires on **April 28, 2016.**

Please print or save this consent form for your records.

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By replying to this email with the words, "I consent", I understand that I am agreeing to the terms described above.

2015.04.29 17:20:06 -05'00'